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22,767	939	24,723	910	27,287	708	1279	324	5671	604	11,948	896	16,800	1154
22,769	867	24,801	817	27,339	453	1303	447	5791	538	12,113	1108	16,836	1102
22,826	27	24,806	1034	27,355	181	1365	1220	5799	653	12,122	861	17,066	985
22,845	1139	24,815	247	27,358	1040	1389	1153	5911	929	12,161	878	17,232	997
22,856	903	24,825	903	27,425	256	1502	543	5921	550	12,188	987	17,235	984
22,869	899	24,838	1108	27,426	254	1503	443	5946	1157	12,201	866	17,240	1087
22,872	27	24,911	662	27,449	382	1505	537	5985	546	12,221	929	17,242	1087
22,899	59	24,924	1220	27,483	487	1617	490	6007	546	12,231	815	17,307	996
22,946	602	24,930	1143	27,496	1204	1695	623	6302	602	12,232	833	17,313	1036
22,966	898	24,931	1079	27,516	610	1767	1098	6303	602	12,238	837	17,431	1040
22,967	76	24,935	780	27,539	982	1797	618	6428	559	12,270	863	17,536	1094
22,970	75	24,936	57	27,613	363	1842	374	6527	601	12,342	713	17,579	1151
22,986	943	24,995	1140	27,621	363	1867	1145	6549	709	12,358	1147	17,580	977
23,045	483	25,010	942	27,626	254	1887	483	6619	717	12,361	878	17,607	1040
23,066	333	25,032	613	27,630	249	1890	434	6718	652	12,541	1034	17,610	998
23,091	1108	25,033	613	27,738	1237	1975	434	6720	1232	12,627	950	17,661	1140
23,145	939	25,059	245	27,823	977	2032	1202	6728	899	12,647	814	17,712	1081
23,151	24	25,060	816	27,870	439	2062	982	6742	675	12,663	829	17,772	1020
23,166	112	25,075	677	27,889	500	2081	836	6775	606	12,727	986	17,866	1102
23,179	898	25,088	933	27,928	188	2102	780	6786	976	12,754	1037	17,957	1029
23,183	894	25,144	950	27,935	1201	2137	364	6846	1088	12,797	826	17,968	1029
23,188	898	25,248	1231	28,022	245	2187	609	6855	600	12,976	826	18,117	1041
23,189	26	25,277	451	28,033	319	2240	930	6891	660	13,090	898	18,152	1226
23,213	1091	25,321	116	28,057	377	2273	664	6945	1220	13,171	836	18,183	1044
23,230	264	25,369	184	28,103	324	2284	441	6972	1205	13,186	814	18,262	1021
23,259	929	25,388	252	28,184	1230	2291	1139	6975	618	13,302	982	18,291	1021
23,310	369	25,390	337	28,185	382	2343	495	7028	607	13,328	986	18,364	1080
23,327	832	25,393	254	28,212	1159	2358	448	7068	710	13,361	967	18,746	1094
23,333	1031	25,409	1086	28,225	265	2460	375	7172	899	13,451	871	18,890	1044
23,361	1220	25,464	980	28,245	254	2481	364	7204	655	13,471	1145	19,068	1100
23,392	931	25,480	1108	28,256	116	2485	539	7210	652	13,489	1152	19,140	1150
23,457	1150	25,481	1112	28,264	946	2541	483	7309	986	13,562	882	19,186	1202
23,472	385	25,541	1025	28,279	1094	2547	859	7313	750	13,689	878	19,924	1088
23,482	1092	25,546	910	28,342	1140	2655	1088	7383	620	13,713	903	20,106	1232
23,484	932	25,547	110	28,353	329	2680	713	7481	817	13,842	873	20,159	1150
23,492	19	25,555	604	28,379	1158	2681	713	7490	1161	14,003	947	20,277	1081
23,550	1153	25,582	264	28,399	259	2682	713	7560	1212	14,007	896	20,291	1108
23,563	934	25,611	1087	28,406	754	2683	713	7694	868	14,028	996	20,371	1141
23,607	1145	25,686	1028	28,464	1150	2684	713	7736	824	14,066	940	20,468	1150
23,616	1140	25,695	267	28,498	1140	2738	367	7766	607	14,075	867	20,797	1147
23,659	815	25,698	1205	28,508	713	2739	936	7795	1036	14,216	905	20,879	1147
23,669	815	25,763	483	28,518	441	2982	448	7895	619	14,372	879	20,880	1147
23,692	72	25,794	1031	28,525	1020	3165	483	7896	724	14,374	867	20,889	1154
23,703	944	25,853	1034	28,563	1025	3170	1104	7979	653	14,381	928	20,896	1225
23,722	911	25,868	1153	28,572	976	3235	444	7981	754	14,383	860	21,053	1158
23,746	1040	25,891	1211	28,585	1147	3253	950	8216	988	14,431	1215	21,101	1154
23,751	54	25,932	118	28,586	1232	3301	622	8233	719	14,434	895	21,204	1239
23,752	266	25,950	1094	28,593	976	3465	452	8311	816	14,445	977	21,300	1021
23,764	118	25,972	1088	28,630	1039	3490	1202	8365	1097	14,449	1040	21,318	1204
23,771	1113	25,986	902	28,682	750	3628	1150	8415	834	14,465	860	21,403	1223
23,772	1108	25,989	182	28,720	1238	3682	556	8433	659	14,482	879	21,452	1226
23,776	950	26,007	787	28,731	1148	3760	662	8461	676	14,483	879	21,766	1225
23,785	976	26,012	1049	28,733	1148	3769	442	8481	894	14,484	969	21,776	1204
23,786	1148	26,037	325	28,761	317	3781	601	8596	815	14,498	882	21,777	1232
23,821	374	26,089	559	28,780	666	3790	494	8859	824	14,621	1079	21,793	1212
23,843	54	26,115	1028	28,782	666	3855	622	8865	833	14,709	879	21,913	1223
23,848	65	26,132	980	28,790	823	3909	453	8993	860	14,718	896	22,090	1097
23,900	1139	26,148	1215	28,791	1201	3912	666	8994	660	14,752	894	22,092	1204
23,909	753	26,149	266	28,800	378	3913	611	9018	719	14,848	866	22,238	1226
23,918	370	26,150	500	28,805	549	3922	976	9033	660	14,966	947	22,395	1227
23,919	186	26,182	1143			4011	452	9038	725	14,971	977		
23,964	192	26,292	664			4130	490	9295	715	14,985	1220		
24,041	64	26,360	1039			4139	698	9311	820	15,057	1217		

ERRATA, 1904.

Vol. XXIII.	Page.	Column.	Line from Top.	Line from Bottom.	Corrigenda.
No. 1—Jan. 15	25	1	..	25	*In title, add name,* "Langbein" *before* "Zeits. f."
" "	7	1	..	31	*For* "qrs." *read* "grs." *Delete lines 26 to 24 from bottom, and substitute* "This escape was a small one, and although water, or water *plus* $H O_2$, gave practically the same result, they might not have done so if the escape had been high."
" "	7	2	41	..	*For* "the chambers were 100 ft. in length and 30 ft. high" *read* "the chambers were 105 ft. long, 25 ft. wide, and 20 ft. high."
No. 3—Feb. 15	107	1	45	..	*For* "neutral" *read* "natural."
No. 5—Mar. 15	261	2	..	2	*For* "0·1 per cent." *read* "5 per cent."
" "	220	2	..	8	*For* "included in the precipitate a sulphide" *read* "occluded in the precipitate some nitric peroxide."
" "	220	2	..	5	*Before* "If vitriol, &c." *insert* "In such a case."
No. 7—Apr. 15	357	..	..	..	*Table of Formulæ, under No. 11, for* "P. 7" *read* "F. 7" or "No. 7" above.
" "	358	..	Last 8 lines of paper		*For* "pages 21, 22" *read* "page 355, col. 2."
No. 8—Apr. 30	414	2	..	Bottom line; 15 lines up.	*For* "amylotic" *read* "amylolytic."
" "	421	1	25	..	
" "	422	2	7	..	
" "	416	1	..	Bottom line	The * (and corresponding footnote) should be after "phosphates." page 415, col. 2, line 5 from bottom.
" "	419	2	37	..	*For* "cæteribus" *read* "cæteris."
No. 9—May 16	494	2	..	5	*Transfer* "about" to follow the – sign; (a_D = about −4°).
" "	494	2	..	4	"v_D" *to read* "n_D."
" "	572	2	15	..	*In title,* "scandens" *to read* "scandens."
No. 12—June 30	659	1	..	30	*After* "Eng. Pat." *insert* "15,108."
" "	643—645	..	..	..	(See this J., 1904, 778, col. 2.)
" "	645	1	..	..	(See this J., 1904, 699, col. 1.)
No. 19—Oct. 15	934	1	..	4	*For* "hydroxylamine" *read* "dihydroxylamine."
" "	935	2	12	..	*In Table, col. 4 to right, bottom number,* "1067," *to read* "106·7.
" "	942	2	32	..	*After* "into" *insert* "one of."
" "	942	2	37	..	*After* "chloride" *insert,* "previously ground like the hard soap, in others of the series of disintegrators already referred to."
" "	942	2	39	..	*After* "carbonate" *delete* "(crystals)," *and for* "69 parts" *read* "26 parts."
" "	942	2	40	..	*Before* "anhydrous" *insert* "combined water, 43 parts;"
No. 20—Oct. 31	975	2	31	..	*For* "One could" *read* "One could not."
" "	975	2	35	..	*For* "or higher" *read* "of higher."
No. 24—Dec. 31	1179	2	..	18	*For* "up of" *read* "up to."
" "	1179	2	..	16	*For* "to" *read* "of."
" "	1179	2	..	3	*Delete* "as."
" "	1183	2	10	..	*Delete* "actually."
" "	1184	1	..	11	Put *semicolon after* "Nitric acid" *and delete comma after* "Nitrous acid."
" "	1198	1	37	..	*For* "their" *read* "other."
" "	1216	2	..	28	*For* "Deselles" *in title, read* "Deselle."

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Myers, Edgar C.; Journals to New Franklin, Mo., U.S.A

Neumann, Dr. Edgar D. M; Journals to 60, Chance Lane, W.C.

Quinan, W. R., (Journals) General Manager, De Bee Explosives Works, P.O. Box 24, Cape Town, Sou Africa, and (subscriptions) c/o De Beers Consolidat Mines, 15, St. Swithin's Lane, London, E.C.

Turner, Basil, l/o Castlereagh Street; 5, Moore Stree Sydney, N.S.W., Australia.

Underwood, G. R.; Journals to 4, Emerson Street, Pe body, Mass., U.S.A.

Whitehouse, Philip L., l/o 44; 10, Victoria Street, We Bromwich, Staffs.

Wilson, Gordon; Journals to c/o Laveaga Herms., Mine Animas, Pueblo Nuevo, Durango, Mexico, and (su scriptions) Benallan, Kirkintilloch, N.B.

Wright, Sidney B., l/o Melbourne; retain Journals.

CHANGES OF ADDRESS REQUIRED.

Remington, J. Percy, jun., l/o 417, Bourse Building, Philadelphia, Pa., U.S.A.
hearer, A., l/o 36, Demesne Road, Alexandra Park, Manchester.

Deaths.

Heriot, Jas., 18, Dumbiedykes Road, Edinburgh. Nov. 15.
Rae, Geo., Craigfoot, Milton of Campsie, N.B.
imeons, C., 70, Finsbury Pavement, London, E.C.
taempfli, Major W., Worblaufen, Bern, Switzerland.
Walker, E. Robinson, 18, St. Ann's Street, Manchester.

Newcastle Section.

Meeting held on Thursday, November 5th, 1903.

DR. J. T. DUNN IN THE CHAIR.

THE COMPOSITION OF MILK IN THE NORTH OF ENGLAND.—PART II.

BY S. H. COLLINS, F.I.C.

The first part of this paper, which was read before this ociety a year ago, and published in this Journal, 1902, 512, was merely introductory, and served to draw attention o the matter. As a result, considerable interest was aroused n the subject, and several farmers in the North of England ame forward and offered their herds to the College for xperimental purposes. The principal objects of these exeriments was to test milk under as practical conditions as ossible, and over as long a period as possible. Two herds vere selected, and examined once a fortnight. I have to hank the owners of the herds, Mr. McLaren and Mr. Iarshall, for the ready help they have given me on all ccasions. I know it has meant no little trouble on their art and on the part of their servants.

These experiments will serve to illustrate facts already hown by others, but perhaps not sufficiently realised, to how local variations from accepted standards; and I trust o show some new aspects of the question, and to suggest leas which I believe will be useful in future investigations. Droop-Richmond gives, as the average of 200,000 analyses ver many years, the composition of milk as 3·9 per cent. f fat and 9·0 per cent. of solids not fat. These figures are ommonly given in support of the "legal" standard of per cent. and 8.5 per cent. respectively. These figures ave, however, been derived from the milk of cows in the outh of England. There are plenty of analyses which rove that milk below the standard may be genuine; these xperiments will serve to confirm this fact, which is perhaps ot as well known as it should be. To show that milk elow the standard may be genuine is, however, only a first tep, and is of little use unless it is followed up by the ttempt to determine the degree of probability that milk elow the standard may be genuine. It is to this point hat I invite your attention this evening. The experiments re still in progress, and will probably continue for some time.

Sampling.—Samples of the milk of about a dozen cows vere taken, in one case twice a day, and in the other case hrice a day. In addition to the samples of the individual ows, samples of the mixed milk of the entire herd were aken. Samples were taken once a fortnight. As careful upervision by experienced persons is essential at this tage, a representative of the College was always present at he sampling, for which assistance I have to thank Dr. Potts, Iessrs. McLaren, Short, Swann, and Willis. The method f sampling adopted was always to pour the milk from one ail to another, and then to pour it into the sample bottle. n the case of the mixed milk of the herd, it was not always ossible to wait for all the milk to be mixed up together, s such a procedure would have interfered too much with he business; but all the milk was passed through a strainer nd cooler, and, as it ran out, small samples of the milk were aken and mixed up; from this mixture a sample was taken o represent the mixed milk of the whole herd.

Preserving.—As there was other work to be attended to besides this milk-testing, it was necessary to preserve the milk in such a way that the analysis could be made as time permitted. For this purpose a preservative had to be found that would not interfere with the determinations of specific gravity, fat, or total solids.

The following preservatives were made:—

(1) *For use in Cold Weather.*—A mixture of chloroform and ether of the specific gravity of 1·032. Of this, 1 c.c. was used to preserve 100 c.c. of milk.

(2) *For use in Hot Weather.*—A mixture of alcohol, chloroform, and formalin of the specific gravity of 1·032, and containing about 1 per cent. of pure formaldehyde. Of this, 1 c.c. was used for 100 c.c. of milk.

The reason of this double arrangement was to avoid the use of formalin as much as possible, this substance being supposed to hydrolyse the milk sugar and thereby increase the amount of total solids in the milk. In the small proportion used I could not find any evidence of such an action. The milk generally kept about two or three weeks. The specific gravity was not altered, and the correction for dilution was so very small that it made little difference to the amount of fat or total solids.

Analysis.—The specific gravity was taken sometimes with the lactometer, but mostly with the "Westphal" balance, both having been checked against the specific gravity bottle. All specific gravities are given corrected to $15\frac{1}{2}$° C., or 60° F. The fat was determined by the "Gerber" centrifugal method, constantly checked by the "Adams coil" and "Werner-Schmidt" methods. The solids not fat were found by calculation, using the formula $G/4 + F/5 + 0{\cdot}14$ = solids not fat. The total solids were frequently checked by direct determination, the difference between the calculated and found amounts of total solids being as a rule less than 0·1 per cent., although a few cases occurred with differences of 0·2 per cent.

My thanks are due to Messrs. Short and Swann for the greater part of the analytical routine work.

The Herds.—Herd No. 1 were all shorthorns of various ages and in various stages of lactation. They were milked three times a day—at 5 a.m., 1 p.m., and 6 p.m. Twelve cows were selected to represent the herd, samples being taken of the milk of the individual cows and of the mixed milk of the herd once a fortnight. The experiment started in January and terminated in March, there being six days in all when the cows were tested. Herd No. 2 were also all shorthorns of various ages and in various stages of lactation. They were only milked twice a day—at 5.30 a.m. and 4.30 p.m. For convenience the milk of one evening and the next morning was taken to represent the day's milk. 22 cows were selected, the first 12 or 13 on the list being tested once a fortnight, and the mixed sample of milk of the whole herd obtained at the same time. As the original cows went dry their place was taken by those further down the list. When cows came in to milk again they were tested again as soon as there was a vacant place for them. Records of temperature, weather, feeding, and many other matters of practical importance have also been kept.

For the sake of ready comprehension, all the analyses have been put into diagrammatic form as curves. To avoid the crossing of lines and yet keep the fat, solids not fat, and yield on one diagram, the scales of all three are different, but are given on the margins of each diagram. The most notable points on studying these curves are: (1) some cows are very regular, some are very erratic (Curves 3 and 8); (2) the fluctuations in the composition of the mixed milk (A) are as nothing to those of the erratic cows (8), but are nearly of the same order of magnitude as those of the regular cows (3); (3) the fluctuations in the amount of fat in the milk of the regular cows and in the mixed milk exhibit no regular rise and fall, giving no clue to the cause of the fluctuation; (4) the solids not fat of the milk of the regular cows and of the mixed milk shows a slight falling off during the period, which may be due to some fixed cause (temperature) (3 and A); (5) the greater part of these fluctuations does not depend upon any regular cause, but is due to the irregular behaviour of the cows; that is, it is "chance." To show the bearing of these results on the chance or probability of milk under the standard being genuine, the following statistical analysis is given :—

Statistical Analysis.

Herd No. 1.

Fat under 3 per cent.	on	15	out of	72	occasions in the	morning.
	„	0	„	71	„	noon.
	„	5	„	72	„	evening.
	„	20	„	215	„	day.
Solids not fat under 3½ per cent.	„	1	„	72	„	morning.
	„	0	„	71	„	noon.
	„	0	„	71	„	evening.
	„	1	„	214	„	day.

or, 21 tests out of 419 have been below standard, of which seven are due to cow No. 27, and five to cow No. 64.

The mixed milk of this head was never under the standard during the period of testing.

Herd No. 2.

Individual Cows.

Fat under 3 per cent.	on	5	out of	124	occasions in the	morning.
	„	11	„	123	„	evening.
Solids not fat under 8½ per cent.	„	16	„	122	„	morning.
	„	21	„	124	„	evening.

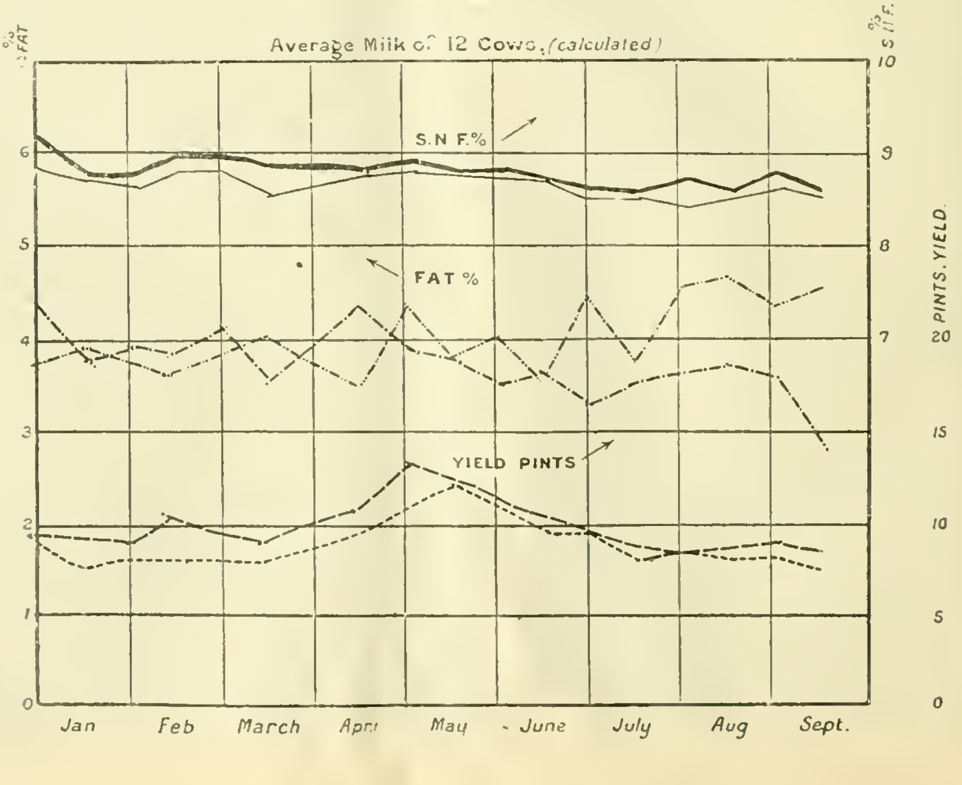
or, 53 out of 493 tests were below the standard in all, of which 16 are due to cow No. 12, 10 to cow No. 17, and six to cow No. 11. The mixed milk of this herd was never under the standard from January to June (inclusive). It is, however, only right to state that the mixed milk has been below the standard in some later tests that I hope to communicate at a later date. It will be noticed that while in herd No. 1 it is the fat that it is generally deficient, in herd No. 2 it is the solids not fat that are generally deficient.

North v. *South.*—If we add up all the results published in both parts of this communication we find that in 96 tests out of 984 the milk was below standard; that is, in nearly 10 per cent.

Ingle, in the Report of the Yorkshire College and in other publications, gives figures which show that he obtained about $3\frac{1}{2}$ per cent. of his tests below standard; and Droop Richmond, in a recent communication to the Society of Public Analysts, gives a case of what he evidently considers a very remarkably bad cow, which was below standard on $5\frac{1}{3}$ per cent. of the tests made. These figures suggest that there is some truth in the opinion that milk in the North of England is not as rich as that in the South, and cannot be judged by the same standard.

The probability of mixed Milk being below the Standard.—Once we have established the probabilities of cows giving milk of certain strengths, it becomes simply a case of an investigation of mathematical "probability" to find the probability of a herd of any number of cows giving milk below the standard. For if p be the probability that any sample of milk is below the standard, then the probability is that in a herd of two cows both will be below standard on p^2 occasions, and one cow only will be below standard on $2p\ (1-p)$ occasions, whilst on $(1-p)^2$ occasions both will be above the standard. It then remains to solve the statistical problem of the probability of a mixture of milk below and milk above the standard being below the standard. If we call this probability n, then the probability that the mixed milk of two cows is below standard is $p^2 + 2np\ (1-p)$, which is $2np + (1-2n)p^2$. As, however, p is a fraction, p^2 will always be small, and is likely to be less than the error of determining p and n, and may for the present be eliminated. From study of the times when milk occurs at each tenth per cent. I think that n may be provisionally taken at about $\frac{1}{4}$. As each cow has to satisfy two tests, and they are rarely both below the standard, the probability is more than 10 per cent. and less than 20 per cent., and nearer the latter than the former—say 16 per cent. Then the probability of the mixed milk of two cows being below standard is $2np = 8$ per cent., that of four cows 4 per cent., and that of eight cows 2 per cent. These calculations are given rather as a demonstration of the value of such methods of investigation than as any attempt to finally determine the probability of cows in the North of England giving milk below the standard. No account has been taken of the fact that the yields of the cows need not be the same, nor that there will be some causes that will tend to make all the cows of a herd give lower-quality milk than

A.

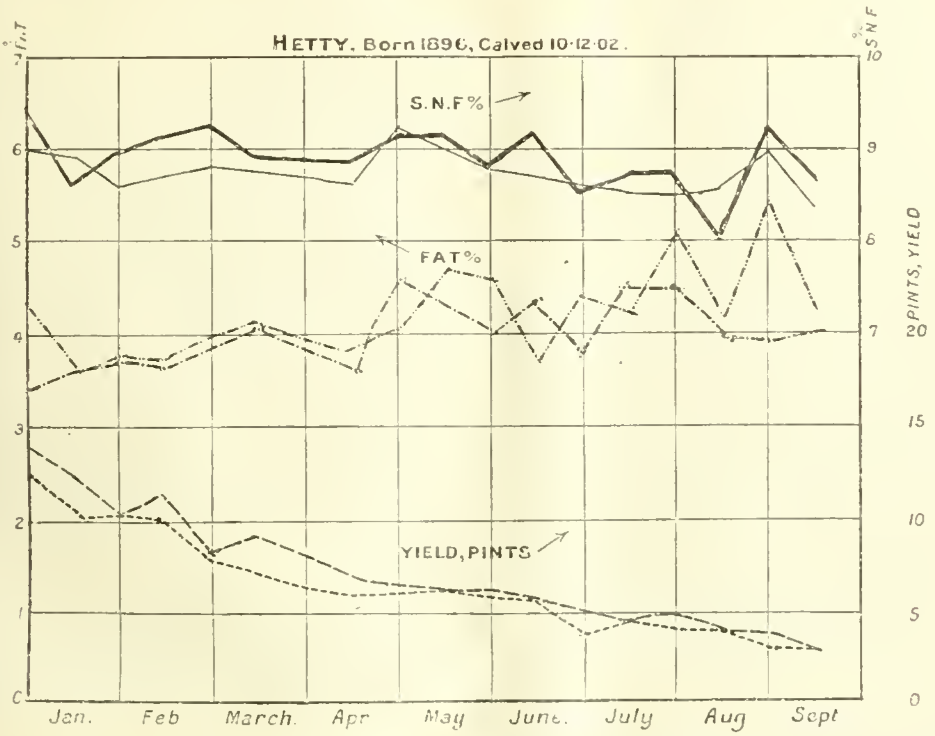


hey would do under average circumstances. In the ormer case, if low yields are accompanied by low per-entages, then the probability of milk being below standard vill be less, and *vice versa*. In the latter case the probability vill be increased.

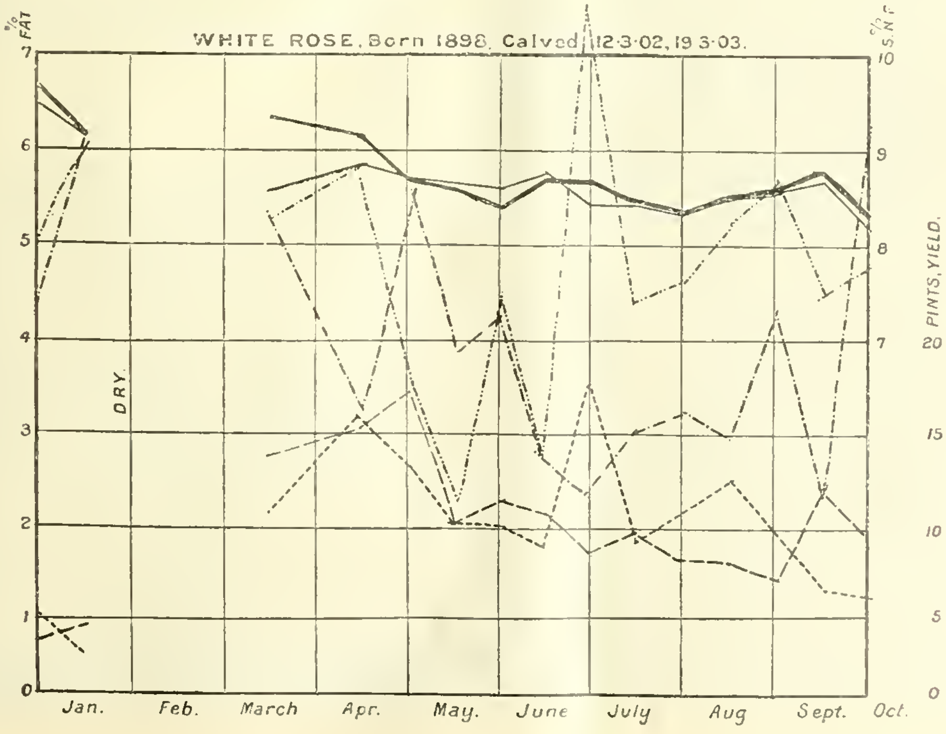
Explanatory Notes to Curves.

At the paper as read, 35 slides of curves were exhibited; the following have been modified so as to be representative of the different types.

3.



8.



3. Represents a regular cow.
8. Represents an irregular cow.
A. Represents the mixed milk calculated from the analyses of the milk of individual cows.

━━━━ solids not fat per cent., morning.
──── „ „ „ evening.
— · — fat per cent., morning.
– · · – „ evening.
— — — yield in pints, morning.
- - - - - „ „ evening.

Of 26 cows tested regularly, 7 give curves resembling No. 3, 10 resembling No. 8, and the remainder, 9, being intermediate.

The most regular cows give milk which, for the greater part of their time, fluctuates less in composition and amount than the mixed milk of 12 cows.

Discussion.

Prof. **Gilchrist** said that the first thing that struck him in connection with the Offerton diagrams was the remarkably low standards for the morning's milk; it seemed as if, when it was necessary to milk three times a day, there was a very great risk of that milk coming under the standard. He was also struck with the remarkably high midday standard. Perhaps the point that came out strongest was the difference in the qualities of milk in the North compared with the South of England. This was certainly not because of the feeding, but was more probably due to the changeability of the weather. Tests made daily with one cow at Cockle Park showed that when the cow was out all night and there was a touch of frost, the quality of the milk next morning was very much lower. He was rather struck with the Gothenburg system. Twice a month (or week; he was not sure which) samples of milk were obtained from the dairymen, and the percentages of fat published in the daily papers, the milks being classified as follows:—3·5 per cent., very good; 3 per cent., good; under 3 per cent., poor.

Mr. **Marshall** thought the analysis of the mixed milk of herds was of much more importance than the analysis of that of single cows, because it had been sufficiently proved that individual cows were most erratic, whereas the mixed milk of a herd as a rule did not vary so much. This year most of his herd had been young cows, and the quality of the milk had been better than usual. During the spring of last year he had been living in perpetual dread of the inspector; his milk was extremely poor, and, do what he would, he could not raise the quality up to the standard. Poor feeding was not the cause of it, because at that time he was feeding them extravagantly, each cow getting a stone of concentrated food per day. As soon as the cows were put out to grass, however, both quantity and quality went up. This is quite in accordance with our experience, but several South-country witnesses before the Standard Committee recommended a lower standard during early grass time. With regard to the difference of the milk in the North as compared with that in the South of England, he could not trace any relation between geology and the quality of the milk. We had still a great deal to learn on these points, and he would like to see some scheme formulated for their further investigation.

Mr. **Smith** said that during last year he had examined between four and five hundred samples of milk, and about 21 per cent. of these were below the standard either in fat or in solids not fat; this is much higher than Mr. Collins' percentage, but there was no doubt that some of the samples had been tampered with. On the whole he agreed with Mr. Collins that the quality of the milk was lower in the North than in the South. In an analysis of 420 samples the percentage of fat was about 3·46, and the solids about 8·88, but as some of these samples were adulterated, these figures might be increased by, say, 20 per cent. Solids not fat very rarely fell below the standard; when they did he was generally able to trace it to irregular feeding. It was almost impossible for anyone to say with absolute certainty that milk had been adulterated simply because it fell below the standard. On one occasion he went out to a farm where there were 42 cows; the percentage of fat in the milk of the herd was under 2½. He did not know the reason, but he believed Prof. Gilchrist considered excessive feeding produced this result; certainly, when the amount of food was reduced the quality of the milk increased very considerably. In another case the reduction of the amount of food immediately increased the percentage of fat from 2·8 to 3, and the substitution of 1 lb. of cake for 7 to 8 lb. a day raised the proportion of fat to over 3 per cent.

Mr. **Garrett** thought that the figures given suggested that as a rule the cow that gave poor milk also gave a poor yield, and would like to know if this has been proved.

Dr. **Potts** also noticed that the percentage of fat seemed to be increased when the cow gave an increased yield, particularly in the Offerton herd. At the second sampling, on the 24th January, the yield and the fat were both high, whereas, at the third and fourth samplings, the yield and the fat were both low. Some two years ago there was a very extensive series of investigations carried out by the South-Eastern Agricultural College, Wye; the milk of about six cows, and also the mixed milk of the herd, was analysed morning and evening; a careful record was also made of the food, and the only factor which was found to alter the quality of the milk was the temperature. Referring to Mr. Marshall's suggestion that further experiments should be devoted to the effect of food on milk, nine-tenths of all milk investigations had been conducted with that end in view. The Americans had done much work in that direction, and had found that food had no effect on the quality of the milk, but that it increased the quantity. It was usually assumed that solids not fat were pretty constant, but one of the outstanding features of last summer's milk was that it was particularly poor in this respect.

Mr. **Collins** replied that he thought the small yields were generally due to the late period of lactation. He did not think that the figures showed that when the yield was high it was therefore rich, or *vice versa*. As to the effect of temperature on the composition of milk, Mr. Dymond had done some work on the subject, and had come to the conclusion that there was no connection between weather and the composition of milk.

The **Chairman** said that researches like these must ultimately lead to important results, and he hoped that Mr. Collins would continue to carry on his experiments, and from time to time acquaint the Section with the result.

Nottingham Section.

Meeting held at Nottingham, on Wednesday, Dec. 16th, 1903.

PROF. F. STANLEY KIPPING, F.R.S., IN THE CHAIR.

EXAMINATION OF METHODS EMPLOYED IN ESTIMATING THE TOTAL ACIDITY OF GASES ESCAPING FROM THE CHAMBER PROCESS FOR THE MANUFACTURE OF SULPHURIC ACID.

BY H. J. WATSON.

(This Journal, 1903, 1279—1284.)

Discussion.

Mr. **Jas. Kay Hill** wrote as follows:—The sulphazotised compound referred to in Mr. Watson's paper is probably formed in the Gay Lussac tower when the supply of oxygen is deficient, and in the chambers when there is a deficiency of oxygen and steam, but with a properly regulated air supply it should not be formed in measurable quantity. We have here, probably, the last of the mysterious causes of loss of nitric and diminished sulphuric acid production. Some may possibly be inclined to attribute its occurrence to deficient chamber space; but I think that even with the highest possible consumption of sulphur per cubic foot of space, there should be no appreciable loss from this source if sufficient draught be maintained to ensure the requisite proportion of oxygen in the chambers. The results of the experiments described, taken altogether, seem to indicate the absolute necessity of regularly testing the exit gases for oxygen, and of using the new absorbents to detect this sulphazotised compound, which, so long as it remains unoxidised, seems capable of passing unabsorbed, through any number of wash bottles containing water, sulphuric acid, or caustic soda, and is not completely absorbed even by such an oxidising agent as non-alkaline hydrogen peroxide. The behaviour of the compound towards caustic soda in solution seems to prove that it is not really an acid at all, properly speaking, being quite devoid of acid properties until decomposed by oxidation, and this is doubtless why it has so long escaped observation.

Mr. F. J. R. **Carulla** said that sulphuric acid manufacturers were allowed to let gases into the atmosphere providing they did not contain over 4 grs. of acid per cb. ft. There were variations, as apparently the escape was at one time 0·089 gr. per cb. ft. and at another 2·64 per cb. ft. The work was done as rapidly as possible, Mr. Watson making in all eight experiments, each occupying 40 minutes, or 5 hours and 20 minutes in all. In that time it was quite possible for such changes to take place in the working of the chambers as to render his figures not comparable. To compare the experiments they should be done almost simultaneously and not one after the other. Then again they ought to know something about the size of the chambers, because very large chambers would not get into disorder so rapidly as small chambers. He was not questioning the accuracy of the facts as to the absorbing mediums; he was only questioning whether the very large differences shown were to be relied upon.

He had that morning absorbed four escapes with the following results:—

—	Water.	H_2O_2.	Absorption.
	c.c.	c.c.	grs. per cb. ft.
1	200	0	0·367
2	200	5	0·432
3	200	0	0·432
4	200	5	0·367

In the last case the escape was a very small one, and although water or water plus H_2O_2 might be the same thing, the escape might be small, and yet not be high. Mr. Watson in his paper said "In February 1903 I made comparative bellows tests with these two absorbents, and always found that the alkaline hydrogen peroxide gave a higher result than neutral hydrogen peroxide, the difference varying in amount from 0·5 with ordinary working conditions to 3 grains of sulphuric anhydride per cubic foot at a period of disorganisation." Now the same thing might happen with water and with water plus H_2O_2. Personally he would prefer the escape to be a sulphurous one rather than lose nitre. The difference in values was immense.

Dr. R. M. **Caven** remarked that, whilst the interaction of sulphuric acid and nitrous fumes resulted in the formation of nitrosulphonic acid, when nitrous and sulphurous acids interacted under certain circumstances, hydroxylamine disulphonic acid, $N(SO_3H)_2OH$, and nitrilosulphonic acid, $N(SO_3H)_3$, were produced. Low temperature and the presence of alkali were generally supposed necessary for the production of these compounds, but if it were possible for them to be formed in vitriol chambers or the Gay Lussac Tower, their hydrolytic reduction in presence of nitrous acid might result in the evolution of nitrous oxide or nitrogen. What evidence was there for the existence of these sulphazotised bodies? It was difficult to understand how such a body could pass unabsorbed through alkaline hydrogen peroxide solution.

Mr. H. J. **Watson**, in reply, said that special precautions were not taken to exclude carbon dioxide before titration. The sodium hydroxide solution, 10 c.c. of N/2 NaOH diluted with 200 c.c. of water, in the experiments performed, was so dilute that little absorption of CO_2 could take place. In order to see how far this was the case he had that day fitted four flasks exactly as in his former experiments. In No. 1 was 200 c.c. H_2O + 5 c.c H_2O_2; in No. 2, 200 c.c. H_2O + 10 c.c. N/2 NaOH; in No. 3, 200 c.c. H_2O + 10 c.c. N/2 NaOH, and in No. 4, 100 c.c. H_2O + 100 c.c. saturated clear solution of barium hydroxide. The four flasks were connected to a filter pump, the pump started and the aspiration of air through the four flasks regulated to, as near as could be judged, the same rate as the chamber escape gases were drawn through in other experiments. The pump was allowed to work for 40 minutes and then stopped. A milkiness was produced in No. 4; No. 1 was found to be neutral, and then No. 3 and No. 4 titrated with N/2 acid without any special precautions regarding carbon dioxide. They each required 9·75 c.c. of N/2 acid, but when boiled the other 0·25 c.c. was required, so that the combined acidity in the two flasks was equal to 0·5 c.c. of N/2 NaOH (0·154 grain of SO_3) on an approximate cubic foot—not a very large acidity. It might be suggested that the increased acidity in vessels containing alkali was due to CO_2. The experiments themselves, however, did not seem to indicate this. In the case of experiment 20, the combined acidity of 5 and 6 in an alkali solution was equal to 0·18 gr. of SO_3 per cb. ft., and the total acidity of 7 and 8 equal to 0·36 gr. of SO_3 per cb. ft. It was hardly possible that the increase in 7 and 8 could be due to CO_2 following after alkali in 5 and 6, but without hydrogen peroxide present. Nitrous acid was proved to be present in experiment 17, and the presence of more active acid gases would probably retard the action of carbon dioxide. With regard solution of H_2O_2 and Na NO_2 in the experiments performed the solutions were exactly neutral.

The chambers were 100 feet in length and 30 feet high. There were three in the set and one set of burners. He was inclined to agree with Mr. Carulla in the matter of the escape of sulphur and nitre. With regard to the theoretical points raised by Dr. Caven, he had not had time to go into them, and he was not at all sure what the compound was. That there was some compound present, and that it was decomposed by water, was shown afterwards. It was to some extent absorbed in alkali, but not altogether. When experiment 21 was performed they were using a very high amount of nitre: 31 lb. to the ton of stone. Calculating the difference from the result of the experiment, the waste came out almost too high, *viz.*, 56 per cent., which was equal to 17½ lb. per ton. When they tried to work with 13½ lb. the escape was very high.

ERRATUM.

EXAMINATION OF METHODS EMPLOYED IN ESTIMATING THE TOTAL ACIDITY OF GASES ESCAPING FROM THE CHAMBER PROCESS FOR THE MANUFACTURE OF SULPHURIC ACID.

BY R. FORBES CARPENTER AND ERNEST LINDER.

(This Journal, 1902, 1490—1508.)

For "metaphenylene diamine" read "metaphenylene diamine hydrochloride" throughout, as in Table VIII. This indicator has an acid reaction.

Yorkshire Section.

Meeting held on Monday, December 14th, 1903.

MR. JAS. E. BEDFORD IN THE CHAIR.

SOME RECENT METHODS OF TECHNICAL WATER ANALYSIS.

BY PROF. H. R. PROCTER.

The analysis of water for technical purposes usually only extends to its mineral constituents, the traces of organic impurity which are important in potable waters, having but little effect on most chemical and technical uses. Bacteriological examination has probably received far too little attention from the technical chemist, since there are many manufactures in which the presence of organised ferments is of an importance only second to that of their existence in drinking water; but on this point I do not intend to touch. The "hardness" of water is, on the whole, of the greatest manufacturing moment, but in my opinion has been considered far too exclusively from the point of view of the soap user, which often differs widely from that of other chemists, and although, viewed merely as an empirical method for determining the quantity of soap likely to be destroyed by a given water, the soap-test has its practical value, there are other and easier ways of learning with so much greater exactitude, what the actual qualitative and quantitative character of the hardness is, that even for the soap-user I believe, with increasing knowledge, this information will come to be of greater value than any merely empirical test. If no other fault existed in the soap-test than that it became practically useless in the presence of much magnesia, it would be sufficient to condemn it for general purposes, but, when the somewhat indefinite character of the reagent, and the still more indefinite character of the reaction is considered, it becomes unnecessary to labour the subject. It is now possible, by simple volumetric methods, and with a high degree of accuracy, to determine not merely temporary and permanent hardness, but the actual quantities of lime, magnesia, iron, carbonic and sulphuric acids, and chlorine contained in a water, and with this information, the effect of the water on any chemical reaction may in most cases be completely foretold. It is because I think that some of these methods are not so familiar to technical chemists as they deserve to be, that I venture to bring forward matter which is not at all original, and which must be familiar to many. The only points on which I may be able to claim the merit of novelty are observations on some of the sources of error which become important in working with such very dilute solutions, and suggestions as to how they may be avoided. In this connection it may be pointed out that a water with "total hardness" equal to 50 parts of calcium carbonate per 100,000 is a very hard one, but looked at as a volumetric solution it is only centinormal, and must be determined with an accuracy which should reach 1/50th of its strength. To do this successfully involves many precautions which are quite unnecessary in the use of normal solutions.

So far as I am aware, the credit of having first introduced a practical and scientific method of hardness determination belongs to Mr. Hehner, who titrates the temporary or bicarbonate hardness with N/10 HCl, using Methyl Orange as an indicator, which is practically insensitive to carbonic acid. The method gives very exact results if certain precautions are taken. Methyl Orange is the sodium salt of a colour acid of moderate strength, and the change from the yellow salt condition to the red colour of the free acid marks the end point, which is sharp and exact when working with strong mineral acids, and with normal solutions. Even in this case it is desirable to use the smallest possible amount of the indicator, but, in working with N/10 solutions, the amount of acid required to completely decompose the colour salt becomes very perceptible, and the change from yellow to red is not instantaneous, but passes through orange to pink with the consumption of an appreciable amount of acid. Thus it was found that, using a 10 grm. per litre solution of the indicator in 25 c.c. of water freed from carbonic acid by previous boiling, the following quantities of N/10 HCl were required to produce a clear pink:—8 drops of methyl-orange solution = 1·5 c.c., 4 drops = 0·5 c.c., 2 drops = 0·5 c.c. As even 0·5 c.c. in titrating 100 c.c. of water would correspond to 2·5 parts of hardness per 100,000 and there is always a question as to what particular colour corresponds to the neutral point, the following procedure may be recommended. To 100 c.c. of distilled water, one drop, or some other definite quantity of the indicator is added, and titrated to orange, or to the tint to the change of which the eye of the individual operator is most sensitive. The water of which the hardness is to be determined is similarly titrated with the same quantity of indicator, and in a similar beaker, until it exactly matches the distilled water, and from the amount of acid so used the quantity is deducted as a correction which was required to produce the same colour change with distilled water only. The results so obtained accurately correspond with those got by using alizarin as an indicator in boiling solution though in the latter method the end reaction is sharper. It may be noted that Methyl Orange is not absolutely unaffected by carbonic acid, a somewhat crocus-yellow being attained instead of the lemon yellow reached with pure boiled water, but the difference is insufficient to interfere with its satisfactory use as an indicator.

Mr. Hehner's method for the determination of permanent hardness is less satisfactory than the foregoing. It consists in evaporating 100 c.c. of the water to dryness with a known excess, say 20 c.c., of N/10 sodium carbonate solution, taking up the soluble matter with cold distilled water, filtering off the precipitated calcium carbonate and magnesia on a small filter, washing the precipitate with cold water, and titrating back the excess of sodium carbonate in the filtrate with Methyl Orange or rosolic acid as indicator. With lime-hardness only, and with the precautions above described, the method may be pronounced fairly satisfactory; with magnesia, it is well not merely to evaporate to dryness but to slightly heat the residue to thoroughly decompose any magnesium carbonate present, and even then, the washing should not be excessive, as calcium carbonate is soluble to the extent of 3 parts per 100,000, and magnesia to about 2·5 parts. A more accurate, as well as a more rapid method is to employ a fair excess of sodium carbonate, and to make up the solution to a known volume, say 100 c.c., and pipette off an aliquot part for titration, as the presence of excess of sodium carbonate materially reduces the solubility both of calcium and magnesium carbonates. Both these methods, however, should be superseded, where really accurate work is required, by those introduced by Pfeifer and Wartha* (Zeits. angew. Chem., 1902, 198). That for the determination of temporary hardness is identical with that of Hehner, except that, in place of Methyl Orange, a drop of a mixture of about 1 grm. of the purest alizarin paste in 200 c.c. of distilled water is employed. This indicator is surprisingly sensitive; even more so I think than phenolphthalein, but as it is unfortunately affected by carbon dioxide, it is necessary to complete the titration at a boiling temperature. The change is from violet in alkaline solution (perhaps slightly varying in shade with the nature of the particular base present) to a perfectly clear pale lemon-yellow when neutral or acid. The titration of the water should be done with N/10 HCl or H_2SO_4 in a silver, platinum, or hard porcelain basin. The acid should be added in the cold till the violet shade gives place to a clean yellow, and the liquid then brought to a boil, when, with the escape of carbonic acid, the violet colour will return, and should at once be destroyed by the addition of another drop of the acid, and so on, until no further change of colour takes place. It is undesirable to boil the indicator long, especially in an alkaline condition, as a violet deposit is

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* Prof. Lunge states, in a private letter, that the use of alizarin for this purpose was originated in the laboratory of the Zurich Polytechnicum by Weithi.

formed on the sides of the basin, presumably of calcium and magnesium alizarates, which can only be dissolved by excess of acid, and is thus apt to cause perceptible errors. In place of titrating to exact neutrality, the acid may be added in very small excess, and the whole of the liberated carbon dioxide boiled off at once, and the solution then brought back to neutrality by N/10 NaOH, the solution boiled for a moment, and the titration completed. The results in either case are exact, a fraction of a drop of alkali changing the clear lemon-colour to a dirty yellow. If 100 c.c. of water are used, multiplication of the c.c. of acid by 5 gives the temporary hardness in parts of $CaCO_3$ per 100,000. The boiling must in no case take place in an ordinary glass beaker or flask, as an amount of alkali is dissolved which may lead to serious inaccuracy. Even hard Jena glass is not free from this effect, though the amount dissolved is so small that for most practical purposes it may be neglected. The following experiment will illustrate the point. 100 c.c. of distilled water boiled for an hour (with additions to maintain the volume in a Berlin porcelain basin showed no alkalinity or colour-change with alizarin; in a Jena flask a perceptible change of colour was visible, but pure yellow was restored with one drop of N/10 acid, while when boiled in an ordinary Bohemian flask, 0·4 c.c. of acid was consumed, and if the neutralised liquid were boiled further it again became alkaline, and further additions of acid were required, so that no coincident results could be obtained. With the precautions named, the results with a known solution of hydric calcic carbonate containing only 5·5 parts of temporary hardness, and whether titrated alone or with additions of magnesium sulphate, were accurate within one part in 100,000, and experiments with other quantities were equally satisfactory.

In the determination of permanent hardness, Pfeifer and Wartha, in addition to the use of alizarin as indicator, have introduced the important improvement of replacing the sodium carbonate of Hehner's method by a mixture of equal parts of N/10 sodium carbonate and hydroxide solutions. While, as has been already explained, sodium carbonate perfectly precipitates calcium salts as carbonates on merely boiling, it becomes necessary to evaporate to dryness and to heat whenever any magnesium salt is present, in order to convert magnesium carbonate into oxide, since magnesium carbonate is not sufficiently insoluble. In presence of sodium hydroxide, however, the magnesium carbonate is at once converted into magnesium hydroxide, and perfectly efficient precipitation is obtained by merely boiling for some time with sufficient excess of the reagent. A good excess, say 50 per cent. or more, is essential, not only because it is impossible to say before analysis what proportion of sodium carbonate and what of caustic will be required, but because the presence of the CO_3 ions of the sodium carbonate in the solution greatly lessens the solubility of the calcium carbonate, and similarly the OH ions of the sodium hydroxide lessen that of the magnesium hydroxide. Unless the water is extremely hard, 50 c.c. of the N/10 mixed solution to 200 c.c. of water is a convenient and sufficient quantity. The mixture may be boiled until reduced within 200 c.c. in a platinum or porcelain basin, or, more conveniently, and with no material loss of accuracy, in a 300 c.c. Jena flask, but on no account in ordinary Bohemian glass. Even the Jena flask will become perceptibly etched at the water line if used repeatedly. The solution after cooling, is made up to 200 c.c. with distilled water in a gauged flask, and allowed to stand till the precipitated bases have settled, and 100 c.c. is pipetted or siphoned off and titrated. As the quantity named corresponds to 100 c.c. of the original water, and 25 c.c. of N/10 alkali, the difference between the acid actually used and 25 c.c. will correspond to the amount of alkali neutralised by the acids of the permanent hardness, and multiplied by 5 will give the latter in terms of milligrammes per 100,000 calculated as calcium carbonate. The temporary hardness will also be precipitated; but, containing no fixed acids, will not interfere. Pfeifer employs the water which has been neutralised in the titration of temporary hardness, in place of the original water. In this case the result obtained will represent total hardness, from which the permanent hardness is obtained by deducting the temporary. In place of allowing the precipitate to settle, the solution may be filtered through a small filter, which is carefully washed with the solution, of which the first 50 c.c. or so is rejected, as filters are rarely absolutely free from acidity or alkalinity, and even if at first perfectly neutral, easily absorb acids or ammonia from the laboratory air, unless very carefully protected. Many irregularities occurred in the determinations until this source of error was detected. 15 cm. filters of three different makes were macerated with distilled hot water, and proved in all cases alkaline to Methyl Orange and acid to phenolphthalein, the difference between the two indicators, + or −, amounting in each case to about 0·75 c.c. of N/10 solution. A case must now be considered which is not very infrequent in Yorkshire waters; it occasionally happens that in the determination of permanent hardness, a larger quantity of acid is required to neutralise the mixture than corresponds to the volume of N/10 alkali which has been added, and that therefore the permanent hardness would appear as a minus quantity. This somewhat puzzling result is due to the presence of sodium carbonate in the original water, which in this case can have no permanent hardness other than that due to the solubility of calcium carbonate, which cannot be removed by softening, but which is not reckoned in the above methods of analysis, though it is counted in the soap test. Where sodium carbonate is thus found, a proportionate amount must be deducted from the temporary hardness. If the total hardness after neutralisation is determined after Pfeifer's method, the presence of sodium carbonate will be indicated by the total hardness coming out as less than the temporary, the difference being obviously the alkalinity due to the soda; each part of hardness corresponding to 1·06 part of sodium carbonate. Since in the ordinary methods of water softening, lime is precipitated as carbonate, but magnesia as oxide, with the consumption of a double quantity of caustic lime or caustic alkali, it is impossible from hardness-determinations alone to calculate the materials required for softening, or the actual weights of the bases titrated, so long as it is uncertain whether or in what proportion magnesia is present. Pfeifer determines this in the following manner:—100 c.c. of the water is neutralised with N/10 acid in presence of alizarin, in boiling solution, exactly as in the determination of temporary hardness, which may be combined with that of magnesia. A known quantity of clear limewater (25 or 50 c.c.) which should be at least 50 per cent. in excess of that required for precipitating the magnesia present, is measured into a 200 c.c. flask, the hot neutralised solution is rinsed in with boiling distilled water free from carbonic acid, and made up with the latter to 5 c.c. above the mark to allow of contraction in cooling; the flask is tightly corked or stoppered, and well shaken to mix, for which purpose the neck above the mark must be a long one, and set aside to cool and settle. Though not essential, it probably increases the completeness of the precipitation if the corked flask is heated for half an hour or so on the water-bath. I prefer to allow sufficient time for the liquid to completely clear, and to pipette off 100 c.c. to titrate back with N/10 acid, which may be done cold with phenolphthalein, or hot with alizarin with equal accuracy. Pfeifer filters, but in this case the strength of the limewater must be determined by a blank experiment conducted in exactly the same way with distilled water; and it is better to reject the first 50 c.c. in each case to avoid error from want of neutrality of the filter-paper, and great care must be taken to filter rapidly, and to avoid possibilities of carbonation by the atmosphere, for which purpose a suction filter with a perforated porcelain disc, covered with a neatly-fitted disc of filter-paper answers well. If, on the other hand, the liquid is settled and pipetted, the risk of carbonation is so small that an equal quantity of the same limewater may be measured direct, and titrated, using the same indicator as has been employed for the water, phenolphthalein in the cold being on the whole preferable. Deducting the N/10 acid required for the mixture of limewater and water from that employed for the limewater alone, and multiplying the difference by five, gives the hardness due to magnesia in terms of milligrammes of calcium carbonate per 100,000, from which actual Mg may be reckoned by multiplying by 0·24; or MgO multiplying by 0·4. Carefully conducted, the method is extremely exact, its accuracy being quite equal to that of the determination of hardness, and probably superior to that of any gravimetric method for such minute quantities. The theory of the process is that, while calcium hydrate will precipitate magnesia, it has no action on lime salts; and a good excess of lime serves not only to quicken the reaction, but to diminish the solubility of the magnesia. If iron is present it will of course be reckoned with the magnesia, and should be determined colorimetrically with thiocyanate (also a process of great accuracy for small quantities), and deducted. It may be assumed that it is present in the ferric state, and that therefore 0·24 of Mg corresponds to 0·3733 of Fe. Aluminium, if present, would behave like iron, any traces of alumina dissolved by lime having no effect (on phenolphthalein at least), but it is rare that more than traces of alumina exist in natural waters, though it would have to be reckoned with in river-waters receiving manufacturing effluents, and its estimation would not be particularly easy. Possibly a colorimetric method with alcoholic extract of logwood or some other mordant dyestuff might be devised where the water was required for dyeing, but it is not likely that it would introduce any material error into water-softening calculations, and it would be removed with the other impurities. Having determined the magnesia, or, more strictly, the acid with which it and any other bases are combined which are precipitable by lime, it becomes possible to calculate the calcium present in the water, by deducting the magnesia-hardness from the total hardness, and calculating the remainder into Ca by multiplication by 0·4. The carbon dioxide present as hydric carbonate is given in parts per 100,000 by multiplication of the temporary hardness by 0·88 for CO_2 or 1·2 for CO_3. When the proportion of hardness due to magnesia is known, it is possible to calculate the quantities of lime and sodium carbonate required for softening, since magnesium salts, as has been stated, cannot be satisfactorily removed as carbonates, but must be converted into hydroxides by lime or some other caustic alkali; and this applies to the permanent hardness which is converted into carbonate by sodium carbonate, as well as to the bicarbonate reduced to carbonate by lime. Thus each equivalent of magnesia present requires an additional equivalent of lime beyond that required by the corresponding calcium salt. Pfeifer gives a formula for this purpose, calculated for German degrees of hardness, which are reckoned in parts per 100,000 of CaO instead of parts of $CaCO_3$, as is customary in France and England. I have, therefore, taken the liberty of transposing it into terms of parts of $CaCO_3$ per 100,000. *Ht* in the formula signifies temporary, and *Hp* permanent hardness, and *Hm* hardness due to magnesia, whether temporary or permanent. The quantities given are in milligrammes per litre, grammes per cubic metre, or lb. per 100,000 gallons of the water to be treated. $5{\cdot}6\,(Ht + Hm)$ = lime (CaO) required; $10{\cdot}6\,Hp$ = dry sodium carbonate; or $28{\cdot}6\,Hp$ = soda crystals ($Na_2CO_3 . 10H_2O$). If only temporary hardness is to be softened by liming only, the quantity required is $5{\cdot}6\,(Ht + Hm - Hp)$ if *Hm* is larger than *Hp*, but if not, only the temporary hardness need be taken in account. Finally, for softening with sodium hydroxide and sodium carbonate only, which is sometimes convenient for small boiler installations, we have $8\,(Ht + Hm)$ = NaOH required; $10{\cdot}6\,Hp - (Ht + Hm)$ = Na_2CO_3 required. Consequently, if the water has less permanent hardness than the sum of the temporary and magnesia hardness, it cannot be softened completely in this way without leaving excess of sodium carbonate in the water.

Some waters contain large quantities of dissolved free carbon dioxide in addition to the "half-combined" present as temporary hardness, and though this is not included in any hardness determination, it, of course, combines with and renders useless an equivalent quantity of the lime added for softening, and must, therefore, be taken into account in reckoning the lime required. The free CO_2 is easily estimated by a method, I believe, due to Archbutt, though I have been unable to find its original publication. 100 c.c. of the water is titrated slowly with N/10 solution of Na_2CO_3 and phenolphthalein, till a tinge of permanent pink is produced, when the number of c.c. used, multiplied by 2·2, will give the parts of CO_2 per 100,000, or by while multiplication by 2·8 will give the weight of lime required to remove it. Of course, such a determination is of no use unless there is some security that the sample of water really represents the average, and has not lost carbonic acid by exposure. The reaction depends on the fact that sodium bicarbonate is neutral to phenolphthalein, while the normal carbonate is alkaline. It must be remembered that the theoretical quantity of precipitants does not always give the best practical results, owing to difficulties of settling and filtration, and in some cases it is necessary to be content with less than the theoretical softening (see Archbutt and Deeley, this Journal, 1891, 511).

It is sometimes necessary to determine not only the bases, but the acids present in a technical water. Several colorimetrical methods exist for the determination of the traces of nitric and nitrous acid sometimes present; chlorine is of course easily determined with silver nitrate with chromate as indicator; and for sulphates the recent volumetric method of Wolf-Muller (Ber., 1902, 1587) with benzidine hydrochloride gives excellent results. This method depends on the fact that benzidine sulphate is very slightly soluble: and especially so in solutions containing excess of benzidine hydrochloride. Benzidine is so weak a base that the hydrochloric acid combined with it can be titrated in presence of phenolphthalein as if it were free, while the sulphate, being insoluble can be filtered off, and calculated from the loss of acidity. I have been making some experiments with this method, and shall be glad at a future date to give some further particulars of the practical working of it, if these would be of interest to the Section.

DISCUSSION.

Mr. F. W. **RICHARDSON** said he thought the paper was a very interesting one for members of the Section, especially in regard to boiler-feed waters, which question assumed great importance in the district. He referred members to a paper he had found very useful and which was published a few years ago in the *Dyers and Colourists Journal* on the analysis of waters, including the estimation of calcium. Ammonium oxalate was added to the water in excess, and the excess estimated in the filtrate by means of standard potassium permanganate solution. As the quantity of water sent for analysis was sometimes very small, he chose to use gravimetric rather than volumetric processes, as being more accurate when working on small quantities of water. As regards Methyl Orange, he had also found it necessary to test each different sample of the dye in distilled water. With regard to the softening of feed-waters, he had found that firms would not go to the expense of putting down plant for that purpose, and so nothing remained but to advise what to put into the boilers. He recommended soda ash in quantity, sufficient to react with the sulphate of magnesia and the soluble salts of lime. He asked Mr. Procter as to whether he thought anything else was necessary for boiler-feed waters.

Mr. W. McD. **MACKEY** was inclined to agree with the last speaker in his preference for gravimetric processes. He never used the soap test unless asked for it, and calculated the hardness from the analysis. He found he could obtain a good indication of what was required on the large scale by using, say, 500 c.c. of water, and weighing out the caustic lime, when it was possible to get reliable data as to the amount of lime to be used in practice on the large scale. He was afraid Archbutt's process for estimation of free CO_2 could not be used in this way. In the case of a water containing much magnesia and chlorine, it was generally considered that acidity was generated in the boiler. He asked Prof. Procter if, in his opinion, the calcium carbonate present in the water was a protection against corrosion arising from this cause, seeing it would be precipitated on boiling.

The **CHAIRMAN** said that, although opinions might differ as to the composition of the water of the River Aire, there was no doubt that it was good for boiler purposes, and to prevent corrosion a little caustic soda was all that was necessary. A little hard scale might be formed, but that was all; he had found also a little "pitting," but thought this might be due rather to electrochemical phenomena. He had found numerous pin-holes in the feed-water pipes when wrought iron was used, but on changing to cast iron his objection disappeared.

Mr. G. Ward upheld the view that caustic soda was valuable for use in boilers, and its usefulness was increased if a mixture of caustic soda and crude gallotannate of soda were used. The gallotannate of soda was readily made by dissolving catechu in caustic soda, and the mixture was one which was used by many large companies who worked their boilers hard.

Prof. Procter, in reply, said that even when small quantities of water were dealt with it was only a question of taste whether gravimetric or volumetric processes were used, and he thought that to get any advantage gravimetrically large quantities should be used. With regard to the softening of water, he agreed that sodium carbonate and caustic soda with almost any tanning substance was very good. He had found Archbutt's process to be very satisfactory, but whether such exact analysis was necessary for softening calculations was open to question, as in practice they were unable to tell whether their instructions would be carried out with a lime containing 30 per cent. or 90 per cent. of CaO. Like Mr. Mackey, he could obtain a good approximation by adding excess of lime to the water, allowing to stand in a stoppered bottle for, say, 12 hours, and then titrate the excess of lime, and so find the amount of lime consumed. With regard to magnesium chloride, the view at present held was that it did not dissociate when alone, but the iron combined with the chlorine, and this led to "pitting"; but he thought this was not to be feared if calcium carbonate were present. The precipitation of calcium carbonate was most to be feared in presence of fats, preventing contact with the water and causing overheating of the boiler-plates. Heavy mineral oils had not this effect, and had been found useful for loosening the hard scale.

The Chairman said he believed the introduction of heavy mineral oils into boilers working at high pressures was dangerous, as it was supposed to induce the water to take the spheroidal condition and prevent it actually touching the plates, and explosions had resulted therefrom.

COAL-ASH.

BY JOHN W. COBB, B.Sc. (LOND.).

The laboratory examination of coal-ash is usually limited to a determination of quantity, but the influence of the nature of the ash is often of so much importance that I thought some notes on methods of examining ash which I have found useful, and on the significance of the results, might not be without their value.

The quantity of ash is interesting in the first place because the ash is the inert and thermally useless constituent of a coal, and, allowing for moisture, the variation in quantity of ash gives a sufficiently good criterion for many purposes of the variation in calorific value. I do not mean that one coal is necessarily of less heating power than another coal because it contains more ash, but if it is required to compare successive consignments of the same coal or of similar coals the quantity of ash forms the readiest basis of comparison. The ash determination can be made in many cases where the tedium of calorimetric determinations renders it impracticable to make them sufficiently often, as in controlling the heat efficiency of a piece of plant such as one particular furnace or range of boilers. I might point out that the loss by ash is larger than at first sight appears. Taking the familiar case of a steam-boiler, the rate of combustion per unit of grate area and rate of steam-raising are determined by the amount of air penetrating to the coal through the interstices beneath it; this quantity diminishes as the ash accumulates on the grates, and although the thermal efficiency, as expressed by the percentage of heat units utilised, is not necessarily lowered, the economic efficiency suffers severely by the reduction of output; the difficulty of keeping up steam pressure is also increased by the excessive time taken in removing clinker, which involves admission of quantities of cold air. Heat losses are even more noticeable in a kiln or furnace fired for the obtaining of a high temperature. As the ash accumulates, the rate of combustion diminishes, and the temperature rises more slowly until, if cleaning-out is delayed too long, the coal which the grates will burn, though perhaps a very appreciable quantity, is not sufficient to raise the temperature at all. The removal of ash in such a case usually means a lowering of the temperature inside the furnace, and hard and unpleasant work outside, and has to be followed by firing for what may prove to be a considerable time, simply to make up lost ground. Taking another case, that of a gas producer, the gradual accumulation of ash is distinctly detrimental to its working, and in some types the output of gas is stopped completely during the periods of ash removal.

The preceding remarks make it unnecessary to insist on the importance attaching also to the fusibility of ash. The checking of air-supply and rate of combustion, by accumulating ash, is greater if the particles fuse together into a clinker, and the heat losses are increased by the difficulty of removing the clinker. This consideration becomes of fundamental importance in the working of inaccessible fires, such as those of the modern blast-blown gas-producer with water-seal. One of the most valuable practical advantages of the Mond gas process is that by the use of a large excess of steam in the blast (an essential feature of the process), the temperature of the fires is kept low; therefore the ash does not melt together into lumps of clinker, and can be drawn easily with the minimum of interference with ordinary working conditions.

It may be noticed that completeness of combustion hinges very largely upon absence of fusion in the ash; the enclosing of unburnt carbon by the melting of surrounding ash, and consequent stoppage of further combustion, is easy to realise.

The composition of ash is usually of importance, mainly in so far as it effects fusibility, but when the solid fuel comes into direct contact with the material of the process, as in blast-furnace work and lime and cement burning, the increased importance of ash composition is evident. In blast-furnace practice, a change in the coke used may make a complete change necessary in the proportions of ore and limestone: this is largely because the slag must retain constant properties, and the coke-ash ingredients (with the exception of the iron) are, roughly speaking, transferred bodily to the slag, and must be allowed for. Harmful elements, such as sulphur and phosphorus, have their own significance, and, altogether, the influence of ash composition is so considerable in such cases as to necessitate complete analysis. The influence of certain properties of ash has been noticed. The laboratory methods of examination now claim attention.

The determination of quantity of ash is simple, so simple that errors are common and considerable. The importance of sampling has been rightly insisted on, and the avoidance of draughts on the crucible, which carry away light particles of ash. If the crucible is heated in a laboratory muffle it is sometimes necessary to guard against too high a temperature, or fusion of the ash may take place before completion of the combustion, in which case unburnt carbon may be enclosed by the ash.

The composition of the ash requires a fusion with alkali carbonates, followed by the methods applied to silicates and iron ores. The process can be quickened somewhat by volumetric determination of the iron, lime, and phosphorus.

My own practice is as follows:—

The silica is separated as usual, and the filtrate made up to 250 c.c., of which aliquot portions are measured off for the succeeding determinations. The alumina, iron, manganese, phosphorus, and titanium are precipitated by ammonia and a drop of ammonium sulphide. (More elaborate separation of manganese, *e.g.*, by ammonium acetate, is occasionally called for.) Only slight alkalinity is allowed; the precipitate settles quickly, and the solution above it is decanted through the filter-paper. The precipitate is redissolved in hydrochloric acid and the solution diluted to the same volume as before precipitation. Ammonia and a drop of ammonium sulphide are added, and the precipitate filtered off, washed, and ignited for some time before weighing to ensure complete oxidation. This precipitate has been obtained in a solution largely freed from alkali and calcium salts; it therefore resembles that obtained by redissolving the alumina and iron precipitate from the filter-paper (which I have not found an easy thing to do quickly and completely), and reprecipitating.

The *Lime* is precipitated by ammonium oxalate for the iron and alumina filtrate after concentration of the latter, but before adding ammonium oxalate the solution is rendered distinctly alkaline with ammonia and allowed to stand 15 minutes. Traces of alumina and iron sometimes come down. The ammonium oxalate precipitate is redissolved in standard sulphuric acid and titrated with potassium permanganate.

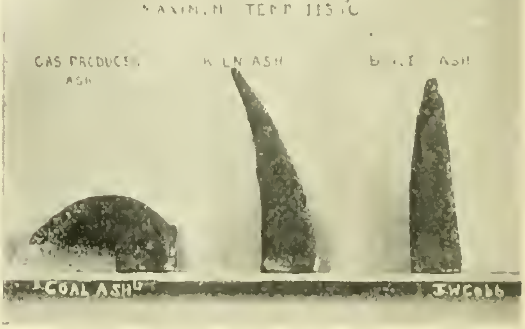
The *Phosphorus* is determined by a process which is not, I believe, in common use, but appears to be quite accurate enough for most purposes and is neat and rapid. 100 c.c. of the 250 c.c. SiO_2 filtrate (a portion representing say 1 grm. of the ash), is taken, diluted to about 500 c.c., ammonia added until a slight permanent precipitate forms, and nitric acid added to re-solution. 50 c.c. of ammonium molybdate solution is then poured into the solution (warm to the hand), and shaking for 5 minutes is followed by settling for 15 minutes. Filtration through asbestos in a Gooch crucible with vacuum, washing with 1 per cent. HNO_3 and with 0·1 per cent. KNO_3 until no acidity remains, solution in standard soda of the molybdate precipitate, and titration of the solution against standard sulphuric acid, using phenolphthalein as an indicator, complete the process of estimation.

A further note on this method will follow.

The fusibility of an ash is, of course, dependent upon the composition; the oxides composing it are infusible separately at ordinary fire temperatures, but are present in the proportion to form some compound of the type $x\mathrm{RO}.y\mathrm{R_2O_3}.z\mathrm{SiO_2}$ and are in intimate contact. Many such compounds are easily fusible, and so the ash melts in the fire to a slag or clinker. The forecasting of the fusibility of any particular mixture of oxides constituting a coal-ash is not practicable yet, although something may be done in that direction; a direct determination of the fusibility is the simplest way to arrive at useful information. The method I have long used for this purpose, and one of very general application, is due in essence to Seger, who used the bending of small pyramids of known composition as a means of measuring temperature. Suppose the fusibility of ash A is to be compared with that of ash B; each is ground to powder—the finer the better, but 100 in. linear sieving is fine enough—and made into a pyramid. This is not a difficult operation, especially if dextrin solution is used to increase coherence during the making and hardness afterwards.

The use of dextrin is unnecessary if the material has been ground to impalpable powder, which is easily done in a pebble-mill, using water. No appreciable effect on fusibility seems to result from any difference in fineness which occurs in practice. The pyramids should be approximately, but need not be exactly, geometrically similar. In some cases all the constituents of an ash are not naturally in a state of intimate admixture, but the conclusions drawn from pyramid experiments are rarely, if ever, invalid for this reason, if discretion is exercised when obviously demanded. The pyramids I use are considerably larger than the Seger cones; they are nearly 1 in. square on the base and 3 in. high, one face standing vertical.

After drying, the pyramids are set in a laboratory furnace, and the temperature is gradually raised until one of the pyramids bends over to touch with its point the surface on which it was set. The firing is then stopped, and the pyramids are examined. It is essential to success that temperature distribution in the space where the pyramids are set be uniform; I have not found a laboratory natural-draught muffle furnace satisfactory, but use a circular regenerative down-draught furnace heated by eight burners arranged equidistant on the periphery. It is often convenient to refer to some constant standard, and in this case an ordinary pyrometric pyramid is useful. If an absolute determination of the fusibility of a pyramid is required, referred to the ordinary centigrade scale of temperature (and such a determination is certainly advisable if work of this kind is to have outside value), a thermo-couple may be put into the furnace with its junction near the pyramids. The rise of temperature should not be too rapid, and as soon as the pyramid bends a little at the point should be checked altogether. This is necessary, because the bending of the pyramid is a summation of all softening effect above the point of incipient fusion; it cannot take place instantaneously, and if the temperature is allowed to go on rising quickly while the pyramid is bending, the reading will be altogether too high when the pyramid touches. The bending should take place slowly through a small range of temperature; in this way an approximately correct reading in degrees Centigrade for the touching of the pyramid can be obtained. The accompanying photograph illustrates results obtained in one experiment.



The unburnt combustible matter in the ash can be determined accurately enough for process control by grinding the dry ash to very fine powder and igniting it; the loss on ignition gives the unburnt carbon directly. It may be pointed out that the permissible percentage of unburnt carbon in the ash is smaller as the percentage of ash in the coal is larger. Thus, assuming a coal to contain 70 per cent. of carbon and 5 per cent. of true ash, if 5 per cent. of the carbon present came unconsumed into the works ash, it would show itself as 41 per cent. of unburnt matter on examination of the works ash. If, however, the coal contained 55 per cent. of carbon and 20 per cent. of true ash, and 5 per cent. of the carbon present again came unconsumed into the works ash, it would show itself as 12 per cent. of unburnt matter on analysis—a very different result at first sight, but really indicating the same amount of waste. If the ash contains a considerable quantity of partially reduced matter, particularly iron, this increases in weight on oxidation, and therefore direct ignition gives too low a result for perfect accuracy, but cases in which this amount of error is of any consequence are rare, I believe. I have several times checked the ignition result by a combustion with quite satisfactory results.

I might point out that part of the loss of ignition of a works ash, though not a large part, may be due to the loss of sulphur. It was once interesting to me to find out how long glowing ashes would give off sulphur compounds when moist air was passing over or through them. Three kinds

Sulphur Account for Clinker from Three Coals.

——	No. 1.	No. 2.	No. 3.
	Per cent.	Per cent.	Per cent.
Sulphur in clinker before heating.	3·05	2·09	1·14
Sulphur evolved on heating in air current	2·50	1·64	1·14
Difference	0·55	0·45	..
Sulphur in clinker after heating (calculated on original clinker)	0·49	0·22	Slight trace.
Unaccounted for	0·06	0·23	..
	Hours.	Hours.	Hours.
Time of evolution of sulphur	16—18	14—16	23—25

of ash were sampled as drawn from a glazed brick kiln when just finishing firing. Air, moistened by bubbling through water, was passed through the finely-ground ash heated to redness in a combustion tube. The sulphur compounds evolved were absorbed in bromine water acidified with hydrochloric acid and estimated by precipitation with barium chloride; the sulphur in the ash before and after heating was determined by fusion with the mixed carbonates and precipitation with barium chloride; the sulphur present in the three ashes was approximately 3 per cent., 2 per cent. and 1 per cent. The results are tabulated.

It is noticeable that the sulphur compounds were almost completely expelled, but very slowly; in cases where small quantities of sulphur gas are believed to work for evil, it may then be advisable to draw the ashes as soon as the firing is finished.

In any industrial process one characteristic of an ash may assume a special prominence for evil or good. Thus the phosphorus, generally unimportant, assumes prominence for blast-furnace work. So, too, the light ash of a coal scattered by the draught over the surfaces of burning bricks may induce material disfigurement, if fixed by wet products of combustion or by fusion. Many other examples might be given, but I limit my remarks to my own experience. Finally, let me express my thanks to Mr. C. P. Finn for assistance given me in some of the laboratory work, and in preparing the photographs, as also to the directors of the Farnley Iron Company, in whose laboratory all the experimental work has been done.

Discussion.

The Chairman drew attention to the importance of the subject to all works, and said that the interest of the paper would have been increased if it had been possible to compare the characters of the different West Riding coals, and their suitability to various industries.

Mr. W. McD. Mackey asked if a number of determinations of phosphorus in local coals could be placed on record, as these would be of value for reference in the future, and as on the West Coast a non-phosphorus pig was a speciality. He drew attention to the importance of maintaining an oxidising atmosphere in the muffle during the estimation of ash.

Mr. F. W. Richardson pointed out that the estimation of arsenic in coal ash was not a very simple matter. His own method was to fuse the ash with the double carbonates of sodium and potassium and so get the arsenic in a soluble form, after which the estimation was easy. He thought there was some need of a standard method.

Mr. Cobb, in reply, agreed that the various properties of coals would form interesting subject-matter for not one but quite a number of papers. He thought Mr. Mackey rightly emphasised the necessity for an oxidising atmosphere in ash determinations. The molybdate method was essentially one for the estimation of small quantities of phosphorus, the volume and weight of the precipitate being so great; this would, however, be dealt with at greater length in a special note.

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I.—PLANT, APPARATUS AND MACHINERY.

English Patents.

Drying and Roasting Apparatus. M. Hecking, Dortmund, Germany. Eng. Pat. 25,209, Nov. 17, 1902.

The apparatus consists of a horizontal mixing drum, mounted on rollers, and adapted to be supplied with hot air or steam from a furnace at the head of the drum. The drum has also a feeding funnel at the head, and a collector for the dried or roasted material at the foot. The collector has an exhaust pipe for gases at the top, and an outlet channel at the bottom, the outlet channel and feeding funnel being provided with counterweighted traps. On the inner surface of the drum are arranged projecting ribs parallel with the axis of the drum, and adjustable crossbars between the ribs, the crossbars having the shape of a part of a spiral. Instead of the crossbars, chains hanging loosely between the ribs may be employed. (See also Eng. Pats. 4560 of 1900 and 14,054 of 1902; this Journal, 1901, 344, and 1902, 1126.)—R. A.

Flasks for Volatile and other Liquids. H. Goetz, Frankfurt a/Main. Eng. Pat. 26,461, Dec. 1, 1902.

See Fr. Pat. 322,141 of 1902; this Journal, 1903, 288. —T. F. B.

Evaporators: Impts. in ——. D. A. Blair, Glasgow. Eng. Pat. 2731, Feb. 5, 1903.

In evaporators of either the single- or multiple-effect type, a tube or pipe is arranged either within or outside the calandria steam-heating vessel, in combination with a spiral or propeller-bladed conveyer, by means of which substances of a viscous or semi-liquid nature can be circulated downwards through the tube while they are being concentrated. —R. A.

Forcing and Drawing off Liquids Evolving Ignitable or Explosive Gases; Process and Apparatus for ——. C. Martini and H. Hüneke, Hanover, Germany. Eng. Pat. 4233, Feb. 23, 1903.

A non-oxidising gas, such as carbon dioxide, coal-gas, or ammonia, is forced under pressure into the reservoir containing the liquid, such gas serving to prevent the formation of an explosive gas mixture during the emptying of the reservoir.—R. A.

Apparatus and Process for the Centralisation of every kind of Chemical or Industrial Treatment of and Operation on any kind of Substances. J. Lühne, Aix-la-Chapelle. Eng. Pat. 8313, April 9, 1903.

See Fr. Pat. 330,322 of 1903; this Journal, 1903, 1078. —T. F. B.

[*Centrifugal*] *Liquid Diffuser.* W. Schwarzhaupt, St. Goar-on the-Rhine, Germany. Eng. Pat. 19,964, Sept. 16, 1903.

The liquid is raised by suitable lifting appliances, and distributed on the inner surface of a rotating cylindrical ring, which has a horizontal projecting flange or rim. By the centrifugal action, the liquid is spread evenly over the rim, and discharged from the circumference of the rim against "rebounding" plates, the coarser particles being caught on these plates and returned to the receptacle, while the finer particles pass through.—R. A.

United States Patent.

Centrifugal Separator. A. C. Van Kirk, Tiffin, Ohio. U.S. Pat. 745,696, Dec. 1, 1903.

The rotating chamber of the separator is formed with its walls inclined outwardly from the bottom, and then inwardly towards the top, a feed cone being mounted concentrically within the chamber. The discharge-opening is formed at the greatest periphery of the chamber, and the liquid outlet at the centre. The discharged matter is delivered into a movable accumulator, which is connected to a valve controlling the discharge opening, so that the valve is operated by the accumulation of the discharge. —R. A.

French Patents.

Vessels Unattacked by Acids; Manufacture of [*Acid Proof*] *——.* J. K. Field. Fr. Pat. 333,928, July 4, 1903.

See Eng Pat. 21,650 of 1902; this Journal, 1903, 1188. —T. F. B.

Centrifugal Apparatus; Arrangement for the complete Separation of Products expelled from ——, within the same Apparatus. Soc. F. Meyer's Sohn. Fr. Pat. 334,041, July 22, 1903.

The products expelled in a centrifugal machine are caught against an annular envelope, constructed in several pieces, surrounding the rotating basket, so that the lower border of the envelope may be moved outwards or inwards from or towards the axis of rotation, whereby the products projected against the sloping sides may be caused to flow into one or other of a series of conduits beneath, leading to separate receivers.—E. S.

II.—FUEL, GAS, AND LIGHT.

Coal-like Substance accompanying Caucasian Petroleum. K. Charitschkoff. J. russ. phys.-chem. Ges., **35**, 695—701. Chem. Centr., 1903, **2**, [23], 1297.

At Grosny and Tschatma the petroleum is accompanied by a coal very similar to lignite, but lighter, and containing less moisture than the latter. The coal cannot be regarded as of vegetable origin, since at Grosny it occurs in thin, regular strata above those in which the petroleum occurs, whilst at Tschatma it occurs in the same strata as the petroleum. The author considers that the coal is formed from the petroleum by dehydrogenisation, and in support of this view cites the formation of hydrogen sulphide from sulphur and petroleum, and the decomposition of petroleum by long-continued heating. Coal similar to that occurring at Tschatma has been found by the author in hot-petroleum mains.—A. S.

English Patents.

Oil-Gas; Apparatus for Making ——. R. Dempster, Marietta, Ohio, U.S.A. Eng. Pat. 16,764, July 30, 1903.

The apparatus consists of an oil-containing tank, in which a heating and agitating device is arranged. This consists of an upper and lower set of hollow horizontal arms, connected by vertical pipes, the lower set being provided with supporting rollers, which rest on the bottom of the tank. Steam is made to circulate through this device, being supplied by a pipe passing through a stuffing-box at the top of the oil tank, and withdrawn through a similar pipe at the bottom, and means are provided for causing the device and steam pipes to rotate. Pipes are arranged to supply steam to the tank, both above and below the surface of the oil By means of an air force-pump attached to the tank, air is made to enter the tank below the surface of the oil.—W. C. H.

Gas Burners; Impts. in Bunsen ——. E. Davies and D. Davies, both of Pontypridd. Eng. Pat. 17,319, Aug. 10, 1903.

The burners are adapted for use in gas heating apparatus and are made wholly or partly of heat non-conducting materials, such as asbestos and porcelain. The upper end of the chamber, in which the gas and air are mixed, is bell-shaped, and contains one or more perforated metal discs or caps, which are said to ensure proper mixing of the gas and air. The receiving pipe of the gas heating apparatus is made bell-shaped, and slightly larger than the upper end of the burner, to allow of the passage of air between the burner and receiving pipe.—W. C. H

Fuel from Peat, Waste Wood, Coal Substances, &c.; Manufacture of ——. M. Ekenberg, Stockholm. Eng. Pat. 20,420, Sept. 22, 1903.

See Fr. Pat. 331,720 of 1903; this Journal, 1903, 1120. —T. F. B.

United States Patents.

Gas [*Carbon Monoxide or Producer*]*; Method of Manufacturing ——.* C. W. Lummis, Cleveland, Ohio. U.S. Pat. 745,635, Dec. 1, 1903.

Powdered coal is introduced into a highly heated chamber, together with air and steam, the volume of steam and air being limited, so as to supply only sufficient oxygen to effect the conversion of the coal into carbon monoxide. The air and steam may be introduced at one or more stages of the process; when at more than one stage, provision is made for maintaining the heat of the gas generated on the first introduction.—R. A.

Gas; Method of Manufacturing ——. C. F. Brush, Cleveland, Ohio. U.S. Pat. 746,452, Dec. 8, 1903.

Water-gas is produced by subjecting bituminous coal or similar solid fuel at a high temperature to the action of steam and sufficient oxygen to maintain the necessary temperature. The volatile constituents of the fuel are led

from the chamber, in which the fuel is heated, into a second chamber containing checker brickwork, and there simultaneously subjected to the action of steam and oxygen.
—W. C. H.

Gas-Producer. G. Campion and M. Wyant, Anderson, Ind. U.S. Pat. 745,781, Dec. 1, 1903.

The fire-box of the gas-producer is polygonal, with portions of the internal walls shelving downwards and inwards towards the bottom. Pyramidal grates, inclined in alignment with the inclined portions of the walls, are mounted on ledges or supports in the bottom corners. In conjunction with the corner supports and ledges, a body is provided having "downward and inward inclined inner wall portions and triangular gates on the ledges" of such supports, and this body portion is adapted to bridge over the branches of a "branched water bosh" between the supports.—R. A.

French Patents.

Briquettes, Coal and Coke; Manufacture of ——. C. Plate and J. Lieb. Fr. Pat. 334,257, July 30, 1903.

This is a process by which the quantity of binding material, such as rosin, pitch, &c., usually employed in making briquettes, can be considerably reduced, and consists in mixing the coal or coke with the binding material, moistened with water, this water, either before or after passing the briquette press, being evaporated, so that the binding material is distributed in the finest condition between the different particles of coal or coke.—W. C. H.

Mixtures of Combustible Gases with Oxygen; Manufacture, Distribution, and Use of ——. Soc. L'Air Liquide (Soc. pour l'étude et l'exploitation des Procédés G. Claude). Fr Pat. 333,984, July 20, 1903.

Coal- or water-gas, or combustible gaseous mixtures, are mixed with so much oxygen as may be safely used, for lighting and heating purposes, without incurring danger of explosion.—E. S.

Gas Generators. J. R. George. Fr. Pat. 334,235, July 29, 1903.

See Eng. Pat. 16,263 of 1903; this Journal, 1903, 1189.
—T. F. B.

Acetylene; Purifying Material for ——. P. Grel. Fr. Pat. 334,111, July 24, 1903.

Ten parts of chromic acid are dissolved in 30 parts of nitric acid, and the solution is absorbed in 100 parts of kieselguhr. The product is claimed to extract organic compounds of sulphur, basic compounds formed by polymerisation, as well as the phosphine of crude acetylene.
—F. H. L.

Collodion Cotton Soluble in Alcohol [for Incandescent Mantles]; Process of Making ——. Soc. R. Eisenmann and J. Bendix. Fr. Pat. 333,824, July 15, 1903.

See Eng. Pat. 15,696 of 1903; this Journal, 1903, 1079.
—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Coal-like Substance accompanying Caucasian Petroleum. K. Charitschkoff. II., page 14.

United States Patent.

Petroleum; Process of Desulphurising Sulphur-bearing ——. T. F. Colin, Elizabeth, N.J. U.S. Pat. 744,720, Nov. 24, 1903.

Petroleum and its distillates are desulphurised by agitating, by means of air, with a slightly acid solution of ferrous sulphate, copper sulphate, and sodium chloride, or, in general, "with a salt of a metal having two or more easily interconvertible states of oxidation, a salt of a metal forming a sulphide insoluble in acid solution, and a halogen compound." (See also U.S. Pat. 723,368 of 1903; this Journal, 1903, 547.)—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Indigo; Manufacture of —— *[from the Plant].* L. Bréaudat. Bull. Econ. de l'Indo-Chine; through Rev. Gén. Mat. Col., 1903, **7**, [84], 357—360.

One of the greatest difficulties in the manufacture of indigo in Cambodia and British India is the bad quality of the water; this may be remedied very largely by the addition of milk of lime, with subsequent filtration through flints and sand. The author finds also that a freshly prepared and rapidly dried sample of indigo shows, on titration with permanganate, 15—18 per cent. more indigotin than a sample dried slowly, under a heavy bed of mould, in the usual way. This difference is not due to the action of micro-organisms, these tending rather to purify the indigotin by decomposing the foreign nitrogenous matter; air has also no action on indigotin, neither has the precipitated proteid matter of the crude indigo; the amount of albuminous substances present is not alone sufficient to account for the large discrepancy, although permanganate is reduced by gluten in sulphuric acid solution. On extracting a poor (50 per cent.) indigo with boiling water, a solution is obtained which reduces permanganate, and which, on evaporation, gives a black residue of nitrogenous organic matter yielding ash; this residue appears to be a compound of indigo, since the author has succeeded in producing indigotin from it; it is also soluble in Nordhausen sulphuric acid, which should not, therefore, be used in the determination of indigotin. The following method appears to reduce the error to a minimum:—1 grm. of indigo is heated with 12 c.c. of sulphuric acid (sp. gr. 1·84) to 70° C. for an hour, poured into about 500 c.c. of water, and the whole made up to 1 litre; 25 c.c. of this solution, added to 250 c.c. of water, are used for the titration, the permanganate being preferably of such a strength that 1 c.c. = 0·0015 grm. of indigotin.—T. F. B.

Catechu. W. E. Ridenour. J. Franklin Inst., 1903, **156**, [6], 417.

Preparation and Purification of Tannin from Catechu.—The clear acetone extract of the powdered cutch is evaporated to dryness and the residue dissolved in hot water, cooled, and water added until it ceases to give a precipitate. The clear filtrate is shaken with ether to remove catechin, and then the tannin is removed by agitation with successive portions of acetic ether. The acetic ether is recovered, the residue dissolved in water, the solution diluted until it ceases to give a precipitate, and the clear filtrate agitated with acetic ether; this process of solution in water and extraction with acetic ether is repeated until the tannin is completely soluble in water. The tannin is then dissolved in a mixture of alcohol and ether, the solution filtered, and evaporated to dryness under reduced pressure, the tannin being obtained in a porous condition.

Properties.—Catechu tannin, as prepared by the above process, is of a reddish-brown colour, and completely soluble in water and alcohol. Ether containing alcohol and water dissolves it, but stronger ether has little solvent action. It behaves like the tannins from mangrove, canaigre, hemlock, rhatany, and the oaks, giving green precipitates with ferric salts.—R. S.

Triphenylcarbinol; Preparation of ——, *from Benzophenone.* R. Delange. Bull. Soc. Chim., 1903, **29**, [23], 1131—1132.

100 grms. of benzophenone are heated with 100 grms. of dry potassium hydroxide, to 170° C., for 20 hours under a reflux condenser; the product when distilled yields 15—16 grms. of benzene, whilst 45 grms. of benzoic acid are obtained from the aqueous extract of the residue; if, however, the aqueous extract, before acidification, be extracted with ether, 25 grms. of triphenylcarbinol are obtained; the reaction may be represented by the equation $3\,(C_6H_5)_2CO + 2\,KOH = (C_6H_5)_3C.OH + 2\,C_6H_5CO.OK + C_6H_6$. It is probable that an addition compound, $(C_6H_5)_2C.(OH).OK$, is formed at first, two molecules of

which react, with elimination of water, giving potassium benzoate and triphenylcarbinol.—T. F. B.

1.2-*Anthrahydroquinone and its Conversion into Alizarin.* K. Lagodzinski. Ber., 1903, **36**, [16], 4020—4022.

1.2-Anthrahydroquinone is prepared by the reduction of 1.2-anthraquinone suspended in acetic acid, with zinc dust. It forms greenish-yellow scales, easily soluble in organic solvents, and melting at 131° C. with decomposition. Acetic anhydride converts it into the diacetyl derivative of 1.2-dihydroxyanthracene, m. pt. 145° C. Treatment of the latter with acetic chromic acid mixture gives diacetylalizarin. This is easily saponified with alkalis to an alkali salt of alizarin, from which free alizarin is liberated by addition of acid.—A. B. S.

Brasilin from Brasileïn. J. Herzig and J. Pollak. Ber., 1903, **36**, [16], 3951—3953.

The quinonoid formula for brasileïn would be established were it found possible to convert the compound into brasilin by reduction, but this has never yet been accomplished. The triacetyl derivative $C_{16}H_9O(C_2H_3O_2)_3$ is obtained by the combined reduction and acetylation of brasileïn. A similar treatment of brasilin gave a substance having the same melting point and being almost certainly identical with the compound from brasileïn. This result does away with the chief objection to the quinonoid formula for brasileïn. The abnormal behaviour of the latter is due to the fact that, instead of a normal reduction, a series of complicated secondary reactions takes place.—A. B. S.

English Patents.

Azo Dyestuffs from 1.8-Azimidonaphthalene-4-sulphonic Acid; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Höchst a/M. Eng. Pat. 953, Jan. 14, 1903.

Picramic acid, 6-nitro-2-aminophenol-4-sulphonic acid or 4-nitro-2-aminophenol, is diazotised and coupled, in alkaline solution, with 1.8-aziminonaphthalene-4-sulphonic acid. The resulting dyestuffs are identical with those obtained according to Fr. Pat. 316,866. (See this Journal, 1902, 911.)—T. F. B.

Anthranilic Acid and its Derivatives; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Höchst a/M. Eng. Pat. 2302, Jan. 30, 1903.

An alkali salt or an alkaline earth salt of *o*-chloro- or *o*-bromobenzoic acid is heated, preferably under pressure, with ammonia or a primary fatty or aromatic amine, or a carboxylic or sulphonic acid of a primary aromatic amine, together with a small proportion of copper powder or of a copper salt. In most cases an alkali salt of the desired product separates on cooling.—A. B. S.

Sulphurised [Sulphide] Dyestuffs; Manufacture of Yellow ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 3480, Feb. 13, 1903.

See Fr. Pat. 329,481 of 1903; this Journal, 1903, 1042.
—T. F. B.

p-Amidoxylyl-p-oxyphenylamine, and Analogous Compounds and Dyestuffs [Sulphide Dyestuffs] therefrom; Manufacture of ——. I. Levinstein, C. Mensching, and Levinstein, Ltd., Manchester. Eng. Pat. 2617, Feb. 4, 1903.

p-Aminoxylyl-*p* hydroxyphenylamine is produced by simultaneous oxidation of *p*-aminophenol with *p*-xylidine [$CH_3:NH_2:CH_3 = 1:3:4$] and subsequent reduction by sodium sulphide. If the *p*-aminophenol be replaced by *o* chloro-*p*-aminophenol, there is produced in an analogous manner *p*-aminoxylyl-*p*-hydroxy-*m*-chlorophenylamine. Analogous compounds are produced in the same way from *p*-aminophenol with mixtures of *o*-toluidine and *p*-xylidine, and from *o*-chloro *p*-aminophenol with *o*-toluidine. The compounds thus produced yield blue to greenish-blue sulphur dyestuffs on heating with sulphur and sodium sulphide for a prolonged period. The dyestuff formed from *p*-aminoxylyl-*p*-hydroxyphenylamine dyes unmordanted cotton bright blue shades, fast to acids, alkalis, and light. If *o*-chloro-*p*-aminophenol be used, the dyestuffs are slightly greener.—E. F.

Indigo; Manufacture of ——, *and of an Intermediate Product therefor.* O. Imray. From Farbwerke vorm. Meister, Lucius und Brüning, Höchst a/M., Germany. Eng. Pat. 4538, Feb. 26, 1903.

Glycollide or glycollic acid is heated with anthranilic acid, preferably in equimolecular proportions. Glycollic acid anilide *o*-carboxylic acid is thus formed. The alkali salts of this compound, when heated with a fixed alkali, yield a leuco compound, from the aqueous solution of which indigo is precipitated on oxidation, either with a current of air or in any other suitable manner.—E. F.

French Patents.

[*Azo*] *Dyestuffs for Wool; Production of* ——. Badische Anilin und Soda Fabrik. Fr. Pat. 328,086, Sept. 15, 1902.

See Eng. Pat. 20,000 of 1902; this Journal, 1903, 903.
—T. F. B.

Azo Dyestuffs Insoluble in Water; Process of Manufacturing New Derivatives of Phenol [Benzyl Ethers] and ——, *derived from these.* Cie. Parisienne Coul. d'Aniline. Fr. Pat. 328,092, Sept. 22, 1902.

See Eng. Pat. 20,577 of 1902; this Journal, 1903, 903.
—T. F. B.

Sulphide Dyestuffs; Process for Producing Yellow ——. Act.-Ges. f. Anilinfabr. Addition, dated July 16, 1903, to Fr. Pat. 329,481, Feb. 17, 1903 (this Journal, 1903, 1042).

See U.S. Pat. 738,027 of 1903; this Journal, 1903, 1082.
T. F. B.

Azo Dyestuffs; Preparation of New Intermediate Products and New ——. Soc. Anon. des Prods. F. Bayer et Cie. Fr. Pat. 334,140, July 25, 1903.

Mono-acetyldiaminobenzene and mono-acetyldiaminotoluene are prepared by the moderate reduction of 2.4-dinitro-acetanilide or 2.4-dinitroaceto-*o*-toluide with iron and acetic acid. One mol. of a *p*-diamine is diazotised and coupled with 1 mol. of aminonaphthol sulphonic acid (2:8:6). The tetrazo compound obtained, is then coupled with 2 mols. of mono-acetyldiaminobenzene, or the similar toluene compound. The tetrazo compound can also be coupled with 1 mol. of one of the above compounds and 1 mol. of a suitable non-sulphonated base, such as phenylenediamine. In either case the product dyes unmordanted cotton in various shades of black.—A. B. S.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

English Patents.

Scouring or Cleaning Yarns; Machine for ——. G. Carter, Leicester, and J. & J. Baldwin and Partners, Ltd., Huddersfield. Eng. Pat. 27,991, Dec. 18, 1902.

In the usual yarn-scouring machine with radial arms, an upper row of revolving rollers is provided, pressing on the lower ones, either with their own weight or by means of springs, and so squeeze the yarn as it revolves on the lower rollers. Arrangements are added to prevent the yarn from getting entangled round the lower rollers.—A. B. S.

Indigo; Manufacture of Fabrics coloured with ——. J. Ribbert, Kreis Hagen, Germany. Eng. Pat. 28,646, Dec. 27, 1902.

See Fr. Pat. 327,763 of 1902; this Journal, 1903, 948.
—T. F. B.

Dyeing Mixed Silk and Cotton Goods with Sulphurised Dyestuffs. C. D. Abel, London. From Act. Ges. f. Anilinfabr., Berlin. Eng. Pat. 3479, Feb. 13, 1903.

See Fr. Pat. 329,422 of 1903; this Journal, 1903, 1044.
—T. F. B.

French Patent.

Printing Effects resembling Silk; Process for Obtaining ——. La Soc. Englische Wollenwaaren-manufact. (formerly Oldroyd and Blakeley). Fr. Pat. 333,835, July 15, 1903.

The process consists in printing a mixture of finely-powdered mica with some cellulose derivative, such as viscose. The mica and cellulose compound can be coloured previously. After printing, the material is dried on ordinary calendering cylinders.—A. B. S.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

English Patent.

Dyed Paper; Process for Producing Coloured Effects on ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/Main. Eng. Pat. 2809, Feb. 5, 1903.

Designs are produced on dyed paper by applying to the paper a solution of a substance or substances which changes the shade of the dyestuff or dyestuffs used. For instance, substances which, by oxidation or reduction, destroy the dyestuff are suitable: such are sulphites or bisulphites, used with many triphenylmethane dyestuffs; hydrosulphite solutions, alkali chlorates, chlorites, bromites, hypochlorites, &c. may also be used. If two or more dyestuffs be used to dye the paper, the results are more marked; for instance, orange-yellow designs on a garnet-red ground are obtained by treating with potassium sulphite, paper dyed with an orange azo dyestuff and Magenta. Contrast effects may be produced if the discharge solution contain some dyestuff not destroyed by the substance used.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Hydrobromic Acid; Preparation of ——. R. L. Taylor. Lit. and Phil. Soc. of Manchester, Jan. 5, 1904.

It is well known that by the action of sulphuric acid on an alkali bromide, hydrobromic acid mixed with free bromine is obtained. If a strong solution of phosphoric acid be substituted for the sulphuric acid, pure hydrobromic acid will be obtained on distilling. The author proposes, however, a cheaper and equally efficacious method. A little amorphous phosphorus is added to the bromide and then a very little water. Strong sulphuric acid is next added and the mixture is heated, when hydrobromic acid is generated, free from bromine. It is stated that thus hydrobromic acid may be prepared, in quantity, just as conveniently as hydrochloric acid is, by the action of sulphuric acid on common salt. This hydrobromic acid is, however, not yet quite pure, since it contains a small amount of sulphur dioxide.—A. S.

Hydrofluosilicic Acid; Distillation of ——. E. Baur. Ber., 1903, **36**, [16], 4209—4214.

Stolba, in 1863, noticed that when hydrofluosilicic acid is boiled down in platinum, the residual liquid dissolves silica; an excess of hydrofluoric acid over the proportion 2HF:SiF_4 thus remaining, an excess of silicon fluoride must have been contained in the vapour. The hydrofluoric acid in the residue being itself volatile, regular results in investigating the progress of the distillation are only to be obtained by distilling from excess of silica. Looking at the reactions—

$$SiO_2 + 4HF \rightleftarrows SiF_4 + 2H_2O$$
$$SiO_2 + 6HF \rightleftarrows H_2SiF_6 + 2H_2O,$$

it would seem that dilution of the acid should increase the tendency to form hydrofluoric acid, and that the vapour from the dilute acid should contain more hydrofluoric acid, that from the concentrated acid more silicon fluoride, than the proportion 2HF : SiF_4. This the author has found to be the case. An acid containing 13·3 per cent. of hydrofluosilicic acid gives a distillate also containing H_2SiF_6 or (2HF:SiF_4); weaker acids give distillates containing relatively more hydrofluoric acid, and stronger acids distillates containing relatively more SiF_4. From these latter, silica separates after a time, from the reaction of the silicon fluoride on the water. If then concentrated hydrofluosilicic acid be evaporated alone, the residual acid will be capable of dissolving silica; whilst if a weak acid (5—10 per cent.) be evaporated, silica should deposit from the residue. This is found by experiment to be the case. Hence the etching effect on glass when hydrofluosilicic acid is evaporated in glass vessels. The author has shown that concentrated hydrofluosilicic acid contains no free hydrofluoric acid, and that on dilution no hydrolytic dissociation of the acid and consequent deposition of silica occurs. Possibly this is due to complete electrolytic dissociation into SiF_6-ions and H-ions. The concentrated acid (30 per cent.), heated with silica, does not undergo any such reaction as $5H_2SiF_6 + SiO_2 = 6HSiF_5 + 2H_2O$; the boiling filtrate deposits no silica on cooling and standing, and has the composition H_2SiF_6.—J. T. D.

Nitrites; Electrolytic Preparation of ——, *from Nitrates.* W. J. Müller. Zeits. f. Elektrochem., 1903, **9**, [51], 978.

On electrolysing hot saturated solutions of nitrates with a cathode of amalgamated copper at a current-density of 1—0·5 ampère per sq. dcm., nitrites are at first produced with a current-efficiency of 85—92 per cent. When the yield of nitrite reaches 50—60 per cent. however, the current-efficiency sinks to less than 40 per cent., owing to formation of ammonia. Attempts to separate mixtures of alkali nitrates and nitrites by crystallisation were unsuccessful. (See also Divers. J. Chem. Soc., 1899, **75**, 85; also this Journal, 1899, 273.)—W. A. C.

Alkaline-earth Metals; Acetates of ——. A. Colson. Comptes rend., 1903, **137**, [24], 1061—1063.

Solutions of calcium or magnesium acetate in glacial acetic acid, when saturated with chlorine, do not yield (as does the corresponding barium compound) acetochlorides; the original acetates are precipitated from the solution. Some reaction between the chlorine and the acetate does occur, especially in the case of magnesium; for the solution, evaporated *in vacuo*, yields a residue containing 1—2 per cent. of magnesium chloride. Glacial acetic acid acts but slowly on calcium oxide, and acetic anhydride appears to be without action on it, though the addition to the acetic anhydride of even a small proportion of acetic acid starts a reaction, which then proceeds as rapidly as though the whole of the liquid were acetic acid.—J. T. D.

Phosphorus [Scarlet]; Investigations on ——. R. Schenck. Ber., 1903, **36**, [16], 4202—4209.

Continuing his investigations on scarlet phosphorus (this Journal, 1902, 368; 1903, 494 and 1225) and the black substances formed by its reaction on ammonia and other bases, the author finds that the black compound produced by reacting with piperidine on solid phosphorus hydride, P_4H_2, almost certainly has the formula $P_4H_2.C_5H_{11}N$. It always contains an excess of phosphorus, however, which proceeds from decomposition of some of the phosphorus hydride into hydrogen, phosphine, and phosphorus. The compound is readily dissociated by water; and the hydrolytic decomposition is supplemented by reaction of hydroxyl-ions on the liberated phosphorus hydride, with production of hydrogen, phosphine, and hypophosphorous acid. For this reason the piperidine used in preparing the compound must be dehydrated with the utmost care by metallic sodium. The author has suggested that the black substance formed by acting with piperidine on his scarlet phosphorus is the same compound as the above, and that formed by substituting ammonia for piperidine is $P_4H.NH_4$ or $P_4H_2.NH_3$. A difficulty was felt here, inasmuch as ammonia was thought not to form a black compound with phosphorus hydride; but it is now found that this depends on the velocity of reaction, and that the black compound is formed if the two reagents be heated together in warm water. The black compound recently obtained by Stock by reacting with liquefied ammonia on yellow phosphorus is no doubt the same substance, formed probably by some such reaction as the following: $14P + 7NH_3 = 3P_4H(NH_4) + 2(NH_2.P{:}NH)$. Stock found that aqueous ammonia at a high temperature dissolved ordinary phosphorus completely, forming phosphine and ammonium hypophosphite only; but the author finds that if the temperature be not too high there is formed, especially in the sunlight, a black substance, no doubt $P_4H.NH_4$. In all probability this is, too, the substance long ago obtained by Flückiger from aqueous ammonia and white phosphorus, and supposed by him to be arsenic.

—J. T. D.

Alkali Bromates; Reduction of ——, by Hydrazine and Hydroxylamine Sulphate. M. Schlötter. XXIII., page 36.

English Patents.

Titanium Compounds; Manufacture or Separation of —— [from other Metals]. C. Dreher, Freiburg. Eng. Pat. 1835, Jan. 26, 1903.

See Fr. Pat. 328,855 of 1903; this Journal, 1903, 996.

—T. F. B.

Crucibles or Saggars for Use in the Production of Barium Oxide, Cyanides, &c. W. Feld, Hönningen-on-Rhine. Eng. Pat. 7510, March 31, 1903.

See Fr. Pat. 330,672 of 1903; this Journal, 1903, 1087.

—T. F. B.

Leucitic Product; New or Improved ——, for the Manufacturing of Products or Compounds of Aluminium, Potassium, and Silicon. J. J. O'Brien, Manchester. From F. Ceribelli, Rome. Eng. Pat. 27,189, Dec. 10, 1902.

Rocks in which leucite occurs in an unaltered condition are reduced to a granular form, and sorted and sifted in suitable apparatus to obtain a product having from 50 to 90 per cent. of leucite associated only with minerals not attacked by ordinary acids. The product may then be treated with sulphuric acid, for instance, to obtain a solution from which compounds of aluminium, potassium, and silicon can be produced.—E. S.

Potassium Bichromate; Manufacture of ——. P. Spence and Sons, Ltd., H. Spence, and T. J. I. Craig, Manchester. Eng. Pat. 2211, Jan. 30, 1903.

A solution containing ammonium chromate (such as the solution of ammonium and of sodium chromate produced as described in Eng. Pat. 5015 of 1901; this Journal, 1902, 253) is treated with calcium hydroxide to precipitate calcium chromate, with liberation of ammonia, which is recovered. If sodium chromate is present, it remains undecomposed, and may be utilised by known means. The calcium chromate obtained as described, or otherwise, is suspended in water with potassium carbonate, ammonia, and carbon dioxide (or the two latter combined as ammonium carbonate) in such proportion as to form an equimolecular mixture of potassium chromate and of ammonium chromate. This is boiled as described in Eng. Pat. 11,847, 1900 (this Journal, 1900, 1014), to expel the ammonia, leaving a solution of potassium bichromate.

—E. S.

Ammonium Bichromate; Manufacture of ——. P. Spence and Sons, Ltd., H. Spence, and T. J. I. Craig, Manchester. Eng. Pat. 2223, Jan. 30, 1903.

Calcium chromate, obtained, for instance, as described in the preceding abstract, is suspended in water with ammonia and carbon dioxide, or with ammonium carbonate, and after separation of the precipitated calcium carbonate, the solution of ammonium chromate is boiled to drive off about one-half of the ammonia, which is recovered for re-use, and the solution of ammonium bichromate produced may be used in the production of other compounds of chromic acid, or in any desired way. Reference is made to Eng. Pat. 3895 of 1885, to U.S. Pat. 342,647 of 1886, and to Eng. Pat. 5015 of 1901; this Journal, 1902, 253.

—E. S.

Copperas or Sulphate of Iron; Utilising the Gases given off in the Calcination of ——. A. Campbell, Rugeley, Stafford. Eng. Pat. 2440, Feb. 2, 1903.

The gases evolved in the calcination of ferrous or ferric sulphate, are passed through a suitable apparatus for absorption by iron oxide, such as the scale from rolling mills, iron pyrites cinders ["purple ore," black peroxide from aniline works, &c.], &c. The ferric sulphate thus produced is stated to yield, when calcined, pigments of red and purple shade. Reference is made to Eng. Pat. 17,012 of 1888 and to Eng. Pat. 4001 of 1893; this Journal, 1894, 163.—E. S.

Electrolysis; Process for Decomposing Water by ——. G. T. Fuery, Birmingham. From W. F. M. McCarty and W. S. Beebe, U.S.A. Eng. Pat. 17,399, Aug. 11, 1903.

One oz. of sodium peroxide and 1 lb. of potassium citrate are dissolved in 2,000 lb. of water, and sulphuric acid of 66° B., is added in the proportion of 1 of acid to 500 parts of water; the liquid is subjected to electrolysis and the liberated gases are collected.—B. N.

Electrolysis of Chlorides of the Alkalis; Process and Apparatus for the ——. C. Kellner. Eng. Pat. 20,889, Sept. 29, 1903. XI. A., page 24.

Town Refuse; Methods of Destroying ——, by Burning and the Utilisation of certain Valuable Ingredients thereof. W. Naylor. Eng. Pat. 26,201, Nov. 28, 1902. XVIII. B., page 34.

United States Patent.

Silicon Chlorides, Hydrochloric Acid, and Alkali Hydroxides; Process of Producing ——. F. J. Machalske, Assignor to C. H. Lyon, both of Chicago, Ill. U.S. Pat. 745,966, Dec. 1, 1903.

A mixture of silica and a chlorine compound (such as sodium chloride) is electrically heated, with the use of silicon electrodes, to a sufficient temperature to bring about reaction, and produce silicon chlorides. To produce silicon tetrachloride, one part of silica is used, mixed with four parts of an alkali chloride. To obtain hydrochloric acid, the silicon chloride is brought into contact with water, and the silica produced is used as part of a new charge. The alkali oxide also produced in the process, is treated with water separately from the silicon chloride, to obtain an alkali hydroxide.—E. S.

French Patents.

Liquid Air; Manufacture of ——. J. Loumiet. Fr. Pat. 334,205, July 11, 1903.

The production of cold by the transformation of internal calorific energy into kinetic energy, as based on the difference of the specific heat in air under different degrees of compression, and hence in the passage of highly compressed air at a low temperature to a state of moderate compression, *i.e.* by expansion, for the production of a much lower temperature, is claimed. The apparatus includes a powerful compressor, a system of driers and purifiers, a long horizontal conical tube, with its contracted end outwards, communicating at its enlarged end with a vertical bottle, which latter also communicates by a valve at the side with a tube enclosing, with a small space between, the conical or expansion tube. The highly compressed air enters the apparatus at the outer end of the enclosing tube, passes through the valve at the opposite end into the bottle, and then through another valve into the conical tube, in which its expansion occasions a great fall of temperature. A turbine is connected to the end of the tubes to utilise the force available. A second bottle, to receive the liquid air produced, is arranged below the above-described bottle. Reference is made to Fr. Pat. 323,400 of 1902.—E. S.

Electrolysis of Metallic Oxides or Salts; Apparatus for the ——. Soc. Usines de Riouperoux. Fr. Pat. 334,229, July 29, 1903. XI. A., page 25.

VIII.—GLASS, POTTERY, ENAMELS.

"Montanin," a New Disinfectant. P. Lindner and P. Matthes. XVIII. C., page 34.

English Patents.

Glass and Glass Objects; Manufacture of Devitrified ——, *and Apparatus therefor.* L. A. Garchey, Paris. Eng. Pat. 25,806, Nov. 24, 1902.

See Fr. Pat. 325,436 of 1902; this Journal, 1903, 697.
—T. F. B.

Glass; Method and Apparatus for Manufacturing Sheet ——. W. A. Page, Morgantown, West Virginia, and F. L. O. Wadsworth, Allegheny, Pa., U.S.A. Eng. Pat. 22,575, Oct. 19, 1903.

The process consists in depositing a mass of glass between two rollers, and rolling it into sheet form by applying a positive pressure to hold the sheet in contact with one of the rollers, while it is acquiring a set, and then transferring the sheet to a table having the same cross-sectional contour as one of the rollers. Means are employed for holding the sheet upon the table, which by suitable gearing is made to travel with a speed equal to that of the surface of the roller that deposits the glass on the table. Figured glass sheets are produced by the use of a figured roller and similarly figured table. The glass is held in contact with the depositing roller and table by the application of an exhaust behind the glass. This is effected by using a hollow perforated roller, mounted on a hollow shaft, the end of which is connected with an exhausting apparatus. The hollow shaft is surrounded by a sleeve with radial partitions, which bear upon the inner surface of the roller and form with it a longitudinal vacuum chamber. The surface of the roller being perforated, the partial vacuum in the longitudinal chamber holds one surface of the glass sheet in contact with the surface of the roller. The travelling table is also hollow and perforated on the surface that receives the glass sheet. A partial vacuum is produced in the table by the exhausting apparatus, which is connected to a rectangular cross-head, fitted with suitable packings into the cavity of the table.—W. C. H.

Filter Presses [Potters' Slip]. T. Willett, Milton, Staffordshire. Eng. Pat. 1194, Jan. 17, 1903.

Each of the frames of the press consists of an outer rectangular frame of wood, &c., with two perforated plates or diaphragms, and staves or stiffening pieces between these plates. When the series of frames are assembled, they form chambers or cavities between them to receive the slip, the liquid from the slip passing through the perforated plates into the intermediate chambers formed between the plates, and being discharged through apertures in the lower parts of the frames.—R. A.

Kilns or Ovens for Burning Earthenware or Pottery or the like. G. J. Chambers and The Fulham Pottery and Cheavin Filter Co., Ltd., both of London. Eng. Pat. 1384, Jan. 20, 1903.

In order to prevent the emission of smoke, one or more shallow air flues are placed immediately above the furnace, extending horizontally to the back thereof, and then descending vertically or in an inclined direction so as to open into the furnace adjacent to the arch. The flue or flues are of a horizontal width equal to that of the furnace itself; they may be provided with tapering exits, and are regulated by means of a shutter, which also regulates the feed-hole. By means of a valve placed in this shutter the air-flues may be opened even when the feed-hole is shut.
—A. G. L.

Silica Glass; Manufacture of ——, *and Means to be employed therein.* H. A. Kent, London. Eng. Pat. 23,492, Oct. 29, 1903.

The apparatus, in which silica is melted by the oxyhydrogen flame or by electric heat, or by both together, is made of iridium or of iridium alloy in all such parts as may come into contact with the molten or softened silica; and the furnace walls are built of such resisting material as magnesia bricks, lined internally with silica glass. The vessel to contain the silica for fusion is closely covered, and may be shaped at the bottom according to requirements. An iridium tube of an external diameter corresponding to the internal diameter of the tube to be made, projects centrally through its side into the vessel containing the silica, and then bending downwards when in the middle, descends centrally through the bottom of this vessel. Compressed air may be blown through this tube; another tube enters the vessel near the top, into which air may be passed to press the molten or softened silica through the outlet at the bottom.—E. S.

Ceramic Ware; Manufacture of Glazed or Enamelled ——. A. Bigot, Paris. Eng. Pat. 3632, Feb. 16, 1903.

See Fr. Pat. 323,657 of 1902; this Journal, 1903, 496.
—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

Bricks; Re-pressing of ——, *and the Influence of the Amount of Water present during the Pressing.* C. Mühlhaeuser. Zeits. angew. Chem., 1903, **16**, [51], 1224.

A number of spherical bricks, each weighing 100 grms. in the wet state, and containing 15 per cent. of water, were formed from a mass consisting of 45 per cent. of clay and 55 per cent. of fireclay sand. One of these bricks was allowed to dry as usual, a second was subjected to a hydraulic pressure of 4,410 kilos. per sq. cm. after it had lost four per cent. in weight by drying, whilst two others were treated in the same way after their weights had decreased by 7 and 10 per cent. respectively; the three last balls were allowed to dry as usual after pressing, and their volume and porosity compared with that of the unpressed one. Burning tests were also carried out on these and some other similar bricks. From the results of these tests, it appears that, after drying, the re-pressed bricks occupy a smaller volume than the others, and that the volume and porosity of the bricks depend quantitatively on the amount of water present when pressed, both volume and density approaching a fixed limit, beyond which a decrease in the water content does not cause a decrease in volume or an increase in density. The diminution in volume on burning is about the same for both classes of bricks, the re-pressing being without any influence thereon.
—A. G. L.

English Patents.

Cement. T. B. Joseph, San Francisco. Eng. Pat 18,736, Aug. 31, 1903. Under Internat. Conv., Aug. 30, 1902.

See U.S. Pat. 732,640 of 1903; this Journal, 1903, 909.
—T. F. B.

Town Refuse; Methods of Destroying ——, *by Burning, and the Utilisation of certain Valuable Ingredients thereof.* W. Naylor. Eng. Pat. 26,201, Nov. 28, 1902. XVIII. B., page 34.

French Patents.

Bricks: Process for Covering ——, *with a Protective Coating.* R. Perkiewicz. Addition, dated June 15, 1903, to Fr. Pat. 330,655, March 27, 1903.

See Eng. Pat. 12,095 of 1903; this Journal, 1903, 1088.
—T. F. B.

Stone; Artificial ——. E. R. Sutcliffe. Fr. Pat. 333,826, July 15, 1903.

From 15 to 40 per cent. of cement, preferably Portland cement, is made into a paste with boiling water, or else mixed with cold water, and the mixture heated by steam, and, after being kept at about 100° C. for 15 to 20 minutes, is intimately mixed with 85 to 60 per cent. of any suitable waste material, such as slag, cinders, &c. The mixture is pressed into the required shape by means of a hydraulic press, the blocks produced being then hardened by exposing them to steam at a pressure of 7 to 10·5 kilos. per sq. cm. for 5 to 10 hours. In certain cases they may be immersed in water for some time before being heated. Lime may also be added to the mixture used.—A. G. L.

Plaster of Paris; Manufacture of ——. W. Brothers. Fr. Pat. 333,858, July 16, 1903.

Powdered calcium sulphate or gypsum is heated in water or in a solution of potassium sulphate, alum, or borax, to a temperature of from 100° to 130° C. The crystals formed are separated and dried without allowing them to cool to a temperature lower than 80° C.—A. G. L.

X.—METALLURGY.

Critical Points of Irons and Steels; Method of Determining ——. O. Boudouard. Comptes rend., 1903, **137**, [24], 1054—1056.

The author has already shown the importance of the thermo-electric properties of a heated iron bar during the process of cooling, as throwing light on the transformation temperatures. He has now adapted to this end Saladin's method of photographic registration. The bar of metal (10 cm. long, 1 cm. diameter) has a 5-mm. hole drilled in its centre to take the junction of a thermo-couple, and a saw-cut at either end, in which are fastened platinum wires leading to a sensitive galvanometer. The reflected rays of light from this and from the galvanometer of the thermopile are focussed on a sensitive plate, and the mirrors are so arranged that the oscillations of the two rays are in planes at right angles to one another. The bar is heated in a porcelain tube in an electric-resistance furnace for an hour and a quarter, and then allowed to cool slowly (six hours at least); during the time of cooling a record is left on the photographic plate.—J. T. D.

Silicon Steels; Composition and Properties of ——. L. Guillet. Comptes rend., 1903, **137**, [24], 1052—1054.

Micrographically, the appearance of silicon steels depends only on the amount of silicon they contain, and is not influenced by the amount of carbon. They form three groups:—1. Steels containing up to 5 per cent. of silicon, and in which the carbon is wholly combined. 2. Steels with 5—7 per cent. of silicon, and in which the carbon is partly combined, partly graphitic. 3. Steels containing more than 7 per cent. of silicon, and in which the carbon is wholly graphitic. This last group divides into two: those formed of a solution of silicon in iron, and containing rare scattered brilliant granules of Fe_2Si, and those containing a relatively large proportion of clean crystals of FeSi. Mechanically, the only silicon steels of any use are those containing less than 5 per cent. of silicon. These show a greater breaking stress and a higher elastic limit than non-silicon steels with the same amount of carbon, but the rise in these constants does not seem to depend on the amount of silicon in the steel above a certain minimum quantity. They show a greater resistance to shock after tempering than before, and this resistance is relatively high for the high-carbon steels. The constitution of silicon steels does not seem to be the same as that of ferrosilicons; especially do they differ in regard to the existence of the compound Fe_2Si. Most probably there are two solutions of silicon in iron—one containing dissolved silicon itself, the other containing Fe_2Si.—J. T. D.

Schuch Cyanide Process. Australian Mining Standard, Sept. 3, 1903; through J. Chem., Metall., and Mining Soc. of South Africa, 1903, **4**, [4], 185.

Low-grade ores are superheated, by steam, with cyanide solution (1 : 1), in air-tight tanks, compressed air is introduced through the bottoms of the tanks, and the contents are mechanically agitated. The solution is run over limestone and then through wood ashes, and passed through an asbestos filter previous to the zinc treatment. This process of first "refining" the solution before passing through the zinc shavings has proved to be a feature of importance, the solution, rid of impurities, becoming clear and active, so that the zinc shavings readily take up the gold contents, and it is said that ores containing not more than 3 per cent. of copper can be treated in less than eight hours.—T. F. B.

Silver Ores; Amalgamation and other Wet Processes for ——, in Mexico. H. F. Collins. Trans. Inst. of Min. and Metall. Paper read Dec. 17, 1903.

At Hacienda del Carmen, the ores, after "cobbing" and "sorting," are crushed (dry) in (7) large Chilian mills provided with steel tyres running on steel paths, of a capacity of 6—10 tons per day each. After passing through $\frac{1}{4}$-in. holes the ore is ground (wet) in *tahonas* or *arrastres*, 20 ft. in diameter, the daily charge being 4 tons. Only sufficient water is added during the grinding to yield a pulp in suitable condition for the subsequent treatment. The pulp is made up into *tortas* of 100 tons, and the amalgamation takes from 10 to 12 days in summer and up to 15 days in winter. The routine is as follows:—First day: Additions are made separately of 5—6 per cent. of salt and from $5\frac{1}{2}$ up to as much as $17\frac{1}{2}$ lb. per ton of copper sulphate, the average of the latter being from 6—9 lb. Second day: Mercury is added, 6 to 8 times the weight of silver present. Third day: After turning over, "copper precipitate" (prepared on the spot) is added, 7 to 18 oz. per ton of ore (45 to 110 lb. per *torta* of 100 tons). The *torta* is well trodden each day, and on the last, mercury is added to the amount of four times the weight of silver present, in order to collect the amalgam. The *lavaderos* in which the torta mud is washed, consists of pits 9 ft. in diameter by 10 ft. deep, in which, after charging, the agitators are kept going slowly for 25 minutes in order to settle most of the amalgam, and then the fluid mud, together with most of the coarse sand, is run out through launders. In the launders a considerable quantity of rough concentrates are deposited, which are rewashed on *planillas* to recover the small quantity of amalgam they retain; concentrates equal to about 7 per cent. of the weight of crude ore are obtained, the assay value being very little more than that of the original ore. These are sold to the smelters. The strained amalgam is formed into balls and retorted under a large cast-iron bell (*capellina*). Retorting takes 10 to 12 hours; the condensed mercury collects in a tank below, and the loss of that metal in the retorted silver and by leakage does not exceed $\frac{1}{2}$ per cent. of the total handled. The following figures show the costs per ton treated for 1900:—Crushing and grinding, 1·42 dols.; patio labour, washing *tortas* and concentrating sulphides, 0·57; Retorting, repairs, salaries, and general expenses, 1·18; salt, 110 lb. at $8\frac{1}{2}$ c., 0·94; bluestone, 8·4 lb. at 14 c., 1·17; precipitate, charcoal, castings, &c., 3·49; mercury, 2·73 lb. at 1·0 dol., 2·73; total, 11·50 Mexican silver dols. At *El Bote* a hard quartz ore is treated which averages about 28 oz. of silver and 8 dwts. of gold per short ton. It passes first through a Gates crusher, then through rolls, after which it is fed by Challenge feeders to a battery of (2) Chilian mills, which crush wet until 94 per cent. of the pulp will pass 120 mesh; the capacity of each mill is 10 tons per day. The pulp then passes to (10) large "spitzkasten," 12 ft. long by 7 ft. wide, provided with the Ayton intermittent discharge for the thickened pulp, which enters a series of (18) Boss pans. In the first pan additions of salt and copper sulphate are made—about 2 per cent. of the first and from 0·6 per cent. to 0·8 per cent. of the second. Lime is fed into the last of the pans to neutralise any remaining copper sulphate or free acid. The loss of mercury averages 2 oz. per ton of ore. From the settlers the pulp passes to (8) 6-ft. end-shake vanners, which yield about 15 tons per month of pyritic concentrates containing 32 oz. to 64 oz. of silver and 15 to 24 dwts. of gold per ton, with about 7 per cent. of zinc, 30 per cent. of silica, and 50 per cent. of iron pyrites. The tailings average about 4 oz. of silver and $1\frac{1}{2}$ dwt. of gold per ton. At the *Hacienda de Loreto, Pachuca*, the ore is crushed when necessary in (2) Blake stonebreakers, having a total capacity of 120 — 140 metric tons per 24 hours. The crushed ore passes to the (12) Chilian mills, arranged in two sets, one of eight and the other of four. Each mill is furnished with a Tulloch feeder, the feed being kept as low as possible. The screens are of 60 to 70 mesh; the capacity of each mill is 10 tons per 24 hours of very hard silicious ore. From the mills the pulp passes to a concentration plant of (3) Bartlett tables and (1) Wilfley, (*a*) in order to take out as much as possible of the silver values as a rich concentrate suitable for shipment to smelters; (*b*) to remove the particles of iron introduced by the process of crushing. With average Pachuca ore nearly one-half of the silver contents are thus taken out in a concentrate worth, say, 90 oz. of silver, from ore originally carrying 32 oz. per metric ton, leaving, say, 16 oz. in the tailings, which pass to masonry settling tanks, each having a capacity of 440 to 500 tons. After draining, the mud is run out and formed into a *torta*. The time occupied in amalgamation is from 15 to 22 days. The loss of mercury averages about 1½ oz. per oz. of silver recovered. The retort silver, which carries enough gold to pay for parting, is charged, 60 kilos. at a time, into one of (6) cast-iron pots, 2 ft. diameter, heated by wood fires, and with covers provided with pipes to convey the fumes to (3) chambers where sulphuric acid is produced by burning native sulphur in retorts. The gold obtained amounts to 1 to 1·2 oz. per 1,000 oz. of silver. The hot copper solution from the silver precipitation vats is siphoned off into a series of shallow lead-lined masonry tanks; in cooling it deposits on lead strips crystals of copper sulphate, which are utilised again in the patio. Practically the whole of the copper sulphate originally added to the torta is in this way regenerated. The mother liquors from the crystallising tanks, called *acido negro* (and still at a strength of 30° B.) are concentrated in a platinum still to 60 B°., and again utilised in the boiling pots, except a small quantity which is added at the end of the boiling operation in order to dilute the silver sulphate sufficiently to enable the gold slimes to settle out. After a considerable time the mother liquor becomes heavily charged with iron. It is then boiled down in shallow leaden pans till it begins to crystallise, when, upon cooling, it deposits nearly the whole of its sulphate of iron, which is utilised in the patio in place of copper sulphate. From the long masonry channels below the *lavadero* the slimes-pulp from the patio, after depositing its amalgam, passes through a series of (7) tanks, each 47 ft. long by 6 ft. 6 ins. wide by 5 ft. deep, where a portion of the slime settles out and is separately treated by concentration on (4) Wilfley tables. The middlings from the Wilfleys are returned; the tailings are said to contain but ¾ oz. of silver per ton. At the *Hacienda de La Union* the "Kröhnke" process is in operation. The pulp from the mills is spread out on huge floors to dry, after which the ore is treated with cuprous chloride solution in (13) large barrels about 8 ft. long by 5 ft. diameter, resting on rollers and rotated, by means of a spur wheel fixed on one end, from four to five times per minute; the charge of each is 4½ tons. The process is as follows: Salt is charged into an empty barrel equal to 25 per cent. of the silver present, sufficient hot water is then added to convert the ore into a thin mud, then mercury equal to eight times the weight of silver present, then the ore itself is run in. Scrap zinc is also added equal to 8 to 10 per cent. of the mercury to decompose the calomel formed by the reaction. The barrel is rotated for 5 or 10 minutes, and the cuprous chloride is then added, containing copper equal to from 50 to 80 per cent. by weight of the silver. The barrel is then rotated for six hours, the door is removed, and the contents are discharged into an inclined masonry channel which leads to the *lavadero*. The washing of the pulp and the treatment of the amalgam are effected in the usual way, except that a solution of ammonium carbonate is employed to remove cuprous oxide. The washed pulp is elevated by means of a tailings wheel, and run over a concentration plant comprising Bartlett tables, round buddles, and *planillas*. The concentrates recovered are of much lower grade than those at Hacienda de Loreto, owing to the greater perfection of the amalgamation. The final loss in tailings is said to be 0·3 oz., or only about one-third of the loss by the patio process, and the extraction is said to reach 99 per cent. of the silver contents of the original ore. The loss of mercury is only 7 oz. per 32 oz. of silver recovered. This process is much more expensive in working than the patio process, and the drying between the crushing and amalgamation is a great drawback, as it necessitates a large area, costly handling, and involves a considerable dust loss. The *Hacienda de San Francisco* employs the pan process. It is well arranged, and works at a low cost for labour, though the cost for power is high. It comprises 50 heavy stamps which supply (6) grinding pans, from which the pulp passes successively through one chemical pan, where salt (44 lb. per ton of ore), copper sulphate (19 lb.), and lime are automatically fed, then a series of (16) Boss pans in two rows, and lastly, (4) Boss settlers. The tailings from the settlers go to a concentration plant of (7) frue-vanners, the tailings from which are re-treated on (5) Wilfley and (1) New Standard tables; the concentrates from the tables treating vanner tailings are of higher value than the vanner concentrates, though smaller in quantity. The value of the tailings is 3 to 4 oz., so that on ores of 25 to 30 oz. the high losses in tailings more than offset the saving in treatment costs over the patio process. The *Hacienda de San Antonio* still employs the old Freiberg barrel process. At *Minas Nuevas*, near Parral, there are three lixiviation mills, only two being in working order. The capacity of No. 3 mill is 70 tons per day, which varies from 12 up to 30 oz., average about 25 oz. The ore is chiefly specular hematite disseminated through a limestone gangue, with some galena; it is tipped over grizzlies, the roughs are fed into two Blake stone-breakers, the crushed product is delivered to a rotary drier. The dried ore is mixed with about 10 per cent. by weight of inferior salt. Rotary self-feeders of simple construction then deliver the mixture to rolls, and the crushed material, after tromelling through a 35 mesh, is elevated and taken by belt conveyors to the roasters, (2) of White-Howell pattern, 33 ft. long by 5 ft. wide, making one revolution per minute. The leaching plant consists of 12 vats, each 14 ft. diameter by 7 ft. deep, and taking a charge of 25 tons. 880 charges are put through per year, which gives about five days for each charge, including filling and emptying. When full and levelled off, base-metal leaching is started by running on hot water and allowing it to leach through for 10 to 12 hours. Sodium thiosulphate solution (0·44 per cent.) is then run on, and 5 to 6 hours after, traces of thiosulphate appear in the effluent liquor, which is then turned from the base metal to the precipitating tanks. Leaching is continued for from 30 to 40 hours, when the level of the solution is allowed to fall below the surface and water is run on. Five or six hours after, the effluent liquor is found to have a strength of under 20 per cent. of thiosulphate, whereupon the weak liquors are turned back into the same tank in which the base-metal leach was already precipitated, and precipitated in the same way as was that leach. There are four precipitating tanks for the base-metal leach, and five for the thiosulphate solution, each 14 ft. diameter by 14 ft. deep. In treating the base-metal leach, from two to three times its volume of clean water is first added, and then 35—48 gallons of strong sodium sulphide solution. The contents of the tank are stirred up with a jet of compressed air and allowed to settle for one hour. For the precipitating tanks only 3 to 5 gallons of sodium sulphide solution are required for each charge, the stirring by means of compressed air is continued much longer, and from 2 to 3 hours are allowed for settling. The precipitate flows direct to the precipitate pumps feeding Johnson's filter presses. Once a month a general clean up is made; the total extraction on the whole process, notwithstanding the volatilisation loss in the furnaces, is 80 to 85 per cent. The press cakes are roasted, fused on a lead bath in cupel furnaces with Lynch test supports, a blast being produced by a No. 2 Root blower running at 85 revolutions per minute. The cupel bottoms are made in two layers, the lower of clay and ashes tamped in and dried slowly in the usual way. The upper or working test is formed of cement, which is mixed with water on the floor until it sets, the mass being then broken up and beaten into shape on the test with hot irons. Each hearth will last six months, but the working surface is renewed after each run by beating fresh cement upon it. Each campaign is commenced by melting down 175 kilos. of lead, and if high grade sulphides are being refined, the total charge is 500 kilos. of roasted sulphides, charged two shovelfuls at a time every few minutes until the whole has been absorbed and slagged, the operation taking about 24 hours. The silver obtained is poured into moulds, forming bars of about 75 lb. each. When low-grade sulphides are refined, each campaign lasts two to three days, lead is charged as required, and the total charge of the campaign is 500 kilos. of sulphides per day, together with 700 to 800 kilos. of wash-water precipitates and trough deposits. Each furnace uses per 24 hours about three cords of hard wood. The slags average 60 per cent. of lead and 250 oz. of silver per ton. At intervals they are smelted with iron ore in a small water-jacketed cupola. The resulting lead bullion is utilised for refining the high-grade sulphides. At the present time the high cost of fuel renders this the cheapest and most convenient reduction process for these ores in spite of the low extraction, but when other classes of ores become available it may prove cheaper to adopt a direct smelting process, by which 97 per cent. of the values could be realised in place of 80 to 85 per cent.—J. H. C.

Hydrochloric Acid and Oxygen; Action of ——, on Metals. C. Matignon. Comptes rend., 1903, **137**, [24], 1051—1052.

Hydrochloric acid gas in presence of oxygen attacks all the metals of the platinum group—palladium, ruthenium, iridium, rhodium, and osmium. The ease of attack is in the order given, palladium being attacked slowly in the cold, and very rapidly when heated in sealed tubes to 125° C., while osmium is but slowly acted upon in sealed tubes at 150° C. The mixture of hydrochloric acid gas and oxygen forms an excellent reagent for detecting the presence of iron in metallic gold, iridium, or rhodium.
—J. T. D.

English Patents.

Ore-Roasting Furnace. W. A. Maddern, Boulder City, Australia. Eng. Pat. 24,124, Nov. 4, 1902.

The furnace, of the horizontal type, may have one or any number of superposed hearths, on to the topmost of which, at the fireplace end, the ore is passed, and is mechanically rabbled to the opposite end, from which it passes on to the finishing hearth, along which it is rabbled in the opposite direction, for delivery on to the "cooling and regenerating" hearth, to which air is supplied at the delivery end, and as the ore is rabbled along this hearth, the air cools the ore and so abstracts the heat. This highly heated air is then passed or drawn onwards for oxidising in the furnace. The rabbling is effected by radially moved semi-rotating arms having blades on the under side, set at an angle, so as to turn the ore over on both forward and backward strokes to suit the traverse of the ore. Cold air is drawn through the rabble and passes into the furnace when heated. Water-cooled rabbles are also used. A special "toggle-joint" for the rabbler is described and claimed.—E. S.

Metals, Metalloids, and Compounds of the same [free from Carbon]; Process and Furnace for Obtaining ——. J. G. Lorrain, London. From Electricitäts Act.-Ges. vorm. Schuckert and Co., Nuremburg. Eng. Pat. 25,954, Nov. 25, 1902.

See Fr. Pat. 324,621 of 1902; this Journal, 1903, 636.
—T. F. B.

Ores; Concentrating —— [by Oil Process], and Apparatus therefor. A. S. Elmore, London. Eng. Pat. 184, Jan. 3, 1903.

Pulped ores are treated with oil, to separate the mineral valuable constituents, in apparatus comprising a mixing tank, a pump or other mixing device, and a floating oil seal to exclude air during the mixing; also, a settling tank having an outlet pipe in the bottom leading to the mixing tank of an auxiliary apparatus for treatment of the tailings, the overflow of the outlet pipe being below the level of the lip of the subsiding tank. The upper layer of mineral-charged oil is drawn or skimmed off, and treated with aid of heat in a centrifugal machine. Before separating, the oil may be thinned by some suitable solvent, in which case the recovered oil is subjected to a blast of cold air before re-use. Compare Eng. Pats. 6519 and 15,526 of 1901, and U.S. Pat. 692,643 of 1902; this Journal, 1902, 349, 862, and 618 respectively.—E. S.

Metallic Compounds, having Iron Partly or Wholly Decarbonised for their Principal Constituent; Manufacture of ——. S. Parfitt, Cardiff. Eng. Pat. 2612, Feb. 4, 1903.

Iron is melted and decarburised in the usual way until not more than about 0·1 per cent. of carbon remains, when it is "tempered" by addition of aluminium, or of aluminium and tungsten, instead of the usual carbon-carrying material. Suitable proportions to be added are 0·5 per cent. of aluminium and 0·3 per cent. of tungsten. The metal thus produced is stated to have similar properties to mild steel, but offering greater resistance to oxidation or attack by acids.—E. S.

Crucible Filling or Charging Apparatus. W. S. Mather, Newark, New Jersey, U.S.A. Eng. Pat. 18,751, Aug. 31, 1903.

The material is conveyed, in predetermined charges, in travelling pans or buckets, and discharged mechanically into the crucible, the holder of which is rocked or shaken, both vertically and horizontally, to settle or shake down the material.—R. A.

Aluminium Alloy, and Process of Producing the Same. A. J. C. de Monthy, L. Trézel, and V. Coppée, Paris. Eng. Pat. 19,504, Sept. 10, 1903.

See Fr. Pat. 325,191 of 1902; this Journal, 1903, 635. Silver (7·5 parts) may also be added to the mixture.
—T. F. B.

Air for Blast Furnaces and the like; Extracting Moisture from ——. J. Gayley, New York, U.S.A. Eng. Pat. 19,933, Sept. 16, 1903.

The air is drawn through a chamber, in which it is cooled to or below 0° C., thus causing its moisture to be eliminated, or reduced to a small and practically uniform proportion. From the cooling chamber, the dried air is fed by the blowing engine, and maintained constantly under compression until it enters the furnace or converter. (See also Eng. Pat. 11,091 of 1900; this Journal, 1901, 27.)—R. A.

Furnace or Kiln for Roasting Finely-crushed Ore, Burning Dolomite, and for other Purposes. G. O. Petersson, Dalsbruk, Finland. Eng. Pat. 22,162, Oct. 14, 1903.

Arches are "arranged in a shaft at different levels, zigzag with reference to one another, and with the space beneath the bottom arch or arches communicating at one end with the outer air, and at the other end with a [gas] fire-chamber, which in its turn communicates with one end of the space beneath the arch or arches above, while the other end of the latter space is in communication with a chamber in its turn communicating with the space beneath the top arch or arches, said space last mentioned communicating with a chimney, either directly or through the aid of other arches, compelling the gases to flow repeatedly back and forth in the furnace."—E. S.

United States Patents.

Steel; Manufacturing ——. C. V. Burton, London. Assignor to W. J. Hartley, London. U.S. Pat. 746,281, Dec. 8, 1903.

Acetylene, diluted with a "less explosive" gas, is blown through molten metal, the waste gases being brought into contact with the metal at an earlier stage of the process.
—E. S.

Ores; Apparatus for Treating ——. W. H. Adams, jun., Assignor to O. H. Hubbard, both of Los Angeles, Cal. U.S. Pat. 745,472, Dec. 1, 1903.

A tank is connected by a horizontal pipe near its top to a precipitation box containing a removable frame having precipitating devices with inclined collecting faces. A pump below the box draws liquid from it, which liquid is discharged into the tank near to the bottom, and also higher up at different levels, through pipes extending around the tank, having nozzles, some of which are pointed in opposite directions to others, the effect being that a rotary movement is imparted to the liquid in the tank, whilst a circulation of liquid goes on between the tank and the box. The bottom of the tank is conical, sloping upwards and inwards;

and there is a gutter around the base of the conical part in which amalgamated plates are fitted between the cone and the walls.—E. S.

Precious Metals; Process of Extracting —— [from Slimes]. T. J. Grier, Lead, S.D. U.S. Pat. 745,490, Dec. 1, 1903.

The slimes are placed in a settling tank, from which the thicker portion is drawn off into a leaching vat having a false bottom, through which a cyanide solution is passed under pressure, so as to displace the water in the slimes. The charge is then treated with air under pressure, after which the cyanide solution is displaced by a salt solution of greater density. In some cases, the slimes are first sprayed with a "protective solution to neutralise the acids therein," and the contents of the vat above its false bottom are heated in order to reduce the density of the upper portion of the liquid.—E. S.

Ore-Roasting Furnace. A. M. Bean, Assignor to the National Automatic Furnace Mills and Mining Co., both of Denver, Colo. U.S. Pat. 745,765, Dec. 1, 1903.

The ore-roasting cylinder, built in sections and capable of being revolved, is fitted centrally, by means of radial arms, within a double flue cylinder, arranged at a slight incline between the stack and combustion-chamber ends of the furnace, with which chamber the flue is in communication. The ore cylinder is fitted with spirally and longitudinally arranged perforated partitions, and the ore is fed by a conveyor in a casing, immediately above and the entire length of the furnace, and through a drier, from above the combustion chamber, and into a hopper, whence it passes through a horizontal pipe connected to a blower into the stack end of the ore cylinder, in which it is carried forward a certain distance by revolving blades, and then taken further by the spiral partitions, and has exit through the combustion chamber into a hood, whence means are provided for its discharge. Air is blown into the ore cylinder, and the sulphurous gases produced are exhausted through a pipe proceeding from a hollow trunnion at the delivery end, into a series of dust-collecting receptacles and condensers for the gases. A supplementary combustion chamber is arranged about the entrance end of the flues and ore cylinder. Numerous claims are made for details of the furnace. Compare U.S. Pat. 708,615 of 1902; this Journal, 1902, 1400; and U.S. Pats. 737,059 and 737,060 of 1903; this Journal, 1903, 1052.—E. S.

Metals; Process of Extracting ——, from Ores. E. B. Hack, Assignor to the American Filter Press Extraction Co., both of Denver, Colo. U.S. Pat. 745,828, Dec. 1, 1903.

Ore pulp is caked by pressure in such manner as to permit the moisture to escape, and a weak solution of the solvent (a cyanide, for instance) of the metals to be extracted, is passed through with compressed air; the pulp is then dried by air under pressure, followed by passage of a stronger solution of the solvent under the same conditions as before, the pulp being finally dried by air under pressure.—E. S.

Magnetic Composition [Alloy], and Method of Making Same. R. A. Hadfield, Sheffield. U.S. Pat. 745,829, Dec. 1, 1903.

A magnetic body is alloyed with from 1 to 5 per cent. of silicon; the alloy is heated to between 900° and 1,100° C., allowed to cool, and reheated to from 700° to 850° C., when it is allowed to cool slowly, to produce a magnetic material of "high permeability and low hysteresis action."—E. S.

Matte; Method of Converting ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 746,241, Dec. 8, 1903.

The method consists in introducing solid flux into the converter, fusing it with auxiliary heat, and then pouring the matte on the flux. Compare U.S. Pats. 722,198 and 727,057 of 1903; this Journal, 1903, 424 and 701.—E. S.

Copper Matte; Converting ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 746,249, Dec. 8, 1903.

The molten matte is intensely heated by the introduction into it of a large volume of air; a portion of the heat so produced is abstracted by a cooling medium at the beginning of the blow, while the oxidation is rapid, and at the end of the blow, when the oxidation fails, the heat is supplemented by a flame.—E. S.

Copper; Refining ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 746,246, Dec. 8, 1903.

A regulated stream of a reducing gas, independently generated, is forced through the copper when molten, after oxidation and removal of its impurities, and the stream is continued until a specimen of the copper cast in a test-mould, remains substantially level.—E. S.

Silicious Ores; Method of Recovering Values from ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 746,260, Dec. 8, 1903.

Silicious ores containing valuable substances are introduced in "solid lumps or particles" into a copper converter, and heated with an "auxiliary heat"; molten matte is then added, and the charge is Bessemerised and the ore fused. The valuable constituents contained in the product are recovered, and the gangue is used in the next operation as a flux.—E. S.

Smelter-Gases; Apparatus for Precipitating Injurious Fumes from ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 746,236, Dec. 8, 1903.

A succession of screens of "vegetable matter," carried by series of hollow and water-cooled rollers, are interposed in the path of the smelter-gases. The series of rollers are each set in a vertical perforated column, the perforations in which are upwardly inclined. The material of which the screens are composed is fed by hoppers, and a horizontal conveyor below the series of the vertical columns of the rollers removes the descending material. The screens referred to are kept wetted during the process.—E. S.

Arsenic Fumes; Method of Arresting ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 746,251, Dec. 8, 1903.

The arsenic fumes are arrested from smelter-gases by passing the latter through charcoal filters, wetted with an alkaline solution, such as of calcium sulphide.—E. S.

Furnace Gases; Apparatus for Arresting Impurities from ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 746,254, Dec. 8, 1903.

A travelling screen having filtering material between oppositely-acting rods with spring-backed faces, adapted to grip and move the screen, is arranged in the path of the gases. The rods are mounted on alternate cranks for reciprocal movement, and are parallel to each other, needful mechanism being provided.—E. S.

Furnace Gases; Apparatus for the Treatment of ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 746,255, Dec. 8, 1903.

The apparatus comprises a screen chamber through which "broken" filtering material is passed through a vertical column by means of an endless chain, the material having a series of pivoted supports separating it into layers, or portions of little depth, the supports constituting the links of the chain which engage with the rotating wheels, discharging the filtering material as they pass outside the chamber. The filtering material is supplied through a hopper to the top of the vertical column through which the material passes. There are cutters to the machinery moving within the chamber, whereby incrustations are removed from the walls. Means for wetting the screen material are provided.—E. S.

Smelter-Gases; Apparatus for Precipitating Injurious Fumes from ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 746,256, Dec. 8, 1903.

The gases traverse a chamber in which a series of inclined surfaces, with inclined gas passages, support a filtering material in "solid pieces" (or grains); there are feeding openings at the upper end, and a screw conveyor removes the material as it descends to the base of one column, and an elevating conveyor delivers it to the feeding opening of another column. Water is discharged upon the filtering material. The supports are movable by rocking mechanism. —E. S.

Smelter-Gases; Apparatus for Precipitating Injurious Fumes from ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 746,257, Dec. 8, 1903.

The gases pass through a chamber in which is arranged filtering material, carried by a travelling rack between adjacent chains or ropes having alternately arranged cross bars. The two sets of endless chains can be worked independently by apparatus outside the walls of the chamber, which the two chains only enter as they form a column in contact, face to face. The screen material is supplied from a hopper above the column, and provision is made for keeping it wet.—E. S.

Smelter-Gases; Process of Recovering Values [Valuable Dust] from ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 746,259, Dec. 8, 1903.

Valuable dust is recovered from smelter gases by causing them to come into contact with wet filtering material composed of ore, matte, or converter-slag, containing metals fit for reduction or smelting with the dust, so that the metals in both the dust and the filtering material may be recovered together. The apparatus shown for carrying out the process is the same as that described in the abstract of U.S. Pat. 726,256, above.—E. S.

Furnace-Gases; Apparatus for Removing Impurities from ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 746,261, Dec. 8, 1903.

In the chamber through which the gases pass, reciprocating bars are set in grooves in the chamber wall, carrying cutter bars so actuated as to dislodge deposited impurities from the walls. A charcoal screen is interposed in the path of the gases, means for removing which when impregnated, and for its replacement by fresh material, are provided. —E. S.

French Patents.

Sulphides, Metallic; Treatment of ——. R. C. Contardo. Fr. Pat. 334,103, July 24, 1903.

See Eng. Pat. 26,090 of 1902; this Journal, 1903, 1093. —T. F. B.

Aluminium; Manufacture of ——. G. Gin. Fr. Pat. 334,132, July 25, 1903.

Aluminium chloride is reduced by the zinc-sodium alloy ($ZnNa_2$) containing 40 per cent. of zinc. The sodium-zinc chloride formed is then employed as the fused electrolyte for the preparation of a further quantity of the $ZnNa_2$ alloy, and there is therefore a complete cycle of operations. —W. G. M.

Complex Ores; Extraction of the Metals from ——. J. Baxères De Alzugaray. Fr. Pat. 334,272, July 30, 1903.

Ores containing copper, lead, and zinc in relatively large proportion are digested with an acidulated solution of a chloride, whereby the copper is dissolved. Alkali and alkaline earth chlorides and ferrous and ferric chlorides are definitely enumerated as suitable. The copper is separated from the solution by usual means. The treated ores are washed, dried, and roasted at a comparatively low temperature. The roasted mass is treated with a weak acidulated chloride solution, and from the solution thus obtained, after concentration, the lead separates as chloride, and the zinc is precipitated by an alkaline-earth oxide. Sulphuric acid and sulphates may replace chlorides in the process, with certain modifications.—E. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Nitrites; Electrolytic Preparation of ——, *from Nitrates.* W. J. Müller. VII., page 17.

English Patents.

Storage Batteries, and Apparatus to be Employed in the Manufacture thereof. T. A. Edison, Llewellyn Park, N.J. Eng. Pat. 322, Jan. 6, 1903.

See U.S. Pats. 721,682 and 727,118 of 1903; this Journal, 1903, 425 and 701.—T. F. B.

Water; Purification of ——. M. Otto. Eng. Pat. 12,522, June 2, 1903. XVIII. B., page 34.

Electrolysis; Process for Decomposing Water by ——. G. T. Fuery. From W. F. M. McCarty and W. S. Beebe. Eng. Pat. 17,399, Aug. 11, 1903. VII., page 18.

Electrolysis of Chlorides of the Alkalis; Process and Apparatus for the ——. C. Kellner, Vienna. Eng. Pat. 20,889, Sept. 29, 1903.

The electrolyte is admitted as a hot solution, in the case of sodium chloride about 22 per cent. in strength, into the anode compartment, and then made to traverse a filtering diaphragm forming the base of the anode compartment. The latter is supported, in a shallow trough forming the cathode and cathode compartment, in such a way that the cathode is not in contact with the diaphragm. This latter is constructed of asbestos or cellulose covered with powdered barium sulphate, and supported by slotted or perforated metal sheets or metal netting or grating of such wide mesh as not to act as electrodes. By maintaining a higher level of liquid in the anode compartment, or by applying suction to the cathode compartment, the liquid is forced from one compartment to the other. The cross sectional current-conducting area of the diaphragm is diminished by arranging insulating material in or upon the same, so that the flow of electrolyte through the filtering diaphragm is somewhat greater than the velocity of travel of the hydroxyl ions, which are moving in the opposite direction to the liquid. A modification is described, in which frames are arranged in series, after the manner of a filter-press. Each frame is divided into two parts by a grating carrying bi-polar electrodes, and the parts of the frames forming the anode compartments are separated by the filtering diaphragms from the parts of the adjacent frames forming the cathode compartments. Various forms of bi-polar electrodes are described, consisting of carbon rods passing at right angles through apertures in a plate of slate, wires wrapped round plates of glass, &c., or platinum foil wrapped round a carbon plate and lying with its cathode side on a plate of iron, nickel, or lead.—B. N.

Circulation of the Electrolyte in Electrolytic Processes; Method and Apparatus for Producing a Suitable ——. H. Koller, Vienna, and P. Askenasy, Nürnberg, Germany. Eng. Pat. 23,151, Oct. 26, 1903.

The diaphragm is arranged in wedge-shaped parts in such manner that the interstices between them form a zigzag path for the electrolyte introduced from the side of the anode, whereby the fresh electrolyte is caused to flow at right angles, or nearly so, to the lines of electrical force and to the direction of the diffusion within the diaphragm, thus effecting a "systematic lixiviation of the reaction-products formed at the cathode from the diaphragm." The arrangement described may be modified by building up the diaphragm parts, which are of parallelopiped form, so that they shall break joint in such a manner that "the electrolyte introduced from the side of the anode is forced on its way through the interstices to the cathode compartment to flow all around the diaphragm parts."—E. S.

United States Patents.

Carbon Chlorides and Silicon. F. J. Machalske, Brooklyn. U.S. Pat. 745,637, Dec. 1, 1903.

A mixture of silica and an alkali chloride is decomposed by heating electrically, and the silicon tetrachloride formed, is heated, by electric arcs, with carbon bisulphide, also produced electrically in an adjoining furnace; carbon tetrachloride and silicon bisulphide are thus produced. The

latter is heated in presence of carbon, thus producing silicon and regenerating carbon bisulphide. (See also U.S. Pat. 742,340 of 1903; this Journal, 1903, 1298.)
—T. F. B.

Silicon Chlorides, Hydrochloric Acid, and Alkali Hydroxides; Process of Producing ——. F. J. Machalske, Assignor to C. H. Lyon. U.S. Pat. 745,966, Dec. 1, 1903. VII., page 18.

French Patents.

Electrolysis of Metallic Oxides or Salts; Apparatus for the ——. Soc. Usines de Riouperoux. Fr. Pat. 334,229, July 29, 1903.

The current is taken out at the upper part of the vessel without traversing the base, the latter being separated from the walls by an insulating material, such as brick, set back in such a position that the electrolyte is not melted at this point. The electrolysis between the vessel and the anode is thus suppressed. The process is applicable to the electrolysis of all oxides and salts containing a metal lighter than the electrolyte.—B. N.

(*B.*)—ELECTRO-METALLURGY.

Copper Ores; Technical Experiments in the Smelting of ——, *in the Electric Furnace.* C. Vattier. Berg- u. Hüttenm. Zeit., 1903, **62**, 549. Chem.-Zeit., 1903, **27**, [99], Rep. 323.

Chili copper ores were smelted with carbon electrodes in quadrangular crucibles, using a current of 3,500—4,000 ampères at 110 volts. Eighteen tons of a 7 per cent. ore were thus concentrated to a 43—45 per cent. matte, the slag containing 0·1—0·2 per cent. of copper. In other experiments the same ores were fused with two carbon electrodes in a crucible 1·8 × 0·9 × 0·9 m. When the crucible was full it was tapped into a kind of fore-hearth, and the mass was reheated to facilitate the separation of the matte from the slag. In this way 25 tons of ore were smelted in 25 hours, using a current of 4,750 ampères and 119 volts. The matte contained silica, 0·8; aluminium, 0·5; iron, 24·3; manganese, 1·4; sulphur, 22·96; phosphorus, 0·005; and copper, 47·9 per cent. The slags may be treated in another furnace for the preparation of ferrosilicon, ferromanganese, and spiegeleisen. The cost, calculated for conditions of work in Chili (1 ton of coke = 80 M.; 1 kw. year = 30·40 M.), works out at 66·40 M. per ton of ingot copper from 16 tons of ore containing 7 per cent. of copper, or from a 4 per cent. ore at only 18 M.
—W. G. M.

Silver-Plating; Current Efficiency in ——. Zeits. f. Elektrochem., 1903, **9**, [51], 979.

The current-efficiency in a cyanide bath containing 1 per cent. of silver is 99·4—99·2 per cent., and in a bath containing 2½ per cent. of silver, 99·3—99·6 per cent. When a bath has been in use for a long time, foreign metals are dissolved, and the current-efficiency decreases slightly. In all cases the agitation of a plating bath lowers the current efficiency by ½—1 per cent., owing to absorption of oxygen.
—W. A. C.

English Patent.

Alkali Group; Production of Metals of the ——, *by Electrolysis.* E. A. Ashcroft, Runcorn. Eng. Pat. 12,377, May 30, 1903.

The alkali chloride is electrolysed in a cell with anode of carbon or carbon and lead, and a cathode of lead or other metal forming a fusible alloy with the alkali metal; the alloy thus formed is run off into a second cell, where it is used as the anode, in an electrolyte of alkali metal hydroxide; the cathode may be of nickel or iron; the contents of each cell are thoroughly agitated. The second cell may contain, instead of the hydroxide, sodium chloride, bromide, or iodide, or halides of the alkaline earths. Suitable apparatus is described, including a form in which the two cells are combined.—T. F. B.

French Patent.

Steel; Electro-Metallurgical Process for the Manufactur of ——. Soc. Electro-Metall. Française. First Addition, dated July 10, 1903, to Fr. Pat. 328,350 of Jan. 7, 1903. (See this Journal, 1903, 955.)

The oxidation of phosphorus is rendered complete in the converter, and the mixture of iron and oxide of iron which is obtained is transferred to the electric furnace. Suitable precautions are taken to prevent the entrance of slag containing phosphorus, to the electric furnace, and the de-oxidation of the metal is then carried out in the presence of a basic slag, which removes the last traces of impurities, notably sulphur. A very pure form of iron is obtained, and into this may then be introduced manganese, silicon, tungsten, molybdenum, &c., so as to give the special properties of hysteresis and permeability. In this way the production of new qualities of metal, which may be usefully applied in magnetic and electrical apparatus, is rendered possible.
—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Indian Oils; Characteristics of Certain ——. J. Lewkowitsch. Analyst, 1903, **28**, [333], 342—344.

Pongam Oil is obtained from the beans of the Pongam tree, *Pongamia glabra*, which grows in East India, where it is used as a lamp oil and medicinally. The author extracted from the seeds 33·7 per cent. of the oil by means of ether, and in the following tables compares the results given by this oil with those from a specimen obtained from India:—

——	Oil extracted in Laboratory.	Specimen of Indian Oil.
Specific gravity at 40° C. (water at 40° C. = 1)	0·9352	0·9240
Specific gravity at 15° C. (water at 15° C. = 1)	..	0·93693
Saponification value	178	183·1
Iodine value	94·0	89·4
Reichert-Meissl value	..	1·1
Unsaponifiable matter (per cent.)	9·22	6·96
Melting point of fatty acids (freed from unsaponifiable matter) (° C.)	44·4	..
Butyro-refractometer reading	78	70
Free fatty acids, as oleic acid, (per cent.)	3·05	0·5

Pongam oil is of a dirty yellow colour, and at 15° C. is of the consistency of butter. The author points out that it might be utilised in the soap and candle industries, since large supplies are available.

Margosa Oil (*Veepa Oil, Veppam Fat, Neem Oil*) is obtained from the seeds of *Melia azedarach*, a large tree found in most parts of India and Burmah. The specimen examined by the author was solid at the ordinary temperature, and gave the following results:—Sp. gr. at 40°/40° C., 0·9023; sp. gr. at 16°/16° C., 0·91423; saponification value, 196·9; iodine value, 69·6; Reichert-Meissl value, 1·1; butyro-refractometer reading, 52·0; and solidification point of fatty acids ("titre"), 42·0° C.

Ben Oil.—Owing to its low iodine value this oil is employed for lubricating delicate machinery, such as watch springs. A specimen of oil obtained from the Jamaica plant, *Moringa pterygosperma s. oleifera*, gave the following results:—Sp. gr. at 15°/15° C., 0·91267; iodine value, 72·2; iodine value of liquid fatty acids, 97·53; and butyro-refractometer reading, 50·0. Two specimens of ben oil, representing the solid and liquid portions obtained by filtration at 0° C., had the following characteristics:—

——	Specific Gravity at 15°/15° C.	Iodine Value.	Butyro-refractometer Reading.
Portion solid at 0° C.	0·91840	109·9	59·0
Portion freed from solid at 0° C.	0·91998	111·8	60·5

A commercial sample of ben oil had an iodine value of 112·6, and gave a reading of 59 in the butyro-refractometer. It was regarded by the author as a filtered oil.—C. A. M.

Linseed Oil; Composition of ——. W. Fahrion. Zeits. angew. Chem., 1903, **16**, [50], 1193—1201.

The author describes experiments to show that it is not possible to obtain satisfactory results in determining the solid fatty acids by precipitation with barium acetate from an alcoholic solution. The method originally proposed by him, based on the oxidation of the unsaturated fatty acids with alkaline potassium permanganate and insolubility of the oxidation products in petroleum spirit, is also shown to be only approximately correct, since the saturated fatty acids yield insoluble oxidation products (about 2 per cent.), whilst on the other hand the unsaturated fatty acids yield some products soluble in petroleum spirit. These two sources of error nearly compensate one another, and the fatty acids from linseed oil when thus examined were found to contain 8·2 per cent. of solid acids—a result judged to be slightly too high from the results calculated by other methods. The oxidation of oleic acid with alkaline potassium permanganate was found to be very incomplete, whereas the linolic, linolenic, and isolinolenic acids gave nearly quantitative results. The author confirms the conclusion of Hehner and Mitchell (this Journal, 1899, 77) that Hazura's linolenic hexabromide must have contained linolic tetrabromide. He agrees, however, with Hazura's melting point (177° C.), and attributes the higher figure found by Hehner and Mitchell to too rapid heating. The general conclusion drawn from all the experiments is that the specimen of linseed oil examined had the following probable composition:—Unsaponifiable matter, 0·8; palmitic and myristic acids, 8·0; oleic acid, 17·5; linolic acid, 26·0; linolenic acid, 10·0; isolinolenic acid, 33·5; and glycerol radical (C_3H_5), 4·2 per cent.—C. A. M.

Fatty Acids; Separation of Different ——. A. Partheil and F. Ferié. XXIII., page 37.

ENGLISH PATENT.

Fatty Acids or their Glycerides; Process for Converting Unsaturated ——, *into Saturated Compounds.* W. Normann, Herford, Westphalia, Germany. Eng. Pat. 1515, Jan. 21, 1903.

Hydrogen, or a gaseous mixture containing hydrogen, *e.g.*, water-gas, is brought into contact with unsaturated fatty acids or glycerides in the presence of a finely-divided metal, such as iron, cobalt, and especially nickel, to act as a catalysing agent. It is stated that oleic acid is thus completely converted into stearic acid, and that the fatty acids of tallow have their melting point raised by about 12° C. by the process. The temperature and quantity of nickel are immaterial, and only affect the duration of the process. —C. A. M.

FRENCH PATENT.

Fatty Acids; Process of Saponifying ——. Raison Sociale Gebrueder Haas. Fr. Pat. 333,974, July 18, 1903.

Claim is made for the use of atmospheric air in a special apparatus to replace the greater part of the steam hitherto used to expel the carbon dioxide formed in the process of saponifying fatty acids by means of alkali carbonates. —C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

ENGLISH PATENTS.

Paint; Manufacture of White ——. R. Scholz, Cologne. Eng. Pat. 13,298, June 13, 1903.

Lead oxide (100 parts) and sodium chloride (20—40 parts) are triturated with water, and the product is washed if desired, treated with sulphuric acid until just acid (about 15 parts), and dried.—T. F. B.

Lithophone [*Lithopone*] *and Glauber Salt; Process of Making* ——. W. D. Gilman, Baltimore. Eng. Pat. 23,189, Oct. 26, 1903. Under Internat. Conv., Oct. 30, 1902.

See U.S. Pat. 732,732 of 1903; this Journal, 1903, 918. —T. F. B.

FRENCH PATENT.

White Lead; Manufacture of ——. J. H. Montgomery. Fr. Pat. 333,851, July 16, 1903.

Molten lead is blown into the lower part of a closed chamber by means of an injector, the air supply of which comes from a tube lying in the furnace that melts the metal. At the top of the chamber is a perforated pipe, whence fine streams of water fall upon the "atomised" lead. The material is constantly stirred up by a screw conveyor, which finally delivers the partially oxidised lead into an agitator placed underneath the chamber. From this agitator a pump raises the material to a revolving drum, where it is further submitted to the action of air under pressure. It next descends to a second agitator identical with the first, whence the same pump lifts it into a flat mill, where it is ground into the water present. From the mill the cream passes to a third agitator, the pump finally raising it to a second revolving drum, where it is treated with carbon dioxide under pressure. The plant is so arranged as to be driven from the one countershaft, and the connections are such that the whole series of operations can be repeated if necessary.—F. H. L.

(*B.*)—RESINS, VARNISHES.

ENGLISH PATENT.

Linoleum, Lincrusta, or the like; Manufacture of —— [*from Wood Oil*]. A. Kronstein, Karlsruhe. Eng. Pat. 26,371, Nov. 29, 1902.

See Fr. Pat. 327,340 of 1902; this Journal, 1903, 918. —T. F. B.

FRENCH PATENTS.

Varnish; Manufacture of ——. [*Use of Naphthalene.*] A. Crebert. Fr. Pat. 334,107, July 24, 1903.

Certain proportions of naphthalene are added to the usual ingredients in making oil varnish, the natural low degree of solubility of the hydrocarbon being increased by mixing it first with the resin or resinous material. The advantages claimed on behalf of the naphthalene are that the varnish is paler and clearer, does not "skin," is cheap, carries a higher proportion of pigment if made into paint, and dries to a hard strong film. (See Eng. Pat. 16,933 of 1902; this Journal, 1903, 705.)—F. H. L.

Oils; Heating Drying ——, *for the Manufacture of Varnishes.* W. Leppert and M. Rogovin. Fr. Pat. 334,233, July 29, 1903.

See Eng. Pat. 17,035 of 1903; this Journal, 1903, 1250. —T. F. B.

(*C.*)—INDIA-RUBBER.

Caoutchouc from the Asclepias syriaca L. J. Marek. J. prakt. Chem., 1903, **68**, [10], 459—460.

The latex from the *Asclepias syriaca L.* yields a dry residue of about 17 per cent., 1½ per cent. being real rubber and about 8·3 per cent. substances soluble in boiling 98 per cent. alcohol. The latter may be divided into two groups—one slightly soluble in hot 95 per cent. alcohol, but practically insoluble in the cold; the other fairly soluble in both hot and cold 95 per cent alcohol. The first group is mainly a mixture of an acetic ester and a butyric ester corresponding to the rational formulæ $C_{30}H_{49}C_2H_3O_2$, $C_{29}H_{45}C_4H_7O_2$. The second group contains similar esters, but with fewer carbon atoms. The author has not yet been able to ascertain whether the alcohol components of these esters are true alcohols or phenols, but their behaviour with nitric acid and Liebermann's reagent point to aromatic hydroxides and phenols. Further study of this latex may throw some light on the formation and constitution o india-rubber, since the hydroxyl derivative of the radical $C_{30}H_{49}$ of the ester $C_{30}H_{49}.C_2H_3O_2$ possesses only the elements of one molecule of water over and above the constituents required by the empirical formula for caoutchouc.—J. K. B.

English Patents.

Rubber, Gums, and like Substances; Apparatus for and Art of Extracting ——. W. A. Lawrence, Brooklyn. Eng. Pat. 21,890, Oct. 12, 1903.

See U.S. Pats. 741,257 and 741,258; this Journal, 1903, 1200.—T. F. B.

Vulcanisation of Rubber Goods; Machines for ——. E. Frankenberg, Hanover, Germany. Eng. Pat. 22,826, Oct. 22, 1903.

The permeable casings fitted to "cold-curing" vulcanisers, and described in an earlier patent (Eng. Pat. 24,574 of 1902), are replaced by lightly hung valves or ventilating flaps opening inwards, which allow fumes to be removed freely from the vulcaniser by an exhaust, but stop their egress into the workroom should the exhaust break down from any cause.—R. L. J.

XIV.—TANNING; LEATHER, GLUE, SIZE.

Tanning Materials and Tanning Extracts; Determining the Weight-giving and Leather-forming Properties of ——. J. G. Parker. XXIII., page 37.

English Patent.

Grain Leather, and Process for its Production. S. E. Page, London. From the Universal Leather Co., New York, U.S.A. Eng. Pat. 22,872, Oct. 22, 1903.

"Flesh splits" are coated with a layer of pure rubber cement, dried, and then pressed. If desired the split may be previously dyed, or dye may be mixed with the cement. The superficial layers of the split are thus united with the body substance, forming a compact surface which admits of the process of graining, and behaves quite differently from a merely filled, flesh split surface. For some purposes a leather dust is lightly applied to the cemented surface.

—R. L. J.

French Patent.

Tanning by Use of Tawed Skins. L. R. A. Berthon and L. A. M. A. Berthon. Fr. Pat. 334,006, July 18, 1903.

Skins previously tawed with salt and alum may be placed in strong tanning liquor (vegetable) without risk of injury; the latter gradually displaces the salt and alum, and produces ordinary leather. The tawing liquor contains salt (10 per cent.), alum (1 to 2 per cent.), and sulphuric acid (1 to 2 per cent.) or an organic acid (5 per cent.) and may be made up from old tan liquor instead of fresh water. After tawing for from 12 to 48 hours the skins are dried in the air, worked on the beam, and placed for 8—15 days in strong tan liquor, to which may be added alkali acetates or sulphites, or soluble salts of barium, strontium, or calcium (5—10 per cent.) to decompose the alum which is otherwise eliminated somewhat slowly.—R. L. J.

XV.—MANURES, Etc.

Lime and Magnesia in Soils; Influence of the Relative Quantities of ——, *on the Growth of Plants.* O. Loew. Chem.-Zeit., 1903, **27**, [100], 1225.

The author, in reply to Gössel, who had criticised his statement that the maximum yield of a crop cannot be obtained if the soil contains an appreciably greater amount of magnesia than of lime, sums up the question as follows. Magnesium salts and calcined magnesia, when present even in moderate amount, act injuriously on plants. A moderate amount of lime is advantageous on many soils, but with an excess, the yield again decreases. Calcium salts counteract the injurious action of an excess of magnesia, and, if present in sufficient quantity, allow the magnesia to play its part as a plant foodstuff. The conclusion drawn from these facts that, with a certain ratio between the amounts of the lime and magnesia, the maximum yield is obtained, has been confirmed by experiments. In the case of most of the cereals the best ratio is $\frac{CaO}{MgO} = 1$, but in the case of other plants, especially of those bearing more leaves, the amount of lime should be from two to three times that of the magnesia.—A. S.

Potassium Salts, 40 per cent.; Value of ——, *compared with Kainite.* W. Schneidewind. Arb. d. Deut. Landw. Ges., 1903, [81]; Biedermann's Centr. Bl., 1903, [12], 803.

The new 40 per cent. "potassium salts" contains three and a half times as much potassium as kainite, and may therefore be employed with advantage in the case of soils which are injured, as regards their physical properties, by large amounts of soluble salts. At the same time the character of the crop has to be considered, since the different potassium manures act very differently on different crops.

—N. H. J. M.

Fertiliser rich in Nitrogen and Potash; Treatment of Vinasses of Molasses Distilleries to obtain a ——. G. Gimel. Bull. de l'Assoc. des Chim. de Sucr. et de Dist., 1903, **21**, [5], 510—513.

After the vinasse has been concentrated to 30°—35° B., it is distilled with quicklime and the ammonia, trimethylamine and a little methylamine, which volatilise are collected in hydrochloric acid. By evaporating the solution obtained, the mass is converted into a residue of ammonium chloride and methylammonium chloride, which is collected and afterwards liquefied. The residue from the distillation with lime, is treated with sulphuric acid until almost neutral, the precipitate filtered or "spun off," and the liquid concentrated to dryness. Glycerin will have been in great part destroyed by the lime. To the mineral matter which remains, the ammonium chloride should be added. The composition of the fertiliser is then: nitrogen (in the form of ammonia) 4·3, calcium sulphate 37, potassium sulphate 28, sodium sulphate 4, potassium chloride 12, water 4, and various 10 per cent.

—L. J. de W.

Tobacco; Manurial Experiments with ——. Max Lehmann. Landw. Versuchs-Stat., 1903, **58**, 439—470.

Whilst nitrogen is equally necessary to all parts of the plant, potassium seems to be chiefly of use to the leaves and roots, and phosphoric acid to the stems. Chili saltpetre proved to be the best nitrogenous manure, then ammonium sulphate and blood-meal. The latter seems to act favourably on the burning properties of the tobacco. Excessive manuring is to be avoided, as it increases the amount of water in the leaves, and promotes a relatively greater development of stems and roots. Chlorides and sulphates are unsuitable, as they decrease the burning properties. Potassium carbonate and "martellin" act favourably in this respect. Perchlorate does not act poisonously on tobacco when present in moderate quantity, but favours the development of the leaves, and especially the roots.

—N. H. J. M.

English Patent.

Distillery Refuse or Pot Ale; Treatment of ——. C. Day and E. W. Gaskell. Eng. Pats. 2519 and 2520, Feb. 3, 1903. XVII., page 32.

French Patent.

Soot; Process and Apparatus for its Recovery ——, *for Utilisation as a Manure.* H. Lamiche. Fr. Pat. 331,085, July 23, 1903.

The stack or chimney to a works is provided with a pipe entering below the damper, and continued externally with enlargements forming chambers, circular in horizontal section, merging above into a pipe which enters the stack at a higher level, so that the draught carrying the soot may be directed through the passage thus formed. Each chamber is fitted with a baffle-plate curved downwards, from which, and also from the sides of the chamber, the soot is continually removed by a revolving scraper. The soot thus detached mingles with powdered peat, introduced by a conveyor from a hopper at the side. Water-sprinklers are provided to form the soot and peat into a mud, which is discharged through a vertical pipe. A set of wings is kept rotating in the lower of the chambers or enlargements. The proportion of soot and peat in the manure obtained is regulated by adjusting the rate of feed of the latter.

—E. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Crystal Sugar; Valuation of ——, for Working up into Refined. K. Wasilieff. Zeits. Ver. deutsch. Zuckerind., 1903, **53**, [574], 1157—1182.

In the first period of the refining (the crystallisation in the filling-house included) the colour of the syrup from crystals of medium quality with a content in reducing bodies corresponding to 0·02—0·25 per cent. of copper oxide increases seven to eight fold. The more strongly the crystals are coloured, the more does the colour of the syrup increase at the time of refining. The quantity of reducing substances increased fourfold. The products of decomposition of sugar must be dextro-rotatory, seeing that the purity-factor is increased. In the same period and under the same conditions, syrups prepared from crystals which had become moist and deteriorated, with reducing bodies equivalent to 0·57 per cent. of copper oxide, increase in colour twelvefold. As the purity-factor has diminished, the decomposition products of the sugar and the altered non-sugar must be lævo-rotatory. That the sugar which had become moist was itself colourless was no guarantee that the colour of the syrup would not increase during refining. No relation could be fixed between the colour of the original syrup and that after treatment in the refinery. A characteristic peculiarity of stored sugar which had become moist is the presence of reducing bodies, and the estimation of these on some strictly uniform plan is of prime importance. Crystals containing much reducing bodies must be regarded as abnormal. Since the non-sugar formed in crystal sugars that have become damp is optically inactive, a deduction should be made from the direct polarisation. The non-sugar formed, which undergoes further decomposition during refining, easily combines with the lime added to the cleare, and in this condition acts as a strong molasses-former. The action of the reducing bodies in damp crystals on the colour of the syrups and on the quality of the refined sugar is so great and so vital that it is difficult to fix the deduction to be made in this case.—L. J. de W.

Sugar Losses in the Refinery. E. von Lippman. Zeits. Ver. deutsch. Zuckerind., 1903, **53**, [574], 1131—1138.

In the complete working up of raw sugar into loaves, cubes, granulated, &c., and molasses, there are certain as yet unavoidable and not inconsiderable losses which do not occur in the mere centrifugalising or washing-up of raw sugar. The losses in total weight and as indicated by polarisation (or sugar content) do not coincide. Many of these losses are purely mechanical; the decomposition of sugar or chemical loss, attended by an increase in organic non-sugar, is ascribed by the author to changes during boiling and re-boiling. Twenty years ago the massecuite boiled amounted to five times the weight of raw sugar produced, now it ranges from 2 to 2½ times that weight. The question of high or low pressure steam for boiling is of relatively minor importance, the greater length of time at the lower temperature outweighs any advantage it might offer. A sugar of the following composition: polarisation 95·5, water 1·8, ash 1·0, organic non-sugar 1·7 per cent., would yield 90 per cent. of white sugar and 9 of molasses, the latter containing only 4·14 of sugar, 1·8 of water, 1·0 of ash, and 2·06 of organic non-sugar; a loss therefore of 1 per cent. of weight, 1·36 of sugar, and a gain of 0·36 of organic non-sugar. As in a refinery working without char, experience shows the loss to be only 0·25 per cent., there is left 1·36 — 0·25 = 1·11 due to chemical changes, of which (regarding the organic non-sugar produced as equal to its own weight merely of sugar) 1·11 — 0·36 = 0·75 per cent. so-called "non-demonstrable" loss. The destruction of sugar during boiling is not confined to its conversion into stable bodies which remain in the syrup, but the non-sugars first formed are further changed into volatile products, which pass over into the water of condensation, and consist of furfural, furfuran derivatives, acetone, and formic and acetic acids. During the boiling of concentrated solutions of sugar the formation of invert sugar is not to be expected, but of products of overheating, characterised, as Herzfeld has pointed out in refinery products, by increasing differences between the results given by direct polarisation and the Clerget inversion method, and not to be explained by the presence of lævo-rotatory invert sugar, but by dextro-rotatory bodies of a nature between sugar and caramel. In the boiling of after products it sometimes happens that an increase in the destruction of sugar is accompanied by a decrease in the reducing power.—L. J. de W.

Sugar; Chemical Nature of the Bodies Produced by Overheating ——. F. Stolle. Zeits. Ver. deutsch. Zuckerind., 1903, **53**, [574], 1138—1149.

Following Wasilieff (this Journal, 1903, 38) the author gives the results of analyses of the clairce and massecuites which were obtained by working exclusively pure white Russian sugar, without the smallest addition of after products or sweet waters. The raw sugar used polarised 99·75 per cent. It was melted and heated to 90° C., and passed over char at 69°—70° Brix. Thus far the slight increase in reducing power lay within experimental errors, and a slight purification had taken place. The massecuite of the first product, which was neutral, showed an increase in reducing power and in organic non-sugar at the expense of the polarisation. The destruction of sugar continued at an increasing rate in the second, third, and fourth products. The difference between direct polarisation and the sugar by the Clerget inversion method increased at each boiling, although the after products were boiled at a lower temperature. The nature of the products of decomposition cannot be determined with certainty, but it is clear that not only dextrose and levulose but also dextrins are formed. At every boiling there is also a caramelisation which is independent of the acidity or alkalinity of the syrup and increases with the temperature. This caramelisation is of influence on the colour, but its influence is usually considerably overestimated. Very little real caramel is formed, but many colouring matters, erroneously regarded as caramel, are produced by the action of lime on the non-sugars. Pellet is of the same opinion, seeing that most (beetroot) molasses contain no reducing bodies, whilst caramel reduces copper solution. Little caramel is contained in refinery molasses. Caramel is not precipitated by lead acetate solution made alkaline with a fixed alkali, but only by ammoniacal lead acetate; the colouring matter of molasses, however, is almost completely precipitated by ordinary lead acetate, while the caramel remains and exerts its reducing power. Caramelan in solutions of 0·1 to 1 per cent. strength, when boiled for two minutes with copper solutions, show a reducing capacity which is a constant, and which rises in exact proportion to the concentration. The ratio of reduced copper to caramelan is 1 : 3·33. The reducing power increases with the duration of heating. It is thus of influence in the determination of invert sugar. By the hydrolysis of caramelan with 3 per cent. sulphuric acid, a hexose, levulinic acid and humin bodies are formed. The hexose closely resembles dextrose, but differs in its osazone, and in the products formed when its calcium salts are oxidised with bromine.—L. J. de W.

Beetroot Juice; Determination of the Purity of ——. P. Herrmann. Bull. de l'Assoc. des Chim. de Suer. et de Dist., 1903, **21**, [5], 528—532. (See this Journal, 1901, 843.)

From tests made by the author at the Dormagen sugar works during seven weeks of work in 1901—2, determining three times each shift the purity of an average sample of the chips by Krause's method and, at the same intervals, the purity of the diffusion juice, he concludes that the determination of the purity of the juice is of the highest interest for the due appreciation of proposed processes for the extraction of the juice as well as for experiments on manuring, cultivating, and for the selection of seed. The method of pressing is to be absolutely rejected for this purpose. The method of digestion proposed by Krause gives, when the conditions are maintained uniform, sufficiently regular values for the quotient of purity. The quotients of purity found by Krause's method correspond relatively to the quotients of purity of the juice contained in the beetroot. The method answers therefore to all that can be required of a process for the determination of the purity of the beetroot. For the uniform execution of the method it is recommended that coarse raspings be used: the temperature of digestion should be 90° C., and the digestion should be continued for 30 minutes.—L. J. de W.

Fertiliser Rich in Nitrogen and Potash; Treatment of Vinasses of Molasses Distilleries to obtain ——. G. Gimel. XV., page 27.

Pineapples; Quantity of Sugar admissible in Imported Preserved ——. H. W. Wiley. *Composition of Fresh and Preserved Pineapples.* L. S. Munson and L. M. Tolman. XVIII. A., page 33.

English Patents.

Sugar Juice; Treatment of ——. H. Winter, Charlottenburg, Germany. Eng. Pat. 26,570, Dec. 2, 1902.

The object of this process is the manufacture of first quality sugar and waste molasses only. The vacuum pan, of large capacity, is fitted with an agitating device consisting of two perforated tubular rings situated near the bottom. One of the rings has small perforations through which air, steam, water, or juice can be admitted at will, whilst the other has larger perforations for the admission of syrups or molasses. Near the pan are situated two clarifiers heated by steam, from which hot syrup is drawn for regulating the purity of the masseeuite towards the end of the boiling. The masseeuite is discharged from the pan in such a condition that its final mother syrup has a purity quotient below 40. It is cooled to a temperature of 35°—45° C. in crystallising vessels provided with stirrers. From these the masseeuite is pumped into a special form of malaxeur, in which it is diluted with final molasses to a workable consistency. Finally the sugar is separated in centrifugals, specially constructed so that the impure molasses may be collected separately from the purer washings, which latter are returned to the syrup tanks.—J. F. B.

Sugar; Apparatus for Whitening ——, *in Centrifugal Machines by means of Steam.* G. Deutsch, Vienna. Eng. Pat 28,186, Dec. 20, 1902.

Steam supplied by the main is separated into wet steam and water, which are fed into the casing of the centrifugal for diluting the molasses and syrups, and into dry steam, which, before entering the basket or drum, is wire-drawn in order to superheat it. The dry steam renders the molasses more fluid by warming rather than by diluting it and thus less sugar is dissolved. The combined steam drier and wire-drawing valve consists of an annular chamber containing a helical or screw-thread shaped partition, designed to admit steam at the top and to eject water at the bottom, while the lower portion of its inner side is provided with holes for the admission of steam to the central chamber, these apertures, or others at the top end of the central chamber, being adapted to be narrowed by means of adjustable slide-valves. The tubular steam-spraying nozzle has a widened end portion with a conically turned-out edge in the shape of a valve seat, and a valve having its tubular stem adjustably screwed into the nozzle behind the widened end portion. Steam passes through apertures in the tubular valve stem into the widened end of the nozzle and thence through the narrow slot between the valve and its seat.—L. J. de W.

Sugar; Manufacture of ——. J. Krivanek, Kiew, Russia. Eng. Pat. 18,044, Aug. 20, 1903.

The specification relates to a process for making sugar in slabs, strips, or blocks. The masseeuite is filled *in vacuo* into the moulds and the syrup contained in the mass is completely driven off with moistened and filtered air, before the addition of better syrup is begun. The apparatus consists of several chambers or compartments arranged in such a manner that the free inner chamber of the mould is hermetically insulated from that of the cleansing apparatus, and can be placed in communication in a suitable manner with the device for the moistening and filtration of the air, and also when required, with the corresponding cleare-collecting vessel. Means are also provided by which the filling of the masseeuite or filling mass into the mould is effected *in vacuo.*—T. H. P.

Soluble Starch; Process for Making ——. W. P. Thompson, Liverpool, from O. Bredt and Co., Unterbarmen, Germany. Eng. Pat. 22,370, Oct. 16, 1903.

This process consists in treating starch, or starch-containing materials of all kinds, in neutral, alkaline, or sulphuric acid solution, and preferably at a high temperature, with more permanganate than is necessary for oxidising the extractive impurities present, the action being continued until all the starch is converted into the soluble form. Starch thus treated may replace dextrin, gelatin, glue, gum, and the like.—T. H. P.

United States Patents.

Glucose; Process of Making ——. L. Roth, Kauth, Germany, Assignor to W. R. Gentzen, Gühlichen, Germany. U.S. Pat. 745,675, Dec. 1, 1903.

Claim is made for a process consisting in subjecting the cellulosic material under exclusion of air in a closed vessel to ozonised oxygen under pressure and afterwards adding sulphuric acid and maintaining the pressure in the vessel. —T. H. P.

Sugar; Process of Making ——. J. O. Schweitzer, Paris. U.S. Pat. 746,177, Dec. 8, 1903.

See Eng. Pat. 16,614 of 1901; this Journal, 1902, 1033. —T. F. B.

French Patents.

Cane Sugar; Production from Beet Sugar of Products Resembling ——. H. Winter. Fr. Pat. 333,813, July 13, 1903.

The pleasant flavour of unrefined cane sugar has been found to be due to residues of the products formed by the action of the lime used in manufacture upon the invert sugar or other hexoses. In order to imitate this flavour in the case of beet sugars, purified beet sugar crystals are "clayed" with a thin layer of a syrup which contains, in addition to saccharose and invert sugar, products formed by the action of alkalis upon invert sugar or other hexose under the influence of heat. In preparing these products it is preferable to employ caustic alkalis, but any substance with an alkaline reaction may be used; the decomposition is not carried so far as to produce caramel.—J. F. B.

Concentrators [for Saccharine Liquids, &c.]. F. Meyer. Fr. Pat. 334,241, July 29, 1903.

See Eng. Pat. 19,962 of 1903; this Journal, 1903, 1301. T. F. B.

Starch; Manufacture of Soluble ——. W. Wotherspoon. Fr. Pat. 334,154, July 27, 1903.

Starch is heated for a sufficient length of time with a mono-carboxylated organic acid, *e.g.*, acetic, formic, or lactic acid, preferably under conditions which do not cause the gelatinisation of the granules. For instance, dried starch is treated with glacial acetic acid to the extent of from 10 to 50 per cent. of its weight, the mixture is heated with agitation in a closed steam-jacketed converter until the starch is soluble in hot water. If an aqueous acid be employed, an inert dehydrating agent may be used, such as alcohol or brine, to prevent the gelatinisation of the starch. The acid is recovered by distillation or other means.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Yeast; Contribution to the Study of ——. J. J. van Hest. Zeits. ges. Brauw., 1903, **26**, [43], 701—706.

Absorption of Nitrogen Compounds by Yeast Cells.—The author's experiments with top-fermentation yeast show that good pitching yeast does not absorb any nitrogen compounds immediately after it has been mixed with wort, nor does it increase the percentage of nitrogen in the wort. On the other hand, inferior yeast, or such as has been improperly washed, will absorb nitrogen compounds as soon as it is brought into contact with wort, and bad or enfeebled yeast (the latter containing numerous dead cells) increases the nitrogen content of the wort, this result being specially noticeable in yeast that has been killed by artificial means.

Enzyme Action without Reproduction.—Up to a certain point this action is found to proceed without any cell reproduction; moreover, it is independent of the temperature. Weak yeast pitched and allowed to ferment at low temperatures, dies, and the contents of the dead cells are dissolved by the wort, wherein they give rise to a considerable loss of extract, the amount of zymase then coming into action being probably much greater than in cases in which the cells remain alive. In one case an addition of 1·2 per cent. of yeast to the wort reduced the extract in the latter from 10·9 to 6·0 per cent. Balling, without any cell reproduction being noticeable. In other experiments, wort of a gravity of 10·7 per cent. Balling was pitched with 0·5 per cent. of wet yeast, at an initial temperature of 11° C., and the gravity was tested daily. At the same time a portion of the wort was drawn off every day for a week, bottled, stored for 10 days at 0·5° C., and the gravity determined after filtration. The results are given in the following table:—

	From the Fermenting Vessel.		From the Bottles.		Loss of Extract without Growth	
—	Temp. °C.	% B.	Temp. °C.	% B.	Temp. °C.	% B.
Initial	10·0	10·7	..	..	..	..
After 1 day ...	10·4	10·0	0·5	9·5	..	0·5
„ 2 days...	10·9	9·1	0·5	7·8	..	1·3
„ 3 „ ...	12·1	7·0	0·5	5·6	..	1·4
„ 4 „ ...	13·7	4·4	0·5	3·9	..	0·5
„ 5 „ ...	13·6	3·4	0·5	3·1	..	0·3
„ 6 „ ...	11·7	3·0	0·5	3·0	..	0·0
„ 7 „ ...	9·8	3·0	0·5	3·0	..	0·0
		(7·7)				(4·0)

This procedure was varied in another instance by bottling two samples of the fermenting wort on the third day, cooling one to 0·5° C. and the other to 5·5° C., and storing them for six days. The second bottle was then cooled to 0·5° C., and the examination gave the following results:—

	From the Fermenting Vessel.		From the Bottles.		Loss of Extract without Growth.	
—	Temp. °C.	% B.	Temp. °C.	% B.	Temp. °C.	% B.
Initial	8·5	10·7	..	..	..	..
After 3 days..	9·9	7·8	0·5	7·8	5·5	7·8
„ 6 „ ..	11·8	3·5	0·5	6·8	5·5	5·9
„ 7 „ ..	10·7	3·2	0·5	..	5·5	..
„ 10 „ ..	..	..	0·5	6·1	5·5	5·3
„ 13 „ ..	..	..	0·6	5·8	0·5	5·0

The ready-formed zymase thus produced a loss of 2·0 and 2·8 per cent. of extract respectively. This is considered to indicate the possibility of arresting fermentation at any desired attenuation, and thus produce beer with a high percentage of extract and little alcohol. The amount of zymase ready formed in 1 litre of normal yeast cells is sufficient to ferment 870 grms. of sugar. —C. S.

Accumulation of Zymase in Colonies of Top-fermentation Yeast.—That yeast grown under conditions favouring reproduction, but in presence of very little sugar (*e.g.*, as colonies on malt gelatin plates), does ferment the sugar and liberate carbon dioxide, can be demonstrated by the colour change produced in gelatin stained with blue litmus and superimposed on the culture. Similar colonies transferred to a solution containing 2·2 per cent. of saccharose, and stored at 17·5 C., were found to have fermented 2 per cent. of the sugar in three days; and in another case a 10 per cent. solution of saccharose was completely fermented in five days. These experiments show that yeast cells cultivated on wort-gelatin plates develop zymase, which is then accumulated in considerable quantities. Even when grown on meat-gelatin plates, and under very unfavourable conditions, the cells begin to ferment when introduced into a medium containing sugar. The deduction from these phenomena is that the formation of zymase bears no relation to the amount consumed, but occurs to a definite extent under certain conditions of environment.—C. S.

Yeast; Treatment of Top-Fermentation ——. J. J. van Hest. Zeits. ges. Brauw., 1903, **26**, [47], 787—788.

Theoretically, the best way to separate the yeast from the barm is by leaving it to settle down, but it was customary to aid and accelerate the operation by washing. In attempting to ascertain how much water may be safely employed, so as not to weaken the yeast by extracting its nitrogenous constituents, the author examined a number of samples of the beer that separates from the barm, and found them to contain on the average 75 grms. of nitrogen per hectolitre. He concludes that so long as the total liquid in contact with the cells contains ¾ per cent. or more of dissolved matter, there is no danger of lixiviation. The importance of using sterilised water for washing yeast was shown by experiments which proved that the voluminous flakes of yeast carry down with them practically all the bacteria present in the water. Further experiments on the prolonged washing of yeast, under conditions precluding the reproduction of the yeast and any bacteria present, showed that between 20 per cent. and 30 per cent. of nitrogenous compounds can be extracted from the yeast in this way. In practice the amount of water generally used is too small to cause any injury by such extraction; but the point is one that should be borne in mind, and particular attention should be bestowed on the freedom of the washing water from bacteria.—C. S.

Pitching Yeast; Determination of the Number of Cells per Litre in Top-fermentation ——. J. J. van Hest. Woch. f. Brau., 1903, **20**, [51], 614—617.

In German top-fermentation breweries the surface yeast is skimmed off and collected in a tub for subsequent use as pitching yeast. Sometimes the frothy yeast is washed with water and allowed to settle, the supernatant water being decanted off. The concentration of this sedimentary pitching yeast is liable to fluctuations of about 100 per cent., which may have a disastrous effect upon fermentations which are pitched with a constant volume of the yeast. The author finds the most rapid practical method for determining the concentration of the yeast to be as follows:—100 c.c. of the pitching yeast are placed in a conical cotton bag, the weight of which is known. The yeast is drained until all the water has run off clear, the bag is then whirled in a centrifugal machine for 20 minutes at a speed of 180 revolutions per minute and then weighed again. The "centrifugal yeast" is thus obtained in a form containing 25 per cent. of dry substance, with a maximum error of only 5 per cent., and the weight of "centrifugal yeast" per litre of pitching yeast is thus found. "Centrifugal yeast" contains on an average 0·7 billion cells per 100 grms. By daily determinations, for several months, of the quantity of "centrifugal yeast" obtained per litre of pitching yeast in practice, the author has defined an average concentration which he takes as the normal standard. One litre of standard yeast contains 600 grms. of excess water and 400 grms. of "centrifugal yeast," containing 100 grms. of dry substance, sp. gr. 1·371, with 47·13 per cent. of albuminoids. Volumetrically, 1 litre contains 600 c.c. of excess water, 371·4 c.c. of "centrifugal yeast," and 28·6 c.c. of carbon dioxide, including 71·4 c.c. of dry substance. In short, 1 litre contains 900 grms. of water and 100 grms. of dry yeast, equal to 3 billion cells. The quantity of any pitching yeast required for pitching the wort at constant proportions may be calculated from the equation :—$G = \frac{400}{d} m \times hl$, where G = the volume (in litres) of pitching yeast required, 400 = the weight of "centrifugal yeast" in a litre of standard pitching yeast, d = the weight of "centrifugal yeast" found in a litre of the pitching yeast to be used, m = the standard proportion of pitching, *i.e.*, the volume (in litres) of standard pitching yeast which it is desired to add per hectolitre of wort, and hl = the volume of wort in hectolitres.—J. F. B.

Yeast ; Behaviour of ——, in Mineral Nutritive Solutions. A. Kossowicz. Zeits. landw. Vers. Wes Öst., **6**, 731—737. Chem. Centr., 1903, **2**, [23], 1286. (See also this Journal, 1903, 374.)

The results of further experiments confirm Wildier's view that the activity of yeast in nutritive media is dependent upon the presence of certain organic compounds, besides sugar and mineral constituents (nitrogen in the form of ammonium compounds). In ordinary nutritive solutions containing sugar, pure yeast cultures when present in very small quantities do not multiply. With somewhat larger quantities (more than 100 cells) of yeast, owing evidently to the organic matter which is simultaneously introduced into the solution, reproduction occurs, but only to a slight extent, and no perceptible fermentation is induced. Large quantities (one million cells) of yeast both multiply and bring about fermentation. Experiments made to ascertain the influence of calcium and iron compounds on the propagation of yeast and on fermentation, showed that calcium in the form of phosphate and chloride has a favourable influence. Iron in the form of sulphate, and to a less extent, in the form of chloride, has also a favourable effect, but not so considerable as that of calcium.—A. S.

Enzymes, especially Lactase ; Sensitiveness of ——, to Alcohol and Acids. T. Bokorny. Milch-Zeit., **32**, 641—642. Chem. Centr., 1903, **2**, [24], 1334.

Zymase was quickly destroyed by absolute alcohol, and was rendered less active by the action of 10 per cent. alcohol after one week. Invertase of yeast was not destroyed in 20 days by the action of absolute alcohol; maltase was less resistant, but appeared to differ in its behaviour according to the kind of yeast by which it was secreted. Lactase was not affected, with regard to its action on lactose, by 10 per cent. alcohol. The fermenting power of pressed yeast was destroyed in 26 hours by 0·5 per cent. sulphuric acid, in five days by 0·1 per cent. acid, but not completely even in six days by 0·02 per cent. acid. By 0·5 per cent. lactic acid the fermenting power was considerably diminished in four days. Lactase is not affected by lactic acid even at a concentration of 1·6 per cent.—A. S.

Amylo-Coagulase. A. Boidin. Comptes rend., 1903, **137**, [24], 1080—1082.

This coagulase exists not only in the grains of cereals (Wolf and Fernbach, this Journal, 1903, 1302), but also in cultures of saccharifying moulds. Its action effects the precipitation, along with starch, of some of the diastase present. The diastatic activity of the solution diminishes in consequence, though the diastase continues to manifest part of its activity even after precipitation. Some of the diastase also precipitates on the matters left insoluble at the end of the fermentation; after thorough washing and centrifugal dryings, these insoluble substances still produce sugar from Lintner's soluble starch. The coagulation of starch by amylo-coagulase is quite a different phenomenon from the precipitation (called by Maquenne the reversion) of starch solutions sometimes observed, which is due to traces of alkali.—J. T. D.

Barley ; Judging Malting ——, by Analysis. C. J. Lintner. Zeits. ges. Brauw., 1903, **26**, [45], 729—734.

So far as the moisture content is concerned, the maximum limit should be fixed at 15 per cent., and any excess should form the basis of a reduction in the price. The system of valuation recommended by Haase, in which the percentage of albuminoid or protein is taken as the basis, with 10 per cent. as the standard, and 11 per cent. as the extreme maximum permissible, appears to give the most satisfactory results. Bauer has traced a fairly definite relation between the percentages of albuminoid and extract present in barleys, 9—10 per cent. of the former corresponding to 78·7 per cent. of the latter; 11 per cent. to 77·4 per cent.; 11—1 per cent. to 76·1 per cent.; and over 12 per cent. to 74·4 per cent. of extract. The separation of the barley into three grades by means of Steinecker sieves, with meshes of 2·8, 2·5, and 2 mm. aperture respectively, is also of assistance. The proportions of the three grades should be 85—90 per cent., 10—15 per cent., and 3 per cent. respectively. —C. S.

Malt ; Relations between the Protein Content and the Yield of Extract of ——. H. Hanow and D. Neumann. Woch. f. Brau., 1903, **20**, [50], 601—602.

In the following table are collected the average results found for the percentage of protein and the percentage of extract (in fine meal) in 203 samples of malt, the colour of which varied only within narrow limits :—

Number of Samples.	Protein. Per Cent. on Dry Substance.	Extract in Fine Meal according to Balling. Per Cent. on Dry Substance.
45	Below 9	78·7
71	9—10	77·8
64	10—11	76·9
20	11—12	76·5
3	Above 12 (maximum 12·7)	74·7

This table shows clearly the general decrease of the extract content with increase of the protein, although many of the samples showed considerable deviations from the average values. The question whether the same relation holds good between the protein percentage of barley and the extract of the malt prepared from it is to be answered in the affirmative, with a few reservations. A series of comparative determinations showed that in most cases the protein percentages of barley and malt are practically identical. In certain cases, however, notable differences may occur, owing either to abnormal qualities of the barley or to special methods of treatment. If in the malting of normal barley a strong rootlet development be allowed, the respiration and consequent loss of extract is curtailed, and a malt relatively poor in protein will result. If, on the other hand, the rootlet development be restricted, the consumption of proteids will be small and the malt will be rich in protein; the same result will follow if the loss of starch be increased by extra respiration and a converse result if the respiration be curtailed. Good brewing barley, being poor in protein, does not tend to get too hot during malting, and the husks being thin, the grain on the couches lies solid and conducts away the heat well, consequently the malt is poor in protein and rich in extract. Coarse-hulled barley lies more loosely on the couch, thus admitting air, which brings about a greater loss of extract by respiration. Bad barley, being both rich in protein and coarse-hulled, gets hot on the floor and lies loosely, involving greater aëration and loss of extract.—J. F. B.

Currant Wine "Disease"; Fermentation of Citric Acid as the Cause of a ——. W. Seifert. Zeits. landw. Vers. Wes. Öst., **6**, 738—747. Chem. Centr., 1903, **2**, [2], 1286.

The disease in question manifested itself, after the completion of fermentation, in a diminution of acidity and production of turbidity, whilst the wine acquired a harsh taste. The scum of such diseased wines contained, besides yeast, numerous rod bacteria. Fermentation experiments with this scum showed that it caused the conversion of malic acid into lactic acid and the decomposition of citric acid into carbon dioxide, acetic acid and alcohol, and the author concluded that the "disease" was caused by the bacteria, which decompose the citric acid. He recommends that the wine, after fermentation, be rapidly clarified and then subjected to a slight "sulphuring" in order to prevent the development of the bacteria. Micro-organisms capable of fermenting citric acid also occur in grape wines. —A. S.

Silesian Potato; Difficult Fermentation of the ——.

Zeits. Spiritusind., 1903, **26**, [50], 530.

Babucke states that the Silesian potato is largely cultivated in his district and is readily saleable for food purposes. It is planted at the beginning of April in order that it may have sufficient time to ripen. This year's crop had an average starch content of 22·3 per cent.; the sweet worts at an initial density of 26° Balling were fermented by yeast of Race xii. only down to 3° Balling. This was not the fault of the yeast, since wort of 24° Balling from "Ceres" potatoes was attenuated down to 1°—1·5° by the same yeast. Consequently the Silesian potato is regarded as specifically difficult to ferment. Brademann has employed the Silesian potato for many years, and has never found that it gave poorer attenuations than other varieties. Being a slow ripener, it must be planted early in April, and not in June as is sometimes done. The potatoes then are harvested fully ripe, provided the development of the tubers be not stopped by the premature death of the green portions. Potatoes harvested under those conditions, whether Silesian or other varieties, always yield very viscous mashes and contain a notable proportion of unfermentable matters. Viscous mashes are unsuitable both for the production of alcohol and for the propagation of culture yeast. Frank has had considerable experience with Silesian potatoes from various soils and has always found them satisfactory both with yeasts of Race ii. and Race xii. He finds that Race ii. is more adapted for the fermentation of concentrated mashes than Race xii., and yields more alcohol per volume of mash tun. Klix states that the Silesian potato is preferred on account of its large crop and good keeping qualities; he has experienced no difficulty in attenuating down to 0·5° Balling. The potatoes should be steamed slowly at three atmospheres pressure and blown off at 2·5 atmospheres; the mashes are then fluid and pale-coloured, but under higher pressures and with rapid steaming, brown, viscous mashes are produced which attenuate badly. —J. F. B.

"Montanin," a new Disinfectant.

P. Lindner and P. Mattkes. XVIII. C., page 34.

English Patents.

Beer Wort; Continuous Process and Apparatus for Purifying ——.

E. Hoffmann. Pfeddersheim-Worms, Germany. Eng. Pat. 1073, Jan 15, 1903.

The beer mash or wort is charged in consecutive order into an endless series of filtering cells, draining off by suction the filtered wort, and removing the residue or husks from each cell before it is again charged with mash or wort of first brewing. The apparatus comprises a circular tank divided into a series of cells by radial partitions, the tank being revolved beneath a wort supply pipe and also beneath another supply pipe preferably arranged diametrically opposite the first and formed as a sparge pipe. The latter delivers wort of second mash. Each cell is provided with a perforated bottom and filtering medium and with means for drawing off the filtered liquor. There is a funnel-like discharge chamber beneath the cells leading to discharge pipes dipping into a common tank, and float valves in the chamber to permit normal discharge but automatically to prevent the pipes becoming empty, in order to ensure a suction on the filtering cells. The cells are each fitted with a hinged filtering bottom plate to facilitate discharge of the exhausted husks. —L. J. de W.

Alcoholic Beverages and the like; New Process for Producing ——.

E. Nowak, Lhotka, Austria. Eng. Pat. 22,542, Oct. 19, 1903.

Starch or starchy materials, previously alkalised, are converted by a separate roasting process into a sort of dextrin. This is then saccharified by boiling with dilute sulphuric acid; the liquid is neutralised by lime or chalk, filtered, purified, and either fermented direct for the manufacture of alcohol or concentrated to a syrup for addition to beer wort, wine must, or the like.—J. F. B.

Distillery Refuse or Pot Ale; Treatment of ——.

C. Day and E. W. Gaskell, Glasgow. Eng. Pat. 2519, Feb. 3, 1903.

The refuse or pot ale is concentrated by evaporation and the concentrated fluid is calcined in a rotary furnace. The product can be used as a manure.—J. F. B.

Distillery Refuse and other Materials of a Hygroscopic Character; Treatment of ——.

C. Day and E. W. Gaskell, Glasgow. Eng. Pat. 2520, Feb. 3, 1903.

The dried or partially dried products or hygroscopic materials are mixed in a pulveriser with kieselguhr. —J. F. B.

French Patent.

Alcoholic Liquors; Process of Purifying Raw ——.

L. S. Highton. Fr. Pat. 328,082, Sept. 13, 1902.

See U.S. Pat. 736,098 of 1903; this Journal, 1903, 1010. —T. F. B.

Saké Beer; Process for Production of ——.

G. Jacquemin. Fr. Pat. 333,833, July 15, 1903.

Rice is saccharified and fermented by means of a symbiotic mixture of pure cultivations of the best selected Japanese "koji" and a champagne yeast of the finest vintage. The propagating apparatus consists of three closed vessels of different sizes in duplicate. The vessels are approximately similar in design, and are provided with agitators, steam and sterilised air supplies, thermometers, aseptic sampling cocks, water pipes, and outlet valves. The yeast is propagated in the smallest pair of vessels, of about 60 litres capacity each, being cultivated in saccharified rice wort obtained from a previous operation. The "koji" is propagated in the second pair of vessels, of about 200 litres capacity. The contents of the yeast and koji vessels, when ready, are mixed together in one of the largest pair of vessels, each holding about 500 litres; in this the two organisms enter into a symbiotic process, and develop a ferment suitable for starting the main saccharification and fermentation. This is effected by discharging the contents of the large vessel into one of a series of wooden tuns, provided with an agitator and cooling worm. This tun is charged with a mash of boiled rice at a concentration of about "10 kilos. per 100 litres"; the capacity of the tun is about 100 hectolitres. The preparation of the ferments requires about 30 hours, and the main fermentation, at a temperature not exceeding 25° C., is complete in about six days; sufficient tuns are provided to make the process continuous. The saké is finally filtered, pasteurised, and bottled.—J. F. B.

Brewing Process for Malt, Separated into Grist, Flour, and Hulls.

R. Kubessa. Fr. Pat. 333,939, July 9, 1903.

See Eng. Pat. 15,935 of 1903; this Journal, 1903, 1144 —T. F. B.

Vinegar from Skim Milk; Manufacture of ——.

A. Barbier. Fr. Pat. 334,071, July 23, 1903.

A sufficient quantity of sugar is dissolved in the skim milk to bring the density up to 1·075. The lactic acid is then neutralised by chalk, and the liquid is pitched with yeast to induce alcoholic fermentation. The fermented liquid, which contains about 10 per cent. of alcohol, is then infected with *Mycoderma aceti*, and is acetified in the same manner as wine vinegar. The vinegar is finally clarified and decolorised by powdered wood charcoal.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Phosphorus in Certain Food Materials and Animal By-Products; Status of ——, with Special Reference to the Presence of Inorganic Forms. E. B. Hart and W. H. Andrews. Amer. Chem. J., 1903, **30**, [6], 470—485.

It is generally believed that part of the phosphorus in plant substances exists in the form of inorganic compounds, such as calcium, magnesium, and potassium phosphates, and the authors tried to work out a method for separating and quantitatively determining this portion of the phosphorus in vegetable and animal feeding stuffs. The following method gave the best results, but the latter were too high, owing to hydrolysis of the organic compounds containing phosphorus. Five grms. of the material were shaken vigorously for 15 minutes with 125 c.c. of 0·2 per cent. hydrochloric acid, the mixture was filtered, and the residue washed with water till 500 c.c. of the solution had been collected. 200 c.c. of this solution were neutralised with ammonia, 10 grms. of ammonium nitrate added, followed, after heating to 65° C., by 2 c.c. of nitric acid of sp. gr. 1·2, and 25 c.c. of neutral ammonium molybdate solution. The magnesium pyrophosphate obtained from the precipitate in the usual manner was dissolved in nitric acid and the phosphorus again precipitated. From the results obtained it is concluded that commercial feeding stuffs of vegetable origin (oats, wheat, malt sprouts, brewers' grains, linseed meal, &c.), do not contain appreciable quantities of phosphorus in inorganic combination. Animal feeding stuffs (liver meal, dried blood) are also practically free from inorganic phosphorus, except in the case of commercial meat meal, which contains an amount varying with the proportion of bone present. During the germination of grains (oats, maize, wheat), proteolysis of nucleoproteids, with formation of more soluble nucleins and nucleic acids, takes place, but not a transformation of organic phosphorus into inorganic.—A. S.

Pineapples; Quantity of Sugar admissible in Imported Preserved ——. H. W. Wiley. *Composition of Fresh and Preserved Pineapples.* L. S. Munson and L. M. Tolman. Bull. de l'Assoc. des Chim. de Sucr. et de Dist., 1903, **21**, [5], 524—526.

Munson and Tolman analysed 38 samples of fresh pineapples, of which 21 were from Florida, 10 from Cuba, 4 from Porto Rico, 2 from the Bahamas, and 1 from Jamaica; 16 preserved pineapples purchased by the Consul-General of Singapore, of which 10 were in juice pressed from pineapples without sugar, 6 in juice with added sugar, and 2 samples from Nassau; 42 commercial samples of preserved pineapples from Singapore, the Straits Settlements, and the Bahamas. Some of the results obtained are shown in the following table:—

——	Fresh Pineapples.			Preserved Pineapples.											
				Without added Sugar.			With addition of Sugar.			Singapore and Straits Settlements.			Bahamas.		
	Minimum.	Maximum.	Average.	Minimum.	Maximum.	Average.	Minimum.	Maximum.	Average.	Minimum.	Maximum.	Average.	Minimum.	Maximum.	Average.
Dry solids, total	10·78	18·86	14·17	10·00	17·44	13·27	16·61	19·11	18·17	17·32	26·84	21·03	8·54	26·78	14·13
Dry solids, insoluble	1·02	1·83	1·52	0·87	2·18	1·37	1·02	2·06	1·41	0·91	1·67	1·14	0·88	2·51	1·39
Total ash	0·27	0·55	0·40	0·24	0·56	0·39	0·27	0·51	0·40	0·21	0·36	0·27	0·22	0·50	0·38
Alkalis = K_2CO_3	0·22	0·60	0·37	0·21	0·66	0·33	0·16	0·34	0·28	0·14	0·32	0·22	0·20	0·39	0·30
Acids = H_2SO_4	0·30	0·85	0·60	0·25	0·71	0·42	0·20	0·42	0·32	0·16	0·43	0·26	0·22	1·18	0·56
Proteid = (N × 6·25)	0·21	0·57	0·42	0·25	0·57	0·46	0·35	0·46	0·41	0·39	0·57	0·46	0·20	0·46	0·33
Reducing sugar	1·76	9·75	3·91	5·44	10·96	8·00	7·51	15·39	11·63	7·05	15·18	9·91	5·55	12·84	7·96
Cane sugar	2·98	10·18	7·59	1·85	6·64	5·40	2·28	8·82	5·14	4·34	16·48	7·77	0·53	9·05	2·78
Total sugar, as invert	8·20	15·28	11·90	8·55	14·89	11·59	16·70	17·93	17·11	14·55	25·10	18·04	6·33	22·37	9·98

Although there are great differences in the sugar content, there is about twice as much cane sugar as reducing sugar. Pineapples preserved without the addition of sugar are generally preserved in 30 per cent. of their juice. These naturally contain less insoluble matter, more reducing bodies, and much less cane sugar. Those from the Straits Settlements and Singapore must have had sugar added, those from the Bahamas only partly so. Wiley concludes that for levying duty, all those that contain as a maximum 14 per cent. of total sugar in each tin, and 13 per cent. as average of the cargo, should be considered as preserved in their juice without addition of sugar; those with more should be regarded as preserved with addition of sugar.
—L. J. de W.

Wheat Flour; Determination of Other Flours in —— G. Volpino. XXIII., page 37.

English Patent.

Tea, Nourishing and Digestible; Method of Rendering ——. International Plasmon, Ltd., London. From S. M. Bergheim, Paris. Eng. Pat. 26,254, Nov. 28, 1902.

Tea leaves are damped and incorporated with from 5 to 20 per cent. of dry powdered casein. The mixture is then dried. Infusions of the tea so treated contain a certain amount of casein, and are to a large extent freed from tannin. (See also Eng. Pat. 11,948, 1900; this Journal, 1900, 842.)—W. P. S.

(B.)—SANITATION; WATER PURIFICATION.

Air in the House of Commons; Chemical Analysis of the ——. W. J. Atkinson Butterfield. J. of Hygiene, 3, [4], 1903, 486—497.

The author made a number of analyses of the air in the Debating Chamber of the House of Commons, for the information of the Select Committee first appointed in April 1902. The report of the Committee was presented to the House on July 28th last, and is published by H.M.'s Stationery Office (No. 283). The following were the results obtained:—

——	Volumes of Carbon Dioxide in 10,000 volumes of Air.		
	Max.	Min.	Mean.
Air supplied to the chamber	3·74	3·14	3·37
Air at breathing level in the body of the chamber	5·23	3·35	4·59
Outgoing air from about 6 ins. below the ceiling of the chamber	5·60	4·82	5·27

—A. S.

Water; Sterilisation of Potable ——, by means of Chlorine and Bromine Compounds. F. Ballner. Arch. f. Hyg., 1903, **48**, 140. Biochem. Centralbl., 1903, **2**, [4], 134.

Schuder has shown that the sterility of water is not proved by the examination of a small aliquot portion, but that it is necessary to examine the whole quantity. Subjected to this stringent test Schumburg's bromine method has not proved satisfactory, and unfavourable results have also been obtained in Hünermann's sodium hypochlorite method. A critical examination of Engel's chloride of lime method applied to water infected with different pathogenic micro-organisms has shown that the prescribed quantity of reagent (150 mgrms. per litre = 30 mgrms. of chlorine in a 20 per cent. solution) is quite insufficient to effect sterilisation in 30 minutes, and that the time must be increased to an hour, or the chloride of lime to 0·45 grm. per litre for sterilisation in 10 minutes. On the other hand, increasing the amount of chlorine to even 50 mgrms. per litre gives an unpleasant alkaline taste to the water. Hence the author concludes that this method is only available in cases where a longer period of sterilisation (two to three hours) is possible.—C. A. M.

Sterilisation by Boiling under Reduced Pressure.
Schut, jun. XXIV., page 39.

English Patents.

Town Refuse; Methods of Destroying ——, by Burning, and the Utilisation of certain valuable Ingredients thereof. W. Naylor, Preston. Eng. Pat. 26,201, Nov. 28, 1902.

The refuse is mixed with alkali or lime and heated in a closed oven by means of the hot gases from the destructor furnace. The liberated ammonia is collected in the usual manner, the residue being discharged into the furnace. When lime has been added to the refuse, the furnace clinker produced may be ground for use as a building cement. (See also Eng. Pat. 17,650, 1902; this Journal, 1903, 865.)—W. P. S.

Water; Purification of ——. M. Otto, Paris. Eng. Pat. 12,522, June 2, 1903.

The water is subjected to the action of an electric current in tanks containing a mass of iron cuttings, the latter forming a positive electrode. The ferrous salts produced are then oxidised by suitably aerating the water, and the precipitate of organic matter and ferric hydroxide is removed by filtration.—W. P. S.

French Patent.

Ammonia from Town Effluents; Continuous Process and Apparatus for Recovering the ——. R. Schilling and C. Kremer. Fr. Pat. 333,819, July 13, 1903.

See Eng. Pat. 15,752 of 1903; this Journal, 1903, 1145.
—T. F. B.

(*C.*)—DISINFECTANTS.

"*Montanin,*" *a New Disinfectant.* P. Lindner and P. Matthes. Zeits. Spiritusind., 1903, **26**, [52], 545—546.

"Montanin" is obtained from by-products of the pottery industry; it is a nearly colourless, odourless liquid, the principal active constituent of which is hydrofluosilicic acid. "Montanin" is said to be poisonous only in relatively large doses, and is practically without action on brewery and distillery metals, such as copper and tin. A 25 per cent. solution disintegrates beer-scale almost immediately; a 50 per cent. solution has no solvent action on tun-lacquer. A 2 per cent. solution of "montanin" prevents the growth of micro-organisms, and in many cases even a 1 per cent. is sufficient. Exposure of the vegetative growths of various cloudy-beer sediments to a 1 per cent. solution of "montanin" for ten minutes at the ordinary temperature prevented all growth when the material was subsequently transferred to sterile wort. Two coats of a 20 per cent. solution on walls and casks preserved them free from mould for six months under very severe conditions.
—J. F. B.

English Patent.

Resinous Product [Disinfectant] or Class of Product from Wood Tar; Manufacture of a ——. K. A. Lingner, Dresden. Eng. Pat. 2377, Jan. 31, 1903.

See Fr. Pat. 329,971 of 1903; this Journal, 1903, 1014.
—T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

Cardboard for Printing; Manufacture of Wood-free ——. C. B. Wochenbl f. Papierfabr., 1903, **34**, [50], 3706—3709.

High-class printing cardboard is generally made at a weight of 200—300 grms. per sq. metre. It is a matter of the first importance to avoid beating the pulp too "wet"; long, "wet" stuff gives strength, but uneven structure and surface, whilst short stuff causes brittleness. The best stock is prepared from a mixture of long and short pulps, beaten separately. The long pulp, which is to impart strength and flexibility, should be prepared from cotton rags or a soft form of wood cellulose, such as soda or sulphate wood pulp; ordinary sulphite pulp is too harsh, and beats "wet." In order to obtain length of fibre without "wetness," the beater must not be charged very thickly, and a further addition of soda pulp should be made a couple of hours before discharging. The short pulp is used for filling and closing up the sheet; it assists the felting, and imparts a uniform structure and surface. This pulp should be composed of straw and aspen wood-pulp, together with a little broken paper of strong quality. Paper of this thickness can only be made satisfactorily on a machine with an extra long wire, since the water must leave the pulp only slowly if a sheet of good texture be desired. On no account should the deficiencies of a short wire be counteracted by beating the pulp. By causing the water to run off too quickly, the use of steam always affects the structure, since the stuff must be very concentrated in order to get the weight of fibre through the gates of the machine, and if the water leaves too freely, the distributing action of the shake cannot come into play. With a long wire, only the slightest warming is necessary; the concentrated and moderately "wet" pulp flows in a thick even stream, regulated preferably by three gates, and is properly felted by means of a long and steady shake. The even distribution of the short fibres on the upper surface of the sheet gives a smoothness equal to that imparted by the wire to the lower surface. The web should be as moist as possible as it passes beneath the dandy rolls, two of which should be provided, whilst a third pair of press-rolls is advantageous as regards the subsequent drying. The first few drying cylinders must be only slightly heated, since rapid drying roughens the surface. The paper must lie for a few days with 6—7 per cent. of moisture before calendering.—J. F. B.

Animal Sizing. C. Hofmann. Papier-Zeit., 1903, **28**, [101], 3643.

In England and America animal sizing has always held its own for the better class of rag papers; in recent years, moreover, there has been a growing tendency to produce imitations of such writing papers by the animal sizing of paper prepared from sulphite wood-pulp and straw. Very fair writing papers are made with about 70 per cent. of sulphite wood pulp and 30 per cent. of straw pulp, only the thinnest sorts containing an addition of 10—20 per cent. of linen rags. Such papers are always half-sized in the engine with rosin, being subsequently passed through a dilute solution of animal size, and air-dried on the well-known form of drying machine; the shrinkage by this method of drying amounts to 1—1·5 per cent. The winding up and calendering of these papers requires the greatest care, since, if the paper be the least bit too dry, wrinkles are produced, whilst imperfect drying causes soft sizing. The temperature and hygrometric state of the air in the rooms where the paper is dried must be capable of constant observation and regulation, and the state of the weather has a considerable influence. A few of the older mills still prepare their own size from bones or hides, but the majority purchase the commercial glue pieces. A dark-coloured animal size has a far greater effect upon the colour of the paper than a dark-coloured rosin. As a rule, the stock solution of size is made up with 6—7 per cent. of glue, whilst 1 per cent. of soap and 1—3 per cent, of alum are subsequently added; the usual temperature of the size-bath is 35°—36° C. The temperature and concentration of the size must, however, be carefully regulated according to the thickness and nature of the paper. An excess of alum affects the colour of the paper and makes it brittle, but this tendency can to a certain extent be corrected by the addition of soap. The practice of half-sizing with rosin is being largely extended, even to the finest rag papers, since the advantages of both types of size are thus secured, and a distinct improvement in the colour of the paper, as compared with full animal sizing, is obtained.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Esterifications by Means of Sulphuric Acid. H. Meyer. Monatsh. f. Chem., 1903, **24**, [10], 840—843.

The author describes a method for the esterification of organic acids, as follows:—The finely powdered organic acid is warmed with 5 to 10 times its weight of concentrated pure sulphuric acid and to the cooled solution a slight excess over the equivalent quantity of methyl alcohol is added, the vigorous action which ensues being assisted by stirring. After cooling, the mixture is neutralised by pouring on to crystallised sodium carbonate, and, since neutralisation takes place without rise of temperature, a solvent such as ether or chloroform may be mixed with the soda in order to dissolve the ester, which is subsequently separated and purified. The method gives almost quantitative yields in many cases, and has been applied to acids of the pyridine, fatty, and aromatic series. There are certain cases in which esterification does not occur, owing to the inhibitive action of substituent groups in certain positions preventing the formation of the acylsulphuric acids, which is regarded as the intermediate step in the process; *p*-hydroxybenzoic acid and terephthalic acid are instances of such exceptions.—J. F. B.

Phosphoric Acid and Glycerol; Esterification of ——. P. Carré. Comptes rend., 1903, **137**, [24], 1070—1073.

When phosphoric acid and glycerol are allowed to react on each other, esterification proceeds further according as the temperature is higher and the pressure lower. In the vacuum of the mercury-pump and at a temperature of 115° C., the two are practically completely esterified when mixed in equimolecular proportions. In the industrial preparation of glycerophosphoric acid, some of the di-ester is, no doubt, always formed. No inquiries seem to have been made as to how this behaves when the acid is converted into glycerophosphates, but no doubt its existence accounts for some of the great discrepancies which have occurred in the analysis of glycerophosphates.—J. T. D.

Hydroxylamine; New Reaction of ——. L. J. Simon. XXIII., page 36.

Arrhenal [*Sodium Methyl Arsenate*]; *Behaviour of* ——, *in Marsh's Apparatus.* D. Vitali. XXIII., page 36.

Morphine in Opium and Tincture of Opium; Determination of ——. E. Dowzard. XXIII., page 38.

Spike Oil; Adulterated ——. E. J. Parry and C. T. Bennett. XXIII., page 37.

Erratum.

This Journal, 1903, page 1363, col. 1, line 15 from bottom (table), *for* "Cornwallis" *read* "Cornwall."

English Patents.

Dimethyl- and Diethylamido-Antipyrin; Manufacture of ——. W. Majert, Berlin. Eng. Pat. 26,353, Nov. 29, 1902.

Amino-antypyrine hydrochloride (1 mol.) is heated with chloro- or bromo-acetic (or propionic) acid ($2\frac{1}{2}$ mols.) and sodium carbonate ($3\frac{1}{2}$ mols.) to 120°—130° C., until evolution of carbon dioxide ceases; the dicarboxylic acid [$C_{11}H_{11}N_2ON:(CH_2COOH)_2$] thus obtained is heated with 3—4 mols. of 10 per cent. sulphuric acid, in an autoclave, to 150°—160° C., for 4—5 hours; on addition of caustic soda, dimethyl- (or diethyl-) amino-antipyrine (1 phenyl-2.3-dimethyl-4-dimethylamino-5-pyrazolone) is obtained. —T. F. B.

Ortho- and Paratoluene Sulphamide; Separating ——. R. Barge, Stassfurt, and L. Givaudan, Geneva. Eng. Pat. 848, Jan. 13, 1903.

The separation of *o*- from *p*-toluene sulphamide is effected by fractional precipitation of a solution of the alkali salts by means of a normal magnesium or ammonium salt, the former giving a precipitate of the magnesium salts of the sulphamide, and the latter giving the free sulphamide, ammonia being liberated; in each case the *o*-compound is rather less soluble than the *p*-compound; thus, by adding a solution of 35 kilos. of ammonium chloride in 80—90 litres of water to a solution of 200 kilos. of the mixed sulphamides in 235 kilos. of sodium hydroxide solution of 23° B., a precipitate (about 110 kilos.) of *o*-toluene sulphamide is obtained; the remainder of the *o*-compound and part of the *p*-compound are precipitated by the addition of 10 kilos. of ammonium chloride to the filtrate, the resulting precipitate being again dissolved in alkali and treated as above.—T. F. B.

Toluene Sulphonic Chloride. R. Barge, Stassfurt, Germany, and L. Givaudin, Geneva. Eng. Pat. 1877, Jan. 26, 1903.

It has been found that when toluene is treated with a mixture of chlorosulphonic acid and sulphuric acid, quite as high a yield of the mixed *o*- and *p*-toluene sulphonic chlorides is obtained as when practically pure chlorosulphonic acid is employed. This enables the sulphonic chlorides to be prepared by the treatment of toluene with a mixture obtained by saturating fuming sulphuric acid, containing about 60 per cent. of the anhydride, with dry gaseous hydrochloric acid.—J. F. B.

Chemical Composition of the Series of Phenols [*Cetyl Guaiacyl*], *By-Products, and Process for making same.* L. H. Cress, Fremont, Ohio. Eng. Pat. 16,349, July 24, 1903.

See U.S. Pat. 736,061 of 1903; this Journal, 1903, 1013. The product is purified either by a "sweating" process or by means of pressure, at about 20° C., the cetyl guaiacyl, $C_{23}H_{40}O_2$, having a lower melting point than the impurities in it. The glycerin liquors, which contain alkali palmitate, are heated with ferric chloride, the "palmitate of iron peroxide" which separates being suitable for medical purposes. The cetyl-guaiacyl is abbreviated as "cetiacol" or "palmiacol."—T. F. B.

United States Patent.

Dialkyl-barbituric Acids; Process of Preparing ——. M. Engelmann, Elberfield, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 744,732, Nov. 24, 1903.

5-Dialkyl-4-imino-2.6-dioxypyrimidine, prepared by condensing urea with dialkyl cyano-acetic esters by means of alkali alcoholates, is treated with saponifying agents, *e.g.*, hot sulphuric acid, whereby ammonia is split off and dialkyl barbituric acids remain.—T. F. B.

French Patent.

Radio-active Metallic Coating; Process for Depositing a ——, *on Articles.* R. Sthamer and R. Kasch. Fr. Pat. 328,096, Oct. 6, 1902.

See Eng. Pat. 20,922 of 1902; this Journal, 1903, 1136. —T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

United States Patent.

Isochromatic Photographic Plate and Film. L. Smith, London. U.S. Pat. 746,594, Dec. 8, 1903.

Isochromatic plates or films are composed of layers of colour-sensitive emulsion, having progressively increasing degrees of sensitiveness, the lowest layer containing the smallest, and the uppermost the highest, percentage of the sensitising agent, which is the potassium salt of tetra-iodo-fluorescein (erythrosin).—T. F. B.

French Patents.

Photographic Developers; Manufacture of ——, by means of Alkali Salts of Glycocoll or its Derivatives which have an Alkyl Radicle attached to the Nitrogen. Cie. Paris. Coul. d'Aniline. Fr. Pat. 328,093, Sept. 24, 1902.

See Eng. Pat. 20,377 of 1902; this Journal, 1903, 380.
—T. F. B.

Photographic Toning by Utilising the Action of Stannic Salts on Photographic Images in Presence of Gold (or Platinum) Chloride, either alone or in conjunction with Gallic Acid. M. Stoicescou. Fr. Pat. 333,637, June 6, 1903

A variety of tones may be obtained on gelatino-chloride or other "printing-out" papers by means of stannic and gold salts, with or without an organic reducing agent, such as gallic acid; the tones depend on the state of division of the gold deposited, and also on the extent of reduction of the gold oxide, the deposit also containing tin peroxide. A suitable method consists in using a solution containing stannic chloride, 3,200 grms.; citric (or tartaric) acid, 32 grms.; soda crystals (or sodium borate), 640 grms.; ammonium (or sodium or magnesium) chloride, 280 grms.; and water, 10 litres: for warm tones, 5 c.c. of this solution are added to 2—5 c.c. of a 1 per cent. gold chloride solution, and 100 c.c. of water, with 20—30 grms. of sodium chloride; the duration of toning may be from 2 to 45 seconds, the tone only appearing during fixation (in sodium thiosulphate, 1 part; sodium chloride, 1 part; water, 5 parts); for tones ranging from rose and violet to blue and indigo, the bath may consist of the concentrated solution, 5 c.c.; 1 per cent. gold chloride solution, 10—20 c.c.; 0·8 per cent. gallic acid solution, 3 c.c.; water, 100 c.c.; toning requires from 5—60 minutes, according to the tone desired; fixation has a considerable effect on the tone obtained, which is rose with short treatment, and varies from rose to blue as the duration is increased. Immersion of the finished print in mercuric chloride solution gives a brilliant red, which, however, is unstable in damp air. Platinum may replace the gold in this process, but brown shades are always obtained, the deposit consisting of platinum and tin peroxide. The gallic acid may be made into small tabloids, containing gallic acid, 0·1—0·3 grm.; potassium hydrogen oxalate, 0·25 grm.; borax, 0·25 grm., worked up with gum arabic, &c.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

Nitrocellulose; Study of ——. I. C. Haeussermann. Ber., 1903, **36**, 3956.

The author has previously shown that the distillate obtained when collodion cotton is boiled with caustic soda solution yields iodoform when treated with alkali and iodine dissolved in potassium iodide solution. He has since found that guncotton and nitrated sulphite cellulose behave in a similar manner, and that the caustic soda solution may be replaced by a solution of calcium, barium, or strontium hydroxide, or of an alkali carbonate. The author previously considered the volatile decomposition product to be acetone, but further examination indicates that it is of an aldehydic nature, although the amount obtained up to the present has been too small to allow of the isolation of the substance in a pure condition.—A. S.

Phosphorus; Investigations on ——. R. Schenck. VII., page 17.

English Patent.

Fireworks; Manufacture of ——. S. Salas, Barcelona. Eng. Pat. 8163, April 8, 1903.

See Fr. Pat. 329,636 of 1903; this Journal, 1903, 1064.
—T. F. B.

French Patent.

Matches, Readily Inflammable; Manufacture of ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 333,816, July 13, 1903.

Suboxide of phosphorus, made, for example, by passing air into a slightly warm solution of yellow phosphorus in carbon tetrachloride, is substituted for phosphorus in match-head compositions.—W. G. M.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUANTITATIVE.

Alkali Bromates; Reduction of ——, by Hydrazine- and Hydroxylamine Sulphates. M. Schlotter. Zeits. anorg. Chem., **37**, 164—171; Chem. Centr., 1903, **2**, [22], 1255.

Alkali bromates in aqueous solution, when treated with hydrazine- or hydroxylamine sulphate, are reduced to bromides, with evolution of nitrogen, and, in the case of hydroxylamine sulphate, of oxygen also. The reactions may be expressed by the equations—

$$2NaBrO_3 + 3NH_2.NH_2 = 2NaBr + 6H_2O + 6N.$$
$$2NaBrO_3 + 6NH_2OH = 2NaBr + 9H_2O + 6N + 3O.$$

The reactions may be used for the determination of bromates. The aqueous solution of the bromate is treated with the necessary quantity of hydrazine- or hydroxylamine sulphate, the mixture warmed, and the bromine precipitated as silver bromide by silver nitrate in presence of nitric acid.—A. S.

Bone Ash [Cupels; Bumping of ——]. A. T. Firth. J. Chem., Metall., and Mining Soc. of S. Africa, 1903, **4**, [4], 176.

"Bumping" of bone-ash cupels appears to be due, not to the carbon dioxide produced by oxidation of the carbon remaining in the bone ash, but to the carbon dioxide evolved from the calcium carbonate present, since cupels made from bone ash containing 7·93 per cent. of calcium carbonate "bumped" badly, whereas cupels made from the same sample, after treatment with dilute hydrochloric acid, showed no tendency to "bump."—T. F. B.

Phosphorus in Certain Food Materials and Animal By-Products; Status of ——, with Special Reference to the Presence of Inorganic Forms. E. B. Hart and W. H. Andrews. XVIII. A., page 33.

ORGANIC—QUALITATIVE.

Hydroxylamine; New Reaction of ——. L. J. Simon. Comptes rend., 1903, **137**, [23], 986—987.

On adding to a dilute solution of hydroxylamine a few drops of a very dilute solution of sodium nitroprusside and a faint excess of alkali, and heating the mixture gradually to the boiling point, the liquid loses its yellow tint, and finally assumes a fine cherry-red colour, which changes to a bright rose on dilution of the solution. The reaction is very sensitive, a visible coloration being obtained with a solution of 1 part of hydroxylamine hydrochloride in 1,000,000 of water. The colour is only transitory, and disappears more or less rapidly according to its intensity. All the salts of hydroxylamine yield this reaction, which is, however, not given by oximes, whether aldehydic or ketonic, aliphatic or aromatic.—T. H. P.

"Arrhenal" [Sodium Methyl Arsenate] in Marsh's Apparatus; Behaviour of ——. D. Vitali. Boll. Chim. farmac., 1903, **42**, 643; Chem.-Zeit., 1903, **27**, [99] Rep. 311. (See this Journal, 1902, 874.)

Whilst cacodylic acid, according to Knoblauch, produces a white odorous vapour in the Marsh's apparatus, and this vapour (provided that no platinic chloride is used) gives an arsenic ring in the heated tube, arrhenal produces no vapour, but (unless platinic chloride be present) shows the black ring in the tube. The author indicates the following points of dissimilarity between cacodylic acid and arrhenal.

With Bougault's reagent (2 grms. of sodium peroxide, 1 c.c of water, and 20 c.c. of hydrochloric acid of sp. gr. 1·07), arrhenal, in the cold, gives at first a white turbidity, which then becomes red, and finally yellowish; on heating, the mixture first becomes grey and turbid, and then deposits a brown powder. Under the same conditions cacodylic acid remains at first unchanged in the cold, but becomes milky after half an hour, and after 12—18 hours covers the glass tube with a yellowish deposit, at the same time evolving a strongly irritating smell. On warming, the mixture at once becomes turbid, and gives out white irritating vapours and forms a red-brown sublimate. With Bettendorf's reagent (a concentrated solution of stannous chloride in fuming hydrochloric acid), cacodylic acid, when warmed, evolves white vapours and the objectionable smell of cacodyl, but does not become coloured; arrhenal, on the contrary, gives out no fumes or smell; on prolonged warming it forms a white sublimate, which later assumes a lemon-yellow hue.—W. G. M.

Spike Oil; Adulterated ——. E. J. Parry and C. T. Bennett. Chem. and Druggist, 1903, **63**, [1247], 1011.

The authors have recently met with numerous specimens of adulterated spike oil, which yielded figures for sp. gr., optical rotation, and solubility within the limits given by most authorities; the usual adulterants were turpentine, oil of rosemary of the commonest quality, and safrol. The optical rotation of spike oil is usually given as up to + 7°, but the authors find that + 4° is the usual upper limit, and that samples with a rotation of over + 5° are very frequently adulterated. With regard to solubility in alcohol, oils containing 25 per cent. of certain adulterants will pass the ordinary test. The authors recommend the use, for the solubility test, of six volumes of 65 per cent. alcohol, by which means additions of 5—10 per cent. of most adulterants can be detected. It is also advisable to determine the percentages of esters and of alcohols, and to fractionate the oil and examine the various fractions.
—A. S.

ORGANIC—QUANTITATIVE.

Indigo; Manufacture [and Determination] of ——. L. Bréaudat. IV., page .

Fatty Acids; Separation of Different ——. A. Partheil and F. Ferié. Archiv der Pharm., 1903, **241**, [7—8], 545—570.

In the separation of palmitic and stearic acids from oleic acid by treatment of the lead salts with benzene (this Journal, 1898, 804), insoluble double salts containing oleic acid are formed. To obviate this the author has tried experiments with monovalent metals, of which lithium has proved the most satisfactory. On adding lithium acetate to a hot alcoholic solution of the fatty acids, the lithium salts of stearic and palmitic acids are precipitated, whilst the oleic acid salt remains in solution. Lauric acid also remains in solution, whilst myristic acid is partially precipitated. The following table gives the solubility of the different lithium salts in water and in alcohol of specific gravity 0·797. In each case the figures represent the numbers of litres required to dissolve the molecular weight in grms. of the respective salts:—

Salt.	Water.		Alcohol. sp. gr. 0·797.	
	At 18° C.	At 25° C.	At 18° C.	At 25° C.
	Litres.	Litres.	Litres.	Litres.
Lithium stearate (290·38 grms.)	2903·5	2642·0	708·3	545·6
Lithium palmitate (262·38 grms.)	2388·0	1476·2	329·5	271·5
Lithium myristate (234·31 grms.)	1003·4	1001·4	127·4	110·5
Lithium laurate (206·27 grms.)..	130·5	119·5	49·3	46·62
Lithium oleate (228·37 grms.)...	427·8	218·4	31·74	28·57

The following method, based on these results, was eventually adopted for the separation of the acids:—0·25 grm. of different pure fatty acids was dissolved in 50 c.c. of absolute alcohol, and the solution neutralised with alcoholic potassium hydroxide solution and diluted with 50 c.c. of water. It was then treated with an excess of a 10 per cent. solution of lithium acetate in 50 per cent. alcohol, and the precipitate collected, washed with 50 per cent. alcohol, dried and weighed. In this way the following results were obtained:—Lithium stearate, 0·2495 grm. (theory, 0·2552 grm.); lithium palmitate, 0·2525 grm. (theory, 0·2558 grm.); lithium myristate, 0·2347 grm. (theory, 0·2565 grm.). No trace of precipitate was obtained from lauric or oleic acids. Hence the author concludes that it is thus possible to separate stearic and palmitic acid quantitatively and myristic acid nearly quantitatively from lauric and oleic acid. On the other hand, oleic acid can be separated from myristic and lauric acids by means of Farnsteiner's method (*loc. cit.*), for although mixed lead salts are precipitated from benzene solutions containing stearic, palmitic, and oleic acids, the lead salts of lauric and myristic acids under the same conditions are obtained free from oleate. Experiments are cited to prove that this is also the case when a mixture of the five acids is present.

Separation of Oleic Acid from More Unsaturated Acids.—In Schüler's method of extracting the barium salts with ether, it is shown that it is essential that the ether should contain water, since the dry barium salts of acids of the linolic and linolenic series are hardly soluble in anhydrous ether. The fatty acids recovered from the benzene solution in Farnsteiner's method of separating oleic from lauric and myristic acids should be dissolved in alcohol, neutralised with potassium hydroxide, and treated with a 10 per cent. alcoholic solution of barium acetate, and the dried barium salts extracted with ether containing water. For calculating the amount of stearic acid in the lithium precipitates, the author converts them into barium salts, and obtains the molecular equivalent of the fatty acids from the amount of barium present. Analyses of various fats by these combined methods are given in detail. In the case of butter the author confirms the statement of previous observers that not much stearic acid is present. One sample examined gave the following results:—Stearic acid, 6·54; palmitic acid, 17·95; myristic acid, 10·65; lauric acid, 17·08; and unsaturated acids (including 5·40 per cent. of highly unsaturated acids), 30·08 per cent.—C. A. M.

Tanning Materials and Tanning Extracts: Determining the Weight-giving and Leather-forming Properties of ——. J. G. Parker. Collegium, 1903, [88], 363—364.

Ten grms. of pure dry hide-powder, free from cellulose, are drummed in a churn of about 2 litres capacity with 150 c.c. of distilled water for about half an hour. A liquor of the material under examination is made up, containing about 8 per cent. of tannin (determined by the I.A.L.T.C. method) and is diluted so that when 350 c.c. are diluted by the 150 c.c. of water in the churn, the total amount of tannin in the churn will be exactly 5 per cent. This liquor (350 c.c.) is added 50 c.c. at a time, and the churn revolved for 30 minutes after each addition, and for one hour after the whole has been introduced. The tanned hide powder is placed on a filter funnel plugged with cotton wool, using the filtrate for washing purposes, is pressed down tightly, and allowed to drip for 24 hours and then weighed. A portion (10 grms.) is dried to determine the moisture, and from the dry weight the amount of combined and uncombined tannin in the whole is calculated. Another portion (20 grms.) is placed on a plugged filter as before and washed with one litre of water. When dried, the amount of chemically and physically combined tannin is calculated. The yield of washed leather and of unwashed leather thus give respectively the strictly combined tannin and the combined plus uncombined tannin. Estimation of the hide substance in the washed and unwashed leathers confirm these weight results to the second decimal place.—R. L. J.

Wheat Flour; Determination of other Flours in ——. G. Volpino. Zeits. Unters. Nahr.- u. Genussm., 1903, **6**, 1089—1095.

If a mixture of wheat flour with rye, barley, maize, or rice flour be made into a dough, and the latter be well washed in a stream of water, a mass of gluten is obtained which in weight is approximately proportional to the amount of wheat flour present. For instance, 30 grms. of wheat flour yielded about 8 grms. of gluten. When mixed with 50 per cent. of other flour, 30 grms. of the mixture gave from 4 to 5 grms. of gluten. The admixture of other flours to wheat flour may also be determined by forming 30 grms. of the sample into a dough with a little water, kneading the lump of dough with the hands under a stream of water and collecting the wash-water in a basin. The latter is passed through a piece of linen to collect any particles of gluten, and the solution is then filtered through an asbestos filter. The residue on the filter is dried at 100° C., and the nitrogen determined in it by Kjeldahl's method. The amount of nitrogen found multiplied by six gives the quantity of proteid matter. Pure wheat flour does not contain more than 0·2 per cent. of insoluble proteids other than gluten, whilst barley, maize, rice, and rye meals yield about 6 per cent.—W. P. S.

Morphine in Opium and Tincture of Opium; Determination of ——. E. Dowzard. Pharm. J., 1903, **71**, [3400], 909.

Morphine in Opium.—8 grms. of opium are treated in a flask fitted with a rubber stopper, with 100 c.c. of water, and the closed flask is heated for about one hour at 80°—90° C., with frequent shaking. After cooling, 3 grms. of slaked lime are added, the flask again closed and allowed to stand, with frequent shaking, for 1—2 hours. The mixture is then filtered through a plaited filter and 51·6 c.c. of the filtrate (= 4 grms. of opium) are treated in a flask, with 50 c.c. of 90 per cent. alcohol, 30 c.c. of ether, and 2 grms. of ammonium chloride. The flask is closed with a cork, shaken for 30 minutes, allowed to stand for 12 hours, again shaken for a few minutes, and the contents poured on to a filter. The aqueous liquid runs through, leaving the morphine attached to the filter, whilst the ether is left perfectly clear and can be completely removed with a pipette. Water saturated with morphine is used for rinsing out the flask and for washing the filter until the filtrate is free from chlorine. The filter is finally washed with about 10 c.c. of distilled water, allowed to drain, and about 15 c.c. of ether poured over the edges of the paper. After a few minutes the ether is removed with a pipette, the filter exposed to the air for half an hour, the paper and contents transferred to a beaker and rubbed to a pulp with 20 c.c. of N/10 sulphuric acid, and the excess of acid titrated with N/10 caustic soda solution, using methyl orange as indicator. Each c.c. of acid consumed is equivalent to 0·0283 grm. of anhydrous morphine; 0·05 grm. is added to the weight of morphine found, as directed in the B.P.

Morphine in Tincture of Opium.—In the B.P. method 80 c.c. of tincture and 3 grms. of slaked lime are used, and the mixture is made up to 85 c.c., whereas, according to the author, it should only be made up to 81·9 c.c. (1·44 c.c. for the lime and about 0·46 c.c. for the extractive matter carried down by the lime). The following method is recommended:—100 c.c. of the tincture are evaporated to about 30 c.c., cooled, the liquid mixed to a smooth paste with 3 grms. of slaked lime and made up to 100 c.c. with water, adding, if necessary, one or two drops of ether to remove froth. Two c.c. of water are then added, the whole allowed to stand for one hour with frequent agitation, filtered, and 50 c.c. of the filtrate (= 50 cc. of tincture) treated as described above.—A. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Ethyl Alcohol; Hydrates of ——. E. Varenne and L. Godefroy. Comptes rend., 1903, **137**, [23], 993—996.

By means of a special form of constant pressure capillary viscosimeter, known as the "chrono-stiliscope," the authors have determined the viscosities of alcohol containing from 0 to 95 per cent. by volume of water. The curve connecting the time of flow with the percentage of alcohol present is an ellipsoid, showing various irregularities corresponding with definite hydrates. The latter contain, for every molecule of alcohol, 2/3, 2, 3, 6, and 22 molecules respectively of water. The method employed by the authors can be generally applied, for example, to the study of velocities of dissociation or esterification, molecular weight measurements, and so on.—T. H. P.

Fermentative Enzymes, Isolated from the Cells of the Higher Animals. J. Stoklasa and F. Cerny. Ber., 1903, **36**, [16], 4058—4069.

The fermentative enzymes, mention of which has previously been made in this Journal, 1903, 374 and 813, may be extracted from the animal organs in the following manner:—The organs, as soon as they are removed from the body, are pounded to a pulp; about 2—3 kilos. of this are mixed with a small quantity of sterilised, sharp-edged sand, together with ice. The mixture is triturated mechanically, in portions of 300 grms. each, until microscopic examination shows that the cells are completely disintegrated. The juice is then immediately expressed from the pulp by means of a pressure of 350 atmospheres. The fresh juice, when mixed with glucose or cane sugar at a concentration of 10—15 per cent., sets up a slight glycolytic action, but alcoholic fermentation is never observed. The fermentative enzymes of the juice are completely destroyed after 12 hours at 35° C. by the proteolytic enzyme and the action of bacteria. The property of setting up alcoholic fermentation is only possessed by the enzymic preparations, precipitated from the fresh juice. These precipitates are obtained as follows:—To 300 c.c. of the clear juice are added 350—500 c.c. of alcohol, and then, immediately afterwards, 300—500 c.c. of ether. The precipitate is allowed to settle in tall glass cylinders, the bulk of the liquid is then poured off and replaced by a volume of ether equal to that of the alcohol-ether mixture originally employed. The supernatant liquid is again rapidly siphoned off, and the precipitate is at once drained on the filter-pump, dried *in vacuo* at a temperature of 25°—30° C., and the horn-like product obtained, ground to a fine powder. The activity of the preparation entirely depends on the rapidity of the manipulation; the whole period of contact with alcohol and ether must not exceed a few minutes. The precipitated enzymes appeared to be of two kinds; those preparations obtained from juice expressed at less than 200 atmospheres have a low activity, and only set up a slight alcoholic fermentation after about 12 hours, whereas those obtained from juices expressed at 250—300 atmospheres are very active. The enzymes extracted from the muscles, liver, and lungs of cattle, if prepared under the most favourable conditions, will start alcoholic fermentations in solutions of hexoses and disaccharides (10—15 per cent.) almost immediately. Fermentation generally reaches its maximum point after 6 or 8 hours at 37° C., the froth rising to a height of some centimetres; the action is entirely ended after 60 hours. The dried preparations may be heated for 4—6 hours at 100° C., and still retain a certain amount of activity, but they lose almost all their fermentative power when kept for a fortnight at the ordinary temperature. The authors have performed a considerable number of experiments to prove that the fermentative properties of these preparations are truly enzymic, and not due to the activity of bacteria or other organisms. All quantitative experiments must, however, be conducted under perfectly aseptic conditions, with due regard to the fact that bacteria develop very readily in the solutions, with the production of carbon dioxide. If the enzymes be added to solutions in which fermentation does not readily take place, their activity will be completely destroyed by that of bacteria after 36 hours. For these reasons it is always advisable to perform experiments in the presence of an antiseptic such as thymol or toluene whenever possible. Tables are given showing the quantitative results of fermentation experiments with glucose, fructose, rhamnose, saccharose, lactose, and starch. It is noted in the case of glucose that the quantity of glucose consumed is greater than that corresponding with the quantities of alcohol and carbon dioxide produced, in spite of the total absence of bacteria; this fact has been accounted for by the observation that lactic acid is one of the products of the activity of the enzymes in solutions of glucose.—J. F. B.

Sterilisation by Boiling under Reduced Pressure. Schut, jan Zeits. f. Hyg., 1903, **44**, [2]. Biochem. Centralbl., 1903, **2**, [2—3], 95.

The author's experiments showed that heating a liquid to a particular temperature had less bactericidal effect than reducing the pressure so that boiling occurred at that temperature. By boiling a liquid under reduced pressure, bacteria were destroyed within the physiological limits of temperature, the rate of destruction increasing with the rise of temperature, at first rapidly and then more slowly. Saturated steam was found to be more effective at all temperatures than mere boiling. In practice, saturated steam at 90° C. was as effective as that at 100° C.

—C. A. M.

Sugars; Multirotation of ——. E. Roux. Ann. Chim. Phys., **30**, [7], 422—432; Chem. Centr., 1903, **2**, [22], 1242.

The aldoses can exist in three tautomeric modifications, α, β, and γ. In aqueous solution both the α-modification with high and the γ-modification with low optical rotation are converted into the β-modification with medium rotation. The author studied the course of this transformation at 18° C. in the case of the α- and γ-glucoses and lactoses. In 5 per cent. aqueous solution, the following values were obtained for $[\alpha]_D$: α-glucose, + 109·1°; γ-glucose, + 19·8°; α-lactose, + 83·16°; γ-lactose, + 35·17°. The rates of transformation of the α- and γ-modifications into the β-form are approximately the same. With a mixture of 36·73 per cent. of α-glucose and 63·27 per cent. of γ-glucose, a condition of equilibrium is attained; such a mixture has, in a 6 per cent. aqueous solution, a constant optical rotation, which is the same as that of β-glucose, namely, + 52·6°.

—A. S.

New Books.

West Indian Bulletin. The Journal of the Imperial Agricultural Department for the West Indies. Vol. IV., No. 3, 1903. Local Agents: Messrs. Bowen and Sons, Bridgetown, Barbadoes. London Agents: Messrs. Dulau and Co., 37, Soho Square, London, W. 1903. Price 6*d*.

This pamphlet-volume contains 92 pages, is of 8vo size and fully illustrated. The matter is subdivided and classified in the following groups:—I. Cotton Cultivation in the United States. II. Origin and Distribution of Sea Island Cotton. III. Varieties thereof. IV. Improvement of Sea Island Cotton by Seed Selection. V. Its Cultivation. VI Cotton Cultivation in the West Indies. VII. The Agricultural Chemistry of Cotton. VIII. Fungoid Diseases of Cotton. IX. Insect Pests of Cotton.

The Grant and Validity of British Patents for Inventions. By James Roberts, M.A., LL.B. John Murray, 50a, Albemarle Street, London. 1903. Price 25*s*. net.

Large 8vo volume, containing preface, table of contents, and tables of Cases and of Statutes and Rules. The text fills 609 pages, and there follows an alphabetical index. The matter is illustrated both with diagrams and engravings representing apparatus and plant, and is preceded by an alphabetised List of Abbreviations, a Table of Cases, also alphabetised, and a Table of Statutes and Rules. The matter is arranged in three principal parts. I. General Principles. II. Abstracts of Leading and Illustrative Cases, with Notes. III. Statutes and Rules, in so far as they bear on the Grant of Patents. Under these as principal heads the following are sub-headings:—I. (i.) Limits of Manufacture in Patent Law. (ii.) Inventions in Relation to the History and Development of the Arts. (iii.) Persons to whom Patents may be granted. (iv.) Conditions on which Patents are granted. (v.) Construction of Specifications. (vi.) Procedure to obtain a Patent. (vii.) Opposition to Grants and Appeals. (viii.) Amendment of Specifications, &c. II. Ninety-three cases referred to and given, dating from 1785 to 1903. III. Patents, Designs, and Trade Marks Act, 1883. Arrangement of Sections. Part I. Preliminary. Part II. Patents. Parts. III. and IV. Designs and Trade Marks. Part V. General. Patents, Designs, and Trade Marks (Amendment) Act, 1885. Patents Act, 1886. Patents, Designs, and Trade Marks Act, 1888. The Patents Act, 1901. The Patents Act, 1902. The Patents Rules, 1903. Law Officers' Rules. Admiralty and War Office Memoranda. The International Convention for Protection of Industrial Property. Instructions to Applicants for Patents.

Trade Report.

I.—GENERAL.

United Kingdom; Trade of ——, with United States.

U.S. Cons. Reps., No. 1823, Dec. 11, 1903.

Imports from the United States into United Kingdom.

Article.	1901.	1902.
	Dols.	Dols.
Caoutchouc	1,276,345	663,910
Chemical manufactures and products	1,132,295	872,040
China and earthenware	88,135	17,565
Starch, farina, and dextrin	1,017,745	433,645
Drugs:		
Opium	48,760	23,875
All other	1,178,355	1,206,375
Dyestuffs and substances used in tanning or dyeing:		
Extracts	329,495	317,555
Indigo		4,570
Glass manufactures of all kinds	166,185	177,945
Glue, size, and gelatin	202,155	168,065
Gum of all sorts	33,420	28,685
Lard	18,878,190	19,173,205
Lard, imitation	748,830	1,390,475
Manures (phosphate of lime and rock)	985,420	1,122,155
Metals and ores:—		
Brass and bronze, manufactures of	175,260	206,890
Copper:		
Ore	157,940	108,330
Regulus and precipitate	3,479,490	2,030,490
Iron—		
Pig and puddled	664,995	298,810
Bar	244,355	14,135
Steel, unwrought	1,471,745	172,965
Lead, pig and sheet	2,908,425	2,825,850
Silver ore	323,206	516,175
Zinc—		
Ore	61,470	187,245
Crude	310,035	679,085
Methyl alcohol	81,920	104,640
Oils:		
Fish (train and blubber)	270,975	225,775
Animal	250,650	164,540
Seed	1,862,655	1,550,345
Turpentine	4,096,635	4,257,420
Chemical, essential, and perfumed	81,800	153,655
Unenumerated	221,670	260,550
Oil-seed cake	5,746,910	5,506,970
Oleomargarine	1,038,535	932,445
Painters' colours	981,740	665,700
Papers:		
Unprinted	1,848,015	1,244,490
Strawboard and millboard	179,600	210,755
Wood-pulp board	257,580	296,030
Paper-making materials:		
Pulp, wood	457,555	185,255
All other	53,310	23,545
Paraffin	4,723,145	4,516,065
Perfumery (without spirit)	29,815	19,870
Petroleum:		
Illuminating	13,197,635	13,430,510
Lubricating	4,164,135	4,281,665
Plumbago	334,875	224,900
Rosin	2,032,695	1,943,750
Seeds:		
Cotton	528,965	657,705
Flax or linseed	746,425	1,328,155
All other	28,815	33,815
Soap and soap powder	1,119,895	1,604,655
Spirits:		
Rum	87,030	166,365
Sweetened or mixed	410,965	433,775
All other	71,540	95,625
Sugar:		
Molasses	1,546,405	1,073,590
Glucose	3,029,885	2,313,390
Tallow and stearin	2,265,370	975,565
Tar	47,435	29,690
Varnish without spirit	190,355	193,560
Wax	65,890	65,340
Wine	117,125	113,220

Exports from the United Kingdom to the United States. British and Irish Produce.

Article.	1901.	1902.
	Dols.	Dols.
Beer and ale	1,022,115	1,031,620
Bricks	130,085	136,385
Caoutchouc, manufactures of	254,335	223,980
Cement	87,645	159,055
Chemicals and chemical preparations:		
Bleaching materials	1,219,585	999,640
Soda compounds	518,560	547,125
All other	2,392,780	2,415,565
Clay, unmanufactured	941,030	1,066,885
Coal, coke, and patent fuel	560,055	2,979,090
Coal products (not dyes)	507,890	642,105
Earthen and china ware	2,561,820	2,491,690
Glass manufactures	658,725	739,995
Glue, size, and gelatin	311,010	312,455
Grease, tallow, and animal fat	19[illegible],895	268,250
Manure	589,600	733,450
Medicines, drugs, and preparations	235,085	240,845
Metals:		
Iron, wrought and unwrought	9,742,075	18,864,640
Brass and manufactures	121,405	115,615
Copper, wrought and unwrought	524,140	364,570
Tin, unwrought	63,655	77,995
Oil:		
Seed	210,710	295,270
Other sorts	412,965	603,655
Oil and floor cloth	791,940	957,860
Painters' colours and materials	557,710	567,965
Paper of all sorts	371,020	424,340
Salt	500,795	433,710
Seeds of all sorts	171,815	212,250
Soap	237,580	250,730
Sugar, refined and candy	36,075	4,190

Foreign and Colonial Merchandise.

Article.	1901.	1902.
	Dols.	Dols.
Caoutchouc	3,959,265	4,193,600
Chemical manufactures and products:		
Saltpetre	3,875	1,875
Unenumerated	732,970	618,725
China and earthenware	1,119,980	1,112,690
Drugs:		
Bark, Peruvian	103,145	128,755
Opium	503 580	415,095
Unenumerated	1,052,145	673,730
Dyeing and tanning stuffs:		
Cutch and gambier	134,490	84,440
Indigo	1,172,045	357,660
Sumac	41,350	38,770
Unenumerated	56,090	119,040
Galls	144,915	49,200
Glue, size, and gelatin	133,570	178,970
Glue stock	113,635	76,535
Gums:		
Kauri	430,440	715,990
Lac dye, seed-lac, shellac, and stick-lac.	557,160	817,085
All other	470,575	445,985
Gutta percha	103,530	116,195
Matches	244,190	128,510
Metals:		
Copper, unwrought, part wrought, and old	6,982,595	3,036,370
Bar iron	134,140	67,675
Iron ore	82,485	179,060
Iron and steel, unwrought	52,150	30,045
Ores, unenumerated	5,850	15,890
Tin—		
In blocks, ingots, bars, and slabs	9,201,755	10,807,320
Unenumerated, unwrought	192,190	246,575
Mica and talc	152,105	146,720
Oils:		
Cocoanut	884,000	108,355
Olive	289,465	526,750
Palm	271,670	1,163,195
Chemical, essential, or perfumed	68,470	95,620
Paper-making materials:		
Linen and cotton rags	256,965	343,845
Pulp, wood	81,500	10,625
All other	128,100	118,305
Perfumery	18,395	16,265
Plumbago	162,215	89,465
Seeds:		
Flax or linseed	277,770	35,430
For expressing oil	414,175	416,475
Soap and soap powders	53,730	47060
Spirits, not sweetened	37,800	42,920
Sugar:		
Refined	3,240	1,305
Unrefined	26,905	5,050
Tallow and stearin	62,945	809,210
Wax	44,740	68,310
Wine	259,170	211,885

PARA (BRAZIL); TRADE OF ——, FOR 1902.

Foreign Office Annual Series, No. 3107, *Dec.* 1903.

British writing paper is very little known here, except by name. A fair demand for the durable kinds suitable for notarial documents would spring up if the matter were properly pushed. Many varieties of excellent paper bearing British watermarks exist, but they come from the United States, Germany, France and Italy. It is high time that the genuine article should reap some of the benefit of its good reputation. The Portland cement that comes here is another article that is British only in name. It comes from various countries, but the bulk originates from the banks of the Elbe. British barrels used to be too large, inconvenient to handle, and liable to break in transit and expose the contents to damage by water. British exporters were recommended to reduce the size, but the advice was not acted upon. German cement is put up in barrels of more suitable size, containing 120 kilos. There is a good demand for patent medicines and compressed drugs, &c., in the interior, among the people who are engaged in forest industries.

SCIENTIFIC APPARATUS: U.S. CUSTOMS DECISION.

Nov. 1903.

The Board of General Appraisers held the following to be free of duty when imported for educational institutions:—Evaporating dishes, combustion boats, Sartorius balances and weights, Royal Berlin crucibles, charcoal blocks, fine chemicals.—R. W. M.

II.—FUEL, GAS, AND LIGHT.

SHALE OIL FOR GAS WORKS: ARGENTINE REPUBLIC CUSTOMS DECISION.

Boletin Oficial, Oct. 26, 1903; *Bd. of Trade J., Dec.* 17, 1903.

A Presidential Decree assimilates for Customs purposes, shale oil, imported by gas companies for the purpose of improving the illuminating power of water gas or coal gas, to carbon bisulphide, which is free of duty under No. 3,147 of the tariff.

ANTHRACITE COAL BRICKS: U.S. CUSTOMS DECISION.

Nov. 24, 1903.

The Board of General Appraisers held that bricks of anthracite coal, cemented together with a small amount of coal tar, were dutiable at 20 per cent. *ad valorem*, as "manufactured articles unenumerated," under section 6 of the Tariff Act, and not free of duty under the Act of Congress of January 15, 1903, removing the duty on all coal for one year.—R. W. M.

III.—TAR PRODUCTS, PETROLEUM, Etc.

PARAFFIN: U.S. CUSTOMS DECISION.

Nov. 10, 1903.

A decision was rendered which is of importance in its effect on importations of petroleum into the United States. Paragraph 626 of the present Tariff Act contains a proviso as follows:—

"That if there be imported into the United States crude petroleum, or the products of crude petroleum produced in any country which imposes a duty on petroleum or its products exported from the United States, there shall in such cases be levied, paid, and collected a duty upon said crude petroleum or its products so imported equal to the duty imposed by such country."

In the cases under consideration, the paraffin was produced from Russian petroleum in Germany, which country imposes a duty on petroleum and its products. The Board held, following a previous decision, that the application of the German rate was erroneous, and sustained the claim of the importers that the Russian rate should have been imposed, and further stated that the Russian rate should be levied when importations were made from countries like Great Britain and Belgium, which imposed no duty on the American product, whenever Russian petroleum was used to produce the paraffin. The Board further held that, in cases where the origin of the crude petroleum was not known, the Collector of Customs was justified in levying the highest rate imposed by any country on petroleum and its products, such rate, however, being subject to change on the importer producing evidence of the origin of the crude oil used.—R. W. M.

CARBOLINEUM: U.S. CUSTOMS DECISION.

Nov. 12, 1903.

The Board held that carbolineum was dutiable at 20 per cent. *ad valorem* as a "preparation of coal tar, not a colour or dye," under paragraph 15 of the Tariff Act, overruling the claim of the importer at New Orleans that it was free of duty under paragraph 524, which provides for various products of coal tar, such as dead or creosote oil, naphthalene, &c.—R. W. M.

VIII.—GLASS, POTTERY, AND ENAMELS.

LEAD POISONING IN THE POTTERIES.

Pharm J., Dec. 26, 1903.

Having considered the award of Lord James and the special rules proposed to be issued under it (see this Journal, 1903, 1374), the Joint Committee of Allied Pottery Manufacturers has resolved to issue a circular stating that it is felt that everything possible has been done to convince Lord James that no such rules as proposed were either necessary or reasonable, and expressing regret that he had seen fit to issue an award which will be very difficult to carry out, and might probably be objected to on legal grounds. The Committee, however, recommends that manufacturers should, unless there are special circumstances in individual cases, which render such rules absolutely impossible, take no exception to them, but continue to work loyally for the reduction of cases of plumbism. At the same time, the committee feels it necessary to again place on record the opinion that the compensation scheme will, for some time at all events, have the effect of increasing the number of reported cases.

X.—METALLURGY.

MAGNETIC IRON SAND IN JAVA.

U.S. Cons. Reps., No. 1825, *Dec.* 14, 1903.

In the neighbourhood of the town of Tjilatjap, on the coast of the island of Java, extensive deposits of magnetic iron sand have been found. The deposits begin opposite the island of Noesa Kembangan, and extend about 29 miles to the east, along the coast line. The sand lies on the surface, and is said to contain in some places as much as 80 per cent. of iron. Samples taken in different parts give a very good result when smelted. Some time ago an English company, with a Hollander at its head, acquired the right of exploiting these deposits, which have been known since 1854.

PLATINUM WIRE: U.S. CUSTOMS DECISION.

Dec. 12, 1903.

The Board held that the provisions of paragraph 642 of the free list of the tariff, providing for the free entry of "platinum, unmanufactured, and vases, retorts and other apparatus, vessels and parts thereof composed of platinum, for chemical use," did not include platinum wire, and affirmed the assessment of duty at 45 per cent. *ad valorem*, under paragraph 193.—R. W. M.

TIN SCRAP: U.S. CUSTOMS DECISION.

Nov. 21, 1903.

Irregularly-shaped pieces of tinplate, unfit for manufacture into other articles, and used only for detinning by electrolytic processes, were held by the Board of General Appraisers to be dutiable at 10 per cent. *ad valorem* as "waste not specially provided for," under paragraph 463 of the Tariff Act, and not at $1\frac{1}{2}$ cents per lb. as "tinplate," under paragraph 134.—R. W. M.

XI.—ELECTRO-CHEMISTRY, Etc.

ELECTRIC ACCUMULATORS; MANUFACTURE OF ——.

Statutory Rules and Orders, No. 1004, *Nov.* 21, 1903.

The draft regulations for the manufacture of electric accumulators (this Journal, 1903, 1029—1030) announced as to come into force on Oct. 1, 1903, have been adopted by the Secretary of State, and came into force on Jan. 1, 1904.

XII.—FATS, FATTY OILS, Etc.

OLIVE OIL PRODUCTION IN AUSTRIA.

Bd. of Trade J., Dec. 17, 1903.

Olive oil production in Dalmatia and Istria shows during the last few years a sensible diminution. During the last three years an annual average of 5,362 tons was produced, as against an annual average of 10,194 tons produced during the nine preceding years. The oil is produced in the proportion of four-fifths by Dalmatia and one-fifth by Istria. The consumption of olive oil in Austria-Hungary during the 10 years 1892—1901 shows an average of 13,056 tons. The limited consumption of olive oil for domestic purposes in the monarchy is accounted for (1) by the very extended use, especially in Hungary, of animal fat (lard, grease, &c.), butter, margarine, goose fat, &c.; (2) by the large consumption of cotton-seed oil; (3) by the addition of sesamé oil with olive oil, which increases every day. The greatest consumption of olive oil is in Austria, as Hungary only consumes annually about 2,500 tons.

YELLOW HARD GREASE: U.S. CUSTOMS DECISION.

Dec. 1903.

A hard grease, obtained by washing the residue of the distillation of wool grease, and which is in substance wool grease, was held to be dutiable at $\frac{1}{2}$ cent per lb. as "wool grease," under paragraph 279 of the Tariff Act. The Board had previously held similar merchandise to be free of duty as "sod oil," under paragraph 568, which opinion was affirmed by the United States Circuit Court. On further appeal the United States Circuit Court of Appeals held as above stated, reversing both the lower Court and the Board. The above decision of the Board follows the decision of the higher Court.—R. W. M.

CHINESE WOOD OIL [TUNG OIL]:
U.S. CUSTOMS DECISION.

Nov. 14, 1903.

Following a decision of the United States Court reversing a decision of the Board, the Board of General Appraisers held that Chinese wood oil obtained from the kernels of various species of Aleurites is free of duty as "nut oil" under paragraph 626 of the present Tariff Act. A decision of the Board had also held that Jatropha nuts, from which an oil is obtained, are in fact nuts, hence the oil is a "nut oil."—R. W. M.

XIII. A.—PIGMENTS, PAINTS, Etc.

HEMATITE ORE PIGMENT: U.S. TREASURY DEPARTMENT.

Dec. 1903.

In a recent suit in the Circuit Court it was decided that certain soft hematite was dutiable at 40 cents per ton as an iron ore under paragraph 121 of the Tariff Act. The Treasury Department, however, holds that it is a "crude pigment," and has directed that future importations be classified at 30 per cent. *ad valorem* under paragraph 58, with the view of bringing the matter again before the courts for decision.—R. W. M.

XIV.—TANNING; LEATHER; GLUE, Etc.

SUMACH TRADE OF SICILY.

Bd. of Trade J., Dec. 17, 1903.

The new season's harvest of sumach is estimated to be about a third less than that of last year. "Stinco"

(*Pistacio lentiscus*), imported from Tunis, is scarce, owing to its being exported direct to France to tanners who have been employing it instead of sumach, the price of which had risen excessively.

XV.—MANURES, Etc.

PHOSPHATE ROCK IN TUNIS; DISCOVERIES OF ——.

Eng. and Mining J., Dec. 17, 1903.

A Belgian company, which has been exploring the district of Uarfa-Tarf, about 50 km. west of Gafsa, reports the discovery of an important deposit of phosphate rock. Six seams in all were found, of which three, having a total thickness of nearly 5 m., were of sufficiently high grade to warrant their exploitation. Analyses give an average of 63 per cent. calcium phosphate, with from 14 to 20 per cent. calcium carbonate and 1·5 per cent. of alumina. The deposits occur near the base of the Tertiary formation.

XVI.—SUGAR, STARCH, Etc.

BEET-SUGAR PRODUCTION AND CONSUMPTION.

U.S. Cons. Reps., No. 1825, *Dec.* 14, 1903.

Under date of October 27, 1903, United States Consul Walter Schumann, of Mainz, Germany, transmits the following estimated beet-sugar production of Europe, as compiled by the International Association for Sugar Statistics:—

Country.	Plants in operation.	Production.	
		1903-4.	1902-3.
	No.	Met. tons.	Met. tons.
Germany	384	1,803,160	1,750,670
Austria	215	1,116,500	1,050,960
France	296	757,000	823,600
Belgium	100	215,300	200,000
Holland	29	129,300	102,300
Russia	275	1,103,000	1,169,600
Sweden	16	110,795	73,400
Denmark	7	51,800	37,067
Total	1,322	5,286,855	5,207,537

World's Sugar Production and Consumption.

A pamphlet recently published by Sir Neville Lubbock gives the following statistics of the world's production and consumption of sugar, beet and cane:—

Production.

Country.	1901 2	1902-3.
	Tons.	Tons.
Europe (beet), except Russia	5,722,000	4,390,000
Russia (beet)	1,090,000	1,215,000
British colonies	545,500	513,000
Egypt	96,000	90,000
India	3,000,000	3,000,000
United States, Cuba, Porto Rico, Manila, and Hawaii	1,804,500	1,920,000
Peru, Argentine Republic, Dominican Republic, Mexico, and Brazil	738,500	582,500
Java	767,000	842,500
French colonies	119,000	104,000
Total	13,882,500	12,657,000

Consumption.

Of the foregoing India and Russia will consume their own product; the United States will consume its own product and that of Cuba, Porto Rico, Manila, and Hawaii; Europe will consume 2,656,000 tons and 2,750,000 tons of its own beet-sugar production for the years given. This leaves available for the United Kingdom and other countries the following amounts.

Product of—	1901-2.	1902-3.
	Tons.	Tons.
Europe (beet)	3,066,000	1,640,000
British colonies	545,500	513,000
Egypt	96,000	90,000
Peru, Argentine Republic, Dominican Republic, Mexico, and Brazil	738,500	582,500
Java	767,000	842,500
French colonies	110,000	104,000
Total	5,323,000	3,772,000

BEET-SUGAR FACTORY IN TURKESTAN.

U.S. Cons. Reps., No. 1826, *Dec.* 15, 1903.

Near Taschkent, the capital of the district of Turkestan, a beet-sugar factory is expected to be in working order in September, 1904. Its annual output is estimated at about 5,000 metric tons, about one-fifth of the total consumption of sugar in Russian Central Asia. The beetroot is said to contain in Turkestan about 2 per cent. more sugar than in European Russia, so that it is very likely the sugar industry in those parts will develop favourably and quickly.

COUNTERVAILING DUTIES ON SUGAR FROM BRITISH POSSESSIONS.

Bd. of Trade J., Dec. 17, 1903.

A Note from the Belgian Government announced the decision arrived at by the Permanent Sugar Commission at Brussels with regard to the countervailing duties to be applied to sugars imported into the territories of the States parties to the International Sugar Convention from the undermentioned British Colonies. In accordance with the declaration made by H.M. Government on the ratification of the Convention, there will be no penalisation of sugars imported into the United Kingdom from any British Possessions; and it is not obligatory upon the other States parties to the Convention to apply these countervailing duties until an appreciable amount of sugar is actually imported into their respective territories from the Colonies concerned. The rates of duty in question are as follows:—

	Per 100 kilos.	
	Frs.	Cts.
Canada:		
On refined sugar	3	63
South African Customs Union:—		
On raw sugar	2	05
On refined sugar	3	89
Commonwealth of Australia:—		
On raw sugar	0	94
On refined sugar	5	62

XVII.—BREWING, WINES, SPIRITS, Etc.

DENATURED ALCOHOL IN ITALY.

Chem. and Druggist, Dec. 19, 1903.

The manufacturers of sulphuric ether in Italy are allowed to use denatured alcohol, subject to conditions to be imposed by the Minister of Finance. Varnish manufacturers will enjoy similar rights.

XIX.—PAPER, PASTEBOARD, Etc.

CELLULOID ARTICLES; DUTY ON ——: U.S. CUSTOMS DECISION.

Dec. 2, 1903.

The Board of General Appraisers held that, in assessing duty on articles composed in part and in chief value of celluloid, the whole weight of the articles, and not that of the celluloid alone, should be taken.—R. W. M.

XX.—FINE CHEMICALS, Etc.

ESSENCE OF ROSEWOOD IN FRENCH GUIANA.

Foreign Office Annual Series, No. 3106, *Dec.* 1903.

Essence of rosewood is produced from the rosewood (*Licaria Guianensis*). The wood itself was formerly shipped to France, but two factories have recently been established to extract the essence, which is now shipped to France in carboys. The wood is sold in the local market at 80 fr. (3*l*. 4*s*.) per ton. The average product of 1 ton of wood is 22½ lb. of essence, the price in France being about 10*s*. per pound.

Salol and Phenacetin: U.S. Customs Decision.

Dec. 1903.

Salol, phenacetin and other medicinal preparations were assessed for duty at 55 cents per pound, under paragraph 67 of the Tariff Act, as "medicinal preparations in the preparation of which alcohol had been used." The importers endeavoured to show that alcohol was not necessary for their manufacture. The Board held this evidence to be insufficient and affirmed the assessment of duty.—R. W. M.

Chloral Hydrate and Salol: U.S. Customs Decision.

The United States Circuit Court of Appeals has rendered a decision regarding the dutiable character of salol and chloral hydrate which has an important bearing on the imports into the United States of medicinal preparations in the manufacture of which alcohol is used. The Court held that if alcohol is used in any way, and even if it is broken up or removed, the finished product is subject to a duty of 55 cents per pound under paragraph 67. In order to be dutiable at 25 per cent. *ad valorem* under paragraph 68, evidence must be submitted showing that alcohol was used at no stage of the process. This decision reverses numerous decisions of lower courts.—R. W. M.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.], "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 27,546. Ritschel, Hagedorn, and Cowburn. Method and apparatus for evaporating, concentrating, drying, &c. Dec. 16.

„ 27,621. Gordon (Licardie). Evaporators.* Dec. 16.

„ 27,863. Marriott. Cupola furnaces. Dec. 19.

„ 27,935. Steenkiste. Drying apparatus. Dec. 19.

„ 28,017. Harvey. *See under* XVI.

„ 28,465. Green. Separation of volatile compounds by distillation, and apparatus therefor. Dec. 28.

„ 28,518. Moll. Process for evaporating weak brine, and apparatus therefor.* Dec. 28.

„ 28,572. Lake (Trump). Process for evaporating liquors.* Dec. 29.

„ 28,593. Lake (Trump). Vacuum pans.* Dec. 29.

„ 28,594. Lake (Trump). Process for treating material.* Dec. 29.

„ 28,595. Lake (Trump). Apparatus for treating material.* Dec. 29.

„ 28,711. Harvey. *See under* XVI.

„ 28,712. Harvey and Williams. *See under* XVI.

„ 28,791. Houghton and The United Alkali Co., Ltd. Apparatus for separating liquid from solid matter, and for partially drying the solid matter. Dec. 31.

[C.S.] 3619 (1903). Nordtmeyer. Disseminating gases in a finely divided state in liquids for effecting intimate contact with the liquid or with matters suspended therein. Dec. 23.

„ 5316 (1903). Winter. Centrifugal separating apparatus. Dec. 23.

„ 9002 (1903). Maggi. Treatment of animal, vegetable, or chemical substances to increase their solubility in liquids. Dec. 31.

„ 23,843 (1903). Rennerfelt. Centrifugal liquid separators. Dec. 23.

„ 25,547 (1903). Scheuffgen and Fabr. Explosionssich. Gef. Device for preventing explosions in vessels containing inflammable liquids. Dec. 31.

II.—FUEL, GAS, AND LIGHT.

[A.] 27,355. Hage. Manufacture of smokeless fuel.* Dec. 14.

„ 27,496. Mond. Gas producers. Dec. 15.

„ 27,613. Ritz. Furnaces.* Dec. 16.

„ 27,766. Craig. Gas calorimetric apparatus. Dec. 18.

„ 27,814. Alzugaray. Manufacture of carbons for arc lamps. Dec. 18.

„ 27,823. Wilson. Gas producers. Dec. 18.

„ 28,031. Mond. Gas producers.* Dec. 21.

„ 28,105. Kirkham. Furnaces. Dec. 22.

„ 28,262. Schlatter and Deutsch. Method and apparatus for ascertaining the quantity of carbonic acid in furnace gases. Dec. 23.

„ 28,279. Samuelson and Hawdon. Blast furnaces. Dec. 23.

„ 28,342. Bell and Masters. Furnaces of gas producers. Dec. 24.

„ 28,408. Williams and Middleton. Artificial fuel. Dec. 28.

„ 28,498. Bowing. Manufacture of combustible gas. Dec. 28.

„ 28,761. Boult (Köneman). Manufacture of water-gas.* Dec. 31.

[C.S.] 23,262 (1902). Blondel. Manufacture of electrodes for arc lamps. Dec. 31.

„ 4260 (1903). Hecking. Method of manufacturing fuel briquettes. Dec. 23.

„ 5910 (1903). Dempster and Sons, Ltd., and Broadhead. Gas purifiers. Dec. 31.

„ 7487 (1903). Collin. Coke ovens. Dec. 31.

„ 23,166 (1903). Rüdemann. Production by means of liquid hydrocarbons of a gaseous mixture which is as dry as possible. Dec. 23.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 27,889. Raetz. *See under* XII.

„ 28,062. Perkin. *See under* IV.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 27,372. Johnson (Badische Anilin u. Sodafabrik). Manufacture of oxyazo colouring matters. Dec. 14.

„ 27,630. Imray (Meister, Lucius, und Brüning). Manufacture of substantive tetrazo dyestuffs.* Dec. 16.

„ 28,033. Imray (Soc. Chem. Ind. Basle). Manufacture of tetrazo dyestuffs with the aid of 2.5.1.7 amidonaphtholdisulphonic acid.* Dec. 21.

„ 28,062. Perkin. Process for preparing anthraquinone. Dec. 21.

„ 28,506. Iljinsky and Wedekind & Co. Manufacture of oxyanthraquinone derivatives. Dec. 28.

[A.] 28,563. Newton (Bayer and Co.). Manufacture of new azo colouring matters and of colour lakes therefrom. Dec. 29.

[C.S.] 3654 (1903). Ransford (Cassella and Co.). Manufacture of polyazo bodies and dyestuffs. Dec. 23.

" 24,936 (1903). Imray (Soc. Chem. Ind. Basle). Manufacture of nitroalphylacidylamidonaphtholdisulphonic acids, nitroalphylamidoacidylamidonaphtholdisulphonic acids, amidoalphylacidylamidonaphtholdisulphonic acids, and amidoalphylamidoacidylamidonaphtholdisulphonic acids, and of azo dyestuffs therefrom. Dec. 23.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 27,483. Keefer. Method of printing yarns or threads.* Dec. 15.

" 27,539. Calico Printers' Association, Ltd., and Garnett. Calico printing. Dec. 16.

" 27,870. Dittmar. Hank-dyeing machines. [Fr. Appl., Dec. 20, 1902.]* Dec. 19.

" 28,508. Boult (Horton). *See under* XII.

[C.S.] 6094 (1903). Johnson (Badische Anilin und Soda Fabr.). Printing cotton or other vegetable fibre with indigo in combination with other colouring matter. Dec. 31.

" 24,387 (1903). Hofmann. Process and apparatus for impressing designs on warp yarns. Dec. 23.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 27,363. Shields. Burning pyrites and apparatus therefor. Dec. 14.

" 27,876. Woltereck. Process for the manufacture of ammonia. Dec. 19.

" 27,948. Allen. Treating substances rich in barium or strontium for the preparation of valuable products therefrom. Dec. 21.

" 28,253. Woakes. Separating silica from earths and minerals. Dec. 23.

" 28,400. Hunt. *See under* XI.

" 28,585. Tixier, Cambier, and Adnet. Manufacture of a barium manganate. Dec. 29.

" 28,667. Mehner. Manufacture of nitrogen compounds from atmospheric and other elementary nitrogen. Dec. 30.

" 28,682. Soc. Exploitn. Procédés G. Claude. Process for the separation of oxygen and nitrogen from liquid air. [Fr. Appl., Jan. 3, 1903.]* Dec. 30.

" 28,772. Akester. Method of obtaining metallic copper from solutions of salts of copper, and means therefor. Dec. 31.

" 28,818. Knudsen. Treatment of liquid air. Dec. 31.

[C.S.] 967 (1903). Reisert. Production of lime water, &c., and purification of water. Dec. 23.

VIII.—POTTERY, GLASS, AND ENAMEL.

[A.] 28,790. Fourcault. Manufacture of glass sheets or plates and apparatus therefor. Dec. 31.

[C.S.] 16,883 (1903). Reed. Method of and apparatus for enamelling. Dec. 31.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 27,626. Herschbach. Manufacture of porous bricks or blocks.* Dec. 16.

[A.] 27,834. Lee. Kilns for burning bricks, tiles, &c., lime and cement; also for burning sanitary ware and for salt glazing. Dec. 19.

" 27,928. Farnham. Waterproofing bricks, stone, and like porous materials.* Dec. 19.

" 27,946. Payton. Means of coating pipes or other articles to prevent corrosion and the like, and apparatus therefor. Dec. 21.

" 28,248. Zimmer. Compositions for the preservation of wood and other materials. Dec. 23.

" 28,602. Mackenzie (Fas). Apparatus for use in producing basic material for use as converter and furnace linings, &c. Dec. 29.

" 28,731. Middleton. Mode or process of manufacturing refractory material. Dec. 31.

[C.S.] 28,256 (1902). Passow. Treatment of blast furnace and other slags. Dec. 31.

" 1309 (1903). Kendall. Separation of granitic substance from associated rocky matter or gangue. Dec. 31.

" 24,041 (1903). Bach. Manufacture of firebricks, crucibles, retorts, and other refractory articles. Dec. 23.

" 25,321 (1903). McAlpine. Composition of building blocks, slabs, and the like. Dec. 31.

X.—METALLURGY.

[A.] 27,576. Jacobsen. Metallic alloys or compounds.* Dec. 15.

" 27,718. Lloyd. Treatment of minerals and metallic substances in general.* Dec. 17.

" 28,464. Edwards. Furnaces for calcining or roasting and desulphurising ores. Dec. 28.

" 28,491. Cammell and Co., Ltd., Fletcher and Hamilton. Manufacture of steel. Dec. 28.

" 28,503. Bloxam (Soc. Anon. d'Etudes Electro-Chim.). *See under* XI.

" 28,537. Hatton. Manufacture of puddled iron. Dec. 29.

" 28,616. Martin. Recovery of metals from their ores. Dec. 30.

" 28,666. Sulman and Kirkpatrick-Picard. Recovery of precious metals. Dec. 30.

" 28,736. Gannon and Phillips. Process for toughening and hardening steel. Dec. 31.

" 28,737. Gannon and Phillips. Process for treating cast iron, rendering the same capable of being brazed or soldered. Dec. 31.

" 28,777. Ogle and Carson. Deposition of the solid constituents of fumes obtained in metallurgical processes. Dec. 31.

[C.S.] 20,465 (1902). Miller. Treatment of refractory ores. Dec. 31.

" 26,295 (1902). Cattermole. Separation of metallic constituents of ores from gangue. Dec. 31.

" 26,296 (1902). Cattermole. Classification of the metallic constituents of ores. Dec. 31.

" 28,178 (1902). Koller. Treatment of iron and steel. Dec. 31.

" 28,938 (1902). Simpson. Method of purifying and separating metals. Dec. 23.

" 1562. (1903). Alzugaray. Manufacture and refining of iron, steel, and their alloys. Dec. 31.

" 5016 (1903). Kunze and Danziger. Manufacture of zinc. Dec. 31.

" 7027 (1903). Bloxam (Soc. Electrométall. Française). Production of iron and steel. Dec. 31.

" 8101 (1903). Young. Manufacture of malleable iron or steel, and apparatus therefor. Dec. 31.

[C.S.] 23,764 (1903). Gröndal. Furnace for burning ore briquettes. Dec. 31.

,, 23,848 (1903). Alzugaray. Treatment of complex ores. Dec. 23.

,, 25,932 (1903). Engels. Process of treating iron and steel with carbides. Dec. 31.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 28,057. Wheatley (Atwood Electric Co.). Composition for use in the cells of electrical batteries.* Dec. 21.

,, 28,400. Hunt. Process for the production of hydroxides and oxides of metals by electrolysis.* Dec. 21.

,, 28,503. Bloxam (Soc. Anon. d'Etudes Electrochim.). Electrolytic extraction of zinc from its ores, and apparatus therefor. Dec. 28.

,, 28,590. Cowper-Coles, and Cowper-Coles and Co., Ltd. Coating metals with copper. Dec. 29.

,, 28,606. Cowper-Coles, and Cowper-Coles and Co., Ltd. Process for coating one metal with another metal. Dec. 29.

,, 28,780. Eimer. Electric furnaces or ovens. [U.S. Appl., May 22, 1903.]* Dec. 31.

,, 28,782. Eimer. Electric sectional furnace. [U.S. Appl., May 28, 1903.]* Dec. 31.

,, 28,805. Schneider. Electric furnaces.* Dec. 31.

[C.S.] 1676 (1903). Meygret. Electrodes for accumulators. Dec. 31.

,, 12,083 (1903). Ashcroft. Agitating the contents of electrolytic cells and effecting systematic transference of portions of the contents of one cell to another. Dec. 23.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 27,449. Cronholm. Edible fats and process of making the same.* Dec. 15.

,, 27,889. Raetz. Process for solidifying such liquid compounds of phenol or cresol and soap which are soluble in water and form emulsions, intensifying at the same time their effect.* Dec. 19.

,, 28,508. Boult (Horton). Manufacture of dyeing soap. Dec. 28.

[C.S.] 27,899 (1902). Zelinsky. *See under* XX.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A*.)—Pigments, Paints.

[A.] 28,289. De la Rue and Rawlinson. Printing inks. Dec. 23.

,, 28,800. Armbruster and Morton. Pigments, and processes of making the same.* Dec. 31.

[C.S.] 15,742 (1903). Montgomery. Manufacture of white lead. Dec. 31.

(*C*.)—India-Rubber.

[A.] 28,353. Bourn. Processes of vulcanising rubber.* Dec. 24.

XIV.—TANNING; LEATHER, GLUE, SIZE, Etc.

[C.S.] 22,482 (1903). Melliuger. Process and compound for removing hair from hides. Dec. 23.

XVI.—SUGAR, STARCH, GUM, Etc.

[A.] 28,017. Harvey. Evaporators for the treatment and concentration of cane juice, beet juice, and other juices and liquors. Dec. 21.

[A.] 28,296. Shaw. Treatment or preparation of sugar. Dec. 24.

,, 28,297. Shaw. Treatment or preparation of sugar. Dec. 24.

,, 28,298. Shaw. Apparatus for use in the treatment or preparation of sugar. Dec. 24.

,, 28,617. Harvey. Evaporators for concentrating cane juice, beet juice, and other juices and liquids. Dec. 30.

,, 28,711. Harvey. Evaporators for concentrating sugar cane, beet, and like juices or liquids. Dec. 31.

,, 28,712. Harvey and Williams. Evaporators for concentrating the juice from sugar cane or from any chemical liquors which require evaporation. Dec. 31.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 28,184. Claussen. Manufacture of English beer or malt liquors and the production of pure yeast cultures for use therein. Dec. 22.

,, 28,415. Bruce. Manufacture of pot still whiskey. Dec. 28.

[C.S.] 28,834 (1902). Valentine. Roasting malt, barley, &c., for use in colouring and flavouring stout and ales. Dec. 31.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A*.)—Foods.

[A.] 27,356. Teed. Treatment of milk. Dec. 14.

,, 27,449. Cronholm. *See under* XII.

,, 27606. Héritte. Method of preserving organic substances. Dec. 16.

[C.S.] 24,692 (1903). Posternak. Process for obtaining the assimilable phospho-organic matter contained in vegetable foodstuffs. Dec. 31.

(*B*.)—Sanitation; Water Purification.

[A.] 28,137. Bonnotte. Manufacture of a compound for preventing scale in steam boilers. Dec. 22.

[C.S.] 967 (1903). Reisert. *See under* VII.

,, 4221 (1903). Hudson Economiser Co., Ltd., and Holehouse. Treatment of the exhaust steam of engines, and the feed-water therefor. Dec. 31.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 27,587. Pfeifer. Process and apparatus for manufacturing paper stock and pulp. Dec. 16.

,, 27,738. Strange, Garle and Longsdon. Treatment and utilisation of residual matters containing alkaline and organic substances, such as residual matters resulting from the treatment of esparto grass, straw, wood, &c., with alkali in the preparation of paper pulp. Dec. 17.

,, 28,186. Meixell and Holt. Process of making paper, &c.* Dec. 22.

,, 28,212. Parkin, William and Casson. Process for rendering celluloid non-inflammable. Dec. 23.

,, 28,611. Milne. Paper- and pulp-making machines. Dec. 30.

,, 28,654. Black, and Harnett and Co., Ltd. Manufacture of celluloid and like bodies. Dec. 31.

[C.S.] 22,970 (1903). Bachrach. Compounds of nitrocellulose and similar substances. Dec. 23.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 28,655. Black, and Harnett and Co., Ltd. Manufacture of artificial lemon oil. Dec. 30.

[C.S.] 27,899 (1902). Zelinsky. Process of producing organic acids. Dec. 23.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 27,353. Balfour. Photographic films. Dec. 14.

„ 28,001. Grant and Stedman. Production of negatives for trichromatic photography. Dec. 21.

„ 28,766. Crocker. Impts. in photographic pictures. Dec. 31.

[C.S.] 8260 (1903). Butler. Means for and method of printing photographic pictures in natural colours. Dec. 31.

[C.S.] 25,981 (1903). Justice (Soc. Anon. Plaques et Papiers Phot. A. Lumière et ses fils). Manufacture of photographic film cards, papers and the like. Dec. 31.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 27,515. Lake (Cyanid Ges. m. b. H.). Explosives. Dec. 15.

„ 27,728. Hope. Explosives. Dec. 17.

„ 28,710. Russell. Explosives for blasting or like purposes. Dec. 31.

[C.S.] 5791 (1903). Bichel. Manufacture of explosives. Dec. 31.

„ 22,970 (1903). Bachrach. *See under* XIX.

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The Annual General Meeting will be held in New York City on Thursday, Sept. 8th, and following days. Members who contemplate attending are requested to communicate with the General Secretary as soon as possible, in order that suitable travelling arrangements may be made. A programme appears in this issue of the Journal.

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Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

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Gaskell, Holbrook, jun., l/o Liverpool; Erindale, Frodsham, Cheshire.

Gaskell, Holbrook, III., l/o Liverpool; Erindale, Frodsham, Cheshire.

Gill, J. Arthur, l/o Stratford; 10, Manor Road, Rusthall, Tunbridge Wells.

Haigh, Dr. Lagnel, l/o Bayonne City; 33, Norwood Avenue, Summitt, N.J., U.S.A.

Harman, E. A.; all communications to Gas Works, Huddersfield.

Hawdon, H. S.; all communications to Harton Road, Westoe, South Shields.

Hellier, E. A., l/o Hull; Avonside Varnish Works, Bristol.

Hemingway, Henry; Journals to Baglan Lodge, Briton Ferry, South Wales; communications as before.

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Hislop, G. R., (subscriptions) Greenhill House, Underwood Road, and (Journals) Gas Works, Paisley.

Johnston, W. G.; all communications to Anchor Chemical Works, 1095, Garngad Road, Glasgow.

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Longstaff, J. P., l/o Heriot Watt College; Chemical Department, The University, Edinburgh.

Macfarlane, Thos.; all communications to 317, Queen Street, Ottawa, Canada.

Milroy, And., l/o Glasgow; House Hill Muir, Nitshill, N.B.

Nact, Dr. E. E., l/o Moss Side; 26, Stanley Road, Whalley Range, Manchester.

Neumann, Dr. Max, l/o Engelufer; Hohenstaufenstrasse 32, Berlin W. 30, Germany.

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Pitman J. R., l/o Pompton Lakes; c/o Laflin and Rand Powder Co., Haskell, N.J., U.S.A.

Richardson, F. W.; Journals to Oak Lea, Menston, Yorks.

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Seymour-Jones, A.; all communications to Pendower, Wrexham.

Simpson, W. S., l/o Enfield; 17, Lakeside Road, Palmer's Green, N.

Smith, H. Procter, l/o Coatbridge; "Gorphwysfa," Shotton, Flintshire.

Smythe, Dr. J. S.; communications to Rantallard, Lance Lane, Wavertree, Liverpool; Journals as before.

Spence, J. Davidson; communications to 39, Mincing Lane, E.C.

Steel, R. E.; all communications to 38, East Park Parade, Northampton.

Stevens, M. White, l/o Plymouth; H.M. Patent Office, Chancery Lane, W.C.

Stoddart, F. W.; all communications to Western Counties Laboratory, College Green, Bristol.

Sundstrom, K. J., l/o Trenton; Sibley, Mich., U.S.A.

Sutherst, Dr. W. F., l/o Wembley; Brimsdown Lead Co., Ponders End, N.

Swinburne, Geo.; subscriptions c/o Jno. Coates and Co., Suffolk House, Laurence Pountney Hill, E.C.; Journals as before.

Tatlock, R. R.; all communications to 156, Bath Street, Glasgow.

Thomson, Jno., l/o Malauney; Overlee, Alexandria, N.B.

Umney, Charles; Journals to 81, Lawrie Park Road, Sydenham, S.E.

Walton, T. U.; Journals (temporary) to 65, Union Street, Greenock, N.B.

Wielandt, Dr. W., l/o Berlin; Maltkestrasse 8^1, Magdeburg, Germany.

Death.

Johnstone, Jas., Shawfield Works, Rutherglen, Glasgow. Jan. 10.

London Section.

Meeting held at Burlington House, on January 4th, 1904.

MR. WALTER F. REID IN THE CHAIR.

THE DEFECTS OF UNCARBURETTED WATER-GAS AS FUEL FOR LABORATORY USE.

BY MASUME CHIKASHIGE, D.Sc., F.C.S., AND HITOSHI MATSUMOTO.

To those who have to find the gas-fuel for their laboratories, water-gas will commend itself by the little room taken up by the apparatus for making it, and by the relative simplicity of its manufacture and purification owing to the fact that very little tar is produced. They will also take into account the smallness of the disadvantage of interrupting the manufacture when necessary, and of thus working the process intermittently. Governed by such considerations as these, we have for several years endeavoured to make use of water-gas in Bunsen burners for ordinary purposes in our laboratories. Having become convinced of its unfitness for this purpose, we offer an account of our experience for the information of those who, like ourselves, have to provide their own gas supply, and also for the information of others who, though more fortunate, may yet find interest in the problem of the utilisation of water-gas.

The Gas used.—The gas which we made and used was analysed from time to time. Its average composition is as follows:—

	Per Cent.
Hydrogen	48·8
Methane	0·8
Carbon monoxide	33·1
Carbon dioxide with some hydrogen sulphide	8·5
Nitrogen	8·5
Oxygen	0·3

The gas was purified only to the extent deemed sufficient, and was supplied under a pressure of 5 cm. of water. The plant being set up very near to the laboratory, the iron main-pipe was very short, and tarring the inside of it was therefore neglected. Iron will consequently have been taken up in minute quantity by the carbon monoxide in the passing gas, and been present in it as iron carbonyl.

The Burning of Water-Gas.—With the Bunsen burner ready to hand as the nearly universal laboratory gas-burner, we always used it for burning the water-gas, although the composition of this gas and its smokeless flame make the air-ways of a Bunsen burner almost useless. The admission of some air with the gas may perhaps raise its temperature a little, but for most purposes this is already too high, as will be shown presently. A problem, however, can be solved by the air-fed flame, of which the solution is not only of practical importance in connection with the use of the water-gas flame, but also of general interest in the study of hydrocarbon flames. It is that of determining the order followed in the combustion of this mixture of water-gas and air, to find out whether the hydrogen and carbon monoxide burn together or one before the other. Now, as water-gas, when fed with air, burns with a flame having the usual two cones, which can be separated in the Smithells and Ingle apparatus, it becomes easy to get the answer to this question. The experiment was accordingly made, and gave the results shown in the following table, together with those obtained with coal-gas by Smithells and Ingle :—

Partly burnt Gas.	Water-gas.	Coal-gas (S. and I.).
	Vol. per Cent.	Vol. per Cent.
Water	17·0	14·9
Hydrogen	20·0	10·9
Methane	0·3	trace
Carbon dioxide	8·8	3·8
Carbon monoxide	19·5	10·2
Oxygen	0·1	..
Nitrogen	34·3	60·3

The numbers given by the water-gas show that about one volume of air had been mixed with two volumes of the gas, that being as much as could well be employed without risk of explosion. In Smithells and Ingle's experiments with coal-gas, nearly ten times as much air was used (9·6 to 2), but this difference is a matter of course and necessity. Two points of interest in the comparison are (1) that in each case the volume of the remaining hydrogen is about equal to that of the carbon monoxide ; and (2) that the concentration of these gases is only half as great in the partly burnt coal-gas as it is in the partly burnt water-gas. Coming now to the problem to solve which the experiment with water-gas was undertaken, it will be seen that the result establishes the fact that the hydrogen burns before the carbon monoxide mixed with it. From this it follows that the inner cone of the flame of water-gas and air is that of burning hydrogen, and that in the outer cone of this flame, and also in that of hydrocarbon flames, the carbon monoxide must be the last constituent to burn.

Relative Value of the Water-Gas Flame.—We began this paper by stating some points in the manufacture of water-gas, which seem to commend its employment in some circumstances in the laboratory. But, as yet, we have made no reference to the advantages of using water-gas which are offered by the properties of its flame. Its advantageous properties when burning are, however, so well known that we need not dwell upon them, and we shall, therefore, only now refer to them in order to point out some drawbacks which attend them. One advantage is that the flame needs no air draught to render it smokeless, and to raise its temperature. Here, however, we often feel the want of the power to at once reproduce the luminous smoky-flame of coal-gas, as when we have to anneal glass just worked in it. Another advantage of this flame over that of coal-gas, is afforded by its particularly high reducing power. Against this may be placed the comparative difficulty of using it for oxidising purposes. Only the outermost region and quite the tip of the visible flame can be thus used, whereas the Bunsen coal-gas flame acts oxidisingly to a considerable depth from its tip and surface. The reason for this difference may be found in the fact that, for fear of its flame passing down the tube, water-gas can be mixed with so little air from below that the gas in the interior of the flame suffers very little combustion there. That, just as in a luminous coal-gas flame, the temperature inside the flame is much the lowest, can be easily demonstrated by holding a glass rod or a wooden splint across it. One more property possessed by the flame to its advantage is its high temperature. There is no ordinary gas-flame that equals it in this respect. In it comparatively thick copper wire and sheet, and even thin platinum wire, are easily melted, and hard glass easily worked. Yet it is just this property of specially high temperature which, along with the presence of so much carbon monoxide, makes its use often unsatisfactory, if not impracticable, for the ordinary work of the laboratory. This objection to the use of water-gas will now be illustrated.

Insufficient Volume of the Flame.—With an equal flow of gas, the volume of the water-gas flame is much smaller than that of the coal-gas Bunsen flame. The reason of this lies largely in the fact that there is so much more to burn in the coal-gas, and that its methane in burning to what is the analogue of water-gas, namely, carbon monoxide and hydrogen, or these two and water, besides the nitrogen of the consumed air, yields several times its volume of this combustible mixture. This fact of the small volume of the flame of water-gas seriously increases the necessary consumption of the gas. For when vessels of some size have to be heated, as is so often the case, the desirability of applying the heat over a wide extent of their surface can only be met by using a large enough flame, quite apart from any consideration of its temperature. In order to bring up the volume of the water-gas flame to that of the non-luminous coal-gas flame, it becomes necessary to increase the flow of the water-gas to about two and a half times as much. To give particulars : in an ordinary small Bunsen, such as we made use of, with its air holes closed, and with a pressure on the gas (after passing through the meter) of 3 cm. of water, 120 litres (nearly $4\frac{1}{4}$ cb. ft.) of gas will be consumed per hour, and the length of the flame will be only 7 cm. or so ; to get the usual Bunsen flame, that is, one about 15 cm. long, the aperture of the gas-nozzle must be enlarged until more than 300 litres ($10\frac{2}{3}$ cb. ft.) of the gas pass per hour. It will be evident that the much greater volume of water-gas required to give Bunsen flames of the ordinary size and also the effect of this requirement upon the capacity of the gas-plant show greatly to the disadvantage of water-gas when comparing it with coal gas, which, even in equal volumes, has much greater heat-giving power than water-gas. It must be remembered that in the routine of a teaching laboratory much gas is burnt to waste, since everywhere the flame must be at hand even though not in use, because to that extent the relative heating power of the flame becomes a secondary point.

Copper Air-baths and Water-baths Rapidly Destroyed by the Flame.—Owing to the high temperature of the water-gas flame, a strip of sheet-copper of considerable thickness not only melts in the flame, but burns away quickly with bright scintillations when held in the outer part of it. The edges of the flame have also a strongly oxidising action upon the bottoms of air-baths and water-baths and cause a constant stripping off of scales of black oxide. In addition to this injury, these vessels suffer gradual destruction from the sulphur and the dust usually present in the gas, a point to be returned to later on. It becomes almost necessary therefore, to replace copper water-baths by others of cast iron, and to fit the copper air-baths with cast-iron bottoms, both of which stand fairly well.

Nickel and Platinum Vessels also Rapidly Destroyed.—Not only is copper so readily corroded, but rapid destruction of nickel and platinum vessels is caused by the flame. In the case of these metals it is probably much less the high temperature of the flame than the presence in it of so large a proportion of carbon monoxide, that accounts for its injurious action upon them. We have had the bottom of a new nickel crucible burnt completely off in one operation, the metal being carbonised into a very brittle black substance. In what was perhaps the earliest attempt to construct an incandescence gas-mantle, Gillard found, in 1848, that a cage of platinum wire network suspended in a water-gas flame was soon corroded and then no longer incandesced brightly. In accordance with this observation, we have found that the bottoms of platinum dishes and crucibles get rapidly damaged by the flame, the metal becoming quite brittle with a very white crystalline-looking surface. After continued use, a crucible of this metal has broken apart spontaneously, the metal when struck yielding no more sound than a piece of lead. The experiment was made of heating a capsule formed out of platinum foil for many hours in the water-gas flame. One effect was a distinct though slight increase of weight. The metal became somewhat coated over by the heating, but this deposit was wiped off each time before weighing the capsule.

	Weight. Grms.
Before heating	4·7661
After 7 hours	4·7664
" 5 " more	4·7666
" 10 " "	4·7672

There was, therefore, a uniform increase of 1·1 part in 4,766 parts. The increase in weight may have been due to the fixation of carbon or of iron. As to the carbon, it is to be remembered that Langer and V. Meyer, in 1885, in their "Pyrochemical Researches," found carbon monoxide to suffer partial decomposition at 1,690° C. into carbon and carbon dioxide. Not only is this the case, but we have found that carbon monoxide, hydrogen, and methane, mixed in the proportions occurring in water-gas, will sometimes deposit soot on the bottom of a porcelain crucible, although the flame is perfectly "non-luminous." With regard to the iron, it is now an established fact that water-gas which has passed some distance through bare iron pipes contains iron carbonyl in the vaporous state, and iron carbide or iron oxide may be deposited from this on the platinum, or the platinum may take up iron. A platinum crucible which has been heated for a long time by water-gas will be found to yield traces of iron when treated with fusing acid potassium sulphate.

Porcelain Crucibles unavailable for Use with the Flame in Quantitative Analysis.—A deposit, such as forms on the bottom of a platinum crucible, is also left upon the bottoms of porcelain crucibles heated in the water-gas flame, but in this case much of it is firmly adherent to the porcelain and cannot be wiped off. As a consequence, the tare of the crucible is so changed as to seriously complicate the usual weighings, and indeed to render accurate weighing impossible. The film thus formed is sometimes brown and then consists of iron oxides, silica, &c., but sometimes it is black and is composed almost entirely of carbon and reduced iron, combined or not as carbide. The bottoms of three porcelain boats were kept for several days in the water-gas flame and became covered with this black deposit. After the increase in their weight had been ascertained, they were heated in a current of purified oxygen in a tube connected with a weighing tube containing crushed potassium hydroxide. The increase in weight of the latter being attributed wholly to carbon dioxide, and the oxidised residue on the boats being assumed to be all ferric oxide, the black deposit proved to be a compound or mixture of iron and carbon, approximately expressed by FeC_2:—Deposit, 0·0097 grm.; carbon dioxide, 0·0117 grm. = carbon, 0·0032 grm.; ferric oxide, 0·0100 grm. = iron, 0·0070 grm. Carbon, 31·9 per cent.; iron, 68·6 per cent. Theory for FeC_2: carbon, 30 per cent.; iron, 70 per cent. The slight error in excess may perhaps have been due to the presence of a little hydrogen, miscalculated as carbon.

Deposition of a Dirty Pale-blue Coating on Copper Vessels.—The action of the water-gas flame upon the bottoms of copper vessels heated in it has already been noticed, where the flame touches the copper, copper oxide is produced and scales off. But, besides this, all the copper above the edge of the flame that comes in contact with the hot products of combustion gets coated with a dirty bluish-white deposit, which easily detaches itself from the copper. It consists of nearly anhydrous copper sulphate, with a little ferric oxide and traces of silica, magnesia, lime, &c. Now, such a deposit is known to be also produced by burning coal-gas, though to a much smaller extent, and in calling attention to this and other objections to the use of water-gas, we do not mean to convey the notion that there is any absolute difference between the burning of water-gas and the burning of coal-gas, but to point out the much greater prominence of objectionable characters in the case of the former. Killing, in 1900, examined a similar whitish deposit on the copper ceiling protectors suspended over incandescence coal-gas burners, and found it to consist largely of copper sulphate, with other matter derived from the dust of the air and from the mantles. In the case of water gas, particularly when used fresh from the generators, the impurities of the copper sulphate come largely from the fine dust in the gas, as well as from iron carbonyl and silicon hydride. When the gas has not stood for some hours over water, its flame is often tinged reddish.

Poisonous Character of Water-Gas.—The danger to health and life of the unrecognised escape of water-gas into the laboratory is well known. But even during the burning of the gas there may be danger. Lewes has pointed out that carbon monoxide in small quantities occurs among the gases from the flame of coal-gas and air of a Bunsen burner under a copper vessel, and Thorpe has recently determined its amount to be 0·022 vol. from 6 vols. of coal-gas. We have made some experiments with water-gas burnt under a sand-tray and with a little air entering the Bunsen, so as to form an inner cone in the flame. We worked according to Thorpe's method. For these experiments the water-gas was freed from hydrogen sulphide by passing it through a solution of lead acetate containing acetic acid, and was burnt at the rate of 170 litres (6 cb. ft.) per hour. When fully burnt, 100 vols. of the gas may be assumed to give 41 vols. of carbon dioxide. The carbon monoxide escaping from the flame was found to vary greatly in quantity according to the position of the sand-tray in the flame, as the following cases show:—(1) With the tray some distance above the point of the inner cone, two experiments gave respectively 0·0010 grm. carbon monoxide to 0·1922 grm. carbon dioxide, and 0·0009 grm. to 0·1844 grm. The mean of these results comes out as 0·32 vol. carbon monoxide from every 100 vols. of gas burnt. (2) When, on the other hand, the tray was placed below the point of the inner cone at about two-thirds of its height, there was a much greater escape of carbon monoxide. In this case, three experiments gave respectively 0·0028 grm. carbon monoxide to 0·1795 grm. carbon dioxide, 0·0028 grm. to 0·2149 grm., and 0·0032 grm. to 0·2241 grm. Calculation from these numbers brings out the mean escape of carbon monoxide as 0·9 vol. to every 100 vols. of water-gas. (3) Lastly, by working, as Lewes did, with the tray at the point of the inner cone, the three results obtained were 0·0016 grm. monoxide to 0·2170 grm. dioxide, 0·0015 grm. to 0·2009 grm., and 0·0015 grm. to 0·1907 grm., making a mean of 0·48 vol. of carbon monoxide to every 100 vols. of water-gas used. The grand mean of these results is that 0·57 vol. of carbon monoxide escapes unburnt in the consumption of 100 vols. of water-gas in the usual ways as described. This contrasts very unfavourably with Thorpe's result with coal-gas, since 0·032 vol. from every 6 vols. of coal-gas burnt represents 0·37 per cent. Further, where work is done, as it usually is, with Bunsen flames of equal heights, when over 300 litres per hour of water-gas are burnt against 170 litres (6 cb. ft.) of coal-gas, the former contaminates the air with carbon monoxide nearly three times more than coal-gas, namely, to the extent of 1 vol. of carbon monoxide in place of the 0·37 vol. from coal-gas. The effect, therefore, is that where in a laboratory 30 coal-gas burners may be kept going without detriment to health, hardly 11 water-gas burners can be used with impunity. For the reasons set forth in what precedes, we have been induced to give up the use of water-gas as a substitute for coal-gas in the laboratory.

DISCUSSION.

Mr. DAVID HOWARD said the question of the use of water-gas or producer-gas, or other gases of that nature, was an increasingly important one. On a large scale it had worked most successfully, but there was a wide sphere for its application to the use of comparatively small flames, small compared to that of a regenerator furnace, but larger than a Bunsen flame. The question that required elucidation was whether a small gas furnace could be worked better with coal-gas, which was effective but expensive, or with producer-gas which had disadvantages, but which was cheaper. He was inclined to think that water-gas might be used for laboratory purposes, in conjunction with the ordinary Argand burner, and a metal tube. With coal gas heat was wasted by the use of an excess of air to prevent smoke, but with water-gas this objection did not obtain.

Mr. Gordon Salamon asked whether, in the burning of ordinary coal gas, mixed with a certain proportion of water-gas as was now the custom, the organic compounds of sulphur present in the gas were capable of exerting a deleterious influence on the platinum. It appeared to him that where gas companies were not subject to the sulphur clauses the amount of organic sulphur introduced would be quite sufficient to cause that question to be worthy of consideration. Having regard to the results now before them he would like to ask if they would be modified in their effect by admixture with oil-gas as was the custom in connection with gas works, also if such a mixture on combustion would yield the same *pari passu* results as were recorded in the tables.

Mr. Arthur Marshall said it had been pointed out that water-gas was now being mixed with the coal-gas supplied by the gas companies in increasing quantities, and it was a serious question as to whether carbon monoxide was given off when gas was burnt in an ordinary batswing burner, since most people, when burning gas for illuminating purposes, kept all the doors and windows shut, consequently the atmosphere contained all the products of combustion.

Mr. G. C. Jones said he had no experience of the use of water-gas in the laboratory, though he had some with regard to generator-gas of about half the strength, which, however, was a hopeless fuel for the laboratory. To make any effective use of it, gas-pipes double the usual diameter, unwieldy rubber tubing, and specially constructed burners were necessary. Moreover, high temperatures were unattainable.

The Chairman said he was sure the Society would authorise Dr. Divers, to whom they were much indebted for having read this paper before them, to convey their thanks to the authors.

Dr. Divers said he should inform the authors of Mr. Howard's suggestion to replace the Bunsen by Argand burners, which he himself believed would meet some of the difficulties in using water-gas. On the point raised by Mr. Gordon Salamon as to the effect upon the combustion of the sulphur compounds in coal-gas by the admixture of water-gas, he could supply no information. He believed that in America water-gas, mixed with hydrocarbons, had not been found to be so objectionable a fuel as water-gas alone had proved. As to the danger of contaminating the air with carbon monoxide during combustion of water-gas or coal-gas, that could only occur to a recognisable extent when vessels or other bodies in the flame prevented complete combustion.

Newcastle Section.

Meeting held on Monday, January 18th, 1904.

DR. J. T. DUNN IN THE CHAIR.

A special meeting was held at the College of Science, when the President of the Society gave a discourse on "Radium and the Inactive Gases of the Atmosphere."

Mr. N. H. Martin moved a vote of thanks to the President for his visit and for the lecture he had delivered.

Mr. John Pattinson seconded the resolution, which was carried by acclamation.

Afterwards the members of the Section dined together, the President being the guest of the evening.

Nottingham Section.

ERRATA.

EXAMINATION OF METHODS EMPLOYED IN ESTIMATING THE TOTAL ACIDITY OF GASES ESCAPING FROM THE CHAMBER PROCESS FOR THE MANUFACTURE OF SULPHURIC ACID.

BY H. J. WATSON.

Discussion (this Journal, 1904, 6—7).

Page 7, col. 1, line 31 from bottom, for "qrs." read "grs."

Delete lines 26 to 24 from bottom, and substitute:—"This escape was a small one, and although water, or water *plus* H_2O_2, gave practically the same result, they might not have done so if the escape had been high."

Page 7, col. 2, line 41, for "The chambers were 100 feet in length and 30 feet high" read "the chambers were 105 feet long, 25 feet wide, and 20 feet high."

Journal and Patent Literature.

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Patent Specifications may be obtained by post by remitting as follows:—

English.—8*d.* each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3ᵉ).

I.—PLANT, APPARATUS, AND MACHINERY.

English Patents.

Disseminating Gases in a Finely-divided State in Liquids; Method of and Apparatus for ——, for Effecting Intimate Contact with the Liquid or with Matters Suspended therein. H. Nordtmeyer, Celle, Hanover. Eng. Pat. 3619, Feb. 16, 1903.

The gases are forced under pressure into the liquid through porous substances, such as sandstone, burnt clay, kieselguhr, &c., so as to obtain, by the formation of extremely fine bubbles, a rapid and perfect absorption of the gas by the liquid, and an increased chemical or mechanical action of the gas on substances suspended or dissolved in the liquid.—R. A.

Separators; Centrifugal Liquid ——. G. T. Renuerfelt, New York. Eng. Pat. 23,843, Nov. 3, 1903.

See U.S. Pat. 744,938 of 1903; this Journal, 1903, 1361.
—T. F. B.

Washing $\frac{\text{and}}{\text{or}}$ Cooling Towers. A. B. Duff, Pittsburgh, Pa. Eng. Pat. 24,262, Nov. 9, 1903.

The invention relates to washing- or cooling-towers for gases, air, &c. The gas or air and the liquid are passed in opposite directions through separately supported sections of packing material alternating with mixing spaces, so that the fluids are thoroughly intermixed in each of the spaces, and then redistributed to the succeeding sections of packing material. This invention also provides means for preventing collapse of the packing and renders it possible to remove such packing in sections or parts, one part being removed without interfering with the others.—R. A.

United States Patents.

Furnace. J. D. Swindell, Assignor to the American Furnace and Machine Co., Pittsburg, Pa., U.S.A. U.S. Pat. 747,020, Dec. 15, 1903.

The furnace contains a fire-box and bridge-wall, which has a vertical duct opening at its upper end into the fire-box, and communicating at its lower end with an air-duct in the base of the furnace, which opens into the air at the back of the furnace. An arch, overhanging the fire-box, projects from the bridge-wall and over the upper end of the vertical duct in it. The front wall of the furnace contains a chamber, opposite the upper end of the bridge-wall, communicating with the upper part of the fire-box. Air-ducts, opening in the back wall of the furnace, are arranged backwards and forwards in the wall of the furnace, and communicate with the chamber in the front wall.
—W. C. H.

Product for Prevention of Furring in Boilers. P. Bez, Léran, France. U.S. Pat. 748,341, Dec. 29, 1903.

See Eng. Pat. 14,789 of 1902; this Journal, 1903, 942.
—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Spirit versus Petroleum for Lighting Purposes [in Russia]. M. Glasenapp. Rigasche Ind.-Zeit., 1903, 28, 250; Chem.-Zeit., 1903, 27, [103], Rep. 330.

The author found, by comparative tests with the Pittner petroleum incandescence burner, the Denayrouze spirit incandescence burner, and ordinary petroleum lamps, that for the same illuminating power, the spirit incandescence burner is about 1½ times, and the ordinary petroleum lamp from 2½ to 3 times, dearer than the petroleum incandescence burner.—A. S.

English Patents.

Binding Compound [for Briquettes, &c.]; Chemical ——, and Process of Manufacture thereof. J. Mellinger, Baltimore, U.S.A. Eng. Pat. 22,441, Oct. 17, 1903.

A solution of calcined sodium carbonate is mixed with slaked lime; the liquid is evaporated, infusorial earth is added, and the whole fused. The melt, after cooling, is lixiviated with cold water, and the filtered liquid is evaporated until it has the sp. gr. 1·25. It is then ready for use as a binder with coal-dust and the like.—H. B.

Gas Generating Apparatus; Improved ——. A. E. Kiderlen, Amsterdam. Eng. Pat. 23,751, Nov. 2, 1903. Under Internat. Conv., Jan. 3, 1903.

A gas generator, acting by suction and attached to a gas motor, is provided with a water vaporiser consisting of a cylindrical, vertical air-tight jacket, through the axial line of which passes a pipe, leading the gas from the generator to the purifying column. Surrounding this pipe is a helicoidal wing, on to which boiling water is discharged at each suction of the motor, saturating a certain quantity of air, sucked in simultaneously, which then enters the generator. The gas, on its way from the vaporiser to the purifying column, imparts its heat to the water which is to enter the vaporiser, and is freed from dust by contact with water in hydraulic joints in the pipes. The amount of water and air fed to the generator is thus regulated automatically according to the work done by the motor. For small apparatus the vaporiser may be arranged horizontally, to work with water at constant level.—H. B.

French Patents.

Briquettes containing Binding Material Soluble in Water; Process of Hardening ——. Soc. Auguste Petit et Cie. Fr. Pat. 334,301, July 31, 1903.

Mixtures of binding materials soluble in water and the materials forming the base of the briquettes, or the finished briquettes made with these constituents, are exposed to a dry heat of not less than 150° C., whereby the binding materials are said to be rendered insoluble in water.
—W. C. H.

Liquid and Bituminous Combustibles; Process and Furnace for the Conversion of ——, into Coke. P. Höring and A. Mjöen. Fr. Pat. 334,448, Aug. 6, 1903.

The gasification of such combustibles as peat, brown coal, &c., is effected by utilising, for the conversion of the body into coke, the aqueous vapours produced by the drying of the materials treated, and introducing these vapours into the zone in which gas is produced, by means of an aspirating or similar device. The process can be carried out in a furnace provided with channels which pass from the coldest zone, in which the materials are dried, to the reducing zone of the furnace, or to another furnace. The furnace may consist of two parts, separated by sliding doors; in the upper section the drying takes place, and in the other the conversion of the materials into coke. Also the furnace may consist of a single chamber into the lowest part of which extends a pipe connected to an aspirator, whereby the vapours produced during the drying process are sucked down into the zone of fuel in which the conversion into coke occurs. Round the bottom portion of the furnace, vessels containing water are arranged, in which steam is produced by the heat derived from the mass of incandescent coke, the steam being led into the reducing zone of this or another furnace.—W. C. H.

Gas; Process and Apparatus for Manufacturing ——. G. Westinghouse. Fr. Pat. 334,776, Aug. 22, 1903.

See U.S. Pats. 742,411 and 742,412 of 1903; this Journal, 1903, 1287.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM AND MINERAL WAXES.

Petroleum Products; Definitions of Nomenclature of ——. Petr. Rev. and Mining News, 1903, **9**, [251], 526.

The following classification of petroleum products, to which the Russian Excise authorities have decided to adhere, has been drawn up by the Baku Section of the Russian Technical Society at the instance of the Department of Trade and Manufactures :—

A. *Crude Oil.*—The natural product before refining. If the flashing point (open test) be above 70° C., the product is classified with residuals in group E.

B. *Light Products of Distillation.*—(1) Petroleum ether, rigoline, sherwood oil: sp. gr. not exceeding 0·700 and distilling completely up to 80° C.; (2) Light benzine: sp. gr. 0·700—0·717, not more than 5 per cent. left on distillation at 100° C.; (3) Heavy benzine: sp. gr. 0·717—0·730, not more than 5 per cent. of residue above 100° C.; (4) Ligroïn: sp. gr. 0·730—0·750; (5) "Putz" oil (cleansing oil): sp. gr. 0·750—0·770.

C. *Illuminating Oils.*—(1) Meteor: sp. gr. 0·806—0·810, flashing point not below 28° C. by Abel-Pensky test, colour, "1—2 marks"; (2) Testefas: sp. gr. 0·820—0·823, flashing point not below 38° C., colour, "1—2 marks"; (3) Kerosene: sp. gr. 0·815—0·826, flashing point not below 28° C., colour, "$2\frac{1}{2}$ marks"; (4) Astraline: sp. gr. 0·832—0·835, flashing point 40°—45° C., colour, "$2\frac{1}{2}$ marks"; (5) Pyronaphtha: sp. gr. 0·855—0·865, flashing point not below 98° C. by the Martens-Pensky test, colour, "discoloured"; (6) Gas oil: sp. gr. 0·865—0·885, flashing point (Martens-Pensky) not below 93° C.; (7) Light Solar oil: sp. gr. 0·878—0·885, flashing point (Martens-Pensky) 125° C.

D. *Lubricating Oils.*—(1) Vaseline oil: sp. gr. 0·885—0·895; flashing point (Martens-Pensky), 135°—185° C.; viscosity (Engler) at 50° C., 2 min. 4 sec.—2 min. 9 sec.; (2) Spindle oil: sp. gr. 0·895—0·900; flashing point, 150° C.; (3) Machine oil: sp. gr. 0·905—0·911; flashing point, 185°—215° C.; viscosity, 6—7·5 min.; freezing point, −10° C.; (4) Cylinder oil: sp. gr. 0·911—0·920; flashing point, 210°—245° C.; viscosity, 12·5 min.; freezing point, 5° C.; (5) Viscosine (valvoline): sp. gr. 0·925—0·935; flashing point, 290°—310° C.; viscosity at 100° C., 5 min.; (6) Residuals for manufacture of lubricating oils: sp. gr. 0·908—0·916; flashing point, 160° C.; viscosity at 50° C., 6—10 min.

E. *Fuel Oil.*—Mazout, residuals, lake oil: sp. gr. 0·895—0·935; flashing point (open test), not below 70° C.

F. *Goudron*: sp. gr. not below 0·935; flashing point, not below 270° C.—A. S.

Petroleum from Saghalien. Klei. Westnik shirow. weschtsch., 1903, **4**, 264; Chem.-Zeit., 1903, **27**, [103], Rep. 331.

Petroleum obtained at a depth of 34 fathoms at Bojatassin yielded hardly any benzine, 28 per cent. of kerosene, 16 per cent. of "pyronaphtha," 44 per cent. of "mineral oil" (lubricating oil), and 12 per cent. of residue.—A. S.

Vaselines; Artificial ——, *and Vaseline Oils.* J. Girard. J. de Pétrole, 1903, **3**, [20], 619—620.

Artificial vaselines are prepared by dissolving paraffin scale in hot vaseline oil or heavy petroleum oil (sp. gr. 0·850—0·860), the solvent being first deodorised and decolorised. One method of effecting this purification consists in agitating the oil with about 6 per cent. of zinc chloride for an hour, this being repeated three or four times and followed by washing with 60—80 per cent. of water. A quicker process, but one confessed as dangerous for the workpeople, consists in the use of concentrated sulphuric acid and potassium permanganate; this operation does not always succeed. For deodorising only, Henry recommends treating the oil with 20 per cent. of water, $1\frac{1}{2}$ per cent. of lead oxide, and 9 per cent. of potassium hydroxide (the potassium hydroxide may be more cheaply replaced by a larger quantity of anhydrous sodium carbonate), the whole being agitated for an hour, after which the oil is decanted. The oils most suitable for the purpose in view are those rich in paraffin. The most suitable proportions for pharmaceutical vaselines are 40 per cent. of paraffin scale (m. pt. 50°—54° C.) and 60 per cent. of heavy oil, any larger percentage of the former giving products too consistent for the manufacture of pomades and ointments. The European oils best adapted for artificial vaseline are those of Galicia and Roumania, the distillates furnished between 300° and 400° C. by Campeni-Parjol oil containing 18 per cent. of paraffin, and those from Tetscan, Moineshti, Campina, and Predeal oils over 12 per cent. of paraffin.

—C. S.

Spirit versus Petroleum for Lighting Purposes [in Russia]. M. Glascnapp. II., page 54.

English Patent.

Organic Acids [from Petroleum]; Process for Producing ——. N. Zelinsky, Moscow. Eng. Pat. 27,899, Dec. 17, 1902.

See Fr. Pat. 326,665 of 1902; this Journal, 1903, 807.

—T. F. B.

United States Patents.

Oils or Distillates; Process of Desulphurising ——. O. P. Amend, New York, Assignor to J. H. Macy, Boonton, N.J. U.S. Pat. 747,347, Dec. 22, 1903.

The acids are removed from "oil or distillates" by treatment with alkali, after which the oil is agitated with a solution of alkali and excess of a soluble copper salt, separated, and washed, first with sulphuric acid and then with water.—T. F. B.

Oils or Distillates; Process of Desulphurising ——. O. P. Amend, New York, Assignor to J. H. Macy, Boonton, N.J. U.S. Pat. 747,348, Dec. 22, 1903.

Sulphuretted hydrogen is removed from the oil by washing and then blowing steam or air, or both; the oil is then treated successively with a solution of a soluble copper salt and with a solution of a soluble carbonate. This may be followed by treatment with ferrous sulphate solution.

—T. F. B.

French Patents.

Asphalt; Artificial ——. J. A. Soriano. Addition, dated Aug. 3, 1903, to Fr. Pat. 332,051, May 13, 1903. (See this Journal, 1903, 1196.)

The bitumen composition claimed in the principal patent is mixed with "any alkaline earth compound, natural or artificial," instead of, or in addition to, the millstone grit.

—T. F. B.

Tar Containing Water; Process of Treating ——. L. Scholvien. Fr. Pat. 334,472, Aug. 7, 1903.

Tar is dehydrated by treatment with lime or with calcined calcium sulphate. When thus treated it is said to give finer pitch. The drying agent used is dehydrated by calcining.

—T. F. B.

Phenols from Mineral Tar; Separation of the ——, *by means of Lime.* Chem. Fabr. Ladenburg, G. m. b. H. Fr. Pat. 334,525, Aug. 8, 1903.

Calcium forms two salts with phenols, the normal, $Ca(OR)_2$, and the basic, $Ca(OR)OH$. The former are unstable at temperatures above 70° C., decomposing into phenols and the basic salts; hence, if tar oils or crude phenols be agitated with excess of milk of lime, filtered, and allowed to stand, the aqueous solution, after distillation under reduced pressure at 60°—65° C., to remove hydrocarbons, contains the normal calcium salts of the phenols. This solution may either be acidified and distilled in the usual way, or it may be distilled without acidification, and preferably by the aid of steam, at the ordinary pressure, whereby one-half of the phenols present distil over; the residue contains the other half in the form of the basic calcium salts, and is mixed with a further quantity of the tar oils or crude phenols, and the process repeated.

—T. F. B.

Sulphur; Process and Apparatus for the Extraction of——, by Continuous Working. E. L. Lalbin. Addition, of Aug. 5, 1903, to Fr. Pat. 333,094, of June 12, 1903. VII., page 62.

IV.—COLOURING MATTERS AND DYESTUFFS.

Colouring Matters; Notes on some Natural ——. A. G. Perkin and E. Phipps. Proc. Chem. Soc., 1903, **19**, [273], 284.

The flowers of the *Prunus spinosa* contain both quercetin and kampherol, whereas in the violet (*viola odorata*) and white clover (*trifolium repens*) quercetin alone has been detected. From the Japanese dyestuff "Fukugi" (botanical origin unknown), a new colouring matter, $C_{17}H_{12}O_6$, has been isolated, forming yellow, prismatic needles (m. pt. 288°—290°), the general properties of which indicate that it is closely allied to luteolin. On bromination, it yields the compound $C_{17}H_{10}O_6Br_2$ (yellow needles, m. pt. 280°), and, when fused with caustic alkali, phloroglucinol and protocatechuic acid are obtained.

Aniline; Action of Carbonic Acid on Solutions of ——, in presence of Nitrites. L. Meunier. Comptes rend., 1903, **137**, [26], 1264—1266.

When carbon dioxide is passed into an aqueous solution containing two molecules of aniline to every molecule of sodium nitrite, practically the whole of the aniline is converted into diazoaminobenzene. If silver nitrite be substituted for the sodium salt, diazoaminobenzene is also formed, but is at once converted into the silver derivative, $C_6H_5.N_2.NAg.C_6H_5$. The precipitation of diazoaminobenzene observed by Niementowski and Roszkowski when sodium nitrite and aniline are mixed in dilute aqueous solution, is really due to carbon dioxide, and does not occur when recently boiled water is used. The sodium derivative of diazoaminobenzene is not formed in aqueous solution; when prepared by reacting with sodium on diazoaminobenzene in ethereal solution, it is readily hydrolysed by contact with moisture.—J. T. D.

Chloranil; Improved Method of Preparation of ——. O. N. Witt and S. Toeche-Mittler. Ber., 1903, **36**, [17], 4390—4392.

p-Nitraniline is converted into 1.2.6.4-dichloro-*p*-nitraniline by adding to its solution in warm concentrated hydrochloric acid a warm solution of the theoretical amount of potassium chlorate. The yield is 87 per cent. of the theoretical amount, and a pure product is obtained by one recrystallisation from glacial acetic acid or acetic acid and alcohol. This product is reduced by means of granulated tin and concentrated hydrochloric acid to 2.6-dichloro-*p*-phenylenediamine, the solution of which is further treated, without previous isolation of the base, by adding potassium chlorate crystals in excess to the strongly acid, boiling solution. Chloranil is thus obtained of melting point 268°—270° C., and by recrystallising once from toluene a pure product melting at 285°—286° C. is isolated. Yields of 90 per cent. of the theoretical amount were obtained.

—E. F.

Triphenylmethane Dyestuffs from Bromomagnesiumdimethylaniline; Preparation of ——. P. Ehrlich and F. Sachs. Ber., 1903, **36**, [17], 4296—4299.

Amino derivatives of phenylmagnesium halides have not hitherto been obtained. The authors find that they can obtain dimethylaminophenylmagnesium bromide by acting on magnesium powder with an ethereal solution of ethyl bromide for a few minutes, pouring off the liquid, and then adding an ethereal solution of bromo-dimethylaniline. The resulting solution of dimethylaminophenylmagnesium bromide yields, with an ethereal solution of Michler's ketone, a yellow-brown precipitate which, on acidification with acetic acid, forms hexamethyltriaminotriphenylcarbinol (Methyl Violet). With benzophenone, dimethylaminotriphenylcarbinol is formed in an analogous manner, and is orange-red in acetic acid solution. From two molecules of dimethylaminophenylmagnesium bromide and one molecule of the ester of an aromatic acid, such as ethyl benzoate or ethyl naphthoate, Malachite Green or its homologues are obtained. With one molecule of dimethylaminobenzaldehyde there is formed, after acidification with acetic acid, the blue hydrol of Michler's ketone, $[(CH_3)_2N.C_6H_4]_2.CH.OH$. With benzophenone derivatives which contain the ketonic group in a closed ring, such as xanthone, fluorenone, or acridone, the compound reacts either feebly or not at all. Thus the sulphone of Michler's ketone whilst reacting readily with phenylmagnesium bromide to form a very similar dyestuff to Malachite Green, reacts with dimethylaminophenylmagnesium bromide with much greater difficulty.

—E. F.

p-Nitrotoluene in Crude Nitrotoluene; Volumetric Method for the Determination of ——. B. Glasmann. XXIII., page 77.

Barium Nitrite; Preparation of ——. O. N. Witt and K. Ludwig. VII., page 61.

English Patents.

Diphenylnaphthylmethane Dyestuffs [Triphenylmethane Dyestuffs]; Manufacture of ——. R. B. Ransford, Upper Norwood. From L. Cassella and Co., Frankfort-on-Main. Eng. Pat. 2694, Feb. 4, 1903.

See Fr. Pat. 328,878 of 1903; this Journal, 1903, 992.

—T. F. B.

Orthoamidophenolsulpho Acid; Manufacture of Derivatives of ——, and of Colouring Matters therefrom. R. B. Ransford, London. From L. Cassella and Co., Frankfurt a/Main. Eng. Pat. 3182, Feb. 10, 1903.

On dissolving acetyl-*p*-aminophenol in sulphuric acid, a monosulphonic acid is formed, with the sulpho group in the ortho position to the hydroxyl. On nitration of this acid, a nitro group enters into the remaining ortho position. The nitro acid can be reduced to the amino acid. The acetyldiaminophenolsulphonic acid can be diazotised and combined with amines and phenols to form dyestuffs. With β-naphthol a dyestuff is obtained dyeing wool in an acid bath a dull claret; this becomes an intense blue-black on after-chroming. Other phenols give similar dyestuffs. These dyestuffs dye very level, and are fast to light and milling.—A. B. S.

Polyazo Bodies and Dyestuffs [Azo Dyestuffs]; Manufacture of ——. R. B. Ransford. From L. Cassella and Co., Frankfurt a/M., Germany. Eng. Pat. 3654, Feb. 16, 1903.

β-Naphthylaminedisulphonic acid [2·4·8] is diazotised, and combined with α-naphthylamine. The resulting compound is diazotised, combined with Cleve's α-naphthylaminesulphonic acid [1.6 and 1.7], rediazotised, and combined with phenolic or amino compounds. The 2.3.6- and 2·5·7 aminonaphtholsulphonic acids, 1.6.3-dihydroxynaphthalenesulphonic acid, *p*-xylidine, and *m*-amino-*p*-cresol ether are especially valuable as final components. The dyestuffs are distinguished by clearness of shade and extreme fastness to light. Those formed with bodies of the naphthalene group dye cotton very fast blue shades; whilst those formed with bases of the benzene group dye directly dull violet shades which turn to deep blue shades, fast to washing and to light on diazotising on the fibre and developing with β-naphthol.—E. F.

Nitroalphylacidylaminonaphtholdisulphonic Acids, Nitroalphylaminoacidylaminonaphtholdisulphonic Acids, Aminoalphylacidylaminonaphtholdisulphonic Acids, and Aminoalphylaminoacidylaminonaphtholdisulphonic Acids, and New Azo Dyestuffs therefrom; Manufacture of New ——. O. Imray. From the Society of Chemical Industry, Basle, Switzerland. Eng. Pat. 24,936, Nov. 16, 1903.

Nitroalphylacidylaminonaphtholdisulphonic acids or nitroalphylaminoacidylaminonaphtholdisulphonic acids are prepared by the interaction through condensation, of a nitro-alphyl acid chloride, a nitroalphyl isocyanate, or a nitroalphyl isothiocyanate with 2.5.1.7-aminonaphtholdisulphonic acid. The acids thus prepared, by means of reducing agents, can be reduced to the corresponding amino compounds. Aminoalphylacidylaminonaphtholdisulphonic acids derived from 2.5.1.7-aminonaphtholdisulphonic acid may also be obtained by saponification of their acetyl derivatives. These latter are obtained by the action of acetylaminoalphyl acid chlorides on 2.5.1.7-aminonaphtholdisulphonic acid. By coupling any of these new acids with an aromatic diazo compound, new dyestuffs are obtained. New dyestuffs are also obtained by eliminating the acetyl group from acetylated dyestuffs obtained by the above method, and also by diazotising, directly or on the fibre an aminated dyestuff obtained by the above methods and combining with an amine or a phenol. These dyestuffs are scarcely distinguishable in shade from those obtained in an analogous manner from 2.5.7-aminonaphtholmonosulphonic acid (see Eng. Pat. 13,778, 1902; this Journal, 1902, 1274; also U.S. Pat. 724,078, 1903; this Journal, 1903, 548), but are more soluble, of equal affinity for cotton, and equally fast to washing. They dye in red shades, which are intensified by diazotisation and development with β-naphthol.—E. F.

United States Patents.

Acridine Dye, and Process of Making same. C. L. Müller, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen a/Rhein, Germany. U.S. Pat. 746,981, Dec. 15, 1903.

Dyestuffs dyeing tannin-mordanted cotton in orange or orange-yellow shades are obtained by heating an aminoacridine or acridine-yellow compound with glycerin.
—A. B. S.

Indoxyl and Derivatives thereof; Process of Making ——. R. Knietsch and H. S. A. Holt, Assignors to Badische Anilin und Sodafabr., Ludwigshafen. U.S. Pat. 746,965, Dec. 15, 1903.

See Eng. Pat. 26,372 of 1902; this Journal, 1903, 1289.
—T. F. B.

Sulphur [Sulphide] Dyestuff; Blue ——, *and Process of Making same.* N. Roegger, Assignor to Chemical Works, formerly Sandoz, Basle. U.S. Pat. 747,643, Dec. 22, 1903.

See Fr. Pat. 332,560 of 1903; this Journal, 1903, 1241.
—T. F. B.

French Patents.

Polyazo Dyestuffs [Azo Dyestuffs]; Process for Producing ——. Act.-Ges. f. Anilinfabr. Addition, dated Sept. 19, 1902, to Fr. Pat. 321,626, May 30, 1902. (See U.S. Pat. 717,550 of 1903; this Journal, 1903, 140.)

The tetrazo compound of a *p*-diamine is coupled, in acid solution, on the one hand with aminonaphthol sulphonic acid H, and on the other hand with α- or β-naphthylamine, β-naphthol, or a monosulphonic acid of either of these compounds; the dyestuffs thus obtained, dye unmordanted cotton black or bluish-black shades.—T. F. B.

Sulphide Dyestuff; Manufacture of a ——. Cie. Par. Coul. d'Aniline. Fr. Pat. 328,110, Oct. 20, 1902.

See Eng. Pat. 22,824 of 1902; this Journal, 1903, 1125.
—T. F. B.

Sulphide Dyestuffs; Process of Making Blue ——. Cie. Par. Coul. d'Aniline. Fr. Pat. 328,122, Oct. 23, 1902.

See U.S. Pat. 728,623 of 1903; this Journal, 1903, 737.
—T. F. B.

Sulphurised Derivative of m-Toluylene Diamine, New, and Sulphurised Dyestuffs [Sulphide Dyestuffs] directly Dyeing Cotton Yellow, derived therefrom; Production of ——. Manuf. Lyonnaise de Mats. Colorantes. First Addition, dated Aug. 4, 1903, to Fr. Pat. 321,122 of May 14, 1902 (this Journal, 1903, 141).

To the melt of *m*-toluylene diamine with sulphur described in the original patent, a primary amine, especially benzidine or tolidine, is added. This addition has the effect of rendering the shades obtained from the final products brighter.—E. F.

Sulphurised Dyestuffs [Sulphide Dyestuffs]; Production of Orange-Brown ——. Manuf. Lyonnaise de Mats. Colorantes. First Addition, dated Aug. 4, 1903, to Fr. Pat. 321,183 of May 15, 1902 (this Journal, 1903, 141).

To the melt of *m*-toluylene diamine with sulphur described in the original patent, a primary amine, especially benzidine or tolidine, is added. This addition has the effect of rendering the shades obtained with the final products brighter.—E. F.

Nitroanthraquinonesulphonic Acids; Preparation of New ——. Soc. Anon. des Prods. F. Bayer and Co. Fr. Pat. 334,576, Aug. 11, 1903.

Anthraquinone-α-sulphonic acid is treated with nitrating agents, such as a mixture of nitric and sulphuric acids. A mixture of 1.5- and 1.8-nitroanthraquinonesulphonic acids is so obtained. These are readily separated, as they differ greatly in solubility.—E. F.

[Azo] Dyestuffs; Process for the Manufacture of [Black] Mordant ——. K. Oehler. Fr. Pat. 334,702, Aug. 18, 1903.

See U.S. Pats. 740,767 and 740,768 of 1903; this Journal, 1903, 1191.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Cotton; Weakening of ——, *by the Action of Malt.* A. Scheurer. Bull. Soc. Indust. de Mulhouse, 1903, **73**, 320.

By treating cotton in four successive baths, each containing 12·5 grms. of malt to a litre of water, the duration of each treatment being two hours, and the temperature 60° C., the strength of the cotton is reduced 7 per cent.

Increasing the number of baths to eight, or lowering the temperature to 40° C., makes no appreciable difference in the result.—R. S.

Dyeing Processes [Mordanting]; Contribution to the Knowledge of ——. P. Heermann. Färber-Zeit., 1903, **14**, [9], 142—145; [18], 335—339; [19], 350—352.

Influence of Temperature on Absorption of Metallic Oxide Mordants by Silk (see this Journal, 1903, 623).—Silk was mordanted for six hours at temperatures ranging from 0° to 30° C., at intervals of 5°, with tin, iron, chromium, and aluminium mordants (52°, 52°, 32°, and 15° Tw. respectively). At temperatures between 0° and 5° C., iron and chromium mordants were absorbed with great difficulty; tin mordants slightly more easily. With iron and tin mordants, the temperature has practically no effect on the amount absorbed by boiled-off silk, but the amount absorbed by raw silk, increases considerably with the temperature, reaching a maximum at 30° C. Chromium mordants act in just the reverse manner, *viz.*, the temperature has no effect on mordanting raw silk, but boiled-off silk absorbs more of the mordant as the temperature rises; with aluminium mordants, raw and boiled-off silks absorb increasing quantities up to 20° C., when a maximum is reached. The following table gives a *résumé* of the results obtained:—

Mordant.	Silk.	Temperature at which Maximum Increase of Weight occurs.	Temperature at which Minimum Increase of Weight occurs.	Increase per Cent. of Maximum Increase at Temperatures						
				0° C.	5° C.	10° C.	15° C.	20° C.	25° C.	30° C.
		° C.	° C.							
Tin	Raw	30	0	74·5	83·5	86·5	89·4	93·3	97·5	100
	Degummed ...	0—30	0—30	100	100	100	100	100	100	100
Iron	Raw	30	0	62·6	68·1	77·8	84·3	90·3	95·3	100
	Degummed ...	0—30	0—30	100	100	100	100	100	100	100
Chromium ..	Raw	0—30	0—30	100	100	100	100	100	100	100
	Degummed ...	30	0	69·1	72·9	78·4	86·8	92·6	97·2	100
Aluminium .	Raw	20—30	0	39·1	54·5	66·4	84·7	100	100	100
	Degummed ...	20—30	0	81·4	85·6	92·0	95·5	100	100	100

Influence of Concentration of Solutions on the Absorption of Mordants.—Silk was mordanted in solutions the strengths of which varied, at intervals of 5° B., between 5 and 50° B. The results showed that the concentrated baths did not in all cases give more mordanting action than the more dilute solutions; thus, tin and iron mordants, when concentrated, have little mordanting action on silk, but corrode it strongly; the latter action decreases and the former increases as more dilute solutions are used, until, when the maximum mordanting action is obtained, corrosion ceases; at greater dilutions the mordanting action of tin and iron gradually decreases. Chromium mordants give increased mordanting action as the concentration increases, whereas aluminium mordants act in exactly the reverse manner, having, apparently, greater mordanting power in dilute solutions. The following table summarises the results of these experiments:—

Mordant.	Silk.	Concentration for Maximum Increase in Weight.	Concentration for Minimum Increase in Weight.	Increase per Cent. of Maximum Increase at Concentration									
				5° B.	10° B.	15° B.	20° B.	25° B.	30° B.	35° B.	40° B.	45° B.	50° B.
		° B.	° B.										
Tin	Raw	10	50	71·5	100	97·2	76·4	78·2	85·8	86·7	82·3	43·0	30·7
	Degummed ...	35	50	15·0	31·3	48·8	68·6	82·3	92·5	100	92·5	55·3	8·7
Iron	Raw	35	50	61·2	70·7	78·4	86·2	94·7	96·4	100	83·6	74·3	54·5
	Degummed ...	40	50	52·8	58·2	68·7	76·4	84·0	87·4	98·4	100	79·2	36·5
Chromium ..	Raw	30	5	33·9	54·4	61·7	72·8	94·0	100	..	..	..	..
	Degummed ...	30	5	19·2	39·2	59·7	78·2	88·4	100	..	..	..	..
Aluminium .	Raw	5	15	100	88·6	72·8	..	..	..	..	..	..	..
	Degummed ...	5	15	100	92·5	89·2	..	..	..	..	..	..	..

—T. F. B.

Mordanting** Wool with Aluminium Sulphate and Lactic **Acid. F. Düring. Bull. Soc. Ind. de Mulhouse, 1903, **73,** 322.

In a sealed note, dated July 26, 1901, the author states that if the tartaric or oxalic acid used as an auxiliary mordant in the presence of aluminium salts be replaced by lactic acid, and alizarin colours be used in dyeing, more beautiful and faster shades can be obtained than by the methods now used. A very full alizarin red is obtained when the wool is mordanted with 5 per cent. of aluminium sulphate and 5 per cent. of lactic acid. It is also noticed that the wool is attacked less and does not shrink so much as when treated with tartaric or oxalic acid. The same differences are noticed on dyeing in one bath, *i.e.*, in a bath containing aluminium sulphate, lactic acid, and the alizarin dyestuff.—R. S.

Mordanting** Wool with Aluminium Sulphate and Lactic **Acid. A. Abt. Bull. Soc. Ind. de Mulhouse, 1903, **73,** 323.

The author found that patterns which had been mordanted with 5 per cent. of aluminium sulphate and 5 per cent. of tartaric, oxalic, and lactic acid respectively, then dyed with 6 per cent. of alizarin red, were very different. The wool mordanted with the aid of lactic acid gave a beautiful bright Ponceau red, which was very fast to milling. The tartaric acid gave the next best result, and the oxalic acid the worst. The shades obtained by these two latter were a dirty yellowish Bordeaux, which on milling changed to bluish Bordeaux. On dyeing and mordanting in the same bath similar results are obtained, but the shades are lighter. When equivalent proportions of the three acids are used, there is hardly any difference in the shades produced, although that obtained by lactic acid is always brighter and faster to milling. No difference was found in the feel or strength of the wool either after mordanting or dyeing. Although lactic acid shows the advantages over tartaric or oxalic acid claimed by Düring, its much greater cost is the reason why it is only of practical value when importance is attached to the great fastness to milling which goods dyed with its aid possess.—R. S.

White Discharge on Paranitraniline Red. C. Kurz. Soc. Ind. de Mulhouse, Nov. 11, 1903.

The author employs the following mixture for discharging Paranitraniline Red:—370 parts of gum senegal solution, 400 parts of "solid hydrosulphite," 150 parts of 40 per cent. formaldehyde, and 80 parts of glycerin. The material is steamed for from four to eight minutes.—R. S.

Discharges and Reserves from the Derivatives of Hydrosulphurous Acid. E. Zundel. Soc. Ind. de Mulhouse, Nov. 11, 1903.

The author describes the uses and formation of discharges formed by the condensation of hydrosulphites with formaldehyde. Formaldehyde-sodium hydrosulphite is obtained by the direct addition of formaldehyde of 40 per cent. strength, to sodium hydrosulphite precipitated from its solution by sodium chloride. It crystallises in white needles. The zinc salt is formed in the same way, also by boiling a mixture of formaldehyde-bisulphite with zinc powder and acetic acid, or by adding formaldehyde to the product formed by the action of zinc on a solution of sodium bisulphite of 35°. These new formaldehyde-hydrosulphites are remarkable for their great stability; they only show their reducing action on steaming. The zinc compound is much more stable than the sodium salt, and requires a longer steaming to decompose it, but on adding a sodium salt, such as the chloride, it decomposes quite as easily on steaming as the sodium compound, double decomposition taking place and formaldehyde-sodium hydrosulphite and zinc chloride being formed.—R. S.

English Patents.

Skein-holding Device. F. Benzinger, Hudson, N.J., and L. Freund, New York, U.S.A. Eng. Pat. 22,899, Oct. 22, 1903. Under Internat. Conv., Oct. 23, 1902.

The specification describes a device for holding skeins of thread, furnished with clips so that single threads can be withdrawn without disturbing the remainder.—A. B. S.

Liquid under Pressure; Method of Circulating or Applying ——, Applicable for the Leaching or Extraction of Mineral or Organic Substances, the Extraction of Fatty or Greasy Substances, the Dyeing and other Treatment of Textile Materials, and to other Useful Purposes, and Means or Apparatus for the Application of the said Method. J. P. L. Dumons, Roubaix, France. Eng. Pat. 26,963, Dec. 6, 1902.

See Fr. Pat. 322,172 of 1902; this Journal, 1903, 295.
—T. F. B.

Dyeing Textile Material on Bobbins; Apparatus for——. A. Marshall and The Times Coloured Spinning Co., Ltd., Heap Bridge, near Bury. Eng. Pat. 24,327, Nov. 10, 1903.

The open ends of the perforated bobbins are fitted into holes in a plate or partition. A bar is fixed parallel to this plate at the other end of the bobbins. There is a hole in this bar opposite the end of each bobbin and through such holes pass screws which hold the free ends of the bobbins firmly. By loosening the special screw any special bobbin can be removed without altering the remainder. The liquid is circulated as usual.—A. B. S.

Designs on Warp Yarns; Process and Apparatus for Impressing ——. A. Hofmann, Gothenburg, Sweden. Eng. Pat. 24,387, Nov. 10, 1903.

The coloured pattern is transferred in a working stroke (*i.e.*, at each working movement) by means of movable pressing or printing devices independent of each other, which move into position and print the surface in a desired number of colours. Each roller is arranged in its own dye-tank, is brought periodically into position, either by hand or automatically (for instance, by a Jacquard machine) and is carried in a suspended oscillating lever worked by a catch. The dye-tank and roller are mounted in a travelling carriage which oscillates backwards and forwards.
—E. F.

United States Patent.

Printing [with] Sulphide Dyestuffs; Process of ——. E. Bourcart, Mülhausen, Assignor to Fab. Prod. Chim. de Thann et de Mulhouse. U.S. Pat. 747,295, Dec. 15, 1903.

See Fr. Pat. 319,504 of 1902; this Journal, 1903, 25.
—T. F. B.

French Patents.

Silk, Artificial; Apparatus for Manufacture of ——. E. Thiele. Fr. Pat. 334,507, Aug. 8, 1903.

The apparatus consists of a funnel-shaped receptacle connected at its smaller end by means of a flexible joint with a long pipe. The silk composition is forced out of a jet into the narrow part of the funnel and passes down the long tube in contact with the precipitating liquid which is run into the funnel at the top and passes down the long tube. As the silk emerges from the tube it is wound on reels as required.—A. B. S.

Dyeing, Bleaching, Mordanting, Washing, or Drying Fabrics, &c.; Apparatus for ——. F. Cleff. Fr. Pat. 334,300, July 31, 1903.

See Eng. Pat. 16,549 of 1903; this Journal, 1903, 1345.
—T. F. B.

Rice-Flour; Treatment of ——, for Use in "Finishing" Yarns and Textiles. Soc. Anon. des Rizeries Françaises. Fr. Pat. 334,369, Aug. 1, 1903.

Rice-flour under ordinary conditions does not give a stiff "finishing" paste on account of the "caseinous" gluten which surrounds the rice-starch granules, and prevents them from swelling sufficiently. This action of the gluten may be removed in one of three ways:—(1) The flour may be boiled with about 2 per cent. of caustic soda together with a quantity of boric acid sufficient to produce sodium triborate; the flour, soda, and boric acid should be mixed together in the dry state. (2) The flour may be mixed in the dry state with powdered sodium thiosulphate which gelatinises but does not dissolve the gluten when the mixture is boiled. (3) The flour may be sprayed with a solution of an organic acid, such as lactic acid, before boiling the paste.—J. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

French Patent.

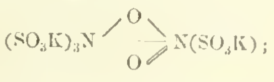
Depositing Silver or other Metals on Paper, Leather, &c.; Process for ——. Soc Nürnberger-Folienpapier-Fabrik, F. Pauli and Co. Fr. Pat. 334,549, Aug. 11, 1903.

A deposit of silver or of other metal is formed on a carefully polished glass plate, by reducing a silver solution or by any other suitable method. The metallic layer is washed and dried and then coated with a warm solution of gelatin or gum. After two or three minutes the sheet of paper, leather, or other material is laid on this and well rolled and dried. During drying the gelatin adheres to the paper or leather, and when the paper is stripped off, it brings the metallic layer with it. The metallic surface is covered with a transparent varnish to preserve it.—A. B. S.

VII.—ACIDS, ALKALIS, AND SALTS.

Peroxylaminesulphonates and Hydroxylaminesulphonates (Sulphazilates and Metasulphazilates). T. Haga. Proc. Chem. Soc., 1903, **19**, [273], 281—282. See also Carpenter and Linder, this Journal, 1902, 1493—1494. Compare also this Journal, 1903, 6—7.

By oxidising potassium hydroxylaminedisulphonate, Fremy obtained the salts which he called sulphazilate and metasulphazilate. Claus re-named the former "oxysulphazotate," and formulated its constitution as—



the latter he called "trioxyazoate," giving it the formula $O : N(SO_3K)_3,H_2O$. Raschig changed these formulæ into

and $(SO_3K)_3N < \substack{O\\O} > N(SO_3K)_3,2H_2O$;

whilst Hantzsch and Semple have re-named the sulphazilate "nitroxydisulphonate" with the formula, $O.N:(SO_3K)_2$, and have gone back to Claus's formula for the metasulphazilate. The author has found that (1) potassium sulphazilate interacts with normal potassium sulphite—

$$(SO_3K)_2NO.ON(SO_3K)_2 + K.SO_3K =$$
$$(SO_3K)_2NOK + (SO_3K)ON(SO_3K)_2,$$

to form normal potassium hydroxylaminedisulphonate, and potassium metasulphazilate; (2) the sulphazilate decomposes spontaneously into the metasulphazilate, hydroxylaminedisulphonate, and much nitrous acid, the last being preserved as nitrite when potassium hydroxide is present: $2(SO_3K)_4N_2O_2 + H_2O = 2(SO_3K)_3NO + (SO_3K)_2NOH + NO_2H$; (3) potassium metasulphazilate is decomposed quantitatively into sulphate and normal aminedisulphonate (iminosulphate) by sodium amalgam or by the zinc-copper couple, $KO.SO_2.O.N(SO_3K)_2 + 2Na = KO.SO_2.ONa + NaN(SO_3K)_2$; and (4) the ultimate products of its hydrolysis, when heated with hydrochloric acid, are hydroxylamine and sulphuric acid. The molecular magnitude of sodium hydroxylaminetrisulphonate and also of the 2/3-normal sodium hydroxylaminedisulphonate, as determined by Loewenherz's method, is in each case that which contains only one atom of nitrogen. The constitution of the sulphazilates is therefore that expressed by the name, potassium peroxylaminesulphonate, and the formula, $(SO_3K)_2NO.ON(SO_3K)_2$, and of the metasulphazilates that expressed by the name and formula, potassium hydroxylaminetrisulphonate, $(SO_3K)_2N.O.(SO_3K)$. The sulphazilates are oxime peroxides or peroximes, being produced by oxidising hydroxylaminedisulphonates with a variety of reagents (including ozone), even in the cold; they behave as oxidising agents, becoming again reduced to hydroxylaminedisulphonates, $2(SO_3K)_2NOH \rightleftarrows [(SO_3K)_2NO]_2$. A metasulphazilate is the only known case of a triacylated hydroxylamine. Having, as a hydroxylaminetrisulphonate, one of its sulphonate radicles in union with oxygen, it is clearly one-third sulphatic, yet without being actually a sulphate. It is a mixed oxide or anhydride of two acid salts, one being the acid sulphate and the other the 2/3-normal hydroxylaminedisulphonate—

$$(SO_3K)O\boxed{H + HO}N(SO_3K)_2.$$

The inorganic mixed anhydride most closely analogous to a hydroxylaminetrisulphonate is Pelouze's salt, potassium hyponitrososulphate, $(SO_3K).O.(N_2OK)$, the two salts agreeing in being stable in presence of caustic alkali and in not yielding barium sulphate with a soluble barium salt, whilst giving rise to a sulphate with sodium amalgam or zinc. To understand this behaviour, it is only necessary to assume that the metasulphazilate ionises into three metallic kations and a complex trivalent anion which includes within itself the sulphate radicle. Dunstan and Goulding have shown that zinc and acid reduce trialkylhydroxylamines to trialkyloxamines, so that if, as has hitherto been supposed, metasulphazilates were oxamines, they should reduce to aminetrisulphonates (nitrilosulphates), and not to aminedisulphonates and sulphates. The author concludes that the nitrogen of the sulphazilates and metasulphazilates is exclusively tri- and not quinquevalent, as suggested by the earlier investigators of these salts. There is so much difference between the properties of a peroxylaminesulphonate and those of the bluish-violet substance produced by the action of sulphur dioxide on a solution of nitrososulphuric acid in sulphuric acid that it is improbable that Sabatier's suggestion will prove correct as to the latter compound being the acid of Fremy's bluish-violet salt (this Journal, 1896, 622). Potassium hydroxylaminetrisulphonate is shown to have 3/2 mols. of water of crystallisation, whereas Claus, who stated that the salt contained 1 mol. of water, was perhaps unaware that some of its water of crystallisation becomes fixed by hydrolysis during the drying. Sodium, ammonium, and hydroxy-lead hydroxylaminetrisulphonates have been prepared for the first time.

Peroxylaminesulphonic Acid. E. Divers. Proc. Chem. Soc., 1903, **19**, [273], 283. Also Sabatier, this Journal, 1896, 622.

In support of Sabatier's assumption that the bluish-violet colour caused by the action of sulphur dioxide on sulphuric acid containing nitrososulphuric acid is due to the formation of the unknown acid of Fremy's bluish-violet potassium salt (sulphazilate or peroxylaminesulphonate), it is pointed out that the difference in properties observed by Haga (preceding note) is hardly greater than that between the behaviour of nitrous acid in the respective forms of nitrosulphuric acid and potassium nitrite. Sabatier's observations are shown to be quite consistent with the view that the acid is peroxylaminesulphonic acid, that is, a peroxide and a compound of trivalent nitrogen.

Nitric Peroxide; Constitution of ——. E. Divers. Proc. Chem. Soc., 1903, **19**, [271], 280—284.

Haga's examination of Fremy's *sulphazilate* has established the fact that it is *peroxylaminesulphonate*, a trivalent nitrogen compound and a peroxide. It is a sulphonated nitric peroxide, as suggested by Hantzsch and Semple, and when decomposed by water, gives a complex anhydrosulphate (hydroxylaminetrisulphonate) on the one hand, and, on the other, nitrous acid and sulphonated nitrous acid (hydroxylaminedisulphonate), equivalent respectively to the nitric and nitrous acids which are yielded by nitric peroxide. Dinitric peroxide is therefore a true peroxide, *nitrosyl peroxide*, $(NO)_2O_2$. Mononitric peroxide must be regarded as $O:N.O$, formulated with a univalent oxygen atom, and not with its nitrogen atom in the quadrivalent condition, $O:N:O$, as suggested by Piloty and Schwerin (Ber., 1901, **34**, 1884 and 2354); for it seems appropriate to consider the constitution of the two forms of nitric peroxide to be the same, the only difference being the presence in the one form of the bivalent double atom of oxygen, and in the other form of a single univalent oxygen atom. A true peroxide is correctly defined as a compound in which some or all of the oxygen is exerting on the rest of the compound only half its usual valency. Piloty and Schwerin's *porphyrexide*, $(C_5H_9N_3):NO$ (*loc. cit.*), is to be regarded as being such a peroxide.

Alkali-Metal Carbonates; Dissociation of ——. P. Lebeau. Comptes rend., 1903, **137**, [26], 1255—1257.

All the alkali-metal carbonates are dissociated when heated *in vacuo* at temperatures above 800° C. (the dissociation-pressure rises in the case of sodium carbonate from 2 mm. at 800° to 41 mm. at 1,200° C.). The oxides formed are volatile at the temperature used, and thus a volatilisation of the carbonate may be said to occur. Grouping the alkali-metals into the divisions: (1) lithium and sodium; (2) potassium, rubidium and cæsium; the more readily dissociable carbonate in the first group has the lower atomic weight, whilst those in the second group have the higher atomic weights.—J. T. D.

Potassium Chloride; Treatment of "Hartsalz" and Mixed Crude Potassium Salts for ——. C. Bauer. Chem.-Zeit., 1903, **27**, [104], 1268—1270.

The process of extraction of potassium chloride requires modification according to the nature of the raw material. A works which had been using a mixture of carnallite, sylvine, and "Hartsalz" of variable composition (see I., below), was compelled, through failure of this raw material, to work upon, first, "Hartsalz" (see II.), and later upon a mixture of salts (see III.); both of these supplies containing much more magnesium sulphate and less magnesium chloride than the original supply.

——	I.	II	III.
KCl	12—14	16	15—17
$MgSO_4.H_2O$	2—18	56	21—26
$MgCl_2$	0—8	..	4—6
NaCl	60—70	47	40—52

When these were submitted to the usual process (solution in mother liquor from a former operation by blowing in steam, settlement, and crystallisation) the crystallised potassium chloride contained less than 80 per cent. of potassium chloride, and lixiviation of it was necessary. The liquors from this, and the condensed steam, increased the bulk of the mother liquors used for extracting the raw material to such an extent that frequent evaporation was necessary. It was found, however, that when the raw material was more finely broken up (no pieces larger than a walnut), heated with the solvent by means of a steam coil, and brought thoroughly into contact with the solvent by mechanical agitation, much better results were obtained. The solvent used at first was a saturated solution of common salt, afterwards the mother liquors from the crystallisation, deficiencies being made up by addition of saturated common salt solution and lixiviation liquors from the preparation of 98 per cent. potassium chloride. The heating and agitation were kept up till the liquid had a sp. gr. of 1·3; then the contents were allowed to settle, the liquid poured off and allowed to crystallise, and the undissolved residue removed and thoroughly drained. The residue, about 80 per cent. of the original material, contained not more than 3·3 per cent. of potassium chloride, and about 7 per cent. of moisture. The crystals tested 83—85 per cent. of potassium chloride. This method was found applicable, not only to "Hartsalz" alone, but to various mixtures of crude salts; but when the magnesium chloride content of these mixtures reaches or exceeds 6 per cent., it becomes practicable to work them after the manner of carnallite. The mode of heating by means of steam coils allows much closer control over the composition of the liquors than the open steam method, and avoids the necessity of evaporating surplus liquor. In spite of the high kieserite content of the "Hartsalz" worked, there was no formation of potassium magnesium sulphate; nor was the same substance produced in the form of fine mud, when extracting the salts with magnesium chloride liquor, as was always the case when heating by open steam.—J. T. D.

Barium Nitrite; Preparation of ——. O. N. Witt and K. Ludwig. Ber., 1903, **36**, [17], 4384—4389.

Barium nitrite cannot be prepared from the nitrate like the alkali nitrites, as it decomposes at too low a temperature; and the only preparation which has come into commerce is made from sodium nitrite by converting it first into silver nitrite and then decomposing this by barium chloride, and is thus expensive. Matuschek attempted to prepare it, at the suggestion of one of the authors, as potassium nitrite is made from sodium nitrite, by direct decomposition of sodium nitrite and barium chloride; but the sodium chloride which falls from the hot liquid, when the exact molecular proportions for complete exchange are used, contains in admixture quite half of the barium chloride originally used. This the authors have found to be due to the "salting out" of barium chloride by the sodium chloride and barium nitrite formed, each containing an ion in common with the barium chloride. Accordingly, by using two molecules of sodium nitrite to one of barium chloride, they have succeeded in "salting out" completely the sodium chloride by means of the excess of sodium nitrite (which has no ion in common with the barium chloride, and hence does not affect it), and crystallising out practically all the barium nitrite on cooling. The process is conducted as follows:—360 grms. of 96 per cent. sodium nitrite and 610 grms. of barium chloride are intimately mixed, while 360 grms. of the nitrite are dissolved in a litre of boiling water. The mixed salts are run into the boiling liquid, and the reaction is completed almost at once. The liquid is filtered by suction in a steam-jacketed funnel, and the filtrate on cooling deposits good crystals of barium nitrite. These are separated centrifugally from the mother liquor, which is again ready, when boiled, to take another charge of the mixed salts, and thus to circulate continually, with only the additions needed to make up the inevitable mechanical loss. The nitrite is twice crystallised, 1 kilo. being dissolved each time in 300 c.c. of water, and the resulting crystals separated from the mother liquors by means of the centrifugal machine. The yield of nitrite in the first operation varies from 280—300 grms. (theory 292); and the ultimate yield of twice crystallised, chlorine-free salt is about 85 per cent. of the theoretical. The mechanical losses would be relatively less if the process were worked on a larger scale. The salt, and its solutions, are quite stable under 115° C., and it can thus be used for the direct preparation of solutions of determinate strength. If used for diazotising amines in sulphuric acid solution, no inorganic salt is left in the filtered solution of the diazo compound; and the salt also forms a starting point for the preparation of other nitrites, by double decomposition with the metallic sulphates.—J. T. D.

Fluorides; Preparation of Anhydrous Crystallised ——. Defacqz. Comptes rend., 1903, **137**, [26], 1251—1253.

Manganese fluoride (Moissan and Venturi, this Journal, 1900, 569) is heated to fusion with 10 times its weight of calcium chloride for two hours at 1000°—1200° C.; the cold product is broken up and extracted first with cold water, later with water acidulated with hydrochloric acid, the latter solvent being finally boiled. A white residue remains, in well-formed cubes, having the composition CaF_2. If the fusion be effected at 800°—1000° C., the crystals formed will be of octohedral form. If the crystals be heated in fused manganous chloride or alkali chloride, or if the mixture made for their preparation contain a large proportion of manganous fluoride (and hence a large proportion of manganous chloride when the reaction has proceeded some way), calcium fluochloride $CaClF$ is formed. The author has prepared by a similar process the fluorides of barium, strontium, magnesium, and lithium.—J. T. D.

Copper: Cause of the Non-precipitation of ——, *by Hydrogen Sulphide, from Potassium Cyanide Solution.* F. P. Treadwell and C. v. Girsewald. Zeits. anorg. Chem., 1904, **38**, [1], 92—100.

The fact that copper is not precipitated by hydrogen sulphide from potassium cyanide solution has been ascribed to the formation of the complex salts, $K_6Cu_2(CN)_8$ and $K_2Cu_2(CN_4)$ respectively. The authors find, however, that whilst concentrated solutions of the former salt are not precipitated by hydrogen sulphide, solutions of the latter salt are. It was also found that an ammoniacal solution of copper containing enough potassium cyanide for the formation of the salt $K_3(NH_4)Cu_2(CN)_6$, is not precipitated by hydrogen sulphide. The authors conclude that the non-precipitation of copper from potassium cyanide solutions is due to the formation of the complex ions $[Cu_2(CN)_8]$ and probably, also $[Cu_2(CN]_6]$.—A. S.

English Patent.

Lime Waste of Alkali Works and Lime Sulphate Waste; Utilisation of ——. H. Oliver and W. Bevan, New Ferry, Chester. Eng. Pat. 9412, April 25, 1903.

The waste lime material is suspended in water, run off from the grit, allowed to settle, dried and caked in kilns. The cakes are ground up, usually with oyster shells or the like, and the powder is wetted with solution of a magnesium salt, and magnesia may be added. Some fine fibrous material or insoluble organic powder is introduced, and the mixture is moulded into blocks adapted to various purposes. Colouring materials may also be added, either disseminated in the mixture or as a transfer.—E. S.

United States Patents.

Hydrocyanic Acid and Cyanide Salts therefrom; Process of Making ——. J. H. Paul, Charlton. U.S. Pat. 746,876, Dec. 15, 1903.

See Eng. Pat. 72 of 1903; this Journal, 1903, 1347.
—T. F. B.

Hydrocyanic Acid and Cyanides; Process of Manufacturing ——. J Tcherniac, Freiburg-in-Breisgau. U.S. Pat. 747,271, Dec. 15, 1903.

See Eng. Pat. 17,976 of 1902; this Journal, 1903, 1045.
—T. F. B.

Alkali Cyanides; Manufacturing ——. P. Danckwardt, Deadwood, S.D. U.S. Pat. 746,795, Dec. 15, 1903.

A nitride and a carbide of an alkaline earth metal are heated with a salt of an alkali metal in an atmosphere of nitrogen, and the fusion is continued after addition of a mixture of an alkali metal salt and a carbide of an alkaline earth metal. The furnace shown is of the electric type.
—E. S.

Alkali Cyanide and Alkali Metal; Process of Simultaneously Producing ——. P. Danckwardt, Deadwood, S.D. U.S. Pat. 746,796, Dec. 15, 1903.

An alkali nitrite, another alkali salt, and a carbide of an alkaline earth metal are heated together with "exclusion of air," or, as expressed in another claim, an alkali nitrite is heated in the presence of nascent carbon or "carbon about to be produced," and of a nascent alkali metal, with exclusion of air.—E. S.

Sulphate of Barium and Chloride of Zinc; Process of Obtaining ——. W. D. Gilman, Roland Park, Md. U.S. Pat. 746,954, Dec. 15, 1903.

Solutions of barium sulphide and of zinc chloride are mixed; the barium chloride solution thus formed is separated from the precipitate, and is mixed with an aqueous solution of zinc sulphate. The barium sulphate thus thrown down is separated from the solution of zinc chloride, from which solution the zinc chloride is recovered.—E. S.

Chromates [*Bichromates*] *of the Alkaline Metals; Process of Making* ——. F. M. and D. D. Spence, A. Shearer, and J. J. Craig, Assignors to Peter Spence and Sons, Ltd., Manchester. U.S. Pat. 747,255, Dec. 15, 1903.

See Eng. Pat. 5057 of 1900; this Journal, 1901, 575.
—T. F. B.

Potassium Chloride; Process of Extracting ——, *from Fuci and Algæ.* D. M. Balch, Assignor to A. P. Stephens, both of Coronado, Cal. U.S. Pat. 747,291, Dec. 15, 1903.

Dried seaweed is cut or broken up, dusted with lime or the like, and carbonised by being heated "under pressure" in air-tight receptacles. The product is powdered and lixiviated, and the cleared solution is evaporated to obtain colourless merchantable potassium chloride.—E. S.

French Patents.

Hydrocyanic Acid and Cyanides; Manufacture of ——. J. H. Paul. Fr. Pat. 334,947, Aug. 31, 1903.

See Eng. Pat. 72 of 1903; this Journal, 1903, 1347.
—T. F. B.

Caustic Soda Solutions, Caustic Soda, Chlorine, and its Derivatives; Method of Obtaining Strong ——, *by Electrolysis of Sodium Chloride.* R. Escriva de Romani. Fr. Pat. 334,332, June 25, 1903. XI. A., page 68.

Caustic Soda; Process of Manufacturing ——. C. E. Dolbear. Fr. Pat. 335,071, Sept. 7, 1903.

See Eng. Pat. 19,243 of 1903; this Journal, 1903, 1291.
—T. F. B.

Sulphur; Process and Apparatus for the Extraction of ——, *by Continuous Working.* E. L. Lalbin. First Addition, dated Aug. 5, 1903, to Fr. Pat. 333,094 of June 12, 1903. See this Journal, 1903, 1292.

Earths, and especially organic matters, containing sulphur, such as tar or woody matters, are charged by aid of a screw conveyor, operating in a hopper into the top of a vertical retort, wider at the base than above, and heated from an adjoining furnace through surrounding flues. A branch from the lower part of the retort, first curved and then horizontal, traverses the furnace above the fireplace, and has entrance into a condenser for sulphur, provided with an exit tube for uncondensable gases. Arrangements are made for blowing into the retort a measurable quantity of compressed air, in order to oxidise gases which might otherwise form explosive mixtures. The spent material is discharged from the bottom of the retort by the operation of a screw. The apparatus may be adapted to the production of sulphur dioxide.—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

Glass Metal; Melting of ——, *for Plate Glass.* H. Knoblauch. Sprechsaal, 1903, **36**, [50], 1881—1882; [51], 1915—1917.

An ordinary charge of "metal" for plate glass consists of: sand, 165 parts; sodium sulphate, 80; calcspar, 50; and anthracite, 4·1—4·2 parts; and these 300 parts will furnish 100 parts of glass containing 72·4 per cent. of silica, 15·3 per cent. of sodium oxide, and 12·2 per cent. of lime. In the furnace, the sodium sulphate melts first, dissolving the lime and afterwards the sand. At the same time the carbon reduces the sulphate to sulphite, with liberation of carbon monoxide, and the calcium carbonate parts with a portion of its carbon dioxide, whilst the silica displaces sulphur dioxide from the sodium sulphite; and this liberation of gases sets the mass in ebullition. Owing to the varying action of the heating gases, which also contain reducing carbon, it is impossible to obtain a uniform result in all cases from a constant proportion of carbon in the metal. When the total carbon is too small, the liberation of gas is diminished and sandiver is formed, the sand and lime also sintering to form incrustations. In such event, the smelter must immediately throw in more carbon, in small quantities at a time, and break up the crust by means of an iron crutch; if this be neglected, the resulting glass will be full of unmelted ingredients. If, on the other hand, there is an excess of carbon, a reddish-brown scum will form on the charge, and the pots will be liable to boil over unless the defect be remedied by throwing in more sodium sulphate and stirring the mass. In the absence of this treatment the glass will be coloured yellow-green to brown-red by excessive reduction of sodium sulphate to sulphide, and its plasticity will also be lowered. In the event of the charge consisting of small quantities of residual metal and a large quantity of cullet, unmelted inclusions may be formed, and there is also a risk of inclusions of sandiver should this latter substance be in a reduced state when fresh portions of metal are added to fill up the pots during the melting process. This may be obviated by providing an oxidising atmosphere in the furnace while the pots are being filled up. In the clarifying stage the sandiver must be eliminated by either skimming or reduction, the latter being preferable as not entailing any prejudicial lowering of temperature. The mass is then clarified by introducing a wet block of wood on the end of an iron rod, the violent liberation of gas thereupon ensuing causing the expulsion of any pre-existing gas bubbles. Arsenic produces the same effect, but has now passed almost entirely out of use. This clearing process must be repeated at intervals of an hour, for if delayed until the glass has become too fluid, the charge is liable to froth over. The final stage of melting is attended with difficulty, owing to the risk of pots giving way under the softening effect of the heat—which is near the melting-point of the pot material—and the weight of the contents. Finally, to impart to the charge the consistence necessary for plate glass, it must be left to cool for several hours, the gas being turned off, the ports opened, and the chimney draught through the furnace reversed every quarter of an hour.—C. S.

Porcelain Glazes; New Yellow ——, *for Strong Fire.* T. Hertwig. Sprechsaal, 1903, **36**, [49], 1845—1846.

On porcelain body rich in alkali (composition, 40 parts of clay substance, 25 of quartz, the quartz and part of the felspar being introduced from Thuringian alkaline sand, and 25 of felspar; to this different quantities of glaze material are added, and the mixture not too finely ground), the author obtained a series of brilliant colours with compounds of tungsten and molybdenum, these furnishing yellow and orange shades in presence of manganese in the reducing fire. At high temperatures manganese peroxide appears to yield oxygen to tungsten, the yellow being shaded from ivory to reddish-yellow orange by the manganese coloration. Natural calcium tungstate is also stained ochre-yellow. A 10 per cent. solution of molybdenum phosphate gave sulphur-yellow on the glaze being fired on a biscuit painted with concentrated manganese chloride. Other molybdenum compounds furnished the well-known Roerstrand black (molybdenum protoxide), the contours shading off into grey-white by oxidation. Colloidal tungstic acid (from the sodium salt) and its compounds give sulphur-yellow, which is converted into a whole range of tones, from ivory to orange-yellow, on refiring after the application of concentrated manganese nitrate or chloride. Alkali tungstates, supersaturated with any acid except nitric, and reduced by metallic zinc, furnish a blue precipitate of tungsten tungstate, which dissolves to an intense blue solution in phosphoric acid. Ammonium tungstate, when heated until the liberation of ammonia ceases, furnishes ammonium metatungstate, which can be used as a glaze pigment; and crystallisable metatungstates, suitable for the same purpose, can be obtained by treating solutions of nitrates or chlorides of alkaline earths or metals with tungstic acid, or by treating alkali tungstates with phosphoric acid. The metatungstates crystallise out, and are soluble in water. Double salts, also suitable for pigments, can be prepared by treating alkali metatungstates with barium chloride, and the resulting barium salt with metallic sulphates. Cadmium borotungstate, when treated with a large quantity of concentrated manganese nitrate solution and sodium metatungstate, followed by gradual additions of water, slowly furnishes a wine-red liquid, which gives an ivory underglaze colour when fired. This, however, converts into brown the subsequently applied glaze pigments, especially iron-red. Orange tones were found to fail unless fired immediately after application, owing to absorption by the porous biscuit.—C. S.

English Patents.

Waste Heat from Reheating Furnaces, known as "Glowry Holes," Used in Glass Works; Means for Utilising ——, and Means for further Effecting Economy in the Use of such Furnaces and for Reducing the Quantity of Smoke Escaping therefrom. G. R. Ridsdale, Walsall. Eng. Pat. 8789, April 18, 1903.

The waste heat of the products of combustion of the reheating furnaces, or the "glowry holes," is utilised to heat the muffles or ovens, known as "lears," in which the manufactured articles are annealed. For this purpose a flue runs from the crown of the "glowry hole" to that part of the "lear" where the grate is usually placed. Further, air flues are formed in the thickness of the two side walls and in the back wall of the heating chamber of a "glowry hole." Air from the atmosphere passes through these flues and mixes with the combustible gases inside, a higher temperature and more perfect combustion being consequently obtained. These air flues may be controlled by dampers.—A. G. L.

Glass; Manufacture of Plates or Sheets of ——, and Apparatus to be Employed in such Manufacture. J. Hirst, Vineland, N.J. Eng. Pat. 21,782, Oct. 9, 1903.

The glass is poured on to a mould table or bed having a perfectly level surface, preferably highly polished. This table may be heated before placing the glass on it. After the glass has been placed on the table, an air-tight cover is caused to descend on it so as to enclose that part of the top of the table which contains the glass. This cover carries a roller, which is caused to traverse the table one or more times, thereby causing the glass to spread out into a sheet of predetermined thickness, the thickness being best regulated by having a recess in the table, the depth of the recess determining the thickness. The whole operation is carried out under air-pressure, which is increased at the end of the rolling to the highest possible point. True smooth surfaces are thus obtained, which require no subsequent grinding or polishing.—A. G. L.

French Patents.

Ceramic Articles; Composition for ——. C. Robin. Fr. Pat. 334,490, Aug. 7, 1903.

The composition is formed either of one or of several clays, the silica in the mixture amounting to 65 to 75 per cent., and being five to six times the alumina. A suitable mixture consists of 69 per cent. of silica, 11·5 of alumina, 1·5 of ferric oxide, 4·5 of lime, 1·5 of magnesia, and 12 of water, carbon dioxide, and organic matter.—A. G. L.

Enamelling; Process and Apparatus for ——. J. C. Reed, U.S.A. Fr. Pat. 334,506, Aug. 8, 1903.

The metal object to be enamelled—as a bath pan, for instance—is transferred from the furnace to a metal receptacle having a movable bottom, and a closely-fitting cover, carrying the mechanism for feeding and distributing the enamel, and protected on all sides from heat radiation by asbestos packing or the like. A predetermined quantity of the enamel is placed in a hopper, and, by mechanism operated by an electric motor, is fed regularly into a vertical pipe descending a certain distance into the pan to be enamelled, where, by rapid rotation and the action of distributing wings, the enamel is dispersed centrifugally, and also falls about in such manner as to cover the internal surface of the pan uniformly. It is a feature of the invention that the object to be enamelled is maintained immovable, whilst the enamel is mechanically supplied, within a space closed from the air, and so protected against loss of heat that the enamelling is effected at a single process without the necessity for re-heating.—E. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

Lime Sandstone; Manufacture of ——. H. Schön. Chem. Ind., 1903, **26**, [24], 621—624.

According to the author, the method in which the lime is slaked in the same vessel in which the moulded blocks of artificial stone are hardened has proved to be the most economical, and it is now in use in 50 factories. The lime is placed in iron chests, which are arranged along the bottom of the cylindrical hardening chamber, and the trolleys bearing the moulded and pressed blocks of stone are wheeled in over them. The hardening is effected by steam under pressure and, by slaking the lime in the hardening chamber, a considerable saving of steam is attained. For example, in two comparative tests the eight lime-chests were each filled in one case, with 3 cwt. of slaked lime, and in the other with 3 cwt. of quicklime. Eight trolleys, containing altogether 6,400 moulded blocks of stone, were then placed above the lime in each hardening chamber. The two chambers were then heated up to 8 atmospheres of steam pressure. The chamber containing the slaked lime was heated entirely by means of steam from a boiler, and the desired pressure was attained in 2 hours 15 minutes. In the other case, by adding 120 litres of water to each of the lime-chests, the heat generated raised the pressure in 3 minutes by 2 atmospheres, and then on introducing steam from the boiler, the pressure of 8 atmospheres was attained in 1 hour 12 minutes. The saving of coal amounted to 0·7 cwt. per 1,000 blocks of stone.—A. S.

Lime-Sandstone Brick; Lime in the Manufacture of ——. S. V. Peppel. Thonind.-Zeit., 1903, **27**, [146], 2204—2205.

Practical experience has shown that 5—10 per cent. of lime is sufficient to furnish a good lime-sand brick, though the researches of Glasenapp demonstrated that, in the case of fine sand, a larger proportion of soluble silica could be obtained by increasing the amount of lime to 10—20 per cent., and more especially by raising the steam pressure in the hardening vessel. The study of the influence of the amount of lime on the crushing and tensile strength of the bricks has been resumed with varying proportions of coarse and fine sand and different kinds of lime (slaked under pressure). The sample blocks were moulded under a pressure of 700 kilos. per sq. cm., and hardened by 10 hours' exposure to a steam pressure of 11 atmospheres. With 3 parts of coarse and 2 parts of fine sand, and 5 per cent. of dolomite lime; the crushing strength of the blocks was 259 kilos. per sq. cm., increasing to 391 with 10 per cent. of dolomite lime. In the latter case the strength was found to be nearly doubled (529 kilos.) by congelation, owing, it is assumed, to the combination of free lime with carbon dioxide absorbed by the water. In other tests with the same proportions of sand, but with white lime, 5 per cent. of the latter gave a crushing strength of 184 kilos., which was not increased more than three-fold (491 kilos.) by raising the proportion of lime to 40 per cent. The conclusion drawn from these two sets is that the increased strength resulting from higher percentages of lime is not commensurate with the greater cost, and that for practical purposes not more than 10 per cent. of lime should be employed. The question of hydraulic lime *versus* white lime was also investigated, one sample being prepared from limestone containing 85 per cent. of calcium carbonate with traces of magnesium carbonate, and the other from dolomite composed of 42—44 per cent. of magnesium carbonate and 56—58 per cent. of calcium carbonate. The bricks were made of mixtures consisting of 2 parts of coarse sand, 1 of fine sand, and 10 per cent. of lime; they were subjected to a moulding pressure of 1,950 kilos. per sq. cm., and hardened under a pressure of 11 atmospheres for 4—14 hours. The crushing strength averaged 544 kilos.

with the grey lime, but only 364 kilos. with the dolomite lime, probably owing to the inferior cementing power of magnesium silicate—an idea that seems to be confirmed by the higher faculty for absorbing water. Finally, the substitution of kaolin for fine sand in the mixture diminished the crushing strength by about one-half, from which the author concludes that high-pressure steam is non-essential to develop the properties of hydraulic lime, whereas moisture is indispensable. He also considers that storage in water will improve the crushing strength of lime-sand brick, an opinion that has been confirmed by experiments at Charlottenburg. On the same subject, Zapf has reported a case where a mixture containing a lime with 84 per cent. of calcium oxide furnished better brick than lime with 97 per cent. of calcium oxide under the same conditions of hardening (10 hours), though on doubling the time of hardening these results were reversed. The more rapid hardening of the 84 per cent. lime is attributed by Cramer to its hydraulic properties, the calcium silicate binding the mass even before it is hardened, whilst the increased crushing strength imparted by hardening is due to the conversion of the still free lime into silicate during the process.—C. S.

Firebrick; Bauxite in the Manufacture of ——.
Thonind.-Zeit., 1903, 27, [140], 2132—2134.

The best variety of bauxite for the manufacture of firebrick for blast furnaces is said to be one approximating in composition to natural clay, with a slight preponderance of alumina to raise the fusing point and so retard combination of the silica and alumina. If, however, the proportion of alumina be excessive, the product is brittle, shrinks unduly, and is susceptible to the action of acid slags. A sample of bauxite, containing 49 per cent. of alumina, 28 per cent. of silica, and 18 per cent. of water, has been favourably reported on by Seger and Cramer, who state that the tendency to shrink is almost counteracted by the appreciable quantity of silica present, and that the substance belongs to the highest class of fireproof materials. It is less affected by strongly basic slags than are the best basic firebricks, and though attacked by slags of analogous composition, the resulting superficial vitrification forms a protecting layer, which advances as the outer portion is gradually fused away in the blast furnace, and therefore prolongs the life of the lining. The fusing point is No. 37 Seger cone, and after the first baking the bricks retain their volume. On the other hand, a bauxite richer in alumina and poorer in silica is preferable for firebrick exposed to the action of basic slags and high dry heat, *e.g.*, forced-draught furnaces, coal-dust firing, steam-raising on torpedo boats, &c. A typical specimen of this class contained 21·2 per cent. of silica, 74·78 per cent. of alumina, and 3·83 per cent. of iron oxide. This fused at Seger cone No. 39, ceased to shrink after the first baking, and resisted the attacks of highly basic slags. When bauxite is used as an adjunct in firebrick, it should first be fired at a high temperature, then finely ground and intimately mixed with the clay bind before the fireclay is added. This is the only way in which the added alumina can be caused to discharge its true function of increasing the fusing point of the mass, adding the bauxite in granules merely resulting in the gradual disintegration of the whole. C. S.

Portland Cement; Constitution of ——. W. Richter.
Thonind.-Zeit., 1903, 27, [120], 1862—1864.

To ascertain the reliability of the hypothesis that the absence of colour reaction between finely-ground Portland cement and phenolphthalein is due to the presumably free lime present being in the crystalline form, the author prepared specimens of crystalline lime by the calcination of anhydrous calcium nitrate. The product, when mixed with water, sets like cement and stands the boiling test well, but gives the colour reaction with phenolphthalein in an anhydrous solvent. This result, he considers, proves that no free lime is present in cement, calcium aluminate being also precluded for the same reason; the probability is that the aluminate is present solely in the form of neutral silico-aluminate. In preparing a synthetic Portland cement, successful results were obtained by fusing equal quantities of anhydrous calcium nitrate and amorphous calcium carbonate with silica, in the proportion $SiO_2:3CaO$, for three hours at white heat, then pulverising the mass and repeating the operation. At the end of eight hours' calcination, the negative result of the phenolphthalein test showed that the whole of the lime had entered into combination. The product formed a sintered mass, which stood the boiling test, and, when triturated with water, set gradually without any increase of temperature. This trisilicate being very unstable had to be stored out of contact with atmospheric moisture. When treated with 95 per cent. alcohol it suffered dissociation in 2—3 hours, and then gave a colour reaction with phenolphthalein. Bicalcium silicate was prepared in a similar manner, and found to be fairly indifferent to alcohol containing up to 50 per cent. of water, the dissociation being very gradual. Its setting properties are inferior, and the cubes soften on boiling. Prolonged incineration of the bisilicate with 1 mol. of calcium nitrate gave a well-sintered, homogeneous product, more indifferent to strong alcohol than the amorphous form, and behaving like well-made clinker. No decidedly crystalline structure could, however, be detected by the unaided eye. From the behaviour of bicalcium silicate in presence of water and lime water respectively, the author confirms the view that the hydration of the trisilicate proceeds in two stages, the first consisting in the formation of bisilicate and calcium hydroxide, the reaction between these in presence of water then resulting in the formation of the monosilicate and the hydroxide. No success attended attempts to combine more than 3 mols. of lime with 1 mol. of silica, even by prolonged exposure to white heat in presence of merely a slight excess of lime.—C. S.

English Patents.

Wood; Impregnation of ——. J. Wetter, London. From O. Heise, Berlin. Eng. Pat. 4435, Feb. 25, 1903.

See Addition, of Feb. 26, 1903, to Fr. Pat. 325,486 of 1902; this Journal, 1903, 1049.—T. F. B.

Paving Material or Asphalt, Filling-up Cement, Waterproofing Material and Paint. W. P. Thompson, Liverpool. Eng. Pat. 24,807, Nov. 12, 1902.

The paving material is made by adding to melted pitch equal parts of burgy (the fine sand of glass works), fine field-sand or sea-sand, coarse-grained sea-sand, and as much fine and coarse gravel or broken macadam as can be added without taking away too much from the plasticity of the material. The burgy used, should pass through a 150-mesh sieve; it may be replaced by equally fine sand obtained by crushing gold ores. If the sand contain no bases, a little lime may be added to combine with the tar acids. The finished composition contains only 10 per cent. of pitch. For use as a waterproofing material, *e.g.*, for foundations, the coarse gravel or macadam is omitted. For ornamental purposes an intensely hard composition is obtained by adding gum, lac, or resin to the pitch.

—A. G. L.

Fire-Bricks, Crucibles, Retorts and other Refractory Articles; Process for Manufacturing ——. J. Bach, Riga, Russia. Eng. Pat. 24,041, Nov. 5, 1903.

Chrome-iron ore is purified by washing from the easily fusible admixtures it may contain. It is then powdered, mixed with powdered fireclay to which aluminium hydroxide has been added and burnt. A substance rich in carbon, such as sugar, resin, or coal, is preferably added in small quantity to the mixture before burning. The hydrated alumina may be replaced by the hydroxides of other highly refractory oxides.—A. G. L.

Lime Waste of Alkali Works and Lime Sulphate Waste; Utilisation of ——. H. Oliver and W. Bevan. Eng. Pat. 9412, April 25, 1903. VII., page 61.

United States Patents.

Stone; Indurated ——. C. A. O. Rosell, New York, N.Y., Assignor to Composite Stone and Brick Co., Del U.S. Pat. 747,229, Dec. 15, 1903.

The stone consists of a mixture of silica, alkali aluminate and alkali silicate, moulded and indurated. The alkal aluminate may be applied, in the form of a solution, to the moulded and partly indurated article, the induration then being completed.—A. G. L.

Asphalt, Stone, &c.; Manufacture of Artificial ——. C. Rubitschung, Frankfort-on-the-Maine. U.S. Pat. 748,019, Dec. 29, 1903.

See Eng. Pat. 17,612 of 1902; this Journal, 1903, 867.
—T. F. B.

Cement [*from Slag*]; *Manufacture of* ——. C. von Forell, Hamburg. U.S. Pat. 747,882, Dec. 22, 1903.

See Eng. Pat. 23,443 of 1901; this Journal, 1902, 347.
—T. F. B.

Cement, and Process of Making same. H. Passow, Hamburg, Assignor to H. Edmunds, London. U.S. Pat. 747,919, Dec. 22, 1903.

See Fr. Pat. 324,687 of 1902; this Journal, 1903, 630.
—T. F. B.

Cement, and Process of Producing same. H. Passow, Hamburg, Assignor to H. Edmunds, London. U.S. Pat. 747,920, Dec. 22, 1903.

See Fr. Pat. 328,533 of 1903; this Journal, 1903, 999.
—T. F. B.

Cement, and Process of Producing same. H. Passow, Hamburg, Assignor to H. Edmunds, London. U.S. Pat. 747,921, Dec. 22, 1903.

See Eng. Pat. 14,278 of 1900; this Journal, 1901, 992.
—T. F. B.

French Patents.

Asphalt; Artificial ——. J. A. Soriano. Addition, of Aug. 3, 1903, to Fr. Pat. 332,051 of May 13, 1903. III., page 55.

Stone, Artificial; Manufacture of ——, *with Magnesite.* C. Groyen. Fr. Pat. 334,562, July 6, 1903.

To avoid the inconveniences attending the use of magnesium chloride, this substance is only made as wanted, by treating magnesite with strong hydrochloric acid. The solution obtained is allowed to cool, and then immediately added to the mixture of powdered burnt magnesia and a filling material, such as asbestos. Marble, Portland or slag cement may also be added, as well as colouring materials.
—A. G. L.

Blast-Furnace Slag; Manufacture of Bricks from ——. H. Schulte-Steinberg. Fr. Pat. 334,737, Aug. 19, 1903.

See Eng. Pat. 17,183 of 1903; this Journal, 1903, 1247.
—T. F. B.

X.—METALLURGY.

Mercury Mines of Idria, Austria. T. L. Genter. Eng. and Mining J., 1903, **76**, [25], 923.

The mercury deposits of Idria are the second largest in the world, and have been worked for over 400 years. The chief ore is cinnabar, but metallic mercury is also occasionally met with. The gangue is generally composed of quartz, calcite, and dolomite, together with barite and an asphaltic mineral called "idrialite." The ores are classified as follows:—(1) "Steel ore" (Stahlerz) is found partly crystalline and partly amorphous. It contains 75 per cent. of mercury, but has been scarce during the past few years. (2) "Liver ore" (Lebererz) is amorphous and liver-coloured; it is generally found in wedge form in the steel ore: it contains 30 per cent. of mercury. (3) "Brick ore" (Ziegelerz) is sandy, bright red in colour, and sprinkled with crystals of cinnabar; it contains 50 per cent. of mercury. (4) "Coral ore" (Korallenerz) is a dark bituminous dolomite, sandstone or slate, containing petrified matter of unknown origin, resembling coral; it contains 6—7 per cent. of mercury. At the present time there are about 1,200 men and boys employed in the mines and mills, and there are six shafts, two drain tunnels, and about 20 miles of workings in operation. There are 12 levels in the mines, the deepest being about 1,100 ft. The main shaft is completely enclosed in masonry and Portland cement. The annual output of ore is about 800,000 metric tons, yielding more than 500 tons of mercury. The ores, after being sorted and crushed, are roasted in muffle furnaces, and the mercury is condensed in large U-shaped earthenware receptacles, on the bottom of which it separates as a slimy black mass or "stupp." This is treated in centrifugal machines called "presses" and the dirt, &c. separated is again roasted. The mercury is placed for shipment in heavy cast-iron vessels, with screw tops, called "arrobas;" each arroba holds about 25 lb. of mercury. It is estimated that the deposits will last for another 40 or 50 years at the present rate of extraction.—A. S.

English Patents.

Metals: Purifying and Separating ——. W. S. Simpson, London. Eng. Pat. 28,938, Dec. 31, 1902.

To facilitate the decarburisation and purification of iron for steel-making, &c., the metal is run into a receptacle lined with a refractory and non-conducting material, which vessel is subjected to repeated concussions, as by dropping many times upon a solid foundation from a height of about 12 in. The same process is used generally with metals while in a molten state, to eliminate metallic oxides and other impurities, and to separate metals of varying densities.—E. S.

Furnaces for Roasting Pyrites and other Substances. F. Benker, Clichy, and E. Hartmann, Wiesbaden. Eng. Pat. 260, Jan. 5, 1903.

See Fr. Pat. 327,832 of 1902; this Journal, 1903, 950.
—T. F. B.

Melting and Heating Furnaces; Improved Combined ——. J. Shanks, Barrhead, Renfrew, N.B. Eng. Pat. 2515, Feb. 3, 1903.

A crucible furnace having a combustion space for gas or oil fuel and a seat or grate part to receive a crucible, is formed with ports or openings extending through the inner lining wall of the furnace into flue and furnace spaces in a surrounding outer wall common to both spaces. A muffle or oven is arranged in the furnace space, so that there is a flue space or passage underneath and partly round it, and a passage leads from this flue and the furnace space, either directly or through a second furnace space containing a lead-melting pot, to a chimney. A number of such furnaces may be arranged in communication with a single central chimney.—R. A.

Waste Pickle Liquor; Treatment of ——, *for the Removal or Utilisation of Free Acid contained therein.* H. W. Hemingway, Walthamstow. Eng. Pat. 423, Jan. 7, 1903.

The waste pickle liquor, whether consisting essentially of an acid solution of ferrous sulphate or chloride, is neutralised with ferrous carbonate (such as spathic iron ore) or with a suitable alkaline earth carbonate; or, in the case of chloride liquors, iron oxide may be precipitated by calcium hydroxide, and the oxide utilised in neutralising other portions of the waste liquor. See also Eng. Pat. 8759, 1902; this Journal, 1903, 561.—E. S.

Vanadiferous Ores and Products; Process of Treating ——. H. L. Herrenschmidt, Genest, France. Eng. Pat. 784, Jan. 12, 1903.

See Fr. Pat. 328,421 and addition thereto; this Journal, 1903, 953 and 1198.—T. F. B.

Copper from Ore; Process of Extracting ——. G. D. van Arsdale, Newark, N.J. Eng. Pat. 4327, Feb. 24, 1903.

See U.S. Pat. 723,949 of 1903; this Journal, 1903, 558.
—T. F. B.

Ores; Treatment of Complex ——. J. B. de Alzugaray, London. Eng. Pat. 23,848, Nov. 3, 1903. Under Internat. Conv., July 30, 1903.

See Fr. Pat. 334,272 of 1903; this Journal, 1904, 24.
—T. F. B.

United States Patents.

Steel; Manufacture of Open-Hearth ——. B. Talbot, Pencoyd, Pa. U.S. Pat. 747,661, Dec. 22, 1903.

See Eng. Pat. 22,408 of 1900; this Journal, 1901, 1118. —T. F. B.

Steel; Manufacture of ——. B. Talbot, Harrogate, Assignor to Continuous Metal Refining Co., Philadelphia. U.S. Pat. 747,662, Dec. 22, 1903.

A charge of molten iron, prepared by heating iron oxide with pig-iron in such a way as to reduce the quantity of silicon present without much affecting the percentage of carbon, is introduced into an oxidised steel bath, covered with a layer of oxidising basic slag; the carbon of the iron and the oxygen of the steel combine to form carbon monoxide, which heats the charge by its combustion.—T. F. B.

Metal Compounds; Method of Converting ——. J. W. MacDonald, Pittsburg, Pa., Assignor to U.S. Sulphide Smelting Furnace Co., Toledo, Ohio. U.S. Pat. 746,721, Dec. 15, 1903.

In smelting ores, an elongated solid body of fluxing material is introduced through a vertical sustaining channel, with its lower portion immersed in the molten compounds within the area of their highest degree of oxidation. The fluxing body sinks by gravity to the bottom of the bath, and as it dissolves, fresh quantities are automatically supplied from the superincumbent portions.—E. S.

Copper Ores; Process of Smelting ——. R. H. Aiken, Winthrop Harbor, Ill. U.S. Pat. 746,773, Dec. 15, 1903.

A mixture of sulphide copper ores with silica and suitable fluxes, but without carbonaceous fuel, is introduced into a furnace, and a blast of air is passed into the charge at the upper zone of action, chiefly to oxidise the iron sulphides present; and simultaneously a separate blast of a mixture of air and of a liquid fuel is passed into the lower zone of action, whereby a melting temperature is maintained by which the iron oxide formed as described combines with the silica of the charge to form a slag, whilst the copper sulphide fuses to form a matte.—E. S.

Zinc; Process of Recovering ——, *from Sulphide Ores.* P. Danckwardt, Deadwood, S.D. U.S. Pat. 746,798, Dec. 15, 1903.

Ore containing zinc or other valuable metals is mixed with a salt of an alkali metal, a metal carbide or carbide-forming material in excess, and with suitable fluxes, and the mixture is heated electrically under a heavy cover of carbon, so that in the gases evolved carbon monoxide, and not carbon dioxide, may occur. The zinc vapours are condensed, and the molten charge is withdrawn from the furnace. After settling of the matte and metals, the slag is lixiviated, and the alkali sulphide solution obtained is treated with carbon dioxide, and the hydrogen sulphide evolved is collected and utilised, and alkali carbonate is crystallised from the concentrated solution.—E. S.

Smelting [Sulphide] Ores. J. W. MacDonald, Pittsburg, Pa., Assignor to U.S. Sulphide Smelting Furnace Co., Toledo, Ohio. U.S. Pat. 746,970, Dec. 15, 1903.

The raw sulphide ore is heaped up conically on a furnace hearth, with the inclined sides exposed, and is sufficiently heated to commence the burning of the sulphur. Several streams of hot air are caused to impinge upon the base of the heap, so that the flames rise along and fuse the exposed surface. As the molten product is drawn off, fresh portions of raw ore are fed upon the surface of the heap.—E. S.

Aluminium; Soldering Flux for ——. C. Ellis and O. J. Flanigan, Boston, Mass. U.S. Pat. 746,802, Dec. 15, 1903.

The soldering flux consists of a salt of a metal the heat of formation of which is less than that of the corresponding salt of aluminium, incorporated with a reducing vehicle. For example, silver chloride, incorporated with an organic reducing vehicle, such as an oil, may constitute such a flux. See also U.S. Pat. 717,833 of 1903; this Journal, 1903, 147.—E. S.

Crucible-Furnace. J. D. Swindell, Assignor to the American Furnace and Machine Co., Pittsburg, Pa., U.S.A. U.S. Pat. 747,019, Dec. 15, 1903.

The combustion chamber has a conical opening in its roof, the wider portion of the cone being towards the inside of the chamber. The bottom of the chamber can be raised or lowered, for example, by hydraulic machinery, and is conical in shape, the wider portion also pointing towards the inside of the chamber, and provided with a bevelled edge, which fits into the conical portion of the opening in the roof, when the bottom is raised. When the bottom is raised to be in contact with the roof, a flange on the lower side of the bottom closes the floor of the combustion chamber. Gas flues in the side walls of the combustion chamber are closed when the bottom of the chamber is raised to be in contact with the opening in the roof. This opening is provided with a movable cover. By the use of this furnace, crucibles can be raised by the moveable bottom, through the opening in the roof of the combustion chamber, which, together with the gas inlets, is simultaneously closed, top and bottom, to prevent the escape of furnace gases.—W. C. H.

French Patents.

Steel; Manufacture of ——, *and Treatment of the Mattes of Copper, Nickel, &c.* Cie. du Réacteur Métallurgique. Fr. Pat. 334,454, Aug. 6, 1903.

The metal to be converted into steel, or the mattes of copper, nickel, &c., are melted in a suitable converter, and jets, of air only, or of air charged with vapour, or oxides, silica, chalk, fluorides, carbon, carbides, hydrocarbons, chlorides, &c., are injected simultaneously upon and below the surface of the bath, or only upon or below, according to circumstances. Converters and subsidiary apparatus are shown adapted to the material under treatment.—E. S.

Iron and Other Metals; Reduction of Ores of ——. C. S. Bradley. Fr. Pat. 334,785, Aug. 22, 1903.

See Eng. Pat. 17,434 of 1903; this Journal, 1903, 1198. —T. F. B.

Metallic Compounds having as Principal Constituent Partially or Wholly Decarbonised Iron. S. Parfitt. Fr. Pat. 334,959, Sept. 1, 1903.

See Eng. Pat. 2612 of 1903; this Journal, 1904, 22. —T. F. B.

Ores and Products Containing Vanadium, Molybdenum, Titanium, or Tungsten; Treating ——. H. L. Herrenschmidt. Fr. Pat. 334,333, June 27, 1903.

The object of the invention is to obtain from ores of vanadium, vanadic acid or a vanadate, and alloys of vanadium with other metals, such as nickel, iron, or copper, the processes described being also applicable to obtaining corresponding products from ore of molybdenum, titanium, and tungsten. Solution of crude sodium vanadate, obtained from the ores by known processes, is concentrated and crystallised with addition of vanadic acid, resulting from a prior fractional precipitation of part of the liquor, by vanadium sulphate, or of an acid, or of a metallic salt. The same process is applied to obtaining a vanadate of nickel, iron or copper from the original solution after purification. These vanadates may be heated with carbon to obtain the corresponding alloys. Compare Fr. Pat. 328,421 of 1903, and Addition to the same; this Journal, 1903, 953 and 1198.—E. S.

French Patents.

Aluminium Alloy; Manufacturing ——. L. Trézel, P. V. G. Coppée, and A. J. De Monthy. Fr. Pat. 334,343, Aug. 3, 1903.

A preparatory "rich" alloy is obtained by fusion at a very high temperature (about 2,000 C.) of approximately equal parts of ferro-silicon and of cobalt, with two parts of aluminium, and variable smaller proportions of silver and of silica. This "rich" alloy is melted with aluminium at a comparatively low temperature, to form an alloy for which special characteristics are claimed; *viz.*, that it may be soldered and braized, &c.—E. S.

Minerals; Process and Apparatus for the Separation of ——, and for the Extraction of Mattes. G. A. Goyder and E. Laughton. Fr. Pat. 334,443, Aug. 6, 1903.

See Eng. Pat. 16,839 of 1903; this J., 1903, 1133.
—T. F. B.

Ores; Furnace for Treating ——. I. Santilippo, Italy. Fr. Pat. 334,444, Aug. 6, 1903.

The furnace, which is especially intended for the treatment of sulphide ores, or for refining sulphur, has as its essential characteristics, two compartments, one above the other, filled with hollow pillars extending to the roof, and perforated laterally to admit free passage of gases, the ore being fed from above. The arrangements are modified in various respects according to the use to which the furnace is put.—E. S.

Tinning and Soldering; Composition for Use in ——. K. Küppers. Fr. Pat. 334,491, Aug. 7, 1903.

The composition is made by mixing 9·5 parts of zinc chloride, 8 parts of ammonium chloride, and 5 parts of zinc oxide, with some water. The mixture is preferably dried at from 140° to 300° C., and then allowed to solidify.
—E. S.

Etching [Designs on] Metals. J. A. Dejey. Fr. Pat. 334,499, Aug. 8, 1903.

The design having been copied on to the roller or plate to be engraved, and a reserve of lead electrically deposited, the ink is dissolved off by turpentine or the like, and the plate is ready for etching by acids or liquors that do not attack lead, but only the design on the copper surface which is laid bare; ferric chloride or chromic acid solution may be thus used for instance. When it is desired to etch very deeply, the plate may be cleaned, and the etching already obtained covered with a varnish, and then a thick reserve of lead deposited and the process continued as before. Fr. Pat. 301,227, 1901, is referred to. See Addition to Fr. Pat. 301,054, 1901; this Journal, 1902, 51.—E. S.

Dust Floating in Roasting Furnaces having Superposed Hearths; Process and Arrangement [of Apparatus] to Prevent the Formation of ——. W. Kauffmann. Fr. Pat. 334,528, Aug. 10, 1903.

The invention consists in arrangements whereby the ore, in its descent from hearth to hearth, of a horizontal roasting furnace, is delivered without encounter of uprushing gases, for which passage is automatically made through independent openings, and the formation of floating dust is thus prevented. The passages for the gases are successively opened and closed by means of plates connected to the mechanism for discharging the ore from hearth to hearth, but in no case is rush of gases possible through an opening which is discharging ore.—E. S.

Waste [or Dust] of White or Pure Pyrites; Treating ——, with view to Recovery of the Iron. H. Sölbiský. Fr. Pat. 334,623, Aug. 14, 1903.

Waste pyrites, or furnace dust, the latter after separation of non-magnetic bodies, is heated sufficiently to "volatilise" sulphur and zinc, and is subsequently more strongly heated in air, to form zinc sulphate, which decomposes into sulphur dioxide, oxygen, and zinc oxide. The complete extraction of the sulphur and zinc is stated to be facilitated by using a mixture of products. It is also stated that the reduction of iron oxide by fusion with pyrites containing copper or nickel, may be effected by heating the mixture of them sufficiently; and that thus molten iron, or an alloy of iron with such metals, is obtained.—E. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

English Patents.

Water and other Liquids; Apparatus for Purification of —— [by Electrolysis]. W. B. Hardy, London. Eng. Pat. 25,041, Nov. 14, 1902.

The electrolytic tank is made in the form of a metal pipe, lined with two longitudinal slabs of wood opposite to each other, and with longitudinal staves with radial meeting edges for supporting the two slabs in position. The latter have longitudinal grooves into which slide aluminium plates, acting as electrodes, alternate ones as anodes and cathodes. The anode plates overlap the cathode plates at one end and the cathode plates overlap at the other, the overlapping portions being secured together by a threaded bar, provided with nuts on opposite sides of the plates for clamping them. The liquid is thus made to circulate in a sinuous course over the plates. The ends of the tank are secured to, and closed by, metal heads lined with slate, the latter fitting within the tank so as to abut against the wooden lining, and the slate is provided with grooves for supporting the electrodes and with openings for the terminals which are connected to the threaded bars. The liquid enters under pressure at one end and passes out in a pure state at the opposite end; but in the entrance pipe is placed a liquid motor of the blade type, attached to a governor and actuating a switch in such a way that a resistance is introduced into the circuit when the speed of the liquid is low, and cut out when the flow is fast, the circuit being broken when the flow ceases. This is accomplished by the centrifugal balls acting on a lever, so as to bring a contact point, attached to the lever, down on to a contact point attached to the electrodes through a resistance; or, if the speed is greater, so as to bring the contact point still lower on to a third contact point in direct connection with the electrodes, and thus cut out the resistance. When the flow ceases the balls drop and the contact points are separated, thus breaking the circuit.
—B. N.

Agitating the [Fused] Contents of Electrolytic Cells; An Improved Method and Apparatus for ——, or Effecting Systematic Transference of Portions of the Contents from one Cell to Another. E. A. Ashcroft, Runcorn. Eng. Pat. 12,083, May 27, 1903.

A pot electromagnet, with concentric poles, is arranged concentrically beneath the bath of fused material (*e.g.*, sodium chloride), and this sets up a violent swirl of the contents of the vessel, the magnet being so placed that the lines of magnetic force cut the lines of current flow more or less at right angles, and lie in planes at right angles to the direction of the required motion. Two vessels may be arranged in this way, with connecting tangential tubes, the second vessel containing fused caustic soda, with a sodium-lead alloy as the anode and a central nickel cathode. By using a horse-shoe magnet, with one pole vertically below each vessel, the swirls in the two vessels may be produced in the same direction and some of the intermediate electrode (sodium-lead alloy) will be transferred from one vessel to the other. Instead of the tangential passages, the two vessels may be placed side by side, with an opening near the bottom for connecting the cells, and in which is placed a baffle plate for directing the contents of one vessel into the other; or a passage may lead from the centre of the first to the periphery of the second cell, and another passage from the periphery of the first to the centre of the second, the increased pressure at the periphery of each vessel producing circulation.—B. N.

Insulating Materials, and Artificial Substitutes for Ebonite and the like. O. D. Lucas, London. Eng. Pat. 2695, Feb. 4, 1903.

Three classes of materials are used, a cheap earthy substance of a fibrous nature, such as peat, for the base, a binding material, such as China- or other clay, chalk, or powdered talc, and cementing materials, such as india-rubber and shellac or colloids like gelatin and glue. If rubber be used, sulphur is added in the proportions required, according to hardness desired and in the case of colloids, bichromate of potash or tannin is added to render them insoluble. The process is carried out by grinding the substances of the first and second classes, first alone and then together, and finally stirring them into a solution of the substance of the third class in a suitable solvent. The resulting material is granular when rubber or shellac is used: it is reground to a fine powder and is capable of being solidified under heat and pressure into a solid compact mass, having high insulating properties. The product from colloids is plastic or gelatinous when cold. It must be dried by the gentle application of heat or some other suitable method. It has a high specific resistance, is capable of taking a high polish, and can be moulded into any form and turned in a lathe.

—J. K. B.

French Patents.

Caustic Soda Solutions, Caustic Soda, Chlorine and its Derivatives; Method of Obtaining Strong ——, by Electrolysis of Sodium Chloride. R. Eserive de Romani. Fr. Pat. 334,332, June 25, 1903.

The conversion of the sodium amalgam, by means of water, into caustic soda and mercury is conducted in a separate cell from that in which the amalgam is produced by the electrolysis of sodium chloride. The former cell is at a higher level than the latter, and a pipe leading from the bottom of the electrolytic tank to the upper part of the other is provided with a valve which automatically passes the amalgam but excludes the solution. This is effected by using a ball-and-socket valve, of which the ball has a specific gravity lower than that of mercury but higher than that of the solution.—W. G. M.

Water; Process of Electrolysing ——. W. F. M. McCarty and W. S. Beebe. Fr. Pat. 334,543, Aug. 10, 1903.

See Eng. Pat. 17,399 of 1903; this Journal, 1904, 18.

—T. F. B.

Electrodes for Electrolysis. J. Hargreaves. Fr. Pat. 335,010, Sept. 2, 1903.

See Eng. Pat. 19,368 of 1902; this Journal, 1903, 1135.

—T. F. B.

(*B.*)—ELECTRO-METALLURGY.

United States Patent.

Metals; Separating ——, from Matte or Ore. P. Danckwardt, Deadwood, S.D. U.S. Pat. 746,797, Dec. 15, 1903.

Valuable metals are separated from metal sulphides and arsenides containing iron sulphide, by mixing the matte or ore with carbide-forming materials, and heating the mixture in an electric furnace to produce a carbide which will reduce the valuable metals to the metallic state, without reduction of the iron sulphide present.—E. S.

French Patent.

Alloy of Iron, Silicon, and Manganese; Process of Manufacturing a Triple ——, in an Electric Furnace. C. A. Keller. Fr. Pat. 334,504, Aug. 8, 1903.

An alloy containing iron, silicon, and manganese, in variable proportions, is produced by heating in an electric furnace, restricted to a tension of about 30 volts, a mixture of ferrosilicon, silica, and a manganese ore, with sufficient carbon to effect the reduction of the silica and of the ore. One application of the alloy is as a final addition to baths of molten steel.—E. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Esters of [Fatty] Acids of High Molecular Weight; Preparation of Pure ——. F. Krafft. Ber., 1903, **36**, [17], 4339—4344.

The author has found that products purified by distillation in the vacuum of the cathode light have sharper boiling points than those prepared by the usual methods. The ethyl esters of stearic, palmitic, myristic, and lauric acids were prepared, and found to be readily volatile. Glycol esters of fatty acids were obtained by heating ethylene chloride for 10 hours at 180° C. with the respective potassium soaps dried at 140° C. The products of the reaction were extracted with ether, and the extracted substance dried and rectified under a pressure of 15 mm. in very shallow vessels (about 20 mm.). The white transparent crystalline masses yielded brilliant plates when crystallised from hot alcohol. On heating the potassium soaps for 12—15 hours with an excess of ethylene chloride or bromide, the respective chloro-ethyl- and bromo-ethyl-esters were obtained. Pure monoglycerides were prepared by heating monochlorhydrin with the dried potassium soaps in a sealed tube in which the air had been replaced by carbon dioxide. *Monobenzoin* ($C_3H_7O_2.CO_2.C_6H_5$) separated by rectification *in vacuo*, boiled at 124° C., and solidified, on cooling, to a crystalline mass melting at 36° C. *Monolaurin* ($C_3H_7O_2.CO_2.C_{11}H_{23}$) was prepared in the same way, the tube being heated for six hours at 180° C. The ethereal extract of the products of the reaction were dried under a pressure of 15 mm., and then *in vacuo* at 80° C., and rectified in the full green cathode light. The monolaurin distilled at 142° C. *in vacuo*, and solidified to a transparent, crystalline, non-hygroscopic mass, melting at 59° C. *Monomyristin* distilled at 162° C. *in vacuo*, and melted at about 68° C. *Monopalmitin* (m. pt. 72° C.), was prepared by heating two parts of potassium palmitate with 0·8 part of α-monochlorhydrin as described above. The ethereal extract was purified by crystallisation from ethyl and butyl alcohols, and the last traces of di- and tri-palmitin removed by means of hot benzene. *Monostearin* prepared in the same way melted at 78° C. *Mono-oleïn* ($C_3H_7O_2.CO_2.C_{17}H_{33}$) was fractionally precipitated by adding water to an alcoholic solution of the products of the reaction, and dried on a porous tile *in vacuo*. It formed white crystals melting at 35° C. The monoglycerides of fatty acids are converted into triglycerides when shaken and heated with benzoyl chloride and sodium hydroxide solution; for instance, *dibenzoyl monopalmitin*, $C_3H_5(CO_2.C_{16}H_{31})(CO_2.C_6H_5)_2$, melting at 69° C., and the corresponding compound of monomyristin (m. pt. 65° C.) were thus prepared. Both distilled without decomposition *in vacuo*. Crude fats were also fractionated in the same way. The solid fat separated by means of alcohol from laurel oil distilled at 250° to 275° C. *in vacuo* yielding trilaurin; trimyristin was also separated from muscat butter in the same way.—C. A. M.

Seeds of the Para Rubber Tree (Hevea Brasiliensis); Commercial Utilisation of the ——. Bull. of the Imperial Inst. (Suppl. to Board of Trade J.), 1903, [4], 156—159.

The seeds (husk and kernel ground together) when extracted with light petroleum, furnished 20 per cent. of oil, whilst the kernels, which constitute about 50 per cent. by weight of the seeds, yielded 42·3 per cent. of oil. The chief point of difference between the oils from the whole seeds and from the kernels is the presence in the former of a very small amount of a solid fat having a high saponification value and a low iodine value. The oil possesses drying properties: it gives a clear transparent film on exposure to the air, and could probably be used as a substitute for linseed oil. The oil prepared from the kernels had the following characters:—sp. gr. at 15° C., 0·9302; acid value, 10·7; free fatty acids (as oleic acid), 5·4 per cent.; saponification value, 206·1; iodine value, 128·3. A specimen of oil extracted from Para rubber seed meal was found to contain 65·6 per cent. of free fatty acids (as oleic acid). This large proportion of free acid, which is due to the decomposition of the neutral oil in the crushed seed by the action of a hydrolytic enzyme, renders the meal unfit for use as a fodder. The residual cake obtained after expressing the oil from the decorticated seeds could, however, be used as a cattle food. It contains:—moisture, 13·36; ash, 5·19; proteids, 26·81; fibre, 5·00; fat, 6·00; and carbohydrates, 43·64 per cent. Para-rubber seed oil has been valued at about 20*l.* per ton. It is not advisable to import the whole seeds, but the decorticated seeds, which are valued at 10*l.* to 12*l.* per ton. The "seed cake" would be of about the same value as linseed cake, *viz.*, 5*l.* 15*s.* to 6*l.* 15*s.* per ton.—A. S.

English Patents.

Fatty Matters from Bones and other Materials; Extraction of ——. W. R. Smith, Chester, and E. G. Scott, London. Eng. Pat. 3150, Feb. 10, 1903.

The material is placed in a chamber above a source of steam-heat (claim being made for "tubes held in tube plates and externally heated by steam"), whilst the solvent is introduced from above and falls through it. The solvent is vaporised by the heat and rising through the material is condensed and extracts more fat, until eventually, when the material becomes hot, the solvent is recovered by means of a condenser. The solution of the fat is conducted into a vessel, where the solvent is evaporated by means of tubes externally heated by steam, the process being accelerated by the introduction of live steam.—C. A. M.

Oils and Fatty Matters; Purifying and Deodorising ——. C. Godard, Termonde, Belgium. Eng. Pat. 22,085, Oct. 13, 1903. Under Internat. Conv., Oct. 16, 1902.

The oils are mixed with sodium silicate, the soap separated, and the neutralised oils deodorised by means of steam in a fine state of division. A special apparatus is claimed for the latter process.—C. A. M.

Oils and Fatty Matters; Decolorising ——. C. Godard, Termonde, Belgium. Eng. Pat. 22,086, Oct. 13, 1903. Under Internat. Conv., Oct. 28, 1902.

In order to prevent oxidation of oils during agitation with decolorising reagents, claim is made for carrying out the process *in vacuo*, and also for special apparatus for the purpose.—C. A. M.

United States Patent.

Seeds; Process of Eliminating Solvents from ——. M. Swenson, Madison, Wis., U.S.A. U.S. Pat. 747,267, Dec. 15, 1903.

The liquid solvent is expelled by the introduction of hot vaporised solvent, the residual seed being dried in the process. The vapour is itself removed from the seed by means of a high vacuum, and a current of hot air finally passed through.—C. A. M.

Oils or Distillates; Process of Desulphurising ——. O. P. Amend, Assignor to J. H. Macey. U.S. Pats. 747,347 and 747,348, Dec. 2, 1903. III., page 55.

French Patents.

Fatty Acids from their Esters; Process of Extracting ——. Vereinigte Chemische Werke Gesellschaft. Fr. Pat. 328,101, Oct. 9, 1902.

Claim is made for the use of vegetable ferments on an emulsion of the fat in presence of acids or acid salts. (See Eng. Pat. 22,111 of 1902; this Journal, 1903, 428.) —C. A. M.

Cacao Butter; Impt. of ——. G. Muller. Fr. Pat. 334,366, July 25, 1903.

This process, which is stated to render cacao butter soft and pliable, consists of heating the fat with water and sodium bicarbonate, then cooling it with constant agitation until it congeals, after which it is left for 24 hours, and is finally subjected to a process of pressing and kneading until supple. Claim is also made for a product thus prepared from a mixture of butter and cacao butter.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

English Patents.

Paving Material or Asphalt, Filling-up Cement, Waterproofing Material and Paint. W. P. Thompson. Eng. Pat. 24,807, Nov. 12, 1902. IX., page 64.

Ultramarine; Manufacture of ——. C. F. Cross, London. Eng. Pat. 3171, Feb. 10, 1903.

A charcoal, rich in silica, such as charcoal from the husks of rice, is substituted either partly or entirely for the coal and kieselguhr, used in the ordinary mixtures for making ultramarine.—J. K. B.

French Patents.

Cement with Zinc Basis for Hot Joints. Bonneville & Co. Addition, dated July 8, 1903, to Fr. Pat. 332,789, June 4, 1903.

In cases where the presence of oxide of lead or its other compounds are either desirable or not objectionable, they may be added to the cement made with finely divided metallic zinc as described in the previous patent in this Journal, 1903, 1357.—M. J. S.

White Paint; Manufacture of a ——. J. E. Kollinger. Fr. Pat. 328,111. Oct. 23, 1903.

Limestone is saturated with petroleum oil, which is then set on fire. The resulting lime is submitted to the same operation a second time, and is then ground with a suitable paint vehicle. The second calcination is stated to improve the opacity of the product. The paints dry rapidly without the addition of a siccative, and acquire a hard surface which is highly resistant to atmospheric influences.— —M. J. S.

Pigments; Processes of Making ——. W. J. Armbruster and J. Morton. Fr. Pat. 334,649, Aug. 17, 1903.

See U.S. Pat. 737,056 of 1903; this Journal, 1903, 1055. —T. F. B.

Pigment, and Process of Manufacturing same. W. J. Armbruster and J. Morton. Fr. Pat. 334,650, Aug. 17, 1903.

See U.S. Pat. 737,055 of 1903; this Journal, 1903, 1055. —T. F. B.

(*B.*)—RESINS, VARNISHES.

United States Patent.

Turpentine Still. W. H. Krug, New York, Assignor to Standard Turpentine Co., Raleigh, N.C. U.S. Pat. 746,850, Dec. 15, 1903.

The still is provided with two delivery pipes, one of which is fitted with an automatic valve controlled by the internal pressure of the still, and the other with a valve operated by hand. The delivery pipes lead to separate condensers. —M. J. S.

French Patents.

Varnish; Process of Manufacturing ——, *by Direct Solution of Gums Without Previous Fusion.* A. Tixier and L. Rambaud. Fr. Pat. 334,430, Aug. 5, 1903.

"Terpineol ($C_{10}H_{16}O$)," obtained by treating oil of turpentine with dilute nitric acid, forms a very energetic solvent for gums in their natural state. The terpineol may be prepared by digesting at 15°—20° C. with acid of 20° B., until the oil of turpentine has been wholly converted into crystallised terpine, which is then washed and converted into terpineol by the action of highly dilute sulphuric acid, or by digesting at 60°—70° C., washing, and distilling by steam. The latter process is the more rapid, but the product is less pure. The commercially pure terpineol has a density of 0·940, and a refractive index higher than 1·478 at 20°. Varnishes may be prepared by dissolving unfused gums in this liquid, or in a mixture of it with oil of turpentine, benzene, or alcohol. To use it in the preparation of oil varnishes, it is desirable to add a fatty acid which is soluble in the oil, since such a mixture does not precipitate the gum from its terpineol solution, as a neutral oil would do if added in too large a proportion.—M. J. S.

Linoleum consisting of Two or More Layers; Process of Manufacturing ——. The Bremer Linoleum Werke Delmenhorst Co. Fr. Pat. 334,635, Aug. 11, 1903.

The mode of manufacture claimed consists in presenting the two or more compositions which are to form the respective layers to simultaneous compression between rollers. The mixtures are kept separate in the charging hopper by partitions which extend nearly to the zone where the compression takes place.—M. J. S.

(C.)—INDIA-RUBBER.

India-Rubber; Chemistry of ——. E. Marckwald and F. Frank. Gummi-Zeit., 1903, **18**, [13], 251—253.

It seems likely that the quantity *x* in the empirical formula $(C_{10}H_{16})x$ will be replaced by 10, for whilst the analysis of the most highly vulcanised product possible gives the formula $(C_{10}H_{16}S_2Cl_2)x$. Weber gives $(C_{10}H_{16})_{10}S_2Cl_2$ as the lowest vulcanisation product containing no free polyprene. In soft rubber Weber found sulphur corresponding to the formula $C_{100}H_{160}S$, and for hard rubber, obtained by mixing equal quantities of sulphur and rubber and vulcanising for eight hours at 140° C., he was unable to get a higher product than represented by the formula $(C_{10}H_{16}S_2)x$. It is evident that the combined sulphur cannot be removed from the rubber molecule without breaking up the latter, so that the so-called regeneration of india-rubber resolves itself into a physical manipulation of the old rubber merely, no real chemical alteration taking place.—J. K. B.

India-Rubber; Action of Metals on ——. C. O. Weber. Gummi-Zeit., 1903, **18**, [13], 255.

Unvulcanised rubber is rarely used in contact with metallic surfaces, but vulcanised rubber, on the other hand, is used for covering metals for very many purposes. It is found that the more readily the metal combines with sulphur the firmer is the combination between the rubber and the metal. This appears to be due to the fact that at the vulcanisation temperatures, certain metallic sulphides actually combine with rubber in a manner not yet fully understood. Arsenic, antimony, lead, copper, and silver act very energetically; tin, zinc, iron, and aluminium much less so; whilst gold and platinum are quite inert. Practical use of this property is made in the manufacture of cables, where the tinned copper wires are always used, wires thus coated resisting action of the sulphur. On the other hand, comparatively inert metals, such as iron and steel, may be coated with antimony or copper when it is desired to obtain the firmest possible adhesion.—J. K. B.

Sulphur for Vulcanising India-Rubber; Properties of ——. C. O. Weber. India-Rubber Journal, 1904, **27**, [1], 21 and 30.

Attention is drawn to the necessity of the sulphur used being free from acidity, especially when used for making pure rubber goods, which contain no fillers likely to neutralise the free acid. The sulphur should be stored in a cool place in order to avoid oxidation as much as possible. The presence of lime in a mixing is not a guarantee of its freedom from any free acid, as perfect admixture is impossible on mixing rolls. The author recommends grinding 2 to 3 per cent. of lime into the sulphur in a ball grinding machine. Such a mixture is peculiarly successful as a vulcanising agent.—J. K. B.

Rubber; Collection and Preparation of Different Sorts of Congo ——. E. de Wildeman. Gummi-Zeit., 1903, **18**, [14], 281.

The rubber called "tjibola" is yielded by a creeper, the bark of which contains a sticky product, which can only be separated by beating. By the beating process the natives eventually obtain rubber flakes about 3—4 mm. thick and 30—40 mm. wide. These are cut into strips and formed into balls, five of which are stuck together by dipping in hot water. A creeper 2 *m.* long yields 30 to 40 balls of rubber weighing about 275 grms., and this small yield represents a whole day's labour. Such rubber loses in drying before export only about 10 per cent. of its weight. Kanianga rubber is obtained from young creepers of the same species by cutting. A longitudinal and transverse cut is made in the bark, and the latex allowed to run down a stick or down the arm or breast of the native, the heat of the body coagulating it thoroughly. Rubber so prepared is of the best quality, practically free from impurities, for it runs fast and coagulates. Creepers yielding a slow-running latex are cut, five or six at a time, in the morning, and the rubber, which slowly gathers at the wounds, collected in the afternoon or next morning. The rubber obtained is of a good quality, but contains particles of bark enclosed. The yield is 15 to 20 balls, weighing about 150 grms. in all; the rubber loses 20 to 30 per cent. in weight in the store. Black rubber, or "tjikala," is white inside, excepting when the balls are very small, and the black colour is due to surface oxidation. It is obtained by cutting a creeper about 2 m. long, in a longitudinal direction only, commencing about ½ m. from the ground. The free-flowing latex is collected in a vessel, and poured into hot water in order to coagulate it. The rubber balls floating on the surface are caught between large leaves, and the water separated by trampling under foot. The resulting thin rubber cakes are cut into strips, formed into balls, and dried on hurdles. A creeper yields 70 to 100 balls of tjikala. Bakuba caoutchouc, called Suma, is obtained from the same creeper as kanianga. The balls are formed by pressing together the product obtained by boiling the half-run latex with water.—J. K. B.

Rubber Resources of the Soudan. Bull. of the Imperial Inst. (Suppl. to Board of Trade J.), 1903, [4], 168.

The rubber-yielding creeper, *Landolphia owariensis*, Beauv., var. *tomentella*, occurs abundantly all over the Bahr-el-Ghazal province; it is known to the natives of the various tribes as "Ndala," "Odiloh," "Ngeleh," and "Atilob." Specimens of the rubber made up in two forms, *viz.*, balls and cylindrical rolls, have been examined, with the following results:—

	Moisture.	Caoutchouc.	Resin.	Dirt and Insoluble Matter.	Ash (included in Dirt).
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Balls	15·7	71·5	7·3	5·5	1·19
Rolls	17·8	69·5	7·4	5·3	1·16

The rubber, which was contaminated with a small amount of extraneous vegetable matter, was not sticky; it was rather hard in the mass, but small pieces exhibited very good elasticity and tenacity. It is valued at about 3*s.* 6*d.* per lb. By a decree issued by the Soudan Government on May 1, 1903, the rubber forests throughout the Soudan, with the exception of those in Kordofan, have been placed under official management, in order to prevent the destruction of the trees through reckless methods of collecting the rubber.—A. S.

Castilloa and Funtumia Rubbers; Experimental Cultivation of ——, *in Trinidad.* Bull. of the Imperial Inst. (Suppl. to Board of Trade J.), 1903, [4], 160—167.

Specimens of rubber from the various rubber-yielding trees cultivated in Trinidad were examined with a view to ascertaining the influence of the age of the tree and the method of treating the latex on the quality of the rubber obtained.

Castilloa Rubber.—The view held by previous investigators that trees of *Castilloa elastica* only yield rubber of good quality after they have attained the age of eight years is confirmed. In all the specimens examined, the proportion of resin was much higher than that hitherto recorded for this variety of rubber. The method of preparation had little influence on the composition of the rubber, except that specimens obtained by "creaming" the latex, *i.e.*, diluting it with a large volume of water and allowing to stand for 12 hours, before coagulating the rubber by the addition of alcohol, contained much less foreign matter than specimens obtained by the direct addition of alcohol to the latex, or by exposing the latter to the air. The two specimens of Castilloa rubber which alone were of commercial value, were obtained from trees 12 years old and upwards, and had the following composition:—Moisture, 15·2, 2·2; caoutchouc, 70·1, 69·1; resin, 11·7, 8·2; dirt, 3·0, 0·5; ash (included in dirt), 0·79, 0·25 per cent.; they were valued at 2*s*. 4*d*. and 2*s*. 9*d*. per lb. respectively. A specimen of Castilloa rubber prepared by Weber's method of adding formaldehyde to the "creamed" latex (this Journal, 1902, 1461) had practically the same composition and value as the second of the two specimens described above, but was much lighter in colour.

Funtumia Rubber.—The rubber from *Funtumia elastica* is much superior to that from *F. africana*. Two specimens of rubber from trees of *F. elastica*, 4½ years old, the first having been prepared by addition of alcohol to the latex, and the second by heating the latex, had the following composition:—Moisture, 29·5, 21·2; caoutchouc, 60·2, 68·5; resin, 7·9, 7·9; dirt, 2·4, 2·4; ash (included in dirt), 1·37, 2·08 per cent.; they were valued at 2*s*. 6*d*. and 2*s*. 2*d*. per lb respectively. The specimen prepared by heating contained a considerable amount of uncoagulated latex.—A. S.

Seeds of the Para Rubber Tree (Hevea Brasiliensis): Commercial Utilisation of the ——. XII., page 68.

English Patent.

Insulating Materials and Artificial Substitutes for Ebonite, &c. O. D. Lucas. Eng. Pat. 2695, 1903. XI. A., page 67.

XIV.—TANNING; LEATHER, GLUE, SIZE.

Myrobalan Extracts; Behaviour of ——, when kept under Various Conditions. J. Paessler. Collegium, 1903, **2**, [89], 369—373. From Deutsche Gerber-Zeit., 1903.

If weak myrobalan liquors, of a strength very slightly above that employed in analysis, are allowed to stand, they show an even more serious loss of tannin than was observed in the case of strong myrobalan liquors (see Youl and Griffith, this Journal, 1901, 428—429). Two liquors, of about 0·5 per cent. tannin strength, lost in the course of five days 11·8 per cent. and 21·8 per cent. respectively of the original amount of tannin, whilst this loss became 27·5 per cent. and 32·7 per cent. respectively in a total period of 15 days. In view of its commercial importance the behaviour of strong liquid extracts was examined in the following manner:—A newly made extract was analysed, and four quantities of 1 litre each measured off into stoppered flasks. Of these, two were kept in the laboratory and two in a cool cellar, one of each pair being treated by addition of 1 per cent. of salicylic acid. Analyses were made of each after periods of 25, 50, 100, 220, and 420 days, and the final results are shown in the adjacent table.

Table showing Alteration in a Myrobalan Extract (25° B.) when kept for 420 Days.

—	Original condition.	Kept in Laboratory. Un-treated.	Kept in Laboratory. 1 per Cent. of Salicylic Acid added.	Kept in Cool Cellar. Un-treated.	Kept in Cool Cellar. 1 per Cent. of Salicylic Acid added.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Tannin........	22·1	20·1	19·8	21·7	21·9
Non-tannin ...	13·7	12·3	12·4	12·8	12·7
Insoluble matter	3·2	7·2	8·3	5·7	5·5
Water.........	61·0	60·5	59·5	59·8	59·9

Thus, whilst myrobalan liquors may deposit 25—30 per cent. of their available tannin in the course of 15 days liquid extracts such as the above lose barely 5 per cent. in the course of a year. It further appears (1) that salicylic acid has practically no effect, and (2) liquid extracts should be stored in a cool cellar to reduce the loss caused by deposition to a minimum.—R. L. J.

Tannin Analysis; Improved Apparatus for ——. R. A. Earp. XXIII., page 77.

English Patents.

Titanium Solutions and the Manufacture of Leather; Impts. relating to ——. C. Dreher, Freiburg, Germany. Eng. Pat. 27597, Dec. 15, 1902.

Tanning liquors are prepared by dissolving titanic acid in a carboxylic acid of the fatty series, or in other acids, in the presence of compounds containing several hydroxyl groups in the fatty residue, and adding alkalis or alkali carbonates until the liquor is neutral or alkaline, after which the liquor is acidified. Alternatively the titanic acid may be at once dissolved in alkali in the presence of the fatty acids (or salt) or hydroxyl compounds. These liquors may be used (1) in conjunction with vegetable tannins or mordant dyestuffs, (2) in acid, alkaline, or neutral condition, and (3) in any desired order or combination.—R. L. J.

Horn-like Material from Raw Skins; Process of Preparing a ——. E. Jetter, Erfurt. Eng. Pat. 4902, March 3, 1903.

See Fr. Pat. 330,006 of 1903; this Journal, 1903, 1056.
—T. F. B.

French Patent.

Tanning Machine. C. J. Glasel. Fr. Pat. 334,908, Aug. 28, 1903.

See Eng. Pat. 17,817 of 1903; this Journal, 1903, 1140.
—T. F. B.

XV.—MANURES, Etc.

Potassium Compounds; Soluble ——, in the Soil, and their Utilisation by Plants. T. Schloesing, jun. Comptes rend., 1903, **137**, [26], 1206—1209.

Maize was grown in pots of different soils, alongside each pot being a comparison pot of the same soil, kept in the same state of humidity, but with no plant growing in it. At the end of the period of growth, 100 grms. of each soil were exhausted of soluble matters by slow continuous percolation with water (containing calcium nitrate to coagulate the albuminous portions and secure a clear percolate). Each successive 7 litres of percolate were evaporated in platinum, and the potassium determined. When the amount in each of the two members of a comparison pair (which in the first washings was greater in the virgin soil) was the same, the washing was discontinued, and the total amount of potassium compounds in the two cases compared. The results were as follows:—

—	Soil from Boulogne. Un-cult.	Soil from Boulogne. Cult.	Soil from Galande. Un-cult.	Soil from Galande. Cult.	Soil from Joinville. Un-cult.	Soil from Joinville. Cult.	Soil from Neauphle. Un-cult.	Soil from Neauphle. Cult.
	Mgrms.		Mgrms.		Mgrms.		Mgrms.	
Soluble potassium oxide per kilo. of dry soil.	443	325	178	103	233	133	283	160
	Grms.		Grms.		Grms.		Grms.	
Difference for the 36 kilos. in each pot.	4·2		2·3		3·6		4·4	
Total potassium oxide in the plants.	5·7		2·3		4·1		5·2	

It appears, then, that the plants draw the greater part, if not the whole, of the potassium compounds which they contain, from the potassium salts dissolved in the water of the soil, and not by direct action of the roots on the solid substances. The author has already shown that the same thing occurs in the case of phosphoric acid.—J. T. D.

Sugar Canes grown on Heavy Clay Lands; Influence of Manures on ——. Report on the Agricultural Work in the Botanic Gardens and the Government Laboratory of British Guiana for 1902-3.

By the addition of nitrogen, in the form of ammonium sulphate, sodium nitrate, raw guano, or dried blood, increased yields of the cane are obtained. Ammonium sulphate and sodium nitrate, when used so as to supply not more than 10 lb. of nitrogen per acre, are of about equal value, but, when used in excess of this proportion, ammonium sulphate gives much better results, the best result appearing to arise from dressings of 2 to 3 cwt. of the salt per acre. Increased yields of cane are also obtained by the use of lime dressings.—T. F. B.

Sewage; Agricultural Value of City —— in India. J. W. Leather. Agric. Ledger, 1903, 37—49.

Analyses of sewage purified by the septic tank process at Manjri and Poona showed that a daily application of 1,000 galls. per acre for nine months would supply 308—423 lb. of nitrogen, 229—219 lb. of phosphoric acid, and 224—350 lb. of potash respectively. The amounts of these constituents contained in a sugar-cane crop were found to be:—Nitrogen, 131; phosphoric acid, 81; and potash, 358 lb. per acre; and these numbers do not represent the amounts permanently removed from the soil, since the ash constituents of the dry leaves and the crushed cane (which are used as fuel in the boiling process) may be returned to the land. The green tops are, moreover, fed to the cattle on the spot, and the manure applied to the soil. —N. H. J. M.

Sewage; Field Experiments with —— on the Bombay Farms. J. W. Mollison. Agric. Ledger, 1903, 50—54.

The experiments were undertaken by the Bombay Agricultural Department, to ascertain the value of purified sewage as manure for sugar-cane and various other crops. Two sets of experiments were made, one in which the effluent from the septic tank was passed through contact beds, and one in which the effluent flowed direct from the tank to the fields. In both cases the water was clear, and had little or no perceptible odour. The purified sewage cannot be applied continuously during the whole period of growth. Some of the more sensitive seedlings might probably with advantage be irrigated with canal water during the first period of growth. Then, again, it is unlikely that the sewage can be applied during the ripening period; in the case of sugar cane, results were obtained which point to the conclusion that the application of the effluent should be discontinued two or three months before the crop reaches maturity. "Lodging" may, however, be avoided, even with the heaviest crops, by adopting the Mauritius system of planting two sets in deep pits about 2·5 ft. apart. It is anticipated that the effluent will furnish remunerative results with sugar-cane, yams, onions, turmeric, surans, sweet potatoes, guinea grass, lucerne, and various sorghums. Very heavy crops of guinea grass, maize, lucerne, and sorghums were obtained at Poona.—N. H. J. M.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar Cane grown on Heavy Clay Lands; Influence of Manures on ——. XV., page 71.

Saccharose; Combination of ——, with Metallic Salts. D. Gauthier. XXIV., page 78.

English Patents.

Separating Apparatus [Sugar]; Centrifugal ——. H. Winter, Charlottenburg. Eng. Pat. 5316, March 6, 1903.

See Fr. Pat. 329,768 of 1903; this J., 1903, 1058.—T. F. B.

Sugar Filling Masses; Column-shaped Crystallisation Vessels for ——. R. Fölsche, Halle a S., and F. Nowak, Roswadze, Germany. Eng. Pat. 23,692, Nov. 2, 1903.

In this type of crystallisation vessel the hot masseeuite is charged into the top of a long, vertical cylindrical vessel, in which it is cooled and crystallised, a similar quantity being withdrawn from the bottom. The general defect of the system lies in the fact that the circumferential portions of the masseeuite cool much faster than the central portions, so that there remains a core of hot, partially crystallised masseeuite. This is remedied by providing stirring arms in the vessels, furnished with inclined blades, scoops, tubes, or inverted cones, or any device which causes a gradual transference of the masseeuite from the circumference to the centre, and *vice versâ*, during the period of cooling. The columns may also be partitioned off into separate chambers, with inlets and outlets on opposite sides of the axis. —J. F. B.

United States Patents.

Sugar Cane; Process of Treating ——. M. Weinrich, Yonkers, N.Y. U.S. Pat. 747,520, Dec. 22, 1903.

The juice of the sugar cane is defecated before the cane reaches the mill. The cane is first shredded into fine fibres, and then steeped in a boiling solution of lime, into which is introduced sufficient lime to neutralise the acidity of the juice; the treated mass is finally delivered to the ordinary cane mill.—J. F. B.

Sugar; Process of Extracting ——. L. Naudet, Paris. U.S. Pat. 746,734, Dec. 15, 1903.

The cold saccharine material is first mashed with sugar juice "at a temperature below that required to effect osmosis"; the mashed material is then subjected to the action of a "circulating body of hot sugar juice," having a density equal to or greater than the juice contained in the cellules of the material to be acted on, until its temperature reaches 77° C. The cell containing the heated material is then coupled up with the other cells of the battery in such a manner that it forms the last member of the series. The enriched heating juice is mixed with the weaker juices obtained from the battery, and the juice from the battery is passed through that cell of the series "which is, at the time, richest in sugar."—J. F. B.

Sugar Juice; Method of Continuous Carbonation of ——. L. Naudet, Paris. U.S. Pat. 746,735, Dec. 15, 1903.

A certain amount of sugar juice of definite alkalinity and a certain amount of carbon dioxide are introduced into a treating vessel, and the relative proportions of such introduced bodies are subsequently varied in accordance with the variations in the alkalinity of the carbonated juice flowing from the vessel, as determined by changes in the initially determined carbonation level.—J. F. B.

Sugar; Apparatus for Extracting ——. L. Naudet, Paris. U.S. Pat. 746,736, Dec. 15, 1903.

This specification relates to the apparatus, battery-cells connections, pumps and tanks, for working the process described in U.S. Pat. 746,734 (above); it includes a compensating vessel for mixing the juices to equalise the gravities.—J. F. B.

Sugar; Process of Purifying ——. C. A. Spreckels and C. A. Kern, New York, Assignors to Federal Sugar Refining Co., Jersey City. U.S. Pat. 716,891, Dec. 15, 1903.

See Eng. Pat. 17,912 of 1902; this J., 1903, 811.—T. F. B.

Sugar Crystals; Process of Cleaning ——, and Recovery of Cleansing Compositions employed. C. A. Spreckels and C. A. Kern, New York, Assignors to Federal Sugar Refining Co., Jersey City. U.S. Pat. 717,256, Dec. 15, 1903.

See Eng. Pat. 17,912 of 1902; this J., 1903, 811.—T. F. B.

Maltose; Process of Producing ——. C. B. Duryea, Sioux City. U.S. Pat. 746,933, Dec. 15, 1903.

See Eng. Pat. 22,537 of 1902; this J., 1903, 378.—T. F. B.

French Patent.

Beet Chips and other Moist or Wet Substances; Mechanical Drying of ——. J. C. F. Lateulle. Fr. Pat. 334,411. Aug. 1, 1903.

The chips are dried by a current of heated air drawn through the apparatus. This consists of a casing and a cylindrical rotary strainer provided with short radial wings on its inner periphery. The chips are fed upon a wire cloth table, which may be travelling or fixed. If travelling, the wire table is placed in a horizontal position diametrically throughout the length of the cylinder, and is given an endless motion transversely to the axis. If fixed, the table is situated at an angle to the horizontal, so that the chips will run down it by gravity. In either case the chips are transferred from one side of the table to the other, and they are then given a slight forward motion by means of a screw. Arrived at the other side of the table the chips are caught by the radial wings of the rotary screen, and returned to the side whence they started, at a point nearer the discharge end.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Yeast Crop; Determination of the ——, from the Nitrogenous Assimilation by the Yeast, and the Relation between Alcohol Production and Nitrogenous Assimilation. J. J. van Hest. Woch. f. Brau., 1904, **21**, [1]. 1—3.

The researches of Delbrück and Grimmer have shown that the loss of nitrogen sustained by the wort is a direct measure of the multiplication of the yeast. The author has confirmed this fact by comparing the results of nitrogen determinations before and after primary fermentation (six days) with those afforded by enumeration and filtration. On the large scale, the increase of the yeast cannot be determined by direct methods, owing to the impossibility of obtaining average samples of the yeast mixture. But if the nitrogen in the [filtered] wort be determined before and after primary fermentation, the yeast crop can be calculated. A litre of standard pitching yeast (see this Journal, 1904, 30) contains 7·541 grms. of nitrogen and about three billion cells. If a = the grms. of nitrogen abstracted from the wort per hectolitre, and if b = the grms. of nitrogen in the volume of standard pitching yeast sown per hectolitre, then the yeast crop [pitching yeast + increase] = $\frac{a + b}{7·541}$ litres of standard yeast per hectolitre. Two series of experiments are recorded, one series with yeast in good condition and another with yeast of poor quality. The average temperatures of fermentation were between 8·5° and 12·5° C.; determinations were made, after three days and after six days, of the alcohol produced and the nitrogen abstracted from the wort. The following are average values:—

——	Good Series.	Poor Series.
Attenuation after three days.........	2·4° Balling	2·5° Balling
" " six "	5·85° "	5·9° "
Assimilation of nitrogen in three days.	76 per cent. of total.	21 per cent. of total.
Yeast crop [standard] calculated from the nitrogen assimilated.	2·5 litres	1·9 litres
Increase calculated from the nitrogen assimilated.	5·3 times	3·5 times

It will be noticed that in spite of the great difference in the behaviour of the yeast as regards assimilation, the attenuations are practially the same in both series. In the good series, which may be regarded as representing normal fermentations, the production of alcohol varies inversely as the assimilation of nitrogen, thus:—

——	First Three Days.	Second Three Days.
Production of alcohol, per cent. of total	40	60
Assimilation of nitrogen, per cent. of total................................	76	24

Whilst the yeast is growing and multiplying, the production of alcohol is small, but when its biological work is nearing completion its physiological work becomes more active. Experiments on the effect of varying the proportion of pitching yeast showed that the yeast crop was unaffected even when the proportion of pitching yeast was doubled.
—J. F. B.

Pitching Yeast; Determination of the Number of Wild Yeast Cells in ——, by Drying with Calcium Chloride. C. Bergsten. Woch. f. Brau., 1904, **21**, [1], 8—9.

The following method is offered as an alternative to that proposed by Lindner (this Journal, 1903, 1018):—One grm. of yeast is carefully spread by a platinum needle, with aseptic precautions, on the bottom of a Petri dish. The yeast is then covered with freshly-ignited powdered calcium chloride and thoroughly mixed up by means of a sterilised pestle; the mixture is covered with a further layer of calcium chloride, closed up, and placed in the desiccator for half an hour. At the end of that time the mixture is dissolved in 100 c.c. of sterilised water, 1 c.c. of the solution is diluted with 9 c.c. of sterile wort, and 1 c.c. of this mixture, equal to 1 mgrm. of the yeast, is used for counting the number of wild yeast growths in drop-preparations or for infecting gelatin plate-cultures. If the operation has been properly performed, only wild yeast cells will have survived. Commenting on the above proposal, Lindner points out that it depends, like so many others (action of chemicals, high temperatures, &c.), upon the time of exposure. Different varieties of culture yeasts and wild yeasts will have different powers of resistance to the action of the calcium chloride. It would always be necessary, before applying the method, to determine the time of action suitable for the variety of pitching yeast under examination, and there must always be some varieties of wild yeasts which will succumb before all the culture yeast cells have been killed.—J. F. B.

Barleys Rich in Protein. Wielding. Woch. f. Brau., 1904, **21**, [1], 12—13.

Discussing the question of judging the protein content of a barley from its outward appearance, the author gives a table of analytical results and descriptions of outward appearance. From this table and from the author's experience, it would follow that the small-corned, plump barleys, with thin, finely-wrinkled husks, have the lowest amount of protein, and yield the highest proportions of extract; in such barleys the judgment of an expert buyer is not often at fault. But in the case of large-corned, elongated barleys with medium or coarse-fibred husks, it is shown that the amount of protein may vary between 9·81 and 15·67 per cent., and the expert maltster can rarely estimate it until he comes to malt the barley. With barley rich in protein, a satisfactory malt is only obtained by ensuring a long development both of rootlet and acrospire. Malting should only be attempted in cold weather, and the temperature in the couches should never exceed 20° C. The author has experienced difficulties in the malting of Saale and Thuringian barleys containing over 11 per cent. of protein, owing to their tendency to get hot. But with most foreign barleys no difficulties have been met with from this tendency, and a case is quoted of a Russian barley with 14·36 per cent. of protein which malted perfectly well, yielding a malt with 75·5 per cent. of extract on dry substance. On the other hand an Anatolian barley containing only 9·81 per cent. of protein yielded a malt with only 74·5 per cent. of extract. Differences like these may occur with barleys of the same origin, and are only to be attributed to qualitative differences in the nature of the protein, depending on soil and nutrition. The relations between the soluble and the insoluble proteids no doubt play a part in the behaviour of the barley, and they certainly affect the stability of the beer. Malts with a high protein content have the advantage over those poor in protein in that they favour the production of full-bodied beers with good "head"-retaining properties. The desire for barleys with low protein content may be pushed too far, and the fact that the effect of a high proportion of protein on the stability of the beer can be avoided by suitable malting is recognised by certain brewers for export, who buy barleys containing up to 12 per cent. of protein.—J. F. B.

Cider Making; Report on Investigations on ——. F. J. Lloyd. Board of Agriculture and Fisheries, 1903, 129 pp.; price 8*d*.

These investigations were made on behalf of the Bath and West and Southern Counties Society from 1893 to

1902. When the apples are ready, they should be cleansed or washed before crushing. The crushed pulp is called "pomace"; this is wrapped in cloths to form "cheeses," which are then pressed. The crushing and pressing apparatus have a great effect on the yield of juice; the improved English presses yield about 71·8 per cent. of juice from the apples. The Continental presses yield much less, but there the maceration of the pressed pulp with water is practised for a second yield of juice. The "pomace" should be pressed soon after crushing, since exposure to air darkens the colour. The only way by which the pressed "pomace," containing 18 per cent. of sugar, can be profitably utilised is by maceration with warm or cold water, equal to half the quantity of original juice, for 24 hours, the strength being made up with sugar to produce "small cider"; this, however, is inferior, and deficient in tannin. The juice is fermented by the yeasts present on the skins of the apples; the amount of sugar which should be present when the fermentation is checked depends on the kind of cider it is desired to make; the lees play no useful part in the production of quality. Filtration of the fresh juice being impracticable, it is clarified by running from the press into "keeves," which are upright tuns with loose covers. At a temperature of 50°—52° F. a "heady" fermentation is here conducted, which carries the suspended matter to the top in the form of a compact "head," which is skimmed off two or three times. Other portions of the suspended matter settle to the bottom, and when this violent fermentation has subsided, the partially clarified juice is carefully racked off into the fermentation casks; at this stage it contains less than 1 per cent. of absolute alcohol. During fermentation the bunghole of the cask should be closed by a "water-seal," whereby the evolution of gas can be observed; frequent hydrometer readings should also be taken. The speed of fermentation should preferably be slow, and if it shows a tendency to be too rapid, it must be checked by racking the cider off into fresh casks when necessary. The contents of the several casks having been brought to approximately the same stage simultaneously by judicious racking, the cider should be made up to a standard quality by blending, according to the results of chemical analysis. Any general departure from the standard strength will preferably have been corrected previous to fermentation by the addition of cane sugar or "small cider" to the juice in the fermentation casks. After blending, the cider should be racked once again before filtration. When the cider contains at least 4 per cent. of alcohol (*i.e.*, about 8 per cent. proof spirit), it is filtered clear and further alcoholic fermentation is checked. Tables are given by which the percentage of sugar and alcohol can be determined from the original and present gravities. From the filter, the cider is passed direct to the storage casks, which should lie on their sides, tightly bunged. After this stage all contact with air must be strictly avoided, and the cider should be drawn from the storage casks when required, only under a pressure of carbon dioxide. The future development of the industry undoubtedly lies in the direction of bottled cider. The bottles should be filled straight from the filter when the cider is perfectly clear; the gravity must not exceed 1·025, and the alcohol must amount to at least 4 per cent.; a slight sediment forms during the process of ripening. Three brands of cider should be manufactured: (*a*) "extra dry," which requires much care and skill, and is consequently expensive; this contains not more than 2 per cent. of sugar; (*b*) "dry," containing less than 4 per cent. of sugar; and (*c*) "sweet," containing more than 4 per cent. of sugar. The "dry" variety promises the greatest development and keeps well, provided acetification be prevented by rigid exclusion of air.—J. F. B.

FRENCH PATENT.

Yeast; Preservation of ——. The Granular Yeast Co., Ltd. Fr. Pat. 334,480, Aug. 7, 1903.

THE yeast is washed, if necessary, and then filter-pressed; the cakes are crumbled up and spread upon open-work trays, which are arranged on waggons. The waggons are placed in a drying chamber, through which dry filtered air, heated to a suitable temperature, is driven or aspirated.
—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Milk; Preservation of ——, by Hydrogen Peroxide. A. Renard. Monit. Scient., 1904, **18**, [745], 39.

THE author first proposed, in 1898, the use of hydrogen peroxide for the preservation of milk. If an amount of hydrogen peroxide not exceeding 2 per cent. of a 12-volume solution be added to milk, it is completely decomposed into water and oxygen in from six to eight hours. With larger additions, the decomposition proceeds more slowly, and with 5 per cent. of a 12-volume solution, a small quantity remains undecomposed even after several days. The rate of decomposition of the hydrogen peroxide varies with different kinds of milk, but, within certain limits, *e.g.*, between + 5 and + 30° C., is not affected by change of temperature. Milk is not sterilised by treatment with a small quantity of hydrogen peroxide, but after such treatment, it can be kept for a much longer time than ordinary milk without undergoing alteration. For example, at 11° C., a sample of milk turned sour after 24 hours; milk with 1 per cent. of 12-volume hydrogen peroxide, after 80 hours; with 2 per cent., after 90 hours; and with 3 per cent., after 95 hours; at 20° C., the corresponding figures were 13, 24, 26, and 32 hours. It is best to add the hydrogen peroxide immediately after milking, and then allow the milk to stand in a cool place for 6—8 hours, till the hydrogen peroxide is completely decomposed; the taste and odour of the milk are not altered. Tests as to the use of milk which had been treated with 1·5 per cent. of 12-volume hydrogen peroxide, for feeding infants, are stated to have given satisfactory results.
—A. S.

Caffeine and Theobromine [in Cocoa]; Determination of ——. J. Fromme. XXIII., page 78.

Seeds of Para Rubber Tree (Hevea Brasiliensis); Commercial Utilisation of the ——. XII., page 68.

UNITED STATES PATENT.

Milk Extract similar to Meat Extract; Process of Making ——. X. Binder, Paris. U.S. Pat. 747,678, Dec. 22, 1903.

SEE Fr. Pat. 329,709 of 1903; this Journal, 1903, 1062.
—T. F. B.

FRENCH PATENT.

Cacao Butter; Improvement of ——. G. Müller. Fr. Pat. 334,366, July 25, 1903. XII., page 69.

(*B.*)—SANITATION; WATER PURIFICATION.

City Sewage in India; Agricultural Value of ——. J. W. Leather. XV., page 72.

Sewage; Field Experiments with ——, on Bombay Farms. J. W. Mollison. XV., page 72.

ENGLISH PATENTS.

Water and other Liquids; Apparatus for the Purification of —— [by Electrolysis]. W. B. Hardy. Eng. Pat. 25,041, Nov. 14, 1902. XI. A., page 67.

Production of Lime Water and the like; Processes and Devices for the ——, and for the Purification of Water. H. Reisert, Cologne, Germany. Eng. Pat. 967, Jan. 14, 1903.

THE water or other liquid is caused to pass intermittently, from below upwards, through the quicklime, &c., under such pressure as to raise the whole mass of the material under operation. During the intervals of rest between the periods of liquid supply, the water becomes saturated, and clarifies by the settling of the solid materials. The quicklime, &c., is preferably in the form of a powder, and may be supported on a layer of gravel or similar material. Lime water formed in this manner may be employed, in the same apparatus, for the purification of water.—R. A.

(*C.*)—DISINFECTANTS.

United States Patent.

Disinfectant [*from Acetylene*]. *and Process of making same.* J. Choulet, Algiers. U.S. Pat. 747,138, Dec. 15, 1903.

See Fr. Pat. 321,088 of 1902; this Journal, 1903, 159.
—T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

English Patent.

Nitrocellulose and similar Substances; Compounds of ——. D. Bachrach, Baltimore. Eng. Pat. 22,970, Oct. 23, 1903.

See U.S. Pat. 743,422 of 1903; this Journal, 1903, 1304.
—T. F. B.

French Patents.

Viscose; Manufacture of Threads of ——. Soc. Franç. de la Viscose. Fr. Pat. 334,515, Aug. 8, 1903.

Soluble sulphides are removed from crude viscose by passing it through a solution of a salt of a metal which forms an insoluble sulphide, *e.g.*, a 10 per cent. solution of ferrous sulphate.—T. F. B.

Cellulose Xanthate; Purification of ——, *for the Preparation of Viscose.* Soc. Franc. de la Viscose. Fr. Pat. 334,636, Aug. 14, 1903.

Crude cellulose xanthate is completely coagulated by heating to 45°—50° C. (a process which only requires a few hours), and treated with some salt solution which will remove the impurities without rendering the viscose insoluble in caustic soda; solutions of sodium chloride, aluminium sulphate, alum, sodium bicarbonate, &c., are suitable. The purified viscose is finally dissolved in an alkali solution.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Solanin and Convallamarin; Sugar Components of ——. E. Votoček and R. Vondráček. Ber., 1903, **36**, [17], 4372—4373.

Referring to the note by Zeisel and Wittmann (this Journal, 1903, 1305), in which it is stated that the glucoside solanin contains another sugar besides glucose, the authors remark that they pointed out this fact a year ago. The same is also the case with the glucoside convallamarin. The products of hydrolysis of these two glucosides contain, besides *d*-glucose, a second hexose, which yields a methylphenylhydrazone melting at 187° C. It has now been found that, when this hydrazone is decomposed by benzaldehyde, *d* galactose is formed, and this sugar is therefore the second hexose in question. The melting point of galactose methylphenylhydrazone has been wrongly recorded by Lobry de Bruyn and A. van Eckenstein as 180° C.—J. F. B.

Cotarnine; Application of Grignard's Reaction to the Study of ——. M. Freund. XXIV., page 78.

Citronella Oil; Adulterated ——. E. J. Parry and C. T. Bennett. Chem. and Druggist, 1903, **63**, [1248], 1061.

A sample of a shipment of citronella oil recently imported was found by the authors to be adulterated with alcohol. The alcohol, which was present to the extent of 20 per cent., had probably been added to make an adulterated oil capable of passing the so-called Schimmel test. The oil had the following characters:—Sp. gr., 0·899; optical rotation, −12°; refractive index, 1·4578; geraniol content, 50 per cent.—A. S.

Citronella Oil; Determination of the Adulterant in ——. M. K. Bamber. XXIII., page 77.

Terpene; A New —— [*from Russian Terpentine*]. Zelinsky and Alexandroff. J. Russ. phys.-chem. Ges., **34**, 848.

The authors have isolated from Russian turpentine a pinene having the following characters:—Sp. gr., 0·8688; m. pt., 16° C.; b.p., 158·5°—159° C.; refractive index, 1·4700; optical rotation, −70° to −75°. It forms a hydrochloride melting at 121° C., but does not give a crystalline compound with nitrosyl chloride.—A. S.

Camphor Industry of Formosa; The ——. A. F. Collins. Scientif. American Suppl., 1903, **56**, [1455], 23,319.

Since the establishment of the monopoly by the Japanese Government, the old, crude methods have been replaced by more modern ones. The camphor wood is steamed in roughly-built furnaces and the camphor is condensed in cooled wooden vessels, and freed from most of the oil by draining, crude or "grade B" camphor being thus obtained. For the production of refined or "grade A" camphor, the crude material is heated in large iron retorts, through which a current of air is passed. For the first 48 hours, only sufficient heat is applied to drive off the water and oil. The retorts are then connected to a condensing chamber, the roof of which is cooled by running water, and are heated to a higher temperature in order to volatilise the camphor. The camphor obtained (flowers of camphor) is formed into blocks in wooden moulds and pressed first by steam power and finally by a very high hydraulic pressure. (See also this Journal, 1899, 799, 872; 1900, 482, 799, 945; 1901, 1261; 1902, 802; 1903, 892, 1032, 1317).—A. S.

Camphor; Artificial ——. A. F. Collins. Scientif. American, 1903, **89**, [21], 368.

The author gives a description of a process, which, it is stated, is being worked on a commercial scale at Port Chester, near New York, for the manufacture of camphor from oil of turpentine. By heating turpentine with anhydrous oxalic acid, two new compounds, pinyl oxalate and pinyl formate, are said to be formed, which, when subjected to steam distillation in the presence of alkali, yield camphor and borneol respectively. The mixture of turpentine and oxalic acid is heated in steam-jacketed tanks, and when the reaction is complete, the liquid mass is pumped into stills, alkali is added, and the mixture is distilled by the aid of live steam. From the distillate a mixture of camphor and borneol is recovered by fractional distillation. The crude product is filter-pressed, washed free from all traces of oil, and treated with an oxidising agent to convert the borneol into camphor. The crude camphor is centrifugalised and then purified by sublimation. The yield of camphor is stated to be from 25 to 30 per cent. of the weight of the turpentine. (See also Eng. Pat. 14,754 of 1900, and addition to Fr. Pat. 303,812; this Journal, 1901, 67; 1902, 1469; also 1901, 604.)—A. S.

Camphoric Acid and Dehydrocamphoric Acid; Synthesis of ——. G. Komppa. XXIV., page 78.

Vanillin; Oxidation of ——, *by the Oxidising Ferment of a Fungus or of Gum Arabic.* R. Lerat. J. Pharm. Chim., 1904, **19**, [1], 10—14.

On oxidising vanillin with a fungus extract or with gum arabic solution, dehydrovanillin was obtained, identical with that obtained by Tiemann by oxidising vanillin with ferric chloride (see this Journal, 1886, 252).—T. F. B.

Arsenious Iodide; Determination of ——. W. Duncan. XXIII., page 77.

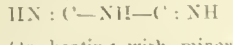
Hydroxylamine; Determination of ——. H. O. Jones and F. W. Carpenter. XXIII., page 77.

Vaselines; Artificial ——, *and Vaseline Oils.* J. Girard. III., page 55.

English Patents.

Pyrimidine Derivatives; Manufacture and Production of ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer & Co., Elberfeld. Eng. Pat. 21,833, Oct. 10, 1903.

By condensing dialkyl cyanoacetic esters with guanidine, by means of alkali alcoholates, dialkyldi-imino-oxypyrimidines, having the general formula—

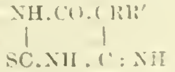


$$\begin{array}{l}N\,.\,CO\,.\,CRR'\\ \;|\qquad\quad\;\;|\\ HN : C—NH—C : NH\end{array}$$

are obtained. On heating with mineral acids the imino groups are replaced by oxygen, dialkyl barbituric acids being produced.—T. F. B.

Pyrimidine Derivatives; Manufacture and Production of ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer & Co., Elberfeld. Eng. Pat. 22,967, Oct. 23, 1903.

Dialkyl barbituric acids are obtained by first condensing dialkyl cyanoacetic esters with thiourea by means of alkali alcoholates, thus forming 5-dialkyl-2-thio-4-imino-6-oxypyrimidines—



$$\begin{array}{l}NH.CO.CRR'\\ \;\;|\qquad\quad\;|\\ SC.NH\,.\,C : NH\end{array}$$

from which the imino group is split off by hydrolysis, and the thiocarbonyl (: CS) group oxidised to a carbonyl group by means of nitric acid, hydrogen peroxide, &c.
—T. F. B.

United States Patents.

Methylene Hippuric Acid, and Process of Making same. A. Nicolaier and P. Hunsalz, Assignors to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 743,986, Nov. 10, 1903.

Hippuric acid reacts slowly with paraldehyde, or less satisfactorily with formaldehyde, in presence of sulphuric acid, forming methylene hippuric acid. This is a white crystalline compound of m. pt. 151° C., only slowly soluble in sodium carbonate solution, sparingly soluble in water, and of therapeutic value.—T. F. B.

Pinene Hydrochloride; Process of Purifying ——. W. Naschold, Assignor to Chem. Fabr. Uerdingen, Lienau & Co., Uerdingen. U.S. Pat. 747,629, Dec. 22, 1903.

See Fr. Pat. 328,009 of 1902; this Journal, 1903, 1101.
—T. F. B.

French Patent.

Anhydrides and Chlorides of Carboxylic Acids; Production of ——. Badische Anilin und Sodafabr. Fr. Pat. 328,120, Oct. 27, 1902.

See Eng. Pat. 24,255, 1902; this Journal, 1903, 1147.
—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic Processes; Theory of —— G. Jaeger. Akad. Wiss. Wien. Sitz. Ber., 1902, **111**, 1132—1143.

According to the author, if a dilute developer be used and the time of development be not too long, the degree of blackening is proportional to the concentration of the developer; to the amount of "active" silver bromide, *i.e.*, silver bromide which by the action of the light has become capable of being reduced; and to the time of development. When the development is prolonged, the degree of blackening tends to become proportional to the square root of the amount of active silver bromide. The active silver bromide can be completely reduced only by the use of concentrated developers.—A. S.

English Patents.

Photographic Pictures in Natural Colours; Production of ——. J. Szczepanik, Vienna. Eng. Pat. 3196, Feb. 10, 1903.

Three monochrome ("three colour") diapositives are printed, without filters, on films of transparent material, coloured with the corresponding dyestuffs, which must be sensitive to light; the three monochrome prints are superposed in register and fastened together in the usual way; or the monochrome diapositive, *e.g.*, for red, is printed on a celluloid film coloured red, the remaining dyestuff is fixed and the film varnished, and a second film coloured yellow is applied, and printed on, in register, through the diapositive for yellow, and so on.—T. F. B.

Developing Photographic Pictures [with m-Amino-o-Hydroxybenzylsulphonic Acid]. H. E. Newton, London. From the Farbenfabr. vorm. F. Bayer & Co., Elberfeld. Eng. Pat. 3546, Feb. 14, 1903.

See U.S. Pat. 729,054 of 1903; this Journal, 1903, 881.
—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

French Patent.

Explosive Powder. N. Schnebelin. Fr. Pat. 334,673, Aug. 18, 1903. Under Internat. Conv., Oct. 30, 1902.

See Eng. Pat. 21,363, 1903; this Journal, 1903, 1367.
—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUANTITATIVE.

Chlorine, Bromine or Iodine in Organic Compounds; Rapid Method of Determining either ——, by means of Sodium Peroxide. H. H. Pringsheim. Ber., 1903, **36**, [17], 4244—4246.

The substance is mixed with 16—18 times its weight of sodium peroxide, according as the carbon and hydrogen it contains, amount to 50—75 or to over 75 per cent. of its weight. Substances poorer in carbon and hydrogen are mixed with sufficient sugar or naphthalene to bring up the percentage to above 50, and the mixture is then mixed with the sodium peroxide. The mixture is placed in a cylindrical flat-bottomed iron crucible, about 2·5 cm. in diameter and 3 cm. high, furnished with a flat lid through which a hole is drilled. The crucible is now set in a porcelain basin filled with water up to within 2 or 3 mm. of the upper edge of the crucible, and the mixture fired by pushing a glowing iron wire through the hole in the lid. After combustion the crucible is turned on its side in the water, the lid also immersed, the basin quickly covered with a clock-glass, and the whole warmed till no more bubbles of oxygen come off, and solution is practically complete. The crucible and lid are removed and rinsed, the liquid is filtered, and the filtrate poured into excess of sulphurous acid, so as to reduce any oxyhalogen compounds. To the liquid (now about 500 c.c.) nitric acid is added, and enough silver nitrate to precipitate the halogen; the whole is warmed for some time on the water-bath, the precipitate filtered off, washed, dried, and weighed. Accurate results have been obtained with a great variety of halogen compounds. This iron crucible method is also suitable for the determination of sulphur in organic compounds as described by von Konek. (Zeits. angew. Chem., **16**, 516; also this Journal, 1903, 381.)
—J. T. D.

Silver Cyanide and Silver Chloride; Separation and Determination of ——. R. H. A. Plimmer. Proc. Chem. Soc., 1903, **19**, [273], 285.

Freshly precipitated silver cyanide, although insoluble in cold dilute nitric acid, readily dissolves in the boiling acid, evolving the theoretical quantity of hydrogen cyanide, so that the gas, when passed into silver nitrate solution, produces an amount of silver cyanide equal in weight to the sample originally employed. In this way silver cyanide may be quantitatively separated from silver chloride. When the cyanide has been dried at 100° C., the hard lumps produced offer a greater resistance to the solvent, and if the boiling be prolonged, the acid, on becoming more concentrated, oxidises a small proportion of the hydrogen cyanide.

Arsenious Iodide; Determination of ——. W. Duncan. Pharm. J., 1904, **72**, [3402], 8.

The method proposed depends upon the titration, with iodine solution, of the arsenious oxide produced by the hydrolysis of arsenious iodide in alkaline solution. A weighed quantity of the arsenious iodide is dissolved in sodium or potassium bicarbonate solution, and the liquid titrated with N/10 iodine solution, 1 c.c. of which corresponds to 0·02261 grm. of arsenious iodide. The author states that the variable composition of commercial arsenious iodide is chiefly caused by undue exposure to light and moist air. The anhydrous salt crystallised from boiling carbon bisulphide, keeps fairly well, if protected from moisture. —A. S.

ORGANIC—QUANTITATIVE.

Hydroxyl Radicles; Determination of ——. H. Hibbert and J. J. Sudborough. Proc. Chem. Soc., 1903, **19**, [273], 285.

In attempting to determine hydroxyl groups by Tschugaeff's method (this Journal, 1902, 1859), the authors have not succeeded in obtaining satisfactory results, owing to the following causes:—(1) Moisture gradually penetrates through the india-rubber, even although this is coated with collodion. (2) The vapour pressure of ether varies so enormously with slight alterations of temperature. (3) Grignard's magnesium methyl iodide solution slowly absorbs atmospheric oxygen. The following method is free from the foregoing objections; dry amyl ether is used as the medium, instead of ordinary ether, and the operation is carried out in an ordinary bottle provided with a double-bored india-rubber stopper, so that the bottle may be attached to (1) a Lunge's nitrometer filled with dry mercury, (2) a glass tube provided with a stopcock, so that the air in the apparatus may be replaced by dry nitrogen. The amyl ether solution of the hydroxyl compound is placed in the bottle and a solution of Grignard's magnesium methyl iodide in the same solvent is introduced in a small tube; when a constant temperature has been attained, the two solutions are mixed. Satisfactory results have been obtained with α- and β-naphthols, resorcinol, o-nitrophenol, acetoxime, deoxybenzoin, and chloral hydrate. Quinol gives somewhat low results, probably owing to the fact that it is only sparingly soluble in amyl ether.

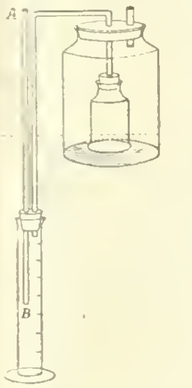
p-Nitrotoluene in Crude Nitrotoluene; Volumetric Method for the Determination of ——. B. Glasmann. Ber., 1903, **36**, [17], 4260—4261.

Ten c.c. of the oil are reduced by warming with 20 grms. of water, 20 grms. of iron filings, and 1 grm. of hydrochloric acid of sp. gr. 1·19 for six hours. 0·2 to 0·3 grm. of the resulting toluidine mixture is dissolved in 80 c.c. of ether and the p-toluidine precipitated with 25 c.c. of a 5 per cent. ethereal solution of oxalic acid. The precipitate of p-toluidine oxalate is washed with ether, dissolved in warm water, and titrated with N/10 sodium hydroxide solution, using phenolphthalein as indicator. —E. F.

Citric Acid; Determination of ——, *by the Lime Method.* O. v. Spindler. Chem.-Zeit., 1903, **27**, [103], 1263.

According to text-books, tricalcium citrate, when converted from the amorphous into the crystalline condition, becomes practically insoluble in water, and a method for the quantitative determination of citric acid has been based upon this statement. The author finds, however, that the precipitation of crystalline tricalcium citrate by boiling, even in concentrated solutions, and in presence of ammonium chloride, is not quantitative, and consequently the lime method for the determination of citric acid is quite unreliable, the amount of precipitate obtained being dependent upon the volume of the solution. Crystalline tricalcium citrate, $Ca_3(C_6H_5O_7)_2 + 4H_2O$, loses part of its water of crystallisation slowly even at 100° C. Tricalcium citrate obtained by neutralising citric acid with calcium hydroxide, always contains somewhat more calcium than the theoretical amount.—A. S.

Tannin Analysis; Improved Apparatus for ——. R. A. Earp. Leather Trades Rev., 1903, [921], 791.



The adjoining sketch illustrates a device for use in connection with the hide-powder filter which permits of any desired exact quantity of the detannised solution being collected automatically. The tube A B, open at both ends, is about 15 ins. long, according to the length of the siphon arm, and slides in the tightly fitting rubber stopper as shown, whilst the cork in the upper vessel fits loosely. To collect 30 c.c., the end B of this tube is adjusted to the level of the 30 c.c. mark in the graduated cylinder, and filtration is started by gentle suction at A. When 30 c.c. have come over, the tube A B simply fills up to the level of the liquid in the upper vessel, and filtration then stops. In a similar manner 50—55 c.c. (for evaporation) may be collected and stopped automatically by adjusting B to the corresponding mark on the cylinder. (See also Leather Trades J., Dec. 9. 1903, 860.)—R. L. J.

Hydroxylamine; Determination of ——. H. O. Jones and F. W. Carpenter. Proc. Camb. Phil. Soc., **12**, [3], 218.

According to the authors, the ordinary methods for the determination of hydroxylamine are inaccurate in presence of metallic salts and carbon dioxide. Reliable results can, however, be rapidly obtained by means of the method devised by Wood and Berry for the determination of reducing sugars (this Journal, 1903, 886). 10—20 c.c. of a solution of hydroxylamine or of one of its salts (containing not more than 0·5 per cent. of hydroxylamine) are run, with stirring, into 30 c.c. of a boiling Fehling solution, or a solution of copper carbonate in potassium bicarbonate. The mixture is heated to boiling, the cuprous oxide immediately filtered off, washed, dissolved in ferric sulphate solution in an atmosphere of carbon dioxide, and the ferrous sulphate produced titrated with permanganate solution. 4 mols. of potassium permanganate are equivalent to 10 mols. of hydroxylamine, the reduction of the copper proceeding according to the equation $2NH_2OH + 4CuO = N_2O + 2Cu_2O + 3H_2O$. Metallic salts, alcohol, and ketoximes do not interfere with the method.—A. S.

Citronella Oil; Determination of the Adulterant in ——. M. K. Bamber. Proc. Chem. Soc., 1903, **19**, [273], 292.

A mixture of 2 c.c. of pure cocoanut oil free from acid and 2 c.c. of the citronella oil under examination is shaken for one minute with 20 c.c. of 83 per cent. alcohol (sp. gr. 0·8273 at 30° C.) in the graduated tube (see figure), this vessel being then rotated in a centrifugal machine for 0·5 to 1·0 minute. The volume of cocoanut oil, which now contains the impurity originally present in the citronella oil, is ascertained, and this reading minus 2 c.c. represents the volume of the adulterant. For example, 2·45 c.c. of residual oil represent 0·45 c.c. of impurity in the 2 c.c. of citronella oil, or an adulteration of 22·5 per cent. A standard oil should be tested occasionally against the unknown samples in order to eliminate errors arising from the use of alcohol of different strengths. In this way, the adulterant is separated and estimated in three or four minutes, the test being conducted at 29°—30° C.

Caffeine and Theobromine [in Cocoa]; Determination of ——. J. Fromme. Apoth.-Zeit., **18**, 68. Pharm. J., 1903, **71**, [3401], 948.

The author finds that the best results are obtained by Welman's method (this Journal, 1902, 1476). He recommends, however, that the cocoa be boiled with water acidulated with sulphuric acid (3 grms. of dilute acid to 200 grms. of water) in order to convert the starch into sugar, and that, after boiling with magnesia in the usual manner and filtering, an aliquot part of the filtrate be taken, so as to avoid the tedious washing of the powder.—A. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Stannimethane; Preparation of the Tetra-alkyl Derivatives of ——. W. J. Pope and S. J. Peachey. Proc. Chem. Soc., **19**, [273], 290.

Tetraethylstannimethane, $Sn(C_2H_5)_4$, is prepared by adding stannic chloride (1 mol.), dissolved in light petroleum, to the ethereal solution of magnesium ethyl bromide (4·5 mols.), washing with dilute acetic acid, and distilling the ethereal solution; it boils at 180°—181° C. under 758 mm. pressure.

Dimethyldiethylstannimethane, $Sn(CH_3)_2(C_2H_5)_2$, may be prepared either by the action of magnesium methyl iodide on diethylstannimethylene chloride, bromide, or iodide, or by that of magnesium ethyl bromide on dimethylstannimethylene chloride, bromide, or iodide in ethereal solution. After treating with water and distilling the ethereal solution, the substance is obtained as a colourless liquid identical with that prepared by Frankland's method.

Trimethylethylstannimethane, $Sn(CH_3)_3C_2H_5$, is obtained by treating trimethylstannimethyl bromide or iodide with the calculated quantity of magnesium ethyl bromide in ethereal solution, washing with dilute acetic acid, and fractionally distilling the ethereal solution; it boils at 107°—108° under 758 mm. pressure.

Trimethylpropylstannimethane is similarly prepared by the action of magnesium propyl bromide or iodide on trimethylstannimethyl bromide, and forms a colourless liquid boiling at 129° C. under 761 mm. pressure. Triethylpropylstannimethane, $Sn(C_2H_5)_3C_3H_7$, from triethylstannimethyl bromide, boils at 195° under 764 mm. pressure.

Dimethylethylpropylstannimethane—

$$Sn(CH_3)_2(C_2H_5)(C_3H_7),$$

prepared by the action of propyl magnesium bromide or iodide on dimethylethylstannimethyl bromide, boils at 153° under 762 mm. pressure.

Methylethyldipropylstannimethane, obtained from methylethylstannimethylene iodide and magnesium propyl bromide, is a colourless liquid boiling at 183°—184° C. under 758 mm. pressure.

Tetraphenylstannimethane, $Sn(C_6H_5)_4$, is conveniently prepared by the action of stannic chloride on magnesium phenyl bromide.

Saccharose; Combination of ——, with Metallic Salts. D. Gauthier. Comptes rend., 1903, **137**, [26], 1259—1261.

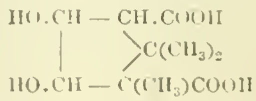
Saccharose forms compounds with potassium iodide, lithium chloride, bromide, and iodide, of the formula $C_{12}H_{22}O_{11}.MR.2H_2O$, with calcium bromide and iodide, of the formula $C_{12}H_{22}O_{11}.CaR_2.3H_2O$, with strontium chloride and bromide of similar formula, and with barium chloride, bromide, and iodide of formula $2C_{12}H_{22}O_{11}.BaR_2$. The characters of these compounds are now being studied.
—J. T. D.

Cotarnine; Application of Grignard's Reaction to the Study of ——. M. Freund. Ber., 1903, **36**, [17], 4357—4259.

Whilst hydrocotarnine is a very stable body, certain of its substitution derivatives, such as cyanohydrocotarnine and ethoxyhydrocotarnine, are very readily converted by dilute hydrochloric acid into cotarnine hydrochloride and hydrocyanic acid and alcohol respectively. Narcotine, which is a substitution derivative of hydrocotarnine of the same type (the α-position), is stable towards hydrochloric acid, and it is probable that bases generally, which are derived from hydrocotarnine by the substitution of a hydrocarbon radical in that position, are also unaffected by hydrogen ions. Such bases can easily be prepared by Grignard's reaction, and the author has obtained α-methylhydrocotarnine by the action of magnesium-methyl iodide. This base is a thick fluid sparingly soluble in water and readily soluble in ether, and several crystalline salts of it are described.—J. F. B.

Camphoric Acid and Dehydrocamphoric Acid; Synthesis of ——. G. Komppa. Ber., 1903, **36**, [17], 4332-4335.

Diketo-apocamphoric ester, obtained by condensing oxalic ester with β-β-dimethylglutaric ester (Ber., 1901, 2472), on methylation, gave a methyl derivative, which, on reduction with sodium amalgam, gave dihydroxycamphoric acid—



$$\begin{array}{l} HO.CH - CH.COOH \\ \quad | \qquad\qquad \rangle C(CH_3)_2 \\ HO.CH - C(CH_3)COOH \end{array}$$

On heating this latter with hydriodic acid and amorphous phosphorus, a dehydrocamphoric acid was obtained, which combined with hydrobromic acid to a bromocamphoric acid; this, on reduction with zinc dust and glacial acetic acid, gave an oily product, consisting of a mixture of *cis*- and *trans*-camphoric acids. The *cis*-acid was converted into its anhydride by means of acetyl chloride, the *trans*-acid, which remains unchanged, being removed by washing with sodium hydroxide solution. The camphoric anhydride thus obtained proved to be identical with the natural product; the identity was further established by conversion into the acid, which was identical with *i*-camphoric acid. This synthesis conclusively establishes Bredt's formula for camphor, since camphoric anhydride can be converted into camphor (see this Journal, 1896, 372).—T. F. B.

Prizes.

Alcohol, Denaturing; Prize for the Best Method of ——.

Bd. of Trade J, *Jan.* 7, 1904.

With regard to the prize of 50,000 roubles (5,300*l.*) offered by the Russian Ministry of Finance for the discovery of the best method of denaturing alcohol (this Journal, 1903, 1109), an Official Notice (in French) issued by the Russian Ministry of Finance with regard to this competition may be seen on application at the Commercial Intelligence Branch of the Board of Trade, 50, Parliament Street, S.W.

New Book.

Rubber, Gutta-percha, and Balata. By Franz Clouth. English Translation, with Additions and Emendations by the Author. Maclaren and Sons, 37 and 38, Shoe Lane, E.C. London, 1903. Price 12*s.* 6*d.* net. D. van Nostrand Company, Murray and Vesey Streets, New York, U.S.A.

8vo volume containing prefaces to English and German editions, table of contents, list of botanical illustrations, and text, filling 212 pages. These pages are illustrated with 30 engravings and a map. The treatment of the subject may be gathered from the following abstract of the contents:—Indiarubber: I. Historical. II Natural History. Indiarubber Plants. Climatic Conditions. Cultivation. III. Production of Raw Rubber. IV. Commercial Points. V. Chemical and Physical Properties of Raw Rubber. VI. Production of Soft Rubber Goods. VII. Vulcanisation. VIII. Chemical and Physical Properties of Vulcanised Soft Rubber. IX. Hard Rubber ("Ebonite."). X. Regenerated and Artificial Rubber. Gutta-percha: I. Historical. II. Natural History. Gutta Plants, &c. Climatic Conditions. Cultivation. III. Production of Raw Gutta-percha.

IV. Commercial Points. V. Chemical and Physical Properties. VI. Production and Employment of Gutta-percha Goods. BALATA: Historical. Geographical Distribution. Methods of Production. Commercial Points. Characteristics. Physical and Chemical Properties. Employment of Balata Goods. Survey of the Principal Products made of India-rubber, Gutta-percha, and Balata.

Trade Report.

I.—GENERAL.

FOREIGN TRADE OF THE UNITED KINGDOM IN 1903.

Bd. of Trade J., Jan. 14, 1904.

The following table shows the foreign trade of Great Britain in certain articles during 1903, with corresponding figures for 1901 and 1902:—

Article.	Imports.			Exports.		
	1901.	1902.	1903.	1901.	1902.	1903.
	£	£	£	£	£	£
Coal, coke and patent fuel	22,223	4,101	3,987	30,334,748	27,581,136	27,262,779
Iron ore, scrap iron and steel	4,672,336	5,091,972	4,888,702	284,944	336,763	455,220
Other metallic ores	5,709,062	5,414,737	5,924,657	55,074	68,469	134,844
Oil-seeds, nuts, oils, fats, and gums	23,208,132	25,234,400	24,163,925	2,815,043	3,132,895	2,976,743
Hides and undressed skins	8,001,576	8,019,045	7,382,588	330,361	375,931	1,279,331
Materials for paper-making	3,453,306	3,386,773	3,430,997	382,670	379,037	409,647
Chemicals, drugs, dyes and colours	9,060,580	9,026,584	8,846,688	10,963,497	11,559,057	12,079,554
Earthenware and glass	4,528,499	4,678,473	4,780,700	3,049,952	2,997,529	3,278,797
Paper	4,342,234	4,537,674	4,843,682	1,668,577	1,672,704	1,797,861

WEIGHTS; NEW BRITISH STANDARD OF ——.

U.S. Cons. Reps., No. 1836, *Dec.* 28, 1903.

The Board of Trade, under a special Order in Council, will sanction the use of a weight of 50 lb., in addition to the present standards of 112 lb. and 56 lb. The 50 lb. is by this action made a legal standard of weight.

II.—FUEL, GAS, AND LIGHT.

CARBON; RETORT ——: U.S. CUSTOMS DECISION.

Dec. 17, 1903.

The residuum of carbon which accumulates on the inner side of gas retorts when the gas is made from bituminous coal was held by the Board of General Appraisers to be dutiable at 20 per cent. *ad valorem,* under paragraph 415 of the present Tariff Act. An analysis showed the substance to contain 92·66 per cent of fixed carbon, and it was assessed for duty under paragraph 97 at 25 per cent. *ad valorem,* as an "article composed of carbon." The Board held that it was similar to coke and reversed the action of the Customs authorities.—R. W. M.

VII.—ACIDS, ALKALIS, Etc.

AMMONIUM SULPHATE STATISTICS.

Bradbury and Hirsch, Jan. 1904.

The estimated production of ammonia calculated into sulphate (including that used in the ammonia-soda and other chemical processes) from all sources in the United Kingdom, during 1903, is shown in the following table, together with the corresponding figures for the three preceding years:—

——	1900.	1901.	1902.	1903.
	Tons.	Tons.	Tons.	Tons.
Gas works	142,000	143,000	150,000	152,000
Iron	17,000	16,500	18,500	18,000
Shale	37,000	40,000	37,000	37,500
Coke and carbonizing works and producer gas.	17,000	18,000	23,500	26,500
	213,000	217,500	229,000	234,000

Of the total production in 1903, England contributed 154,500 tons; Scotland, 77,000 tons; Ireland, 2,500 tons.

NITRATE OF SODA STATISTICS.

W. Montgomery & Co., Dec. 31, 1903. *Shipments, Consumption, Stocks, and Prices from* 1901 *to* 1903.

——	1901.	1902.	1903.
	Tons.	Tons.	Tons.
Shipments from South American Ports to all parts for the six months ended 31st December	683,000	765,000	874,000
Shipments from South American Ports for the 12 months ended 31st December	1,238,000	1,360,000	1,424,000
Afloat for Europe on 31st December	374,000	374,000	478,000
Stocks in United Kingdom ports:—	25,000	26,000	23,000
Stocks in Continental ports on 31st December	218,000	237,000	132,000
Consumption in United Kingdom for the six months ended 31st December	35,000	35,000	33,000
Consumption on Continent for the six months ended 31st December	229,000	249,000	263,000
Consumption in United Kingdom for the 12 months ended 31st December	118,000	111,000	110,000
Consumption on Continent for the 12 months ended 31st December	1,036,000	917,000	1,017,000
Consumption in United States for the 12 months ended 31st December	192,000	214,000	265,000
Consumption in other Countries for the 12 months ended 31st December	18,000	17,000	20,000
Consumption of the World for the 12 months ended 31st December	1,364,000	1,259,000	1,412,000
Visible supply on 31st December (including the quantity afloat for Europe and Stocks in United Kingdom and Continent)	617,000	660,000	633,000
Price on 31st December per Cwt.	*9s. 6d.*	*9s. 1½d.*	*9s. 7½d.*

——	1901.	1902.	1903.
	Tons.	Tons.	Tons.
Liverpool	5,000	6,500	4,500
London	2,000	3,600	4,100
Out ports	18,000	15,900	14,400

COAL TAR AND AMMONIA PRODUCTION OF THE UNITED STATES IN 1902.

U.S. Geological Survey; through Chem. Trade J., Jan. 9, 1904.

In 1898 the 433 companies from which returns were received produced about 4,023,000 galls. of tar and 7,152,600 lb. of ammonium sulphate. The figures are approximations, although believed to be fairly accurate, and are estimated on a basis of 10 galls. of tar and 20 lb. of ammonium sulphate to the ton of coal carbonised. Including the output of tar and ammonium sulphate from retort-oven coke plants in 1898, the total production in that year (reducing the ammonia liquor reported to its equivalent in sulphate) was as follows:—ammonium sulphate, 31,102,296 lb.; tar, 28,407,798 galls. In 1902, the production of ammonia, reduced to its equivalent in sulphate, was 68,248,686 lb., and the production of tar 53,171,733 galls., an increase of more than 100 per cent. in the case of sulphate and of nearly that percentage in the case of tar. The aggregate value of all the products obtained from the distillation of coal in gas works or retort ovens in 1902 was 43,869,440 dols. About two-thirds of this amount, or 29,342,881 dols., was represented by the value of the gas produced. The value of the coke produced was 11,267,608, while the tar was worth, at the works, 1,873,966 dols. Most of the ammonia produced was sold in the form of ammoniacal liquor, which varied widely in the strength of the solution. This strength of solution ranged from 1·72 to 35·83 oz. of of ammonia per gallon. The total quantity of ammoniacal liquor sold was 49,490,609 galls., containing 14,683,374 lb. of ammonia, and was worth, at the works, 1,065,300 dols. In addition to this, there was an actual production of 11,276,502 lb. of sulphate, which sold for 319,685 dols.

The total production of tar from gasworks and bye-product ovens in 1902 amounted to 53,171,733 galls., valued at 1,873,966 dols., or 3·524 cents per gallon. In 1898, the production from gasworks alone was 24,384,798 galls., worth 902,400 dols., or 3·7 cents per gallon. The price in 1902 varied from 2·7 cents in Alabama to 10 cents in Oregon. The lowest price reported in 1898 was 2·23 cents in Indiana, and the highest price was 10·17 cents in Montana and New Mexico. From this it will be seen that, on the whole, the value of the tar produced has not changed materially since 1898.

The largest production of tar in 1902 was in Massachusetts, with New York second, Ohio third, and Pennsylvania fourth. In 1898, New York held first place, with Pennsylvania, Ohio, and Massachusetts following in the order named.

Of the 533 companies from which reports were received in 1902, there were only 106 which reported the recovery of ammonia, either in the form of ammoniacal liquor or as sulphate. These 106 companies reported a total production of 49,490,609 galls. of ammonical liquor, which sold for 1,065,300 dols., and 11,276,502 lb. of sulphate, which sold for 319,685 dols., a total value for the ammonia sold of 1,384,985 dols. The total quantity of coal carbonised or coked at the works operated by the companies in 1902 was 4,077,478 short tons. The companies which produced ammoniacal liquor used 3,436,312 tons of coal, and 641,166 tons were carbonised by the companies selling their ammonia as sulphate. From this it appears that the average yield per short ton of coal carbonised was 14·4 galls. of liquor and 17·6 lb. of sulphate.

In the report on this subject covering the year 1898, the total amount of ammoniacal liquor sold by 70 establishments from which returns were received was reported at 25,749,792 galls., which sold for 248,148 dols. This production, reduced to its equivalent in ammonium sulphate, is estimated to have been 23,949,696 lb. The sulphate equivalent of the 49,490,609 galls. of liquor sold in 1902 was 56,972,184 lb., which, added to the 11,276,503 lb. of sulphate separately reported, would be equal to a total production of 68,248,686 lb. of sulphate in 1902. Comparatively little progress in the manufacture of chemical products from coal tar has been made in the United States. Although over 50,000,000 galls. of coal tar are produced annually, the principal uses made thereof are in the manufacture of roofing paper, the creosoting of lumber, and for the preparation of street-paving material. The coal tar produced in 1902 was worth, at first hand, 1,873,966 dols. In the fiscal year ended June 30, 1902, the coal-tar products imported into the United States were worth, at points of shipment, 7,494,340 dols. The duty paid on these imports amounted to 1,594,799 dols., making the total cost, exclusive of freight, other expenses, and jobbers' profits, 9,089,139 dols. In the fiscal year ended June 30, 1903, the value of these imports was 7,690,895 dols.; duty, 1,692,145 dols.; total, 9,383,333 dols. A conservative estimate would place the total value of these products in the wholesale markets of this country at 12,000,000 dols., in both 1902 and 1903. The following figures show the value of the coal-tar products imported into the United States in the fiscal year 1903:—Salicylic acid, 19,012 dols.; colours or dyes, natural and artificial, 660,464 dols.; aniline salts, 789,553 dols.; coal-tar colours or dyes not specially provided for, 5,252,611 dols.; coal-tar preparations, not colours or dyes, 544,176 dols.; coal-tar products, not medicinal and not dyes (benzol, toluol, &c.), 425,019 dols.; total, 7,690,885 dols.

SULPHUR PRODUCTION OF SICILY IN 1902.

Eng. and Mining J., Dec. 24, 12, 1903.

The official returns of sulphur mining in Sicily in 1902, which have just been published, show that the production was 510,332 metric tons, as compared with 537,615 tons in 1901. At the close of the year there were 1,119 mines, of which 750 were actively operated, or 16 less than in the previous year. The number of labourers employed in the mines was 32,045, and in the refining works 5,744. The statistics show that the decline in the quantity of sulphur obtained from kilns (*calcaroni*), which has been noted in previous years, continued in 1902, and there was a corresponding increase in the output of the works employing other methods of extraction.

PHOSPHATE DEPOSITS IN SOUTH AUSTRALIA.

Bd. of Trade J., Dec. 31, 1903.

The *Queensland Government Mining Journal* states that another deposit of phosphate has been found on Yorke Peninsula, South Australia. The Government geologist of the State reports that it is similar in mode of occurrence to the deposits of Clinton, Bright, and Belvidere. Trenches have been made in two principal places, at a distance of about 100 yards apart, which have exposed boulders and lumps of phosphate rock, associated with argilaceous, arenaceous, and calcareous beds.

Samples taken from the workings showed on analysis tricalcic phosphate, 82·95 per cent., 74·8 per cent., 72·36 per cent., and 70·07 per cent. At the north end of the section samples, consisting of basic phosphate of alumina, with limestones, clay, &c., on analysis returned from 13 to 22·4 per cent. of phosphoric acid. The Cambrian limestone is exposed in several detached areas over this and the adjoining hundreds as far south as Curramulka, and it is in the vicinity of these outcrops that phosphate rock deposits are most likely to be found.

X.—*METALLURGY.*

MINING INDUSTRY OF BELGIUM IN 1902.

Eng. and Mining J., Dec. 24, 1903.

The output of the principal minerals other than coal in 1902 is shown below, the values being converted into English currency on the basis of 25 fr. to 1*l.*:—

——	Metric Tons.	Value.
		£
Barytes	33,000	9,220
Iron ore	156,580	27,190
Lead ore	164	514
Manganese ore	14,440	7,092
Marble	15,490	101,700
Phosphatic chalk	*315,200	56,584
Phosphate rock	135,850	59,568
Slate	37,120	53,666
Zinc ore	3,852	7,621

* Cubic metres.

As compared with the production in the previous year, the table shows a marked falling off in the output of iron and zinc ores and a slight gain in slate, manganese ore, and barytes.

The output of coal in 1902 showed an increase of 664,060 tons, or 3 per cent., but it was still about 600,000 tons less than the total recorded in 1900. The mines of the Liège basin contributed the greater part of the increment. The number of mines in operation was 119, giving employment to 134,889 workmen. The output was :—

——	Metric Tons.	Value.
		£
Coal	2,877,470	12,081,116
Coke	22,048,070	1,182,312

The production of spelter amounted to 124,780 tons, showing a decrease of 2,390 tons, or 3 per cent., as compared with 1901. There were nine sheet-zinc works in operation, and the output was 37,070 tons. The production of lead was 73,357 tons, against 61,900 tons in the previous year.

COBALT-NICKEL ARSENIDES AND SILVER IN ONTARIO.

W. G. Miller. Eng. and Mining J., 1903, 76, [24], 888.

Deposits of cobalt-nickel-arsenic and silver ores have been recently discovered in the northern part of Ontario, five miles south of Haileybury, a village on the Ontario side of the northern part of Lake Temiscaming. Four veins have been located, of which three are rich in native silver. In vein No. 1, the ore consists chiefly of niccolite ($NiAs$) and smaltite ($CoAs_2$), together with chloanthite ($NiAs_2$), dyscrasite (antimonial silver), and much native silver. In vein No. 2, the ore is chiefly smaltite and niccolite; no silver has been detected. The ore in vein No. 3 is similar to that in vein No. 1. Vein No. 4 is very clearly defined, but is considerably decomposed. Weathered specimens of the ore were found to be rich in native silver and also to contain cobalt bloom. The unaltered ore probably consisted of smaltite and niccolite, in addition to the silver. It is probable that the Haileybury deposits can be worked profitably for cobalt, nickel, arsenic, and silver, but the proportion of nickel does not appear to be sufficient to interfere materially with the lower-grade but larger deposits at Sudbury.—A. S.

XIII. C.—INDIA-RUBBER, Etc.

RUBBER INDUSTRY OF BRAZIL.

U.S. Cons. Reps., Dec. 1903.

The rubber crop of 1901–2 was the largest ever produced —29,998 tons. That of the season just closed was 29,890 tons, a decrease of only 108 tons. Of last season's crop, Europe took 15,261 tons, and the United States 14,566 tons, an increase in shipments to the United States over the previous year of 510 tons, while the shipments to Europe fell off correspondingly.

The product was shipped as follows :—

From	To Europe.	To United States.
	Lb.	Lb.
Manaos	16,619,381	18,425,657
Para	13,422,609	13,686,142
Iquitos	3,578,739	..
Serpa	22,583	..
Total	33,643,312	32,111,799

The stock on hand on June 30th was 129 tons. During the past year prices ruled fairly firm, at good figures. The exceedingly high prices which prevailed formerly may never be restored, but producers as well as dealers find there is still a very handsome profit for them, once they have accommodated themselves to the new and more healthy conditions.

XVI.—SUGAR, STARCH, Etc.

MOLASSES : ENTRY OF ——, INTO CANADA.

Bd. of Trade J., Jan. 7, 1904.

A Customs Memorandum (No. 1,254 B) relates to the duty payable on molasses imported into the Dominion of Canada, which is as follows :—"In view of the frequent importations of molasses found to contain an admixture of glucose, it is ordered that ¾ cent. per lb. duty be collected on molasses entered at Customs in Canada, and claimed to test not less than 35° pending test by polariscope at the Customs Department at Ottawa—subject, however, to refund of duty if the molasses be subsequently found entitled to entry under Tariff item 441. In the case, however, of molasses imported direct to a Canadian port from the West Indies or Guiana, the collector may allow delivery on payment of duty under Tariff item 441, upon importers undertaking to amend the entry when so required, if the Collector deems it advisable to do so after examination of the importation." The text of Tariff item No. 441 referred to is as follows :—Molasses produced in the process of the manufacture of cane sugar from the juice of the cane without any admixture with any other ingredient, when imported in the original package in which it was placed at the point of production, and not afterwards subjected to any process of treating or mixing, the package in which imported, when of wood, to be free :—(*a*) Testing by the polariscope, 40° or over, 1¾ cents per gall. (*b*) When testing by the polariscope less than 40° and not less than 35°, 1¾ cents per gall., with an additional duty of 1 cent per gall. for each degree or fraction of a degree less than 40°.

XVII.—BREWING, WINES, SPIRITS, Etc.

METHYLATED SPIRITS ; NEW CUSTOMS REGULATIONS RESPECTING ——, IN ORANGE RIVER COLONY.

Bd. of Trade J., Jan. 7, 1904.

The following is a copy of a Government Notice (No. 687 of 1903), issued at Bloemfontein on the 24th Nov. 1903 :—

"Be it hereby made known to all whom it may concern, under and by virtue of Article XVIII. of the Customs Union Convention and Article 18 of Law 34 of 1903, that His Excellency the Governor has been pleased to make the following Additional Customs Regulation, *viz.* :—

"Article 35.—Methylated spirits or alcohol imported from oversea solely for manufacturing or scientific purposes within the borders of this Colony shall be classified under Clause V. of the Customs Union Tariff, and be liable to the general *ad valorem* rate of 10 per cent., subject to the provisions of Article III. of the Customs Union Convention, provided :

"That such spirit or alcohol be imported under a certificate signed by the Collector of Customs or his representative, setting forth that such spirit or alcohol will be used exclusively for the purposes above specified ; and that on arrival of the spirit at its destination a sample will be submitted to the Collector of Customs for the purpose of being tested or that such spirit or alcohol be imported into this Colony under bond in terms of Article 11 of Law 34 of 1903, and Articles 12 to 24 of the Customs Regulations."

XX.—FINE CHEMICALS, Etc.

ALCOHOLIC TOILET ARTICLE : U.S. CUSTOMS DECISION.

Dec. 1903.

A preparation marked "Langbein's Eau de Quinine" or "Langbein's Chinawasser" was decided by the Board of General Appraisers to be dutiable at 60 cents per lb. and 45 per cent. *ad valorem* as an "alcoholic toilet preparation," under paragraph 2 of the present tariff. The importer claimed it to be dutiable as an "alcoholic medicinal preparation," under paragraph 67, at 55 cents per lb. Following a previous decision, the Board overruled this claim and decided as above.—R. W. M.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.], "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 105. Redmann. Apparatus for purifying gases. Jan. 2.

„ 458. Seger. Centrifugal separating apparatus.* Jan. 7.

„ 642. Pidgeon. Rousers for mixing purposes. Jan. 11.

„ 831. Kittn. Crushing or pulverising apparatus. Jan. 12.

„ 891. McMinn. *See under* II.

„ 1112. Von Echt. Process and apparatus for filling casks or other vessels with liquids. Jan. 15.

„ 1144. Parkes. *See under* XIV.

„ 1208. Gutensohn. Treatment of spent material, and apparatus therefor. Jan. 16.

[C.S.] 3287 (1903). Maiden. Covers or stoppers of vessels in which it is desired to maintain a vacuum. Jan. 20.

„ 22,164 (1903). Rismuller. Apparatus for drying, grinding, and screening. Jan. 20.

„ 23,964 (1903). Tone. Method for reducing elements which are reduced and volatilised at nearly the same temperature. Jan. 13.

„ 26,666 (1903). Lake (Jacob). Disincrustant for steam generators. Jan. 20.

II.—FUEL, GAS, AND LIGHT.

[A.] 54. Denny. Gas cleaning apparatus for blast furnaces and gas producers. Jan. 1.

„ 126. Kittler. Process and apparatus for removing water from peat.* Jan. 2.

„ 323. Tully. Apparatus for the production of water-gas, producer gas, or steam. Jan. 6.

„ 541. Armstrong. Manufacture of producer gas and apparatus therefor. Jan. 8.

„ 568. Adams. Incandescent mantles. Jan. 9.

„ 576. Key. System for the manufacture of coke, construction of coke ovens, and recovery of by-products. Jan. 9.

„ 669. Mengwasser. Apparatus for purifying gas. Jan. 11.

„ 700. Roman. Fuel. Jan. 11.

„ 753. Johnson and McKean. Mantles of incandescent gas burners. Jan. 12.

„ 768. Stevens and Timmerman. *See under* VII.

„ 769. Stevens and Timmerman. Furnaces.* Jan. 12.

„ 770. Stevens and Timmerman. Furnaces.* Jan. 12.

„ 891. McMinn. Machine for breaking up and preparing lime and other materials used in gas purification or for other purposes. Jan. 13.

„ 966. Feld. Treatment of coal-gas and other gases containing ammonia and cyanogen for the extraction of ammonia and cyanogen therefrom, and the partial regeneration of agents employed in the extraction. Jan. 14.

[C.S.] 501 (1903). Custodis. Manufacture of coke. Jan. 13.

„ 1994 (1903). Jahns. Process and apparatus for generating producer gases. Jan. 20.

„ 4052 (1903). Sugg. Burners for testing gas. Jan. 20.

„ 10,597 (1903). Meininghaus. Generator for a simultaneous production of heating and lighting gas. Jan. 20.

„ 10,770 (1903). Meininghaus. System of purifying and distributing gas. Jan. 20.

„ 14,420 (1903). Moon and Moon. *See under* IX.

„ 20,330 (1903). Pooley and Poulson. Apparatus for the enrichment of coal gas or other gas. Jan. 20.

„ 22,547 (1903). Hertzog. Process and apparatus for producing combustible gas. Jan. 13.

„ 27,355 (1903). Hage. Manufacture of smokeless fuel. Jan. 20.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[C.S.] 25,989 (1903). Haddan (Paradell-Mateu). Method for purifying naphthalene. Jan. 20.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 712. Johnson (Badische Anilin und Soda Fabrik). Manufacture and production of colouring matters of the anthracene series. Jan. 11.

[C.S.] 5269 (1903). Newton (Bayer and Co.). Manufacture of a new azo dyestuff. Jan. 13.

„ 5689 (1903). Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matter. Jan. 13.

„ 6078 (1903). Ellis (Soc. Chim. des Usines du Rhone, ancien. Gilliard, P. Monnet et Cartier). Manufacture of sulphurised colouring matters. Jan. 20.

„ 6419 (1903). Johnson (Badische Anilin und Soda Fabrik). Manufacture of indoxyl and indoxylic acid. Jan. 13.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 829. Ingham and Ingham. Waterproofing, dyeing, or filling woven fabrics. Jan. 12.

„ 877. Bartelt. Washing and bleaching and apparatus for that purpose. Jan. 13.

„ 1041. Sutherland. Method of de-gumming or cleansing stalk fibres. Jan. 15.

[C.S.] 218 (1903). Mackintosh and Smith. Manufacture of certain kinds of waterproof cloths and fabrics, and machinery for use therein. Jan. 13.

„ 3778 (1903). Schmid. Printing vegetable fabrics. Jan. 13.

„ 24,289 (1903). Forster. Metallisation of textile fibres and products therefrom, and also of leather, paper, and the like. Jan. 20

„ 25,369 (1903). Burgher. Apparatus for steaming cloth and other fabrics. Jan. 20.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 227. Hemingway. Desulphurisation of sulphuretted hydrogen. Jan. 4.

„ 295. Blackmarr and Willford. Method of and apparatus for converting oxygen into ozone. Jan. 5.

[A.] 456. Leetham and Bousfield. *See under* XI.

,, 473. Naumann. Process for producing nitrate of ammonia from nitrate of soda and sulphate of ammonia.* Jan. 7.

,, 768. Stevens and Timmerman. Apparatus for making carbides.* Jan. 12.

,, 966. Feld. *See under* II.

,, 1066. Niedenführ. Process and arrangement for manufacturing sulphuric acid.* Jan. 15.

,, 1097. Ratner. Recuperation of alumina in the shape of aluminium acetate. Jan. 15.

[C.S.] 6180 (1903). Boult (Soc. Romana Solfati). *See under* X.

,, 23,919 (1903). Keogh and Broughton. Manufactute of alumina and by-products. Jan. 20.

,, 25,388 (1903). De Wilde. Treatment of regenerated hydrochloric or nitric acid to remove calcium sulphate. Jan. 20.

IX.—BUILDING, MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 218. Von Forell. Process for the manufacture of cement from slag.* Jan. 4.

,, 388. Gogler and Seinfeld. Process for manufacturing white cement.* Jan. 6.

,, 523. Marchant. Manufacture of Portland cement. Jan. 8.

,, 676. Moorwood and Brearley. *See under* X.

[C.S.] 14,420 (1903). Moon and Moon. Tiles or bricks for use in regenerative furnaces. Jan. 20.

,, 25,393 (1903). Niessen. Process of manufacturing artificial stone suitable for pavements, building, and hydraulic purposes. Jan. 20.

,, 26,478 (1903). Reinke. Artificial stone. Jan. 13.

X.—METALLURGY.

[A.] 199. Mathesius. Process of manufacturing slag powder. Jan. 4.

,, 263. Brand. Extraction of zinc. Jan. 5.

,, 372. Alzugaray. Manufacture of metallic alloys. Jan. 6.

,, 433. Alzugaray. Soldering and welding metals. Jan. 7.

,, 434. Alzugaray. Making iron and steel. Jan. 7.

,, 566. Frith and Lightfoot. Treatment of metals. Jan. 8.

,, 661. Alzugaray. *See under* XI.

,, 662. Alzugaray. Manufacture and refining of iron, steel, and other metals. Jan. 11.

,, 676. Moorwood and Brearley. Metallic cements for the treatment of castings, &c. Jan. 11.

,, 689. Clintar and Clintar. Extracting gold in solution with water. Jan. 11.

,, 755. Foster. Manufacture of iron in blast furnaces. Jan. 12.

,, 1004. Preston and Rogers. The manufacture or treatment of metals. Jan. 14.

,, 1013. Kauffmann. The working and construction of furnaces for roasting ores and like materials.* Jan. 15.

[C.S.] 2036 (1903). Gin. Process for the extraction of copper from its sulphuretted ores. Jan. 13.

,, 4981 (1903). Hadfield. Toughening of manganese steel. Jan. 13.

,, 6180 (1903). Boult (Soc. Romana Solfati). Process for treating ores of aluminium to obtain alumina and other products. Jan. 13.

,, 23,587 (1903). Oeser. Method for the manufacfacture of bronze or other metal leaf or foil. Jan. 20.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 214. Kamperdyk. Electric batteries. Jan. 4.

,, 456. Leetham and Bousfield. Manufacture of chlorine by electrolysing sodium chloride solution and apparatus therefor, part of which may be used for other electrolytic purposes. Jan. 7.

,, 474. Sutherland and Marcuson. Electric batteries. Jan. 7.

,, 661. Alzugaray. Obtaining metals by electricity. Jan. 11.

,, 968. Threlfall. Electrodes for electrochemical processes. Jan. 14.

,, 1036. Pescatore. Accumulators. Jan. 15.

,, 1187. Elieson. Electric accumulator plate.* Jan. 16.

[C.S.] 6145 (1903). Fennell and Perry. Storage batteries. Jan. 20.

,, 18,934 (1903). Pratt and Vince. Electric storage batteries or accumulators. Jan. 20.

,, 23,482 (1903). Rosset. Secondary batteries. Jan. 20.

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[C.S.] 1570 (1903). Shukoff. Process for converting fatty acids of the oleic series and derivatives thereof into lactones. Jan. 20.

,, 24,240 (1903). Reiss. Production of readily resorbent medicated soaps or ointments. Jan. 13.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(*A.*)—PIGMENTS, PAINTS.

[A.] 890. Graham. Method of treating white lead skins. Jan. 13.

(*B.*)—RESINS, VARNISHES.

[A.] 195. Scott. Apparatus for use in the manufacture of inlaid linoleum. Jan. 4.

,, 748. Sellars. Composition mainly applicable as protective coverings for metal and other surfaces. Jan. 12.

(*C.*)—INDIA-RUBBER.

[A.] 377. Thom, Gregory, and Merrylees. Treatment of waste vulcanised rubber. Jan. 6.

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[A.] 890. Graham. *See under* XIII. A.

[C.S.] 1144. Parkes. Process and apparatus for evaporating gelatinous and like solutions. Jan. 16.

,, 24,289 (1903). Forster. *See under* V.

XV.—MANURES.

[A.] 25. Wardle. Manufacture of artificial manure from sewage and like matter. Jan. 1.

,, 494. Myers. Manufacture of a fertiliser or manure. Jan. 8.

[C.S.] 18,423 (1903). Morris, Jenner, and Wakeley B and Co., Ltd. Manufacture of manure. Jan.

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[A.] 183. Hoadley. Process for the inversion of sugar. Jan. 4.

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[C.S.] 6604 (1903). Schidrowitz and Kaye. Manufacture of certain products from waste brewery and distillery yeast. Jan. 13.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

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[A.] 990. Heritte. Preservation of organic substances. Jan. 14.

[C.S.] 5446 (1903). De Jong and van der Heide. Process and apparatus for sterilising milk and other liquids. Jan. 20.

(*B.*)—Sanitation; Water Purification.

[A.] 25. Wardle. *See under* XV.

[C.S.] 274 (1903). Wormald. Purifying and softening feed water. Jan. 13.

„ 4430 (1903). Baxter and Watson. Softening and purifying water for use in steam boilers and for other suitable purposes. Jan. 13.

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[A.] 828. Ingham and Ingham. Manufacture of paper. Jan. 12.*

[C.S.] 412 (1903). Toone. Manufacture of pasteboard, and apparatus therefor. Jan. 13.

„ 3045 (1903). Ensminger. Manufacture of compounds having a nitrocellulose and casein base. Jan. 20.

„ 18,030 (1903). Farwell. Paper-making machines. Jan. 13.

„ 24,289 (1903). Forster. *See under* V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 449. Fehrlin. Production of compounds of pyrocatechuic-monoalkyl ethers, and especially of guaiacol and guaethol, with proteine substances. Jan. 7.

[A.] 710. Weichardt. Antitoxins. Jan. 11.

„ 1180. Evers. Process for obtaining licorice juice from partly or completely dried licorice root.* Jan 16.

[C.S.] 540 (1903). Bloxam (Fab. Prod. de Chimie Organique de Laire). Manufacture of a new odoriferous substance suitable for perfumery. Jan. 20.

„ 1570 (1903). Shukoff. *See under* XII.

„ 3173 (1903). Imray (Meister, Lucius und Brüning). Manufacture of artificial perfume, and intermediate products therefor. Jan. 13.

„ 3545 (1903). Newton (Bayer and Co.). Manufacture of *m*-amido-*o*-oxybenzyl sulphonic acid. Jan. 13.

„ 5772 (1903). Newton (Bayer and Co.). Manufacture and production of new pharmaceutical compounds. Jan. 20.

„ 9327 (1903). Johnson (R. Koepp and Co.). Preparation of oxalates. Jan. 20.

„ 26,785 (1903). Ellis (Chem. Fabr. von Heyden, Akt.-Ges.). Manufacture of new aromatic esters, and of useful products therefrom. Jan. 20.

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„ 808. Riebensahm and Koppmann. Process for producing coloured photographs. Jan. 12.

„ 925. Abel (Act.-Ges. f. Anilinfabr.). Films for use in photography. Jan. 13.

„ 1008. Drac. Method and apparatus for the production of coloured photographs. Jan. 14.

[C.S.] 372 (1903). Lemberger and Böhn. Process for the production of multicoloured photographs. Jan. 13.

„ 3545 (1903). Newton (Bayer and Co.). *See under* XX.

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Notices.

ANNUAL GENERAL MEETING, NEW YORK, 1904.

The Annual General Meeting will be held in New York City on Thursday, Sept. 8th, and following days. Members who contemplate attending are requested to communicate with the General Secretary as soon as possible, in order that suitable travelling arrangements may be made. A programme appears in the Jan. 30 issue of the Journal.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

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Young, A. H. I., 1/o Lange Reihe; Capaunenstr. 10, Greifswald, Pomerania.

Deaths.

Grimshaw, Harry, North Road, Clayton, Manchester. Jan. 29.

McMillan, W. G., 8, Drewstead Road, Streatham, S.W. Feb. 2.

ERRATUM.

The announcement of the death of Mr. Jas. Johnstone, of Rutherglen (this J., Jan. 30, p. 50), happily turns out to be unfounded. The gentleman who died was not a member of this Society.

Canadian Section.

Meeting held in McGill College, December 22nd, 1903.

PROF. W. R. LANG IN THE CHAIR.

Dr. G. P. Girdwood (Vice-Chairman) read an interesting paper on Chemical Education, after which a discussion on the subject took place, the speakers being Mr. Thomas Macfarlane, Dominion Analyst, Ottawa, Prof. Walker, Lieut.-Col. Burland, and the Chairman. The Chairman also addressed the meeting, tracing the formation of the Section and explaining the objects of the Society.

Manchester Section.

Meeting held on Friday, January 8th, 1904.

MR. J. CARTER BELL IN THE CHAIR.

PREPARATION AND COMPRESSION OF PURE GASES FOR EXPERIMENTAL WORK.

BY R. S. HUTTON AND J. E. PETAVEL.

Introduction.—Having been engaged for some time past on experimental research dealing with the effect of high gaseous pressures upon electric furnace reactions, the necessity arose of preparing, compressing, and storing several gases which were either not available commercially, or which could not thus be obtained in the desired state of purity. Although a very great deal of information had been published relating to the production of the various gases in sufficient quantities for ordinary laboratory experiments, such methods cannot be easily applied when the required scale of working is considerably larger. On the other hand, the commercial manufacture in some cases has been most carefully worked out, but the plant required is too large and costly to be practical for temporary use. The object of the present paper is to describe how, with little more than such apparatus as should be available in any chemical laboratory, the preparation of a number of gases can be carried out at a trifling cost and with due consideration as to their purity. It will be noticed that the equipment is so devised as to be available for use in the different cases with but little modification. Those who look for any novelty in the principles of the methods adopted will, we fear, be disappointed; we venture, however, to think that to the increasing number of workers, who either for commercial or scientific purposes require, like ourselves, pure gases in considerable quantities, the information which we offer will be of some value. The apparatus has been devised for gas generation and purification at a rate of about 1 litre per second (130 cb. ft. per hour). Hydrogen, nitrogen, carbon monoxide, and ethylene are dealt with in detail. Apart from the information which we have been able to obtain by direct experiment, references are given to several of the more important published accounts dealing with the manufacture on the full commercial scale. For some chemical purposes, the gases would be passed straight from the generator for use in the chemical process for which they were required; on the other hand, it is frequently necessary for convenience to store the gas for subsequent use; in fact, where the experiments are at all general in character, it is advisable to have a stock of different gases constantly available. This involves the erection of compressing and storing plant even where high pressure *per se* does not play a part in the work. Our account, therefore, includes a description of a small plant which we have found satisfactory for these purposes.

Hydrogen: Commercial Manufacture and Applications.—Hydrogen is at present principally employed for inflating military balloons, autogenous welding, and lead-burning (Zeits. f. Elektrochem., 1895, 2, 204), and is manufactured in considerable quantities for these purposes. The older and purely chemical methods of generation based on the action of acids or steam on metals are being to a large extent displaced, where a continuous supply is required, by electrolytic processes, the working cost of the latter being considerably lower. Suitable electrolytic cells can now be installed at a reasonable expense. The plant for the chemical manufacture by the action of acids on metals is of two principal types. The first, a development of the ordinary laboratory "Kipp," will be described later. The second type is designed to give for a limited time a very

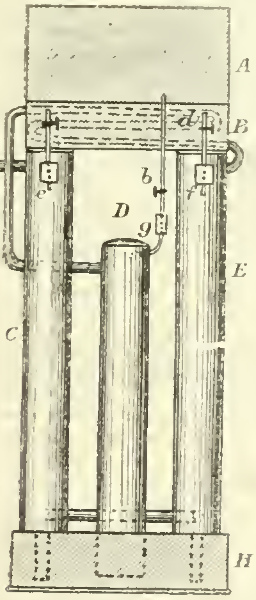

Fig. 1.—Hydrogen Generator Plant.

(Scale, ½ inch to foot.)

A. Acid reservoir.
B. Cooling tank.
D. Generator proper.
C and E. Washing towers.
b. Valve regulating admission acid.
g. Sight feed for ditto.
K. Outlet for gas.
e and *d*. Valves regulating water admission to washing towers.
e and *f*. Sight feed for ditto.
H. Cast-iron tank acting as seal to the cylinders and into which spent acid flows.
K. Outlet for gas.

large quantity of gas, and in principle consists in employing a tall cylindrical receiver filled with metal turnings or granulated metal, the outflow of gas being regulated by the amount of acid which is allowed to flow into the top of the cylinder, the spent acid being run off at the bottom. This latter method is of the two, by far the more important for large-scale working, such as for inflating balloons. In this case some 10,000 cb. ft. of gas may be required to fill a single balloon, an operation which has to be effected within a short space of time. The process has also been employed for many years at the Royal Institution for the manufacture of hydrogen in connection with the liquefaction experiments, and at a more recent date by Morris W. Travers at University College, London (Phil. Mag., 1901, [6], **1**, 411). A plant on these lines has been recently constructed by Messrs. Lennox, Benton, and Reynolds, Ltd., capable of delivering some 800 cb. ft. of hydrogen per hour. The receiver is a copper cylinder about 6 ft. high and 1 foot diameter, and contains a charge of 4 cwts. of granulated zinc. As will be seen by the diagram, Fig. 1, the actual generator is mounted in the centre between two washing towers, each 8 ft. high. The three cylindrical towers, which are open at the bottom, are supported in a cast-iron tank, which forms a water seal and collects the spent acid. The towers are surmounted by two superimposed tanks, the lower one containing a lead coil immersed in water to act as cooling chamber, the upper one, lead-lined, acting as acid reservoir. A spray of water keeps the flints in the two washing towers moist. The rate of flow of the acid is observed through a sight feed. An apparatus of a similar type, the design of Ch. Renard, has been adopted by the French army for field use. The employment of zinc has, however, the serious disadvantage that the gas often contains sufficient arsenic to be dangerous if dealt with in any quantity.* Moreover, the gas generated by the action of acids on ordinary spelter or metallic iron is liable to be considerably more dense than pure hydrogen. (W. Dürer, Zeits. f. Elektrochem., 1901, **8**, 2.) Of other chemical processes, the heating of zinc-dust and soda-lime briquettes is employed in the German army in a portable equipment for balloon inflation, whilst the reaction between heated iron and steam has recently been applied by the Industrial Engineering Co., who regenerate the iron with producer-gas, and have thus brought this method into a convenient and practical form. The electrolytic manufacture of hydrogen is coming much to the front; in this case, whereas the first cost is relatively high, the working expenses, whenever the plant can be run continuously, are generally lower than for the chemical method. Numerous types of plant have been designed, the principal requirements being a low working voltage and the effectual separation of the hydrogen and oxygen; the latter, particularly where the gases have to be compressed, being of the utmost importance from the point of view of safety. The electrolytic methods will be found described in monographs by Victor Engelhardt and P. Schoop [V. Engelhardt, Die Elektrolyse des Wassers (Halle: W. Knapp, 1902); P. Schoop, Die Industrielle Elektrolyse des Wassers (Stuttgart: F. Enke, 1901)]; suffice it to say that in principle they can be grouped under three types:—

(1) The Schmidt and Ch. Renard systems employ iron electrodes in alkaline solution, the electrodes being separated by diaphragms of asbestos.

(2) The Schoop system, in which each cylindrical electrode is surrounded by tubular diaphragms, has the advantage of absolute safety from any danger of admixture of the gases, but involves some loss of power through additional resistance. In this case lead electrodes are employed in an acid electrolyte.

(3) The Garuti, Siemens Bros., and Schuckert plants employ metallic diaphragms and generally work with alkaline electrolytes.

At the present time almost all the European military authorities have adopted one or other of these electrolytic plants for balloon purposes, but in Germany the Government makes use largely of the waste hydrogen evolved in the electrolytic alkali industry, an example which will, no doubt, be widely followed in the future, when it is considered that, even at a moderate estimate, some 240,000 cb. ft. of hydrogen are going to waste daily in this way (*cf.* Zeits. f. Elektrochem., 1895, **2**, 290). At least three large installations (Buffa, Bull. de l'Assoc. des Ing. Electr. (Liège), 1900, **11**, 305), those at Brussels, Lucerne, and Rome, exist on the continent for putting on the market compressed hydrogen obtained by the Garuti process, a notable economy resulting from the fact that the oxygen, which is also compressed, finds a still more ready sale. A complete consideration of the question of cost would carry us too far, but full details will be found in the monographs referred to. Suffice it to say that, with spelter at 21*l.* a ton, a cost of at least some 35*s.* is incurred in zinc alone per 1,000 cb. ft. of hydrogen obtained, whereas by several of the electrolytic processes the same amount of hydrogen can be obtained for 157 kilowatt hours, which, even at 1*d.* per unit, a high estimate for power generation when used continuously, only amounts to 13*s.* 1*d.* It should be borne in mind that the oxygen produced simultaneously is also of considerable commercial value. Thus where an uninterrupted supply of gas is required throughout the entire year the electrolytic methods offer considerable advantages. Owing, however, to the much smaller capital outlay, the older chemical process is preferable when the hydrogen is required occasionally only, but in large quantities. Several years ago Dewar showed, as a lecture experiment, how coal-gas could be freed from methane and other hydrocarbons by cooling it to a sufficiently low temperature. Recently d'Arsonval (Ann. Chim. et Phys., 1902, [7], **26**, 446) has proposed this as a method of obtaining hydrogen; the process has, however, not yet proved of any commercial value.

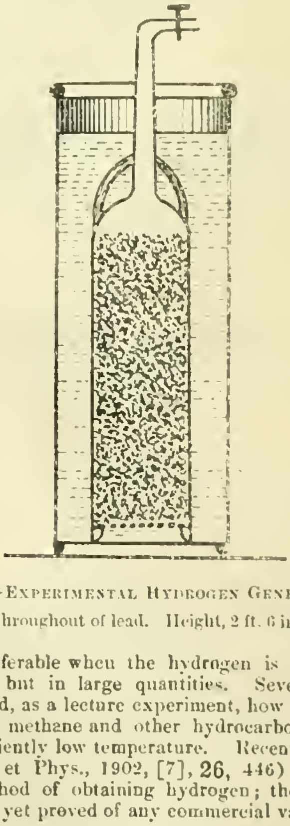

FIG. 2.—EXPERIMENTAL HYDROGEN GENERATOR.

Constructed throughout of lead. Height, 2 ft. 6 ins.; diam., 1 ft.

Experimental Plant.—In considering the type of apparatus suitable for experimental work, it must be borne in mind that the plant should be capable of producing gas at a comparatively high rate, at least for a limited number of hours. As will be more fully explained in describing the compressing plant, it is advisable to make the gas in sufficient quantities to supply the pump at its normal rate of working, which in our case was 100 to 130 cb. ft. per hour Under all conditions where the cost of a large capacity gasometer is not prohibitive, it would doubtless be mor

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* Numerous attempts have been made to remove the arsenic from the gas, amongst which passage through a heated tube or a solution of a permanganate should be mentioned. Recently Ch. Renard has carried out some experiments on the use of liquid air for condensing the arseniuretted hydrogen in connection with the aeronautical department of the French army. It is found that cooling to −110° C. is essential for complete elimination of the arsenic. (C. R., 1903, **136**, 1317.)

convenient to generate the gas slowly and continuously, and then compress it, whenever the gasometer was filled. With such an arrangement it would have been more convenient even in the laboratory to use the electrolytic process. Preliminary experiments made in this direction showed that a satisfactory electrolytic cell could be easily and cheaply fitted up. This was effected by lining the sides of an ordinary stoneware mixing-pan with sheet lead, and using as a cathode a spiral coil of lead tube, covered with an inverted bell jar. From the top of this the gas is drawn off. To equip a plant to make gas at the rate mentioned above was, however, too costly for a temporary outfit. The preparation from Brunner-Mond zinc and 20 per cent. arsenic-free sulphuric acid was therefore resorted to, spelter of this quality being found to give gas of high purity. Sufficiently finely granulated zinc can be obtained by pouring the molten metal into water from a height of about three feet. Three lead generators were used of the ordinary type employed for lead-burning as shown in Fig. 2. These were arranged in parallel, and so connected that, whilst two were in actual use, the third was cut off, to allow the gas to displace the partially spent acid, after which it was reconnected and one of the others turned off. By working in this manner, the required rate of generation could be maintained. The gas was found to need no purification, but was led, through two towers containing solid caustic soda, direct to the gasometer and compressor. Analysis proved the purity to be 99·8 per cent. hydrogen.

Nitrogen: Commercial Manufacture and Applications.—Already at the present time nitrogen is coming into use in several of the cyanide processes, an application which will doubtless increase largely so soon as a satisfactory and economical method of generation has been devised. For, despite the apparent simplicity of the process, no very economical method of effecting the separation from the oxygen of the air is available. The older method of passing air over heated iron or copper is chiefly employed technically. In those cases where a large supply of nitrogen is needed, it would be advisable to carefully consider the employment of the waste gases from gas engines and sulphuric acid plants, which are available in quantity and contain a much reduced percentage of oxygen. It must also be borne in mind that similar gases are passed to waste in the course of manufacture of oxygen by Brin's process; whilst, provided any of the proposed methods of extraction of oxygen from liquid air by fractional distillation become of permanent commercial value, they will prove of direct assistance for the problem under consideration. As will be seen below, pure nitrogen can be prepared at moderate cost by an adaptation of the Harcourt method (Lupton, Chem. News, 1876, **33**, 90; R. Marston, Eng. Pat. 19,074 of 1900), consisting in burning out the oxygen of the air by the hydrogen contained in ammonia. Finally, the laboratory process of generation from ammonium nitrite (K. T. Fischer and H. Alt, Ann. der Phys., 1902, [4], **9**, 1149; von Knorre, Chem. Ind., 1902, **25**, 531 and 550) is out of question for large scale working, owing to the prohibitive cost of material. At the recent International Chemical Congress, R. Knietsch (Chem.-Zeit., 1903, [48], 586) proposed passing air and excess of hydrogen over warmed platinised asbestos; and at the same meeting a few details were given of the process of Messrs. Elkan, of Berlin, who supply the compressed gas in cylinders.

Experimental Plant.—From preliminary trials the Harcourt method seemed to be the only one which could be fitted up in a limited space with ordinary apparatus and suitable to produce gas at a moderate cost. The plant is shown in Fig. 3. An iron gas-pipe about 5 feet long and 2 inches internal diameter was filled with copper turnings, connections being made at one end for the introduction of air, supplied by a blower, and of the required quantity of ammonia liquor; at the other end to condensing, washing, and drying plant, and through these to the compressor. The method works without the slightest difficulty provided that the rate of admission of air and ammonia is properly regulated. From the preliminary experiments it was found that unless the ammonia is always in considerable excess of that required theoretically, oxides of nitrogen are produced

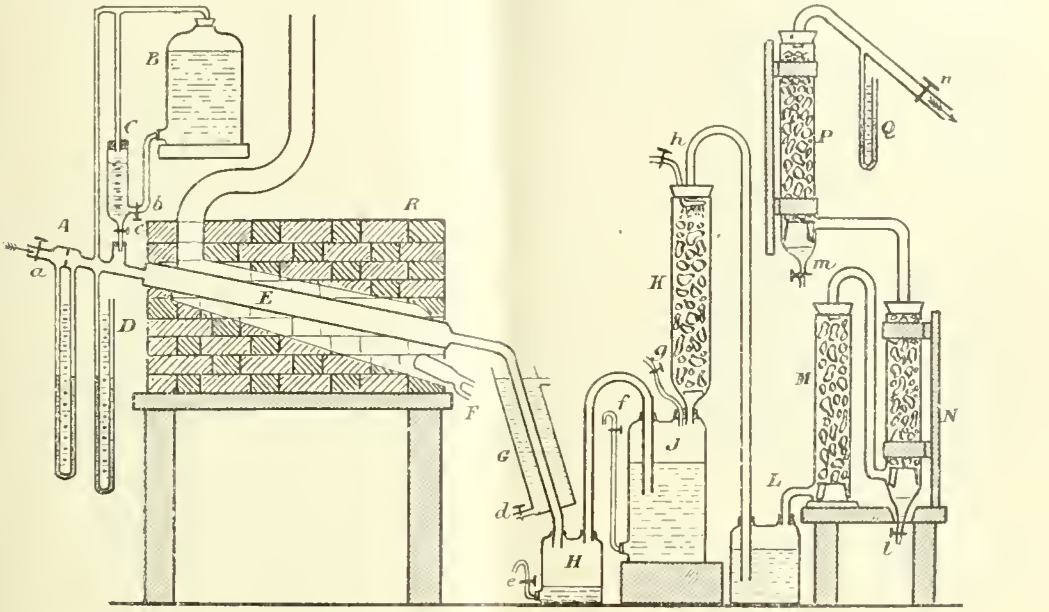

Fig. 3.—Diagram of Nitrogen Plant.

a. Air-inlet tap from blower.
A. Gauge indicating rate of flow of air.
B. Reservoir of ammonia liquor.
C. Graduated tube for measuring rate of flow of ammonia.
b. Tap for filling tube C with ammonia.
c. Tap for regulating admission of ammonia.
E. Iron gas-pipe filled with copper turnings.
R. Furnace: built up of loose firebricks, and heated with large Fletcher furnace tuyère F.
G. Condenser with water-inlet cock *d*.
H. Condensed ammonia receiver with draw-off *e*.
J. Water washer, through which water or acid could be passed, inlet cocks at *g* or *h*, outlet at *f*.
L. Acid washer.
M. Quartz tower scrubber.
N and P. Two caustic soda towers with draw-off cocks at *m* and *l*.
Q. Manometer.
n. Exit to gasometer and compressor.

which cannot easily be removed. When gas containing such impurities is compressed serious corrosion of the valves and cylinders of the pump occurs. On the other hand, if the excess of ammonia is not removed, similar difficulties are met with. The method of working actually adopted was to admit approximately twice the theoretical amount of ammonia, and by passing a fairly rapid current of water through the washer J, such part of the ammonia as was not condensed in H was efficiently removed, the last traces of ammonia being held back by the sulphuric acid in L. To regulate the quantity of ammonia necessary, a rate gauge A was inserted in the air-supply pipe. This gauge was of a very simple construction, and consisted of a constriction in the supply tube, each side of the constriction being connected to one limb of a U-tube containing water, the difference in heights of which indicated the rate of flow of the gas. The instrument is calibrated, once for all, by taking observations with an ordinary gas meter or gasometer. The scale of the readings depends, of course, simply on the size of the constriction. As an example, one of these gauges, having a constriction of about ⅛-inch bore, gave about 40 cms. difference of level for a rate of 60 cb. ft. per hour. Knowing in this way the rate of flow of the air, the admission of ammonia liquor was regulated by means of the graduated tube so as to supply about twice the theoretical amount. The method by which this was performed will be quite clear from the diagram. The gas obtained was entirely free from oxygen and oxides of nitrogen, but contained about 4 per cent. hydrogen. This could, of course, be easily eliminated by passing through an additional tube of heated copper oxide, but for most purposes the presence of hydrogen would be of no disadvantage. For the guidance of any one employing the method in this form, we might state that in one operation some 200 cb. ft. were compressed, about 9 litres of 0·880 ammonia being passed through the apparatus; the flow of gas was regulated from time to time so as to supply the pump continuously at its normal rate of working. The cost of the ammonia for 1,000 cb. ft. of nitrogen would be about 17s. 6d., or half this amount if the excess of ammonia is efficiently recovered.

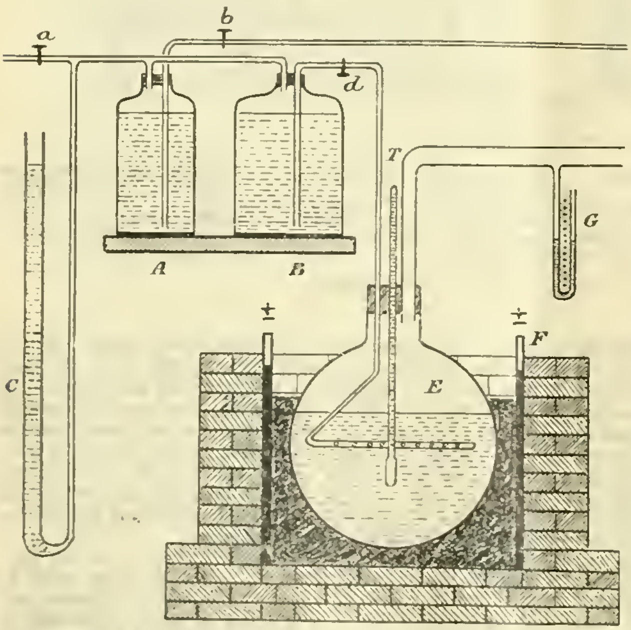

Fig. 4.—Diagram of Carbon Monoxide Plant.

E. Bolt head containing boiling H_2SO_4.
T. Thermometer.
B. Reservoir for formic acid.
d. Cock for regulating supply from B.
G. Gauge on main gas-pipe before washing apparatus.
F. Electric heating furnace.
a. Inlet cock from compressed air.
C. Tube acting as constant pressure valve, keeping a pressure equal to 2 or 3 ft. of water on upper surface of liquids in flasks A and B.
A. Reservoir of caustic soda solution connected with washing tower K (Fig. 3).
b. Regulating cock for same.

Carbon Monoxide: Experimental Plant.—For most chemical processes pure carbon monoxide is rarely required, some form of producer- or water-gas being generally employed. Where, however, the pure gas is a necessity, the manufacture of formates by the recent synthetical Goldschmidt process renders it possible to obtain it at a reasonable cost and in an extremely simple manner. The actual apparatus used is shown in diagram (Fig. 4), and consists of a bolt head E (9 litres) half filled with sulphuric acid (sp. gr. 1·73). The heating was performed, either by an electric resistance furnace as represented, or by an ordinary gas furnace; the former is preferable, when working with combustible gases, where electric current is available. An electric furnace of the kind can be built up temporarily at trifling cost. The outer walls are constructed of loose firebricks; the electrodes consist of two flat pieces of boiler plate, the space between which is filled with ground coke. An electric current passing through the coke heats this up to any desired temperature. In the present case the iron plates were each 11 ins. square, the distance between them being 14 ins.; the layer of coke G, about 40 lb., being 7 ins. deep. This gave a resistance when cold of 13 ohms and about 1·5 ohms when heated up to the working temperature. When generating gas at full rate, over 4 k.w. are required to maintain the temperature. The reservoir B contains a supply of technical 90 per cent. formic acid, from which the carbon monoxide is generated. This reservoir is kept slightly above atmospheric pressure by being connected to a supply of compressed air, thus enabling the acid to be easily forced over. The formic acid is delivered below the surface of the boiling sulphuric acid in the bolt head, the flow being regulated by the cock *d*. The temperature, which, when the formic acid is added, of course tends to fall, is maintained throughout the run at about 150° to 170° C. In this way, with a limited amount of sulphuric acid the process can be run continuously. The gas is purified in the apparatus shown in Fig. 3, the only modification being that the bottle L is in this case filled with 20 per cent. caustic soda solution, and a similar solution is also allowed to drip into the quartz tower K (Fig. 3), from the supply bottle H (Fig. 4). Nearly the full theoretical yield of gas is obtained, about 133 lb. of 90 per cent. formic acid being required per 1,000 cb. ft., costing 50s. The purity of the gas thus prepared was over 99 per cent.

Ethylene: Experimental Plant.—Up to recent years ethylene has been used in considerable quantities in connection with the production of liquid air; the apparatus which we have already described for carbon monoxide can, without modification, be employed for this preparation. There is not, however, the same latitude with regard to temperature and rate of production as in the former case. It is essential that the sulphuric acid should be kept between 160° and 165° C., since, even at a few degrees above this, carbonisation commences, accompanied by production of sulphurous acid and carbon monoxide; at a temperature below 160° C. the yield falls very rapidly, almost all the alcohol being transformed into ether. The sulphuric acid used in the bolt-head should be of such dilution as to boil at 160° C. Methylated spirit is admitted through a perforated lead tube (see Fig. 4). At first scarcely any ethylene is evolved, but as part of the water in the acid becomes displaced by the alcohol, the temperature being kept constant, the rate of production gradually increases, and, after about half an hour, becomes fairly steady. A constant evolution of gas can be maintained under these conditions for any length of time, but the flow of gas is only about one-tenth of what the same sized apparatus would produce in the case of carbon monoxide. The yield obtained was not much more than half the theoretical. An addition of ferrous sulphate to the sulphuric acid has been proposed by R. N. Lennox as ensuring against carbonisation and evolution of sulphurous acid. This addition seems to be a considerable improvement on the original process. The acid mixture is made with concentrated sulphuric acid (sp. gr. 1·84) and sufficient saturated ferrous sulphate solution to bring the boiling point down to 160° C.

Another method proposed by Newth (G. S. Newth, J. Chem. Soc., 1901, **79**, 915), which consists in employing syrupy phosphoric acid in place of sulphuric acid, was tried in the same apparatus. The temperature should be kept between 200° and 220° C.; there is no carbonisation, but a considerable amount of ether is collected. The yield in this case was even lower than with the sulphuric acid method, but the process can be worked quite continuously, and the quantity of phosphoric acid required is not large.

Notes on Various other Gases.—The foregoing pages deal with the preparation of such gases as cannot easily be obtained commercially. With regard to many other gases similar methods could of course be adopted, but producing them on the scale with which we have been dealing would hardly repay the trouble involved, in those cases where they are already on the market. Further, for such gases as sulphurous acid, chlorine, and ammonia, a special pump would be necessary; and even before oxygen could be compressed, much time would have to be spent in carefully removing all traces of organic matter from the pump cylinders, connections, and gauges.

Oxygen, nitrous oxide, carbonic acid, sulphurous acid, and ammonia can readily be obtained from the various companies in this country who make a speciality of their manufacture. Where a compressed gas is not required, oxygen in a similar way to acetylene can be produced by the action of water on one of its solid compounds. A French company has recently put on the market a mixture of sodium peroxide and bleaching powder, under the name of "Oxylith," which yields oxygen of satisfactory purity. The cost of the gas produced by this method (5*s*. 9*d*. per 20 cb. ft.) would, however, be prohibitive where a large quantity is required. So far as acetylene is concerned, it will be recalled that, as a result of the exhaustive investigations which followed on numerous and disastrous accidents, Berthelot and Vieille showed that it is highly dangerous to compress this gas above four atmospheres. The gas, however, can now be stored in cylinders, filled with some porous material saturated with acetone, this liquid absorbing about 24 times its own volume of gas per atmosphere pressure (A. Janet, Génie Civil, 1903, **43**, 180). In Germany (O. N. Witt, Die Chemische Industrie des deutschen Reiches im Beginne des 20 Jahrhunderts, pp. 100—105) considerable use has been made in recent years of liquid chlorine, which is produced by several companies, and notably by the Badische Anilin Company, and can be obtained retail (*e.g.*, Kahlbaum, Berlin) for 1*s*. 6*d*. per lb. in bombs of 20 lb. or over. Methyl chloride (2*s*. per lb., Douane, Paris), phosgene (Kahlbaum, 6*s*. per lb.), and ethyl chloride (2*s*. per lb.) can all be obtained commercially, and find uses particularly in the colour industries and for refrigeration.

Compression and Storage of Gases.—The portion of the subject which we have to deal with now is of rather a special nature. Much of the information given below will be well known to those few who have been connected with commercial gas-compression plants; but now that pumps can be obtained at a moderate cost and of sufficiently simple construction to give no trouble for continuous working, there is no reason why the great convenience of storing gas in the compressed state should not be more generally made use of. For work of this kind, the smallest convenient plant comprises:—

(1) A compressor capable of dealing with 60 to 130 cb. ft per hour, and of working up to 120 or 200 atmospheres.

(2) A small gas-holder (10 to 20 cb. ft. capacity), which is used, not to store the gas, but to act as an equaliser between the pump and generating apparatus. It being assumed that, wherever possible, the gas is made and pumped at the same rate.

(3) A stock of weldless steel gas cylinders.

As a general guidance with regard to cost, the price of the compressor may range from 60*l*. to 100*l*., and the gasometer from 10*l*. to 20*l*. For most purposes it is convenient not to exceed the commercial pressure of 120 atmospheres. For this pressure, gas cylinders, ready fitted with valves, can be obtained at about 1*s*. per cubic foot of gas stored, when purchased in small quantities; or at half this price when bought on a larger scale. For higher pressures, the cylinders have to be made to order, and are correspondingly more expensive. Another 10*l*. to 20*l*. should be allowed for the purchase of two or three pressure-gauges, a dozen cone connections, eight or ten high-pressure valves, and the capillary copper tubing which serves to conduct the gas from the compressor into the receivers. Weldless copper tubing of $\frac{1}{8}$ in. bore and $\frac{1}{4}$ in. external diameter is both strong and large enough for this purpose, and can be readily obtained from any copper tube manufacturers. This size has the further advantage, when annealed, of being quite flexible, and can thus be bent, whenever used, to the most convenient shape. The ends of each length of such tubing are soldered into brass or gunmetal cones, as shown in Fig. 5. These are screwed to the cylinder or pump valves by a nut which surrounds them. In a plant of this kind it is advisable to keep to a standard size, "half-inch gas" being most convenient for this purpose.

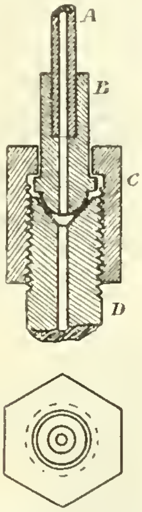

Fig. 5.—Cone Connections.

A. Flexible copper tubing. B. Cone.
C. Nut by which cone is pressed home: Screwed "½-in. gas."
D. Standard connection forming part of cylinders, valves, or compressor.

An ordinary air-pump is, of course, not suitable for dealing with combustible gases. The cylinders of the compressor should be entirely closed, the piston-rods passing through properly made stuffing-boxes. The smaller compressors are usually of the tandem two-stage type, the low-pressure cylinder compressing to about 7 atmospheres, the gas being then passed through a cooling coil into the high-pressure cylinder, which forces it up to the full pressure. The high-pressure cylinder delivers its gas, through another copper coil immersed in a cooling tank, into a small gas cylinder, which serves to separate the water used to lubricate the pump. At the bottom of this separator is a valve for withdrawing the water. If the pump is required to suck in its supply of gas under a partial vacuum, the low-pressure inlet valve should be arranged so as to be mechanically lifted at the top of each stroke. The water for lubricating the cylinders is fed through a sight feed, and for a compressor of the size we are dealing with, a single drop per two or three revolutions is an ample supply. The clearances should, in both cylinders, be about $\frac{1}{32}$ in., or at any rate not exceed $\frac{1}{16}$ in., in order that, at the highest working pressures, the pump may deliver its full volume, and not merely compress and expand the same gas.

The following precautions are of the highest importance from the point of view of safe and satisfactory performance:—

(1) The greatest care must be taken never to allow much more than the above-mentioned quantity of lubricating water to enter, as with such small clearances this water

carried into the high-pressure cylinder would be unable to pass through the narrow outlet valve and would burst the cover or bend the crank shaft.

(2) If the apparatus is to be used for air, or more especially for oxygen, it is of vital importance that no oil should be employed, either in the pump cylinders or in any of the valves, connections, or gauges. Many disastrous explosions have resulted from the neglect of these precautions. The water may, however, if desired, be replaced for lubrication by glycerine, which forms an excellent substitute for oil for this purpose.

(3) Each time before running the pump, it is advisable to turn it through one or two revolutions by hand to ensure that it is working freely. If the gas to be pumped is combustible, before connecting to the gas-holder the pump should be run for a minute or two with the inlet cock closed, and the end of the delivery pipe placed under water. In this case, if the stuffing boxes and connections are satisfactorily tight, the pump will be running under a vacuum and should deliver absolutely no gas.

(4) The purity of any combustible gas must of course be properly ascertained, as any admixture with air would lead to serious explosions.

(5) It is very advisable to adopt the excellent system, employed by all the gas-compressing companies, of distinguishing between combustible and non-combustible gases, by invariably storing the former in cylinders characterised by a bright red colour, and fitted with left-handed connections. Even where this is done it is advisable before connecting a partially filled cylinder with the pump to test its contents at a flame.

(6) All storage cylinders, connections, and other apparatus, with the exception of gauges, should be occasionally tested hydraulically to double the maximum working pressure.

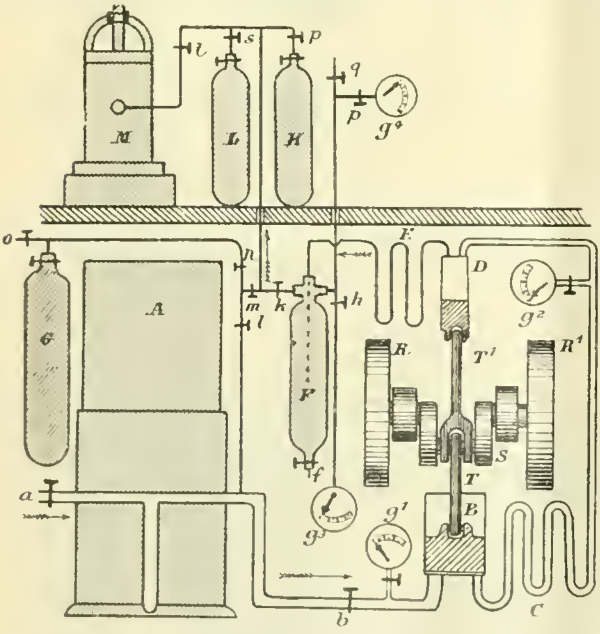

FIG. 6.—DIAGRAM OF COMPRESSING PLANT, GASOMETER, AND CONNECTIONS.

a. Inlet cock to gasometer from gas generating and purifying apparatus (see Fig. 3).
A. Gasometer (10 cb. ft. capacity).
b. Inlet cock to compressor.
g_1. Vacuum gauge on inlet to low-pressure cylinder.
B. Low-pressure cylinder.
C. Cooling coil for ditto.
g_2. Gauge showing pressure at exit from low-pressure cylinder.
D. High-pressure cylinder.
E. Cooling coil for ditto.
F. Water separator.
f. Water blow-off.
G. Gas cylinder used as auxiliary receiver.
g_3. Gauge on high-pressure outlet.
g_4. Duplicate high-pressure gauge.
K, L, M. Receivers for compressed gas.
q, *o*. Blow-off valves.
R, R^1. Pump fly-wheels.
S. Crank shaft.
T, T^1. Connecting and piston rods.

So far as the actual compressing is concerned, a clear idea will be obtained from the diagrammatic sketch (Fig. 6). The gas passes from the purifying apparatus shown in Fig. 3 to the gasometer A (Fig. 6), from which the two-stage compressor, driven by an electric motor, forces it into the water separator F. At its exit from this separator the gas is sufficiently dry for almost any purpose for which it may be required, since the percentage of aqueous vapour in a gas at 100 atmospheres is only 1/100 of its amount at ordinary pressure. When the gas is being made at the normal rate the valve *k* is kept open, the valve *m* closed, and the gas passed directly into a storage cylinder such as L or K, or, in the case of our own work, direct into the pressure furnace M. These were situated in the room on the next floor of the building to the compressor. A high pressure connection is also led direct to a duplicate gauge g_4, by which the pump pressure can be independently read. When necessary the gas can be blown off from the valves *q* on the upper floor, or *o* on the lower; *o* being connected to a pipe leading outside the building, for use with poisonous gases such as carbon monoxide. If, for any reason, the supply of gas fall below the normal rate, the valves *m* and *l* are partially opened, *n* being kept closed; a part of the gas delivered by the pump then returns to the gasometer, and is compressed again, thus avoiding the necessity of either stopping the pump or working it under a partial vacuum. When dealing with gases which can only be conveniently prepared at a very slow rate, it is of course necessary to give up any idea of continuous pumping. In these cases the gasometer is allowed to fill slowly; the pump is then started, and stopped a few minutes afterwards, so soon as all the gas has been pumped. The storage cylinder is thus filled step by step up to any desired pressure. It is not possible to restart the pump against a high pressure; the gas contained in the water separator F must therefore be blown off, and since, at a high pressure, the volume thus returned to so small a gasometer would take up a large part of its capacity, it is preferable to employ an auxiliary cylinder G, which takes the major part of the contents of F, the residue only being returned to the gasometer by the valves *k*, *m*, and *l*. The contents of G can be returned to the gasometer and pumped during the course of the next run through the valves *n* and *l*, *m* being kept closed. This last method of working is of course somewhat complicated, but has proved very useful in a few cases where it was practically impossible to produce the gas at the normal rate. For those purposes where it is required to study some chemical reaction or to purify a gas when under high pressure, a gas cylinder with a removable cover is employed. The ordinary cone joint as shown in Fig. 5 works satisfactorily to close the

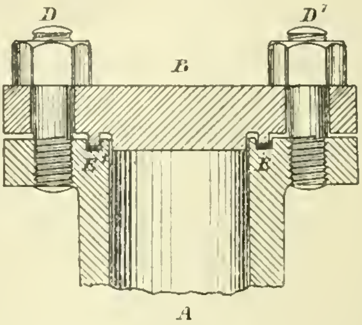

FIG. 7.—SPIGOT JOINT.

A. Cylinder containing solid reagent to dry or purify a gas under pressure, or react with it.
B. Cover.
D. and D^1. Bolts.
E. Spigot and spigot groove (about $\frac{1}{8}$ in. wide for 2-in. bore, rising to $\frac{1}{4}$ or $\frac{5}{16}$ in. for sizes up to 1 ft.).

The central part of the cover projects beyond the spigot, and is turned to nearly fit the bore of the cylinder. This acts as a guide when putting on the cover, and protects the spigot itself from injury when the cover is off.

opening of any tube up to one-inch bore. Above this size it is necessary to resort to some form of spigot joint, such as is shown in Fig. 7. One or two turns of lead wire about the same diameter as the groove are inserted in it, the ends of the lead being bevelled so as to overlap each other. The cover is then forced home by means of the bolts provided for the purpose, and, crushing the lead outwards and upwards, forms a gas-tight joint. When making such a joint for the first time, exceptional care must be taken that the nuts are pulled down evenly, as otherwise the cover may be strained or, being out of truth, the joint will not be gas-tight. When the cover has once been fitted correctly it can be removed and replaced some hundred times before it is necessary to add fresh lead packing. We have used joints of this kind up to a foot diameter, which have always worked satisfactorily. Above this diameter the weight of the cover and the size of bolts required become somewhat unmanageable when designed for pressures of 100 or 200 atmospheres.

Discussion.

Mr. **Wm. Thomson**: Mr. Hutton had stated that hydrogen prepared from zinc direct cost 35*s.* per 1000 cb. ft., and by the electrolytic method it cost 15*s.* He also referred to the process worked at the present time by the Industrial Engineering Company at Newton, near Hyde, but he (Mr. Thomson) did not think that Mr. Hutton had dwelt sufficiently upon the merits of that process as a comparatively large-scale laboratory method. It was one which could be easily carried out in the laboratory. Superheated steam was passed through iron turnings (heated to redness in a retort); the turnings became oxidised, liberating the hydrogen from the steam. Coal gas or producer gas could then be passed over the oxide of iron, which would liberate a large amount of heat from the combination of the oxygen of the oxide of iron with the hydrogen and carbon monoxide contained in the coal gas or producer gases. When the iron had become thoroughly deoxidised, superheated steam was again passed over the reduced iron, which decomposed the water, again producing oxide of iron and free hydrogen, which could be obtained almost chemically pure at a cost of about 1*s.* per 1,000 cb. ft.

Dr. **Markel** asked, in view of the large excess of ammonia, *viz.*, not less than 100 per cent., which Mr. Hutton found necessary to use when producing nitrogen by means of Harcourt's process, whether he had taken any precautions with regard to the elimination of the water vapour from the mixture of ammonia and air entering the combustion tube. It was well known that water vapour had of all gases the greatest protective influence on ammonia, and that, therefore, in the presence of water vapour a very much higher temperature was required to destroy ammonia by heat, or to burn it with air. Had Mr. Hutton taken this important protective property into account, and had he not found that when the water vapours were removed he could work with a very much smaller excess of ammonia, or a considerably lower temperature?

Mr. **Scudder** asked if the authors of the paper had made any observations on the effect of compressing and storing gases in steel cylinders. Reference had been made to the compression of carbonic oxide gas. Some years ago he (Mr. Scudder) had occasion to put down a plant for compressing water gas into steel cylinders, and he found that after the gas had been stored for a time it was found to be contaminated with iron carbonyl, which rendered the compressed gas useless for illuminating and experimental purposes. He should like to have the experiences of the authors of the paper as to any observed effects produced either by impurities in the gas or the effect of storage.

Mr. **Hutton**, in reply to Dr. Markel, said that they had always employed double the required amount of ammonia in order to ensure against the presence of oxides of nitrogen. Doubtless, a smaller excess would be sufficient, but they had not had time to study the reaction in detail, although this would doubtless give interesting results. It should be remembered that Ostwald's method of producing nitric acid consisted in passing air and small quantities of ammonia over various heated catalysing agents. In reply to Mr. Scudder, it was pointed out that the chief object of the work the authors were engaged in, was to study such reactions as were referred to in the question. It was, however, too early to deal with the results which have up to the present been obtained. So far as the action of carbon monoxide on the steel cylinders was concerned, other observers have noted the formation of iron carbonyl. The action does not, however, seem to be very rapid at ordinary temperatures. It has, however, caused trouble by deposition on the limes in lantern work even when compressed coal gas containing a small percentage of carbon monoxide is employed.

New York Section.

Meeting held at Chemists' Club, on Nov. 12th, 1903.

DR. VIRGIL COBLENTZ IN THE CHAIR.

MODERN SYNTHETIC MEDICINAL PRODUCTS.
PART II.

BY DR. VIRGIL COBLENTZ.

(See this Journal, 1898, 725.)

It was originally my purpose to continue the subject of my last annual address, devoted to the impurities of our medicinal chemicals and reagents. However, I have found this subject to be a very ungrateful one, for, in America, criticism I have had in this line seems to bear the type of resentment. The subject selected therefore is a continuation of my paper on Modern Synthetic Medicinal Products, presented to the Society in 1898. During the intervening five years many very important syntheses have been made in this direction, and much has been accomplished to still further elucidate the relationship between chemical structure and physiological action, which subject has been so ably and thoroughly treated in Fraenkel's "Die Arzneimittel Synthese" (Julius Springer, 1901).

Notable advances have been made among the alkaloids, as, for example, the synthesis of theophyllin (theocin), caffeine (from uric acid of guano), morphine derivatives (epiosin, heroin, dionin), eumydrin, and new quinine derivatives. Very interesting derivatives are to be found among the hypnotics, local anæsthetics, antiseptics, uric acid solvents, cacodylates, &c. Of interest to physiological chemists and indispensable to the invalid are the class of the patent foods. Unfortunately the writer is unable to give the patent numbers, owing to objections of many of the patentees. As an aid to those who may wish to secure further, more detailed information concerning any one of the products mentioned in the paper, the name of the manufacturer or patentee is given wherever possible.

Local Anæsthetics.

The search for local anæsthetics which offer, as cocaine substitutes, the advantages of stability (against hydrolysis) and lesser toxicity, has continued unabated. These are either derivatives of such basic groups as the eucaines, orthoforms, holocain, &c., or such phenols as the guaiacol derivatives, eugenol, &c. Directly related to cocaine, which is a derivative of the mother substance ecgonine, is *Tropacocaine Hydrochloride* (Merck). This is the hydrochloride of tropacocaine or benzoylpseudotropeine, $C_8H_{14}NO(C_7H_5O).HCl$, which forms white needles fusing at 271° C.

The *Eucaines* (E. Schering), derivatives of di- and tri-acetone-alkamine, which originated through the investigations of Ehrlich and Merling on the structure of cocaine, still retain their place. The investigations of Einhorn on the substituted amino derivatives of benzoic esters, demonstrated that they all possessed local anæsthetic properties[*] of greater or lesser intensity. Among these is Orthoform (Hoechster Farbwerke), *p*-amino-*m*-hydroxybenzoic acid methyl ester, $C_6H_3(COOCH_3)(NH_2)(OH)$, which has during recent years been replaced largely by the cheaper isomer *Orthoform New*, *m*-amino-*p*-hydroxybenzoic acid methyl ester, melting at 142° C.

Chloral-Orthoform New (Kalle & Co.) is a chloral-amino-hydroxybenzoic methyl ester, $C_6H_3(COOCH_3)(OH)N:CH.CCl_3$, prepared by interaction between molecular quantities of chloral and orthoform. More recently the orthoforms have had to give way to Ritsert's *Anæsthesin* (Hoechster Farbwerke) which is para-amino-benzoic acid ethyl ester, $C_6H_4(NH_2)CO.OC_2H_5$, fusing at 89·5° C. Besides being a local anæsthetic, this substance is valuable in hyperæsthesia of the stomach. A product of greater stability is *Subcutin*, *p*-phenol-sulphonate of anæsthesin, $HO.C_6H_4.SO_3H, NH_2.C_6H_4.COOC_2H_5$, a substance fusing at 195·6° C. Another derivative of this class prepared by Einhorn is *Nirvanin* (Hoechster Farbwerke), the hydrochloride of diethylglycocoll-*p*-amino-hydroxy-benzoic-methyl ester, which fuses at 185° C., $HCl(C_2H_5)_2N.CH_2.CO.NH.C_6H_4(OH).COOCH_3$. This substance produces complete and lasting anæsthesia when brought into contact with the nerve terminals through subcutaneous injection or open wounds. It is free from irritating action, and is especially adapted for Schleich's infiltrations in place of the ten times more toxic cocaine. Amino cinnamic ethyl ester, $C_6H_5CH:C(NH_2)COOC_2H_5$, has been introduced, with but little commercial success. The amino group, when in the para position to the hydroxyl group, produces a strong local anæsthetic action; this likewise exerts a toxic action in the circulatory system. Close proximity of the two groups accounts possibly for the comparative non-toxicity of the orthoforms and the absence of the hydroxyl group in anæsthesin. In nirvanin and subcutin the para amino groups, through substitution, have lost much of their toxic characters, which accords with the views of Oscar Loew (Natuerliches System der Giftwirkung) "that relative toxicity is determined by the degree of reactivity with the amino or aldehyde groups of the protoplasm." In these latter two compounds, the reactive amino group is rendered more resistive through the presence of these substituting groups. According to Ehrlich, the structure of the molecule must be such that it readily anchors with certain molecular groups of the protoplasm; also, this molecule must, in addition, contain the atomic complex with which it will exert its specific action in the protoplasm. For example, in cocaine the carrier of the anæsthetic action resides altogether in the benzoyl group, as may be noted in the loss of local anæsthetic action through the replacement by other acid radicles, while the balance of the molecular structuro is such that it anchors itself in the protoplasm.

Under the Holocain group is included a number of amidin and guanidin derivatives; the former may be considered to be derivatives of methylene-amino-phenol ethers of the general formula $CH_2 : N.C_6H_4.OR$. The older members of this group are *Holocaine* (Hoechster Farbwerke) *p*-diethoxyethenyl-diphenyl amidine, $C_2H_5OC_6H_4.NH.C(CH_3):N.C_6H_4.OC_2H_5$, which fuses at 121° C.; *Pyrocaine*, a guaiacol benzyl ester $CH_3O.C_6H_4.OCH_2.C_6H_5$; *Eugenol acetamide*, $CH_3.C_3H_5(OCH_3)OCH_2.CONH_2$, which fuses at 110° C.; and *Guaiacyl*, calcium orthoguaiacol sulphonate, $[C_6H_3(OH)(OCH_3)SO_3]_2Ca$. To these may be added *Methenyl-p-phenetidide*, $C_2H_5O.C_6H_4.NH.CH : NC_6H_4.OC_2H_5$, which fuses at 114° C., and its analogous *p*-anisidine base, fusing at 119° C., both of which are local anæsthetics. Of recent introduction, and belonging to the class of alkyl-oxyphenylguanidines, are the

Acoïns (V. Heyden Fabrik).—These are the hydrochlorides of the above-named derivatives, among which the Acoin C, di-*p*-anisyl-monophenetyl guanidine, has been proposed as a substitute for cocaine, possessing a minimum degree of toxicity and a greater degree of intensity of action. An objectionable feature is the necrosis following the hypodermic use of strong solutions. Its formula is $(CH_3O.C_6H_4NH)_2:C:NC_6H_4.OC_2H_5$.

Acetone Chloroform, otherwise known as *Aneson* and *Chloreton*, is a tertiary trichloro-isobutyl alcohol melting at 80° to 81° C., of the formula $(CH_3)_2C(OH).CCl_3.\frac{1}{2}H_2O$. A 2 per cent. solution of Aneson is equivalent in local anæsthetic activity to one of like strength of cocaine. This remedy is likewise employed as a hypnotic and sedative, also it will prevent nausea following anæsthesia. Chloretone appears in every respect to be a superior substitute for cocaine.

Nervocidin.—The active principle of the East Indian plant Gasu-Basu, which has found application as a dental local anæsthetic in 0·1 per cent. solutions, while anæsthesia of the cornea may be accomplished with a 0·01 solution.

Among those remedies which produce local anæsthesia by cold through rapid vaporisation, no new derivatives have been introduced. New in title are *Anestile* (Bengué), a mixture of ethyl and methyl chlorides, and *Narcotile*, a mixture of methyl and ethylene chlorides.

Synthetic Morphine Derivatives.

No department of chemical research has proved so alluring and yet so slowly productive of results as the chemical constitution of the vegetable alkaloids, and among these, in particular the alkaloid morphine. As soon as the structure of any one of these bases has been accurately established, it is only a matter of time until the pharmacologist and chemist are able, from a knowledge of the physiological action of various organic nuclei which enter into these compounds, to prepare derivatives of like or modified action. In the case of morphine it has been the constant effort of chemists to prepare a derivative which would be free from its objectionable secondary action. It is only very recently that any approach to this ideal has been accomplished.

The hydroxyl groups are intimately associated with the toxic action of morphine, which, through its narcotic characters, differs from all other opium alkaloids, its action being chiefly upon the nerve centres of the brain. Upon closing these OH groups by substituting one or both of the hydrogens by alkyl or acidyl radicals, the narcotic characters disappear, while, on the other hand, a spinal excitant (tetanic action) is developed, increasing with the number of alkyl radicals introduced. Thus, codeine produces, like morphine (but in lesser degree) narcosis, followed by an elevated reflex, which, if the dose be sufficiently large, develops tetanic convulsions. Other morphine esters, as codethyline, $C_{17}H_{17}ON(OH)(OC_2H_5)$, and thebaine, $C_{17}H_{15}(OCH_3)_2NO$, the latter of which is the most toxic alkaloid of opium, are characterised by their action on the spinal cord, the tetanic effects being identical to those produced by strychnine. This action increases with the number and molecular weight of the alkyl groups introduced; hence codethyline with its ethyl group is more intense in action than codeine, which contains but one methyl group. Among all possible derivatives, it is immaterial as to whether an acidyl or alkyl radical, aliphatic or aromatic, is introduced; there is practically no qualitative difference in action so long as the same hydrogen is replaced. The morphoxyacetic acid ($C_{17}H_{18}NO_3.CH_2COOH$), morphoxy propionic and butyric acids are pharmacologically inactive, where, on the other hand, the methyl and ethyl esters of these acid derivatives produce intense picrotoxin-like convulsions, the seat of action being the *crura cerebri*. In all instances the narcotic action of morphine is very much diminished, while the tetanic and also the action on the motor nerves is increased.

It is only during very recent years that any attempt toward producing morphine derivatives of the codeine type have been attempted. These substances, while less active for relieving pain, exert a sedative effect on the unstriped muscles of the bronchi, and reduce the disposition to cough; hence are of value in phthisis, bronchitis, asthma, &c. One of the first of this class of derivatives to appear, introduced by E. Merck, of Darmstadt, in 1896, was *Peronin*, the hydrochloride of benzylmorphine, $C_{17}H_{17}(OH)ON.O.CH_2.C_6H_5, HCl$. This narcotic was proposed as a substitute for codeine and

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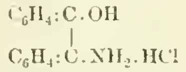
[*] Members of this class are the *o*- and *m*-methyl and ethyl esters of hydroxy- and dihydroxy-benzoic, salicylic, anisic, creosotic, protocatechuic and vanillic acids. Most of these possess objectionable irritating properties.

morphine in alleviating the cough in pulmonary tuberculosis, chronic bronchitis, and pertussis. This was followed by

Heroin (Elberfelder Co.).—The hydrochloride of the diacetic ester of morphine, $(CH_3COO)_2C_{17}H_{17}ON, HCl$. This preparation, which melts at 230° C., possesses a decided advantage in its ready solubility in water (1 in 2). Heroin, like others of this class, is valuable in affections of the respiratory passages. Stockmann and Dott prepared, in addition to the diacetyl morphine, the dipropionyl, dibutyryl, and divaleryl derivatives, the comparative action of which resulted to the advantage of the acetyl derivative. A later introduction and improvement over the older peronin was

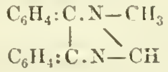
Dionine (E. Merck).—The hydrochloride of ethyl morphine $(HO.C_{17}H_{17}.NO.OC_2H_5.HCl)$. This compound, which fuses at 123° to 125°, appears to be a mild substitute for morphine, being equally available as an anodyne, hypnotic, and sedative.

As a result of the more recent investigations of Knorr and others, based on the breaking up of the ring structure of morphine, the presence of a phenanthrene and also an oxazine (morpholine) nucleus have been conclusively demonstrated. Assuming that either one of these nuclei might be responsible for the physiological action of morphine, E. Vahlen endeavoured to prepare a nitrogenated derivative of morpholine, in the hope of obtaining a therapeutically active body (Archiv f. exp. Path. u. Pharmak., **47**, 368). Such a compound he found in morphigenine hydrochloride—



$$\begin{array}{l} C_6H_4:C.OH \\ \qquad\quad | \\ C_6H_4:C.NH_2.HCl \end{array}$$

which he was able to obtain only in solution; this substance possess marked narcotic properties. Vahlen further prepared an amidazole derivative of morphigenine, to which he gave the name *Epiosin* (Dr. Heineman, Eberswalde). This new synthetic, which fuses at 195° C., is a methyl-diphenyleneamidazole of the structure—



Physiologically, epiosin possesses the anodyne and hypnotic action of morphine without any of its objectionable secondary effects. Clinical experiments are still in progress.

Alkaloids.

During the last five years much has been accomplished, not only in the isolation of many new plant principles, but also in the preparation of valuable derivatives of the well-known alkaloids. Only the more important members of the latter class are enumerated. The synthesis of theophyllin is mentioned elsewhere.

Eumydrin (Elberfelder Fabrik).—Atropine methyl nitrate is obtained either by the action of nitric acid on atropinium nitrate (or alkyl halides), or by treating atropine with alkyl nitrates, or atropinium alkyl sulphates (atropinium methyl sulphate, $[C_{17}H_{23}NO_3.CH_3]_2SO_4$) with the nitrates of such metals as form insoluble sulphates. This salt is without action on the central nervous system, and exhibits a less powerful effect on the pupil than atropine.

Lactyl Tropeïn, $C_8H_{14}NO.CO.CH(OH)CH_3$, accelerates the action of the heart.

Mydrol (Merck).—Iodo-methyl-phenyl-pyrazolone, a mydriatic.

Mydrin (Merck).—A combination of ephedrine and homatropine used as a mydriatic.

Quinine Derivatives.—Efforts in the preparation of new derivatives of quinine have been directed towards the production of insoluble tasteless products, free from the disagreeable secondary effects which usually accompany the use of the more common salts.

Aristochin (Elberfelder Fabrik).—A diquinine carbonic ester, $CO:(O.C_{20}H_{23}N_2O)_2$, which forms a tasteless powder fusing at 189° C. Of all the various quinine preparations this contains the largest percentage of alkaloid, namely, 96 per cent.

Euchinin (Zimmer, Frankfort).—Quinine ethyl carbonic ester, $C_2H_5O.CO.OC_{20}H_{23}N_2O$, forms tasteless needles fusing at 95° C. The inorganic soluble salts of euchinin possess the bitter taste of the alkaloids.

Quinine Chlorocarbonic Ester (Zimmer, Frankfurt), $Cl.CO.OC_{20}H_{23}N_2O_2$.—Tasteless crystals, fusing at 187° C.

Salochinin (Elberfeld Co.; also Zimmer Co.).—The quinine ester of salicylic acid. Insoluble crystals, which fuse at 130° C.

Rheumatin (Zimmer, Frankfurt).—Salicylate of salochinin. This fuses at 179° C.

Bromchinal (Zimmer, Frankfurt).—Quinine dibromosalicylate. Fuses at 198° C.

Chinaphtol (Merck).—Quinaphthol. β-naphthol monosulphonate of quinine. Fuses at 185°—186° C.

Quinine Lygosinate (Zimmer, Frankfurt).—Quinine di-*o*-cumaric ketone, $(C_{20}H_{23}N_2O_2)O.C_6H_4.CH:CH.CO.CH:CH.C_6H_4.O(C_{20}H_{23}N_2O_2)$. This salt is employed exclusively as an antiseptic. It fuses at 114° C.

Among the derivatives of minor importance are Acetyl quinine (m. pt. 108° C.), Ethyl quinine (m.pt. 116°—117° C.), Quinine acetylsalicylate, Quinine sulphoguaiacolate, Quinine sulphocreosotate, Quinine urethane, and Quinine carbamido dihydrochloride, $(C_{20}H_{24}N_2O_2)HCl + CO(NH_2)_2HCl + 5H_2O$; the latter three, because of ready solubility, are adapted for hypodermic use.

Hypnotics.

These may be divided into two classes, one in which the hypnotic action is largely dependent on the presence of alkyl radicles, while either an aldehyde or ketone group carries this effect in the other.

Under the former class very few synthetics of any importance have been introduced. That a firmly-linked ethoxyl group carries a definite narcotic effect is shown in the well-known ethoxy caffeine, tertiary-amyl alcohol, sulphonal, trional, and the analgesic phenacetin. Further experiments in this direction were made recently by Professors Emil Fischer and Merling in testing the hypnotic action of a series of compounds containing one or more ethyl groups linked to one and the same carbon, as is the case of tertiary amyl alcohol and trional. A series of such compounds have been discovered among the derivatives of urea, as, for example, diethyl acetyl urea, $(C_2H_5)_2N.CO.NHCOCH_3$, diethyl malonyl urea and the dipropyl malonyl urea. The second of these was selected for therapeutic use, and introduced under the title of

Veronal (E. Merck).—Diethyl malonyl urea, a crystalline powder which melts at 191° C.

The urethanes (carbamic acid esters) possess mild hypnotic action, increasing in activity with the molecular weight of the alcohol radical. Heretofore hypnotic action has been accomplished to a certain extent through the introduction of a substituted aldehyde, as in Uraline (Chloral Urethane) and Somnal (Uraline Alcoholate); however, such combinations are open to criticism, because of the objectionable action of the chloral. Recently an ideal and harmless hypnotic has been introduced, in which the methyl propyl carbinal group replaces the simple ethyl of urethane, the product being known commercially as

Hedonal (Elberfelder Fabrik).—Methyl propyl urethane, $NH_2CO.OCH(CH_3)C_3H_7$, an aromatic crystalline powder, which fuses at 76° C., and boils at 215° C.

Among the latest additions to a series of valuable valeric acid derivatives examined therapeutically by Drs. Liebrecht and Kionka are

Valyl (Hoechster Farbwerke).—A valeric acid diethyl amide, $C_4H_9.CO.N(C_2H_5)_2$, which boils at 210° C. This antispasmodic is useful in hysteria, neurosis, neurasthenia, &c.

Validol (Zimmer & Co.).—The mentholester of valeric acid $(C_{10}H_{19}O.CO.C_4H_9)$, which contains 30 per cent. of menthol.

Second Class.—The objectionable secondary action of chloral upon the heart and respiration, and the disagreeable burning produced in the stomach, which led to the introduction of various more stable combinations from which chloral is slowly eliminated, has not been altogether realised. Among such combinations were Chloral Formamide (Chloralamide), $CCl_3CH(OH)NH.CHO$; Chloralimide, $CCl_3.CH:NH$; Chloralose, Chlorosonin (chloral hydroxylamine), &c. More recently, a new combination of chloral with the hypnotic amylene hydrate (tertiary amyl alcohol) has been introduced under the title of

Dormiol (Chem. Fabrik "Rhenania"). — Amylene Chloral or Chloral dimethyl ethyl carbinol—

$$CCl_3.CH(OH)OC(CH_3)_2C_2H_5.$$

Although much slower in action, recent reports state that Dormiol is not much less toxic than chloral.

Isoprol.—A trichloroisopropyl alcohol, which fuses at 49° C.

In addition to the oximes of chloral (Acetaldoxime, Acetoxime, Camphoroxime, Benzaldoxime), A. C. Jensen (Frankfurt a/M.) introduced the

Chloral Acetophenone Oxime, $C_6H_5.C(CH_3):N.OCH.(OH)CCl_3$, fuses at 81° C.

To the limited number of ketones (the hypnotic properties of which are due to the carbonyl group), Propione (diethyl ketone) and Hypnone (acetophenone) have been added.

Hypno-acetin, the acetyl-*p*-amino phenol ether of acetophenone, $C_6H_5CO.CH_2O.C_6H_4.NHCOCH_3$, is obtained by condensing *p*-aceto-aminophenol with phenol and glacial acetic acid by aid of zinc chloride. This forms scales which fuse at 160° C.

Antipyretics.

Aniline Derivatives.—Safety in administration and freedom from secondary action, which accompany the use of the derivatives of the Pyrazolone and Phenetidine class have been the causes of the diversion from this once popular group of antipyretics. The few additions noted are special products.

Aniline Camphorate.—Used as an antispasmodic.

Sodium Acet-Sulphanilate (Hoffman, La Roche).—A rapid-acting antipyretic.

Anilipyrin. — Phenyldimethylpyrazolone acetanilide, made by fusing together antipyrine and acetanilide.

Aceto-Toluide (*Ortho*) (Merck) fuses at 107° C.

Para-phenetidine Derivatives.—On glancing over the additions to this group, it is evident that the list of organic acids which have been proposed in place of the acetyl groups of phenacetin has not yet been exhausted. Very evidently the attempt has been made to employ substituting groups which possess special medicinal properties as in the case of phenetidine agaricinate, valerydin, &c., adding otherwise to their value as antipyretics.

Agaric Acid Phenetidides (Riedel, Berlin).—These products represent a combination of the antihydrotic properties of agaric acid with the antipyretic action of the phenetidine nucleus, and are prepared by heating the components together at a temperature of from 140° to 160° C. Two products result, a monophenetidide, $C_{14}H_{27}(OH)(COOH)CO.NHC_6H_4.OC_2H_6$, which when anhydrous, fuses at 100° C., and a diphenetidide which fuses at 151° C.

Benzacetin.—Acet-amino-ethyl salicylic acid, $C_6H_3(OC_2H_5)(NH.COCH_3)COOH$. An acetylated amido-salicylic acid which fuses at 190° C.

Chinaphenin (*Quinaphenin*) (Zimmer, Frankfurt).—Quinine carbonate phenetidide, $(C_{20}H_{23}N_2O)O.CO.NH.C_6H_4.OC_2H_5$, obtained by the action of *p*-ethoxy-phenyl-carbamic chloride or *p*-ethoxyphenyl-isocyanate on quinine. The antipyretic properties of this compound combine those of the slowly acting quinine and more rapid phenacetin. Chinaphenin fuses at 186°—185° C.

Eupyrin (Zimmer, Frankfurt). — Para-phenetidine vanillin ethyl carbonate, $C_6H_4(OC_2H_5).N:CHC_6H_3(OCH_3)O.COOC_2H_5$. A non-toxic stimulating antipyretic for children. The fusing point is 87°—88° C.

Valerydin (*Sedatin*) (Erdmann, Leipzig).—Iso-valeryl para-phenetidine, $C_6H_4(OC_2H_5)NH.C_5H_9O$. A combined nervine and antipyretic.

Apolysin and Citrophen.—Anselmino (Ber. d. Deutsch. Phar. Gesellsch., 1903, 5), as a result of his investigations, claims that the usual accepted formulæ for these compounds are erroneous. Apolysin, formerly considered as a monophenetidine citrate, $C_3H_4.OH.(COOH)_2.CO.NH.C_6H_4.C_2H_5$, is, according to this author, a mono-phenetidide of aconitic acid $(C_6H_7O_6)NH.C_6H_4.O.C_2H_5$, while citrophen instead of being a citro triphenetidide, is in reality a monophenetidine citrate, fusing at 188° C.

Antipyrin Derivatives.—The camphorates (acid and neutral) of antipyrin and pyramidone (dimethyl amino antipyrin), serve as antihydrotic antipyretics, which are of special value in tuberculosis.

Acopyrin.—Acetopyrin (Heyden, Dresden).—An acetyl salicylate of antipyrin, which fuses at 61° C.

Pyrosol (Hofmann, Meerane i/S.).—A soluble salicyloacetate of antipyrin, which fuses at 150° C. $(C_9H_8O_5.C_{11}H_{10}N_2O)$.

Thiopyrin and Selenopyrin.—These are prepared by interaction between potassium hydrosulphide, also potassium selenide and the so-called antipyrin chloride (chloromethylate of 1 phenyl, 3 methyl, 5 chloropyrazole). The thiopyrin $(C_{10}H_{12}N_2S)$ fuses at 166° C.

Kryogenin.—Metabenzamido-semicarbazide—

$$C_6H_4(CO.NH_2)(NH.NH.CO.NH_2).$$

Acetyl Ethyl Phenyl Hydrazin.—An ethyl derivative of pyrodine (hydracetin).

Neurodin (Merck).—Acetyl *p*-hydroxy-phenyl urethane, $C_6H_4(OCOCH_3)NH.COOC_2H_5$, fuses at 87° C.

Antiseptics.

The majority of the synthetics introduced during the past five years belong under this class. However, comparatively few of these have found a permanent place in *materia medica*.

1. *Derivatives of the Amines:* — *Iodoformin* (Marquardt).—Hexamethylene tetramine-iodoform, $CHI_3(CH_2)_6N_4$. This compound, which fuses at 178° C., breaks up in presence of the wound secretions, with liberation of iodoform.

Iodoformal (Marquart).—Iodoformin ethyl iodide forms yellow needles, which fuse at 128° C. (German Patent 87,812.)

Iodoformogen (Knoll and Co.).—Iodoformin albumin. A readily sterilized preparation containing 10 per cent. iodoform. (German Patent, 95,580.)

Kresamin (Schering); Cresamin; Tricresolamin. An ethylene diamine cresol.

2. *Formaldehyde Combinations.*—These represent combinations of formic aldehyde with various antiseptics, from which the former is slowly eliminated when in contact with a wound.

Kreoform (Henning, Berlin).—A condensation product of creosote and formaldehyde.

Forman (Lingner, Dresden). — Chloromethyl menthylether, $C_{10}H_{19}O.CH_2Cl$, a chlorinated methyl ether of menthol prepared by the action of formaldehyde on menthol in presence of gaseous hydrochloric acid. This compound boils at 160° (16 mm.), and decomposes by the moisture of the air into formaldehyde, menthol, and hydrochloric acid.

Thymyloform (Henning, Berlin) *Thymoform.*—A condensation product of thymol and formaldehyde—

$$[C_6H_3(CH_3)(C_3H_7)O]_2CH_2.$$

Iodothymoform is an iodised thymoloform, which fuses above 150° C.

Naphthoformin (Henning, Berlin).—A condensation product of α- or β-napthol and formaldehyde.

Polyformin, soluble (Henning, Berlin).—A di-resorcinol-hexamethylene tetramine $[C_6H_4(OH)_2]_2.(CH_2)_6N_4$.

Polyformin, insoluble (Henning, Berlin).—On dissolving polyhydric benzenes or phenols with a condensed benzene nucleus in an aqueous solution of formaldehyde and adding excess of ammonia, insoluble compounds of high formaldehyde content are obtained, of which this polyformin is a representative.

Galloformin (Henning, Berlin).—A hexamethylene tetramine gallic acid, $C_6H_2(OH)_3COOH.(CH_2)_6N_4$. Similar to this are *Resorcinol Formin* and *Pyrogallol Formin.*

3. Aromatic Derivatives: (*a*) *Phenols: Antinosin* (Rhenania Fabrik).—Nosophen sodium or tetra-iodo-phenol phthalein sodium, $C_6H_4.COO.C.(C_6H_2I_2ONa)_2$.

Egols.—The mercury salts of *o*-nitro phenol (cresol or thymol) *p*-sulphonic acid. These are distinguished by prefixes Phen-egol, Cres-egol and Thym-egol.

Eosolates (Lehmann, Berlin).—The salts of the sulphonic acid derivatives of alipathic creosote esters (trisulphoacetyl creosote). (German Patent 94,078.) Calcium eosolate, $(C_9H_7S_3O_{12})_2Ca_3$; Silver eosolate, $C_6H(OCH_3)(OCOCH_3)(SO_3)_3Ag_3$; Quinine eosolate, $(C_{20}H_{21}N_2O_2)_3C_9H_7S_3O_{12}$.

Iodozols (Voswinkel, Berlin).—Various salts of di-iodo-phenol sulphonic acid.

Euresol (Knoll and Co.) — Monoacetyi resorcinol, $C_6H_4(OH)OCOCH_3$, which boils at 283° C.

Eunol (Henning, Berlin).—A condensation product of the naphthols and eucalyptol.

Ready saponifiable esters of pyrogallol and chrysarobin:—

Eugallol (Knoll and Co.).—Monoacetyl pyrogallol.

Lenigallol (Knoll and Co.)—Triacetyl pyrogallol, $C_6H_3(OCOCH_3)_3$.

Saligallol (Knoll and Co.).—Pyrogallol disalicylic ester.

Eurobin (Knoll and Co.).—Triacetyl chrysarobin.

Lenirobin (Knoll and Co.).—Tetracetyl chrysarobin.

Iodo-eugenal.—A compound analogous to aristol (di-thymol di-iodide) melting at 78° C.

Di-Fluor Diphenyl (Valentiner and Schwartz), $FC_6H_4—C_6H_4F$, obtained by the action of hydrogen fluoride on benzidine. It fuses at 87° C.

(*b*) *Aromatic Aids: Peruscabin* (A.-G. f. Anilinf.).—Benzoic benzyl ester. This along with cinnamein, styracin, and cinnamic acid. is the most active constituent of Peru balsam. Peruscabin boils at 173° C. (9 mm.)

Lygosins (Zimmer and Co.).—These are the sodium and quinine salts of di-ortho-hydroxycinnamic ketone obtained through the interaction between salicylic aldehyde and acetone in presence of sodium hydroxid. This ketone, of the formula $CO:(CH:CH.C_6H_4.ONa)_2$, fuses at 114° C.

Salibromin.—Dibromo-salicylic acid.

Epicarin (Elberfelder Fabriken).—β-hydroxy-naphthyl *o*-hydroxy-*m*-toluic acid, $C_6H_3(OH).CH_2(C_{10}H_{16}OH)COOH$. This belongs to a new group of creosotic acid derivatives in which a hydrogen of the methyl group of creosotic acid is replaced by a phenol rest, epicarin being the β-naphthol derivative. This fuses at 199° C., and is specially employed in scabies and various skin diseases.

Thymotal.—Thymol carbonate, thymol urethane (v. Heyden). Thymotal, which fuses at 49° C., splits up in the intestines, liberating thymol, which serves to destroy intestinal parasites.

Acetozone, Benzosone (Parke, Davis and Co.).—$C_6H_5CO.O.O.COCH_3$, benzoyl acetyl peroxide, which fuses at 40° to 41° C. In aqueous solution, owing to its ready hydrolysation, acetozone acts as a powerful oxidising agent.

Benzoyl Peroxid (Dr. Hellin, St. Petersburg).—This substance, which fuses at 103·5° C., is employed likewise as an oxidising agent.

Hetocresol (Kalle and Co.).—Cinnamic acid meta cresol, $C_6H_5CH:CH.COOC_6H_4CH_3$, fusing at 65° C. (German Patent No. 99,567.)

Hetol (Kalle and Co.).—Sodium cinnamate; both this and hetocresol are employed intravenously in treatment of tuberculosis.

(*c*) *Quinoline Derivatives: Vioform, Nioform* (Basel Fabrik).—Iodochlorohydroxyquinoline.

Quinosol (Fritzsche, Hamburg).—Hydroxyquinoline alum, hydroxyquinoline potassium sulphate $2(C_9H_6NOH)H_2SO_4 + K_2SO_4$.

Sulphurated Tarry Products.—The popularity of ichthyol, as well as the lapse of its patents, has led to the introduction of several products of similar composition. The Ichthyol Company has introduced some valuable combinations of ichthyol.

Ichthargan (Ichthyol Co.).—Silver ichthyol sulphonate, 30 per cent. silver.

Ichthermol (Ichthyol Co.).—Mercury ichthyol sulphonate, 24 per cent. mercury.

Ichthoform (Ichthyol Co.).—Ichthyol formaldehyde.

Ichthalbin (Knoll and Co.).—An ichthyol albumin analogous to tannalbin (tannin albuminate). An agreeable ichthyol substitute for internal use. (English Patent No. 11,344).

Petrosulfol (Hell and Co.).—Obtained by sulphonating a highly sulphurated Tyrolese bituminous oil and neutralising with ammonia.

Thiogenol (Hoffmann La Roche).—A 33 per cent., solution of the sodium salt of a sulphonated sulphur oil.

Sphagnol, Corbaoel.—A product of the dry distillation of turf. This contains anthracene, benzene, phenol, and cresols.

Gabamiol.—A sulphurated oil obtained from the natural shale of Herat.

Isarol (Ges. Basel).—A product identical with ichthyol, containing 8·5 to 9·5 per cent. of sulphur.

Ichthydrin.—Apparently a side product in the preparation of ichthyol.

Illyrin.—A product similar to ichthyol.

(*d*) *Miscellaneous Organics: Fluoroform Solution* (Valentine, Leipzig).—A saturated solution (28 per cent.) of fluoroform (CHF_3) in water.

Solvosal Salts (Helfenberg, Dresden).—The potassium and lithium salts of salol-o-phosphinic acid, *e.g.*, $C_6H_5O.CO.C_6H_4O.PO.(OH)OK$. This splits up into salicylic acid, salol, and a phosphate.

Toluidine Blue.—The soluble salt of a dimethyl toluthionine and zinc chloride, $C_{15}H_{16}N_3SCl.ZnCl_2$. A substitute for Methylene Blue in ophthalmology.

Acetyl Leuko-Methylene Blue (Hoechster Farbwerke). A product of the reduction of methylene blue.

4. *Organic Compounds of Bismuth.*—Recent years have added quite a formidable list of new bismuth combinations. Only the more important of these are given, among which are some valuable additions to antiseptic surgery, as, for example, airol, iodogallicin, and xeroform.

Bismuth Sulphophenate.

Bismuth Albuminate (Merck), 9 per cent. bismuth.

Dibismuth Mono-Iodo-Methylene-di-Cresotinate.

Bismuthose (Kalle and Co.).—A bismuth albumin compound, containing 22 per cent. of bismuth. (This Journal, 1902, 1244.)

Bismuth-oxy-iodo-Agaricinate.

Crurin (Kalle and Co.).—Quinoline bismuth sulfocyanide $(C_9H_7N.HSCN)_2Bi(SCN)_3$.

Hetaform.—Bismuth cinnamate, $Bi(C_9H_7O_2)_3.Bi_2O_3$.

Airol (Hoffmann, La Roche).—Bismuth oxy-iodo gallate, obtained by action of hydriodic acid on bismuth subgallate. It contains 20 per cent. of iodine, $IBiO_2.C_6H_2(OH)COO.C_6H_2(COOH)O_2BiOH$. Airol is the most important addition to this group. (German Patents 80,399 and 82,593.)

Ibit (Gesellsch. Basel).—Bismuth oxy-iodo tannate, a preparation closely related to airol, $C_6H_2(OH)_2(COOH)O.CO.C_6H_2(OH)O_2BiI$.

Iodogallicin (Sandoz and Co., Basel).—Bismuth oxy-iodid-methyl gallol obtained through action of bismuth oxyiodid on gallacin (gallic acid methyl ester)—

$$C_6H_2(COOCH_3)(OH)_2.OBi(OH)I.$$

This contains 23·6 per cent. of iodine, and 38·4 per cent. of bismuth.

Hæmostatin or *Zeroform* (V. Heyden).—Bismuth tri-bromo-phenate $(C_6H_2Br_3O)_2.BiOH + Bi_2O_3$. This preparation, which contains about 60 per cent. of Bi_2O_3, serves not only as an antiseptic, but also as a hæmostatic.

Bismutan (Mindes, Zürich).—A bismuth resorcinol tannate.

The Silver Antiseptics.—Although one of the standard remedies for the treatment of inflammation of the mucous membranes, silver nitrate possesses an irritating and often caustic action, which has greatly restricted its field of application. Aside from this, it has only a limited penetrating power, due to the fact that it is precipitated by albumin and sodium chloride, two of the ordinary constituents of the secretions and tissues. This is a serious disadvantage, since many of the conditions in which it is employed are due to micro-organisms, which are found not only in the superficial, but also in the deeper portions of the mucous membranes, and hence cannot be reached by solutions of this chemical, owing to the formation of an insoluble silver albuminate in the upper layers. The recognition of these drawbacks is responsible for the host of substitutes for silver nitrate which have been introduced in recent years. Most of these represent combinations of various percentages of metallic silver with different proteids. They are all said to be less irritating than the nitrate, and unaffected by either albumin or sodium chloride.

I. *Organic Combinations: Albargin* (Hoechster Farbwerke).—A gelatose silver containing 15 per cent. of the metal, which is prepared by mixing a neutral solution of glucose with silver salts, and precipitating with alcohol. Neither hydrogen sulphide, nor boiling with alkalis, produces any reaction, while chlorides produce only opalescence.

Argentol (F. Fritzsche, Hamburg).—An oxyquinoline sulphonate of silver ($C_9H_5N.OH.SO_3Ag$), containing 32 per cent. of the metal.

Argyrol (Drs. Barnes and Hille).—A non-irritating silver vitellin, which contains 30 per cent. of silver.

Argonin (Hoechster Farbwerke).—A casein-silver compound, which contains 10 per cent. of metallic silver. This yields very stable aqueous solutions.

Largin (Merck).—Protalbinsilver containing in the air dry condition 11 per cent. of the metal.

Nargol (Parke, Davis, and Co.).—A nucleide of silver containing 10 per cent. of the metal.

Protargol (Elberfelder Fabriken).—A silver proteid preparation, containing about 8 per cent. of silver in a fixed combination. Not precipitated by albumin, chlorides, or alkalis; it possesses great penetrating properties.

Ichthargan (Ichthyol Gessells.).—A silver ichthyol sulphonate. Contains 15 per cent. of sulphur and 30 per cent. of silver.

Argentamine (Schering, Berlin).—A solution of one part of silver phosphate and one part of ethylene diamine in 10 parts of water: 10 parts correspond to one part of silver nitrate.

Silberol.—Silver sulphophenate (1.4) obtained by action of a solution of phenol sulphonic acid on silver carbonate.

Itrol and Actol (v. Heyden).—Citrate and lactate of silver.

II. *Inorganic Combinations: Tachiol.*—Silver fluoride. It is claimed that this destroys pathogenic organisms in solutions of 1 to 200,000.

Collargol (v. Heyden).—Collodal silver which contains 90 per cent. of the pure metal. The preparation is completely soluble in water, is employed locally subcutaneously and in ointment form. According to Henriot (Chem. Zeit., 1903, 686) collargol is not an allotropic form of silver, but the alkali salt of collargolic acid prepared from Paal's lysalbate of silver. Collodal silver prepared by different methods deports itself differently.

7. *Mercurial Antiseptics.*—The value of mercurials in the treatment of syphilis and also as antiseptics has brought forward a variety of combinations, some of which, because of their ready solubility, freedom from irritation, and slow elimination from the system, are especially adapted for subcutaneous and instramuscular injection. While others represent antiseptics equal in value to sublimate yet free from its objectionable action on steel instruments.

Hyrgol or Colloidal Mercury (v. Heyden).—The solution of the commercial product deposits on standing a slight insoluble residue; this is objectionable because of variations in strength. This solution is free from irritating action; the metal is precipitated by acids, bases and salts of the heavy metals. Hyrgol is valuable for preparing various pharmaceutical preparations of mercury.

Mercurol (Parke, Davis, and Co.).—A nucleide of mercury, which contains 10 per cent. of the metal. It is not affected by albumin or alkalis, and is free from irritant action.

Mercuriol. — An aluminium-magnesium amalgam of Swedish origin.

An almost innumerable list of salts of mercury representing combinations with all the various aliphatic and aromatic acids, phenols, &c., have been already introduced; among the more important are—

Mercuric Formamide. — The hydrogen of the amino group in formamide, being replaced by mercury ($(H.CO.NH)_2Hg$.

Mercury Phenolates. — The mono-phenol derivative, $(C_6H_5O)_2Hg + H_2O$, which is quite unstable in the organism, is a valuable mercurial, while the diphenyl mercury is very poisonous, because of its stable character and cumulative action. Similar to these are the dimethyl and diethyl mercury $(CH_3)_2Hg$ or $(C_2H_5)_2Hg$, which, according to Hepp (Fraenkel, Arzneimittel, p. 464), ar very stable in the organism, producing at first the effect of the pure salt, which is followed later by symptoms of serious mercurial poisoning. Such salts as the oxycyanate, $HgO.Hg(CNO)_2$, vanillate, benzoate, tribromophenolacetate, phenylacetate, &c., have received but little attention. When employed hypodermically, these salts accumulate locally and frequently produce mercurial poisoning. Far more successful are the soluble non-irritating—

Mercuric Succinimide, $[C_2H_4(CO)_2N]_2Hg$ (Mering).

Mercuric Asparaginate, $C_2H_3O.OC(NH_2)CO(NH_2)_2Hg$ (Ludwig).

Mercuric Amino Propionate (Alaninate) $[CH_3.CH(NH_2)COO]_2Hg$.

Hydrargyrol.—Mercuric para phenol sulphonate.

Hermophenyl.—Mercuric sodium phenol disulphonate.

Asterol (Hoffmann, La Roche).—A double salt of *p*-phenol sulphonate of mercury and ammonium tartrate $[C_6H_4(OH)SO_3]_2Hg, 4C_4H_4O_6(NH_4)_2 + 8H_2O$.

Phenegol.—Mercuro-potassium salt of nitro-phenol *p*-sulphonate. The nitrated derivatives of phenol *p*-sulphonic acid unite readily with mercury; such compounds are termed Egols, as phenegol, cresegol, thymegol, &c. $[C_6H_3(NO_2)(SO_3K)O]_2Hg$.

Apallagin.—The mercury salt of nosophen (tetraiodophenolphthalein. For subcutaneous use the albumin derivatives of mercury, like those of silver, have evidently attained greater success. Upon adding an aqueous solution of mercuric chloride to one of a casein alkali salt, followed by alcohol, a casein-mercury is precipitated. A preparation of this nature, containing 7 per cent. of mercury, soluble in water upon the addition of a trace of ammonia, which is unaffected either by hydrogen sulphide or by the alkali sulphides, is prepared by the Hoechster Fabrik.

Sublamin (Schering).—Mercuric sulphate ethylene diamine, $HgSO_4(C_2H_8N_2)_2 + 2H_2O$. This double salt, which contains 43 per cent. of mercury, possesses the advantages of sublimate with ready solubility, freedom from irritation, penetration and failure to coagulate albumin.

8. *Guaiacol and Creosote Derivatives.*—The favourable action of creosote and guaiacol as internal antiseptics in the treatment of phthisis has led to a more extended search for new combinations free from taste, caustic and toxic action, which frequently accompany the administration of large doses of these chemicals. As is well known, the toxicity of the dihydroxybenzenes depends on the presence of free hydroxyl groups, reaching a maximum of convulsive action in pyrocatechol; if both of the hydroxyl groups are methylated as in veratol, the compound becomes three times less toxic than guaiacol; however, at the same time a material loss in intensity of action is experienced, which accounts for the preference given to guaiacol over veratrol. This same observation explains the relative non-toxic character of anisol and phenetol when compared to phenol, also the loss of narcotic action to morphine.

The number of esters of guaiacol, as the benzoate, cinnamate, carbonate, salicylate, &c., has not been increased materially, because the list of available organic acids has been practically exhausted. In other directions, however, advantages have been gained in the preparation of condensation products and more complex derivatives.

Guainform or Geoform (Henning, Berlin).—Methylene di-guaiacol, a condensation product of formaldehyde and guaiacol, $CH_2[C_6H_3(OH)OCH_3]_2$.

Guaialin.—The benzoic ester of methylene di-guaiacol.

Pulmoform (Zimmer, Frankfort).—Methylene guaiacol.

Pneumin (Dr. Speir, Berlin).—Methylene creosote.

Guaiacol Ethylenate (Merck). — $(CH_3O.C_6H_4O)_2C_2H_4$, fuses at 138° C.

Eugoform (Gustrow Fabrik).—An acetylated methylene diguaiacol, which is employed chiefly externally as a local anæsthetic and antiseptic.

Guaiasanol (Hoechtser Fabrik).—The hydrochloride of diethyl glycocoll guaiacol, fusing at 184° C., $CH_3O.C_6H_4.O.CO.CH_2.N(C_2H_5)_2HCl$.

Guaiacol Piperidine (Guaiaperol. Guaiaperon).—This fuses at 80° C. $C_5H_{11}NH.C_6H_4(OH)OCH_3$.

Guaiamar (Endemann). — Guaiacol ·glycocoll ester, $C_6H_4(OCH_3)OC_3H_7O_2$, fuses at 75° C.

Oresol (Dr. Knapp, Basel).—Glycerin mono-guaiacol ether.

Guaethol (Kalle and Co.).—Aethacol · Ajacol ; Thanatol. The mono-ethyl ether of guaiacol, which fuses at 26° C. and boils at 209°—210° C. Various other esters, such as the benzoate, butyrate, salicylate, &c., have been prepared.

Guaiachinol.—Dibromo-guaiacol of quinine—

$$C_6H_2Br_2(OCH_3)OH.C_{20}H_{24}N_2O_2.$$

Guacamphol (Henning, Berlin).—Guaiacol camphoric acid ester, $C_8H_{14}(COO.C_6H_4O.CH_3)_2$.

Guaiacetin (Majert, Berlin).—Guacetin. Phenoxyacetate of sodium, $C_6H_4(OH).OCH_2.COONa$. Fuses at 130—131° C.

Guatannin (A. Nissel, Benthen o. S.).—Guaiacol tannocinnamate. More popular among the inorganic combinations of guaiacol and creosote are—

Thiocol (Hoffmann, La Roche).—Guaiacol potassium orthosulphonate, $C_6H_3(OH).(OCH_3).SO_3K$.

Guaiacyl.—Guaiacol calcium ortho sulphonate—

$$[C_6H_3(OH).(OCH_3)SO_3]_2Ca.$$

This salt possesses local anæsthetic properties.

Cacodyliacol (Merck).—Guaiacol cacodylate—

$$As(CH_3)_2O_2C_6H_4OCH_3.$$

Phosot is Creosote phosphate, *Taphosot* is the tannophosphate and *Tannosal* is the tannic acid ester of this.

9. *Miscellaneous Inorganic Salts : Alkasal or Alkasol.*—An aluminium potassium salicylate.

Alkasal (Athenstaedt).—An aluminium potassium acetate, $Al(OH)_2(CH_3CO)_5K$. Ger. Pat. 78,903.

Aluminium Caseinate.—An intestinal astringent obtained by the addition of basic aluminium acetate to a sterilised milk free from albumin.

Aluminium Boroformate.—$Al_2O_3.H_3BO_3.H.COOH + 5H_2O$. Prepared by precipitating a solution of potash alum with a solution of borax. After washing the aluminium borate, it is dissolved in a solution of formic acid and the product crystallised.

Borogen (Bender and Hobein, Munich).—Boric acid ethyl ester. $B(O.C_2H_5)_3$ which is employed as antispetic in diseases of the air passages. In contact with moisture this ester splits up into its components.

Borol is a preservative made by fusing boric acid and sodium bisulphate.

Calcinol.—Calcium iodate, $Ca(IO_3)_2 + 6H_2O$.

Cupriaseptol.—Cupric meta phenolsulphonic acid—

$$[C_6H_4(OH)SO_3]_2Cu + 5H_2O.$$

Cupratin.—A copper albumin compound.

Cuprol.—A copper nucleinate. (See nucleinic acid compounds.)

Antigermin (Elberfelder Fabriken).—The copper salt of a feeble organic acid. When treated with hot water an insoluble basic salt separates.

Didymium Chloride (Zimmer, Frankfort) ($Di_2Cl_6.12H_2O$). In solutions of from 1/500 to 1/2000 grms. a very active disinfectant and preservative. Didymium salicylate, otherwise known as *Dymal*, is employed externally as an antiseptic dusting powder.

Fluorides.—Aluminium fluoride, $Al_2F_6 + 18H_2O$.

Chrysolein (Sodium Fluoride) has been employed as a preservative for foods ; for example, 0·5 per cent. is added to butter, and, before consumption, is removed by washing ; 0·3 per cent. is sufficient to preserve milk almost indefinitely. It is claimed that this salt is non-toxic internally. Ammonium and sodium silico fluorides, *e.g.* ($2NaF.SiF_4$) are employed largely as antiseptic inhalants.

Peroxides.—The peroxides of the alkaline earths have received some attention during recent years because of their antifermentive as well as their antiseptic properties. Among these are Calcium peroxide (*Gorit*), $CaO_2 + 4H_2O$; Magnesium Peroxide (*Biogen*), MgO_2; and Zinc Peroxide (*Dermogen*).

Vanadic Acid.—The various salts of meta vanadic acid possess a local stimulating action on the stomach, hence are of value as appetizers in debilitating diseases. They do not possess any cumulative action as in certain arsenicals. Larger doses of these salts paralyse the heart and respiratory centre.

Intestinal Antiseptics.

Investigation during recent years have conclusively demonstrated that thorough intestinal asepsis through the agency of this class of derivatives is not attainable, theoretical possibilities have not been borne out in practice. According to Schottelius (Münch. Med. Wochenschr., 1898, 35) there is no remedy which is capable of hemming bacterial action in all accessible portions of the intestinal tract without simultaneously exerting a destructive action upon the cell. Substances which possess in general superior antiseptic properties and have shown themselves to be useful in disinfection of the stomach, utterly fail to hem fermentation in the intestinal canal. As has been repeatedly pointed out, this is due to the alkalinity of the intestinal secretions which renders the antiseptic useless. Again other members of this group are so readily soluble in alkaline media that they are removed by absorption in the upper intestinal canal, as, for example, preparations of cresol, phenol thymol, &c. The third class of antiseptics which are best adapted for intestinal disinfection are the condensation products, which, because of their insolubility, reach the lower intestines, yet many of these fail in their object owing to the slowness of their decomposition. Of this class, the condensation products of tannin and gallic acid are still in favour.

Resaldol (Elberfelder Fabriken), $C_{20}H_{11}O_5\ (COCH_3)_2$.—The acetyl derivative of the condensation product of chloromethyl salicylic aldehyde and resorcinol.

Tannopin or Tannon (Elberfelder Fabriken).—$(CH_2)_6N_4.(C_{14}H_{10}O_9)_3$ Hexamethylene tetramine tannin. A condensation product of tannin and urotropin which contains 87 per cent. of the former and 13 per cent. of urotropin.

Tannoform (Merck).—Methylene ditannin. A condensation product of tannin and formaldehyde, which fuses at 230° C.

Tanocol (A.-G. f. Anilinfabr., Berlin).—A tannate of gelatin.

Tannosal, Kreosal.—The tannic acid ester of creosote.

Tannalbin (Knoll & Co.)—Tannin albuminate.

Tannogen (Elberfelder Fabriken). — Diacetyl tannin. $C_{14}H_8(CH_3CO)_2O_9$.

Tannin Albuminate (Merck).

Tannocasum (Romijn).—Produced by the action of formaldehyde on casein tannate.

Tannochrom (Hell & Co.).—A chrom tannin containing resorcinol.

Glutannol (Hundhausen in Hamm).—A combination of tannin and vegetable fibrin like tannalbin.

Protan (Mulford, Philadelphia).—Tannin nucleo-proteid.

Honthin (Hell & Co.).—Keratinized albumin tennate.

Gallogen (Heinemann, Eberwald). Egallic acid. This is pure egallic acid prepared by a patented process from the divi-divi pods ; the relationship of this product to tannin and gallic acid may be seen from the following :—

$$\begin{array}{ccc} & \longrightarrow -2H_2O-H_2 \longrightarrow & \\ 2C_7H_6O_5 & & C_{14}H_6O_8 \\ \text{Gallic acid.} & & \text{Egallic acid.} \\ & \longrightarrow -H_2O: \longrightarrow & C_{14}H_{10}O_9 \\ & & \text{Tannin.} \end{array}$$

Tribenzoyl Gallic Acid.

Pyridine Tannate.

Uric Acid Solvents.

Treatment of uric acid diathesis is usually directed either toward securing a diminution in the formation of uric acid in the organism, or the employment of a preparation which is intended to exert a solvent action on the uric acid already deposited in the tissues.

Weiss, of Basel (Berliner Klin. Wochenschr., 1899, 14), proposed (as one of the first-named group) the use of quinic acid, $C_6H_7(OH)(COOH)$, which, through reduction in the system to benzoic acid, combines with glycocoll to benzoyl glycocoll, the salts of which are far more soluble than those of uric acid. Based on the evidence that quinic acid reduces the formation of uric acid, various combinations of this with uric acid solvents, more particularly the substituted diamines, have been introduced, namely :—

Sidonal and New Sidonal (Verein Chem. Werke, Charlottenburg).—The quinate of piperazine or its derivatives, as lysidine (dimethylpiperazin). As a cheaper substitute for sidonal, the lactone of quinic acid was introduced in 1901. This is converted in the system into quinic acid, which in the nascent state is far more active.

Urol (Schnetz, Gummersbach, Rhein). Urea quinate, $C_7H_{12}O_6$, $2CO(NH_2)_2$. This salt fuses at 106° C. Ger. Pat. 124,426.

Quinotropin (Schering, Berlin).—Urotropine quinate $(CH_2)_6N_4.C_7H_{12}O_6$. This preparation is known as quinotropin I, and contains 73 per cent. of quinine and 27 per cent. of urotropin. Quintropin II contains 80 per cent. of the alkaloid and 20 per cent of the amine. Another preparation of identical composition is quinoformin (Adrien and Trillet, Paris).

Urosin Cryst (Urnmer, Frankfort) Lithium quinate.

Urotropin, *Formin*, *Aminoform* (Schering, Berlin), or *Uritone* (Parke, Davis & Co.) otherwise known as hexamethylene tetramine $(CH_2)_6N_4$. This old and well tried agent, which has a well established reputation as an antiseptic in the treatment of diseases of the urinary passages, also in allaying intestinal putrefaction, has been tested by G. Markmann (Zeitschr. f. angew. Microscopie, IX. 4) as a preservative agent. A 0·1 per cent. solution in milk preserved it for two days under adverse conditions. Meat containing 0·2 per cent. showed no signs of change after twenty-four hours. The mixture employed consisted of urotropin, 20 parts; sodium chloride, 170 parts; potassium nitrate, 3 parts; and sugar, 7 parts.

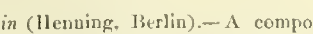
Based on the fact that the aliphatic organic acids diminish the quantity of uric acid formed, increasing in efficiency with carbon content, we find citric acid employed in the more recent combinations with urotropin.

Urotropin "New" (Schering, Berlin).—The anhydro methylene citrate of urotropin which splits off formaldehyde more readily in the urine than urotropin.

Helmitol (Elberfelder Fabriken).—Hexamethylene tetramine-anhydromethylene citrate—

$$(HO.CO.CH_2)_2CO:(CH_2)_2:O.(CH_2)_6N_4.$$

Citarin (Elberfelder Fabriken).—Anhydro methylene citrate of sodium. This compound liberates formaldehyde in the blood forming staple combinations with the uric acid, preventing thereby the uratic concretions in the joints and renal tubules—



$$(NaO.CO.CH_2)_2CO.<{}^{CH_2}_{CO}>O.$$

Galloformin (Henning, Berlin).—A compound of urotropin and gallic acid $C_6H_2(OH)_3COOH(CH_2)_6N_4$.

Saliformin (Merck) Urotropin salicylate.

Caffeine Derivatives.—The exciting action of caffeine on the central nervous system is governed by the presence or absence of certain molecular groups, thus di-methylxanthine (theobromine) exhibits the diuretic action of caffeine with but little effect on the nervous system. The objectionably slow action of this derivative was relieved by the preparation of soluble double salts with the benzoates and salicylates of the alkalis; more recent among this class are—

Agurin (Elberfelder Fabriken).—A sodio theobromine acetate, $C_7H_7N_4O_2Na + CH_3COONa$.

Uropherin (Merck).—U. Benzoate is a theobromine lithium-lithium benzoate $(LiC_7H_7N_4O_2 + LiC_6H_5CO_2)$. U. Salicylate is the corresponding double salt with salicyl acid.

Diuzazin.—A theobromine acetyl methylene disalicylate.

The introduction of the sulphonic acid group (as in the Symphorol) not only destroys the action of the caffeine upon the nervous system, but also its diuretic effect was so much diminished that but little could be expected in this direction.

According to the researches of Ach, the dimethylxanthines are the most active diuretics; among these are theobromine (3·7 dimethyl, 2·6 dioxypurin); theophylline (1·3 dimethyl, 2·6 dioxypurin); and paraxanthine (1·7 dimethyl, 2·6 dioxypurin); theobromine being the weakest, and paraxanthine and theophyllin the most active.

An example of the modern triumphs in synthetic chemistry is the synthesis of this latter purin derivative from urea, which has been introduced under the titles of

Theocin (Elberfelder Fabriken).—Theophyllin (m. pt. 268° C.) prepared by Traube's method (Berichte, 1900, **30**, 3053) from urea. The most powerful diuretic on the market.

Theophyllin (Boehringer und Sohn).—Prepared according to the German Patent 121,224 from uric acid (guano), by the action of acetic anhydride, converting the resulting 8-methylxanthine, after methylating, into a chlorine derivative, which, with water, breaks up into theophylline. A recent patent (No. 145,880) starts from synthetic caffeine (from guano), which, after chlorinating with a solution of chlorine in phosphorus oxychloride, yields 7·8-dichlorocaffeine; on further treatment with formaldehyde and hydrochloric acid, 1·3-dimethyl-8-chloroxanthine or chlorotheophylline results, which on reduction yields theophylline.

Santheose.—Theobromine of French origin Among the more recent interesting additions to this group is the

Caffeine Ethylene Diamine.—As shown by E. Fischer, the chlorine in chloro-caffeine is readily replaceable by amino groups. Besides amino caffeine, a number of substituted amino caffeines have been produced, and according as to whether one or both of the amino groups of ethylene diamine are linked, a caffeine ethylene diamine or a dicaffeine ethylene diamine results. It has been found that the former, which contains an unchanged amino group, is, in conjunction with its salts and acetyl derivates, a valuable diuretic.

The objectionable gastric disturbances which frequently accompany the use of salicylic acid or its salts, lead to the suggestion of a substitute in the old and well known glucoside salicin, which hydrolyses in the system into glucose and saligenin, $C_6H_4(OH)CH_2OH$. A condensation product of this saligenin and castania tannic acid (phlobaphene) has been introduced under the name of *Antiarthrin*. This castania-tannic acid is one of a class of tannins, which yield on hydrolysis a tannin phlobaphene instead of gallic acid.

Antirheumatics.

Ever since the introduction of salicylic acid as a remedy in the treatment of rheumatic affections, efforts have been directed towards the preparation of derivatives free from gastric irritation and tinnitis, which usually accompany the internal use of this acid and its inorganic salts. The depression of the heart, serious gastric disturbances and irritation of the kidneys, which clinical experiences have amply demonstrated as very frequently accompanying the use of the synthetic acid, have led many practitioners to resort to the acid prepared from natural sources, as the oils of birch and wintergreen, or these esters themselves, which, however, have been unpopular because of the very intense odour, causing in some instances severe headache, especially when employed externally. This disagreeable feature has been almost entirely eradicated in the following new esters :—

Mesotan (Elberfelder Fabr.).—Ericin. Salicylic methoxymethyl ester, $C_6H_4(OH)COOCH_2.OCH_3$, boils at 162° C., and is employed chiefly locally. It has a feeble aromatic odour.

Amylénol.—An unnecessary title for the old and well-known amyl ester of salicylic acid, $C_6H_1(OH)COOC_5H_{11}$, which boils at 270 C. This is employed externally and internally.

Glycosol (Merck).—Monosalicylic glycerol ester. This forms white crystals which fuse at 76° C. It is employed internally as well as externally.

Salacetol (Chem. Fabr. Ludwigshafen). — Salantol; Salicylacetol, an acetalkyl salicylic ester, $C_6H_4(OH)COOCH_2.CO.CH_3$, which fuses at 71° C. This preparation is also offered as an intestinal antiseptic.

Propionyl Salicylic Acid (Elberfelder Fabriken).—$C_6H_4(COOH)O.CO.C_2H_5$. A product of the action of propionic anhydride on salicylic acid, which fuses at 95° C.

Ulmarène.—A mixture of the salicylic esters of the higher aliphatic alcohols.

The most popular and successful of the salicylic acid derivatives introduced during recent years is

Aspirin (Elberfelder Fabriken).—Acetyl salicylic ester, $C_6H_4(COOH)O.COCH_3$. This product, which fuses at 135° C., passes unchanged into the intestinal tract, where it undergoes slow decomposition without producing any of the objectionable features of the free acid.

Methyl Aspirin, $C_6H_4(COOCH_3)O.COCH_3$, fuses at 48° C.

Rheumatin (Zimmer, Frankfort).—Salicylate of salicylic acid quinine ester, $C_6H_4(OH)CO.OC_{20}H_{23}N_2O$, $C_6H_4(OH)$ COOH. This forms tasteless white needles which fuse at 179° C., the preparation being free from gastric irritation.

Cordol.—Tribromo salol, $C_6H_4(OH)COO.C_6H_2Br_3$ fuses at 195° C.

Salcreol (Heyden, Dresden).—The salicylic acid ester of creosote, produced by the union of this acid with the active constituents of wood creosote.

Sodium p-Cresotinate, $C_6H_3(CH_3)(OH)COONa$. —Prepared similarly to salicylic acid by the action of carbon dioxide on *p*-cresol sodium.

Bromide and Iodide Substitutes.

Where it is desirable to subject the system for a considerable period of time to the action of these halides and to avoid the undesirable secondary effects such as usually accompany the use of the usual alkali salts, recourse may be had to such organic compounds of bromine and iodine as contain these elements in a loose state of combination, or those which readily split them off after digestion.

Bromalin (Merck).—Hexamethylene tetramine ethylbromide $C_6H_{12}N_4.C_2H_5Br$. While this preparation is less liable to produce bromine intoxication then the alkali bromides, yet it has not been successful because of its feeble action.

Bromocoll (A.-G. f. Anilinfab.).—A combination of bromine, tannin and gelatin obtained by precipitating a solution of brominetannin with gelatin. This contains 20 per cent. of bromine.

Bromipin and Iodipin (Merck).—These are bromo and iodo addition products of sesame oil which contain 10, 25, and $33\frac{1}{3}$ per cent. of either of the halogens. These preparations have been very successful therapeutically, being adopted for subcutaneous use as well as per os.

Bromolein.—A sterilized bromine addition product of the unsaturated fatty acids of almond oil which contains 20 per cent. of bromine.

Chloralacid (W. Gans).—This is stated to be a chlorinated albumin preparation containing 3 per cent. of halogen, obtained by the action of the gas on moist or dissolved albumins, peptones or albuminates.

Eigons (Helfenberg Act. Ges.)—Iodine and bromine derivatives of albumin which are of constant composition. α-eigon contains 20 per cent of iodine which is readily split off by acids or alkalies. β-eigon is an iodized peptone which is more readily assimilable than the α compound. The corresponding bromine compounds contain about 11 per cent. of this element.

Iodalbacid (W. Gans).—An iodo albumin preparation which contains 10 per cent. of iodine. While equal in activity to potassium iodide, it never produces the intoxication symptoms or other secondary effects peculiar to this salt.

Iodyloform (Kohlmeyer and Co., Berlin).—A combination of iodine and gelatin which readily splits off 10 per cent. of this halogen.

Iodolen (Kalle and Co.).—A combination of iodol and albumin; one preparation intended for external use contains 36 per cent. of iodol, while the other contains 10 per cent. of this antiseptic.

Lipbromol and Lipiodol.—Bromine and iodine derivatives of the poppy, nut or sesame oils, which contain $33\frac{1}{3}$ per cent. of the former and 40 per cent. of the latter

Tribromhydrin, $(C_3H_5Br_3)$, with *Tetra and Penta-Bromo-Acetone*, have proved likewise unsuccessful.

Inorganic Salts of Nucleinic Acids.—Nucleinic acid, a substance common to the blood corpuscules, organs, and vital tissues of the animal organism, has suggested itself as a means for the more ready and effectual administration of metals. The hypothesis that inorganic salts of the heavy metals pass into the blood only so far as they combine with the nucleinic acid, has been accepted as offering sufficient ground for the artificial preparation of such derivatives which would be more readily absorbed and utilised in the human organism. Aside from this, certain of these combinations are especially adapted for external use as antiseptics because of their penetrability, freedom from irritation, and decomposition by contact with albuminoids.

Thus combined, the metal deports itself quite differently from the other more common organic salts, in that the usual inorganic reagents fail to respond to any of the characteristic qualitative reactions. For example, copper nucleinate fails to turn blue upon the addition of ammonia water, nor does it react with hydrogen sulphide. The addition of chlorides fails to precipitate the silver from this combination.

Nucleinic acid may be obtained from the blood, salmon, sperm, and yeast; from the latter source the acid is prepared by extracting with an alkali, when, after acidifying with acetic acid, the albuminoids are coagulated by heating to 75° C.; from the filtrate the crude nuclein is precipitated by means of acidified alcohol. Purification is effected by careful oxidation with permanganate. The slightly alkaline nuclein solution is then brought into reaction with the salts of silver, mercury, iron, &c., and then precipitated through the addition of alcohol and a neutral salt.

In such combinations as the nucleinate or other albumin derivatives of the metals, the latter are retained in the albumin molecule in a masked (larvated) state beyond the reach of the usual inorganic reagents. In the case of the iron preparations we have a ready means of distinguishing this masked metal from that present in the form of the ordinary organic salts, as the peptonate, lactate, &c., in the well known Macallum's test. This consists in adding a few drops of a 1 per cent. solution of haematoxylin to the solution of the preparation, wherby a blue to blue-black coloration ensues if it belongs to the latter class.

Cuprol (Parke, Davis & Co.).—A compound of nuclein and copper which contains 6 per cent. of the metal.

Argyrol (Drs. Barnes and Hille).—A silver vitellin compound containing 30 per cent. of the metal.

Ferratogen (Baseler Fabrik).—An iron nuclein compound containing 1 per cent. of the metal.

Mercurol (Parke, Davis & Co.)—A mercury nucleinate containing 1 per cent. of the metal.

Nargol (Parke, Davis & Co.).—Nuclein silver which contains about 10 per cent. of silver.

Cacodylic Acid Derivatives (Arsycodyles).—During recent years considerable attention has been attracted to this class of arsenical derivatives, which have been introduced as relatively non-toxic substitutes for arsenous oxide or its older inorganic salts. As already noted, a material decrease in toxic action results through the introduction of alkyl groups in place of one or both hydroxyls in polyatomic phenols, as guaiacol and veratrol; this is particularly the case with the dimethyl arsenic acid or cacodylic acid, $(CH_3)_2As.O.OH$, and its salts. These combinations dissociate exceedingly slowly within the organism without exhibiting any symptoms of cumulative action. They have been employed with marked success in all diseases arising from disturbances in nutrition; also in tuberculosis, goitre, malarial cachexia, urinary diseases, &c.

Cacodylic Acid forms white soluble crystals fusing at 200° C. Among the salts of this acid are the cacodylates of mercury, magnesium, iron, strychnine, and guaiacol.

Arrhénal Arsynal, Stenosine, Sodiumarseno-methylate (Adrian & Cie., Paris).—This salt, of the formula $OAs(CH_3)O_2Na.5H_2O$, fuses between 130 – 140° C.

Triphenyl Arsine Oxychloride $(C_6H_5)_3As(OH)Cl$.—This preparation, which contains 20·9 per cent. of arsenic, is not broken up by the fungus *Penicillium brevicale*; hence, according to Kobert, is devoid of arsenical action, passing through the system in unchanged condition.

Glycero-arsenic Acid Salts.—These were introduced by Schlagdenhauffen and Pagel. $AsO(O_2\overset{II}{Me})O.C_3H_5(OH)_2 + 2H_2O$.

Atoxyl (Ver. Chem. Werke., Charlottenburg).—Meta-arsenic acid anilid $(C_6H_5NHAsO_2)$, which contains 37 7 per cent. of arsenic acid. Doses from 40 to 50 times greater than arsenous oxide are readily tolerated.

Histogénal.—A compound of nucleinic acid and methyl sodium arsenate.

Patent Foods.

By this term we refer to a class of solid food-products which have been prepared from various raw food-stuffs through the agency of chemical processes. Their purpose is to present readily assimilable and highly nutritious forms of food free from all unnecessary and useless ballast materials, such as are necessary in the treatment of diseases of the digestive organs or in cases where the healthy functions of these organs are impaired or still further as a prelude to solid food for patients convalescing from disease or surgical operations. According to the class or classes of food material represented and the condition in which they are present, these products may be divided into the following general classes:—

1*st. Soluble Predigested Foods of the Somatose Type.*—These consist chiefly of albumoses prepared from meat or other forms of albumin. In addition to their general nourishing properties these preparations are especially adapted in diseases of the alimentary canal because of their freedom from irritating effects and stimulating action on the appetite and general nourishment.

2*nd. Highly Concentrated Nutritious Foods:* (*a*) *Insoluble Foods of the Tropon Class.*—These are mixtures of carbohydrates and albuminoids of vegetable and animal origin.—(*b*) *Soluble Concentrated Albumins of the Casein Type.*

3*rd. Infant Foods.*—These consist of mixtures of albumin, carbohydrates and fats. The class of meat extractives which possess purely stimulating properties, and cannot be classed as foods, are omitted from this list.

Class I. Soluble Predigested Foods of Somatose Type.—The crude proteids employed in this class have undergone a preliminary artificial or natural digestion, either through the agency of animal or vegetable enzymes or organic or inorganic acids, or the agency of superheated steam under pressure or *in vacuo.* The products aimed at in most cases are either pure albumoses or mixtures of these with some peptone. The presence of much peptone is objectionable, because of the bitter taste imparted, as well as the tendency, in conjunction with atmid-albumose, to produce intestinal irritation causing diarrhœa. One of the first of this class to be introduced was—

Somatose (Elberfelder Fabriken).—This is an artificially digested meat albumin containing 51·6 per cent. of deutero and 13·4 per cent. of hetero albumoses, 5 per cent. of peptone, 11 per cent. of moisture, and 5 per cent. of nutrient inorganic salts. Iron Somatose is a similar preparation, containing 2 per cent. of iron in organic state of combination. Milk Somatose is a soluble nutrient prepared by the same digestive process from casein containing 5 per cent. of tannin.

Carnigen.—A soluble nutrient containing albumoses, which, according to Denayer, consists of 52·12 per cent. of albuminoids, 24 per cent. of meat extractive, 4 per cent. of meat salines, and 10 per cent. of water. The total nitrogen is 12·6 per cent., of which 8·7 per cent. consists of albuminoid nitrogen and 3·9 per cent. of extractive nitrogen.

Heyden's Nutrient (Nährstoff) (Chem. Farbik v. Heyden).—An albumose prepared from egg albumin containing 85·31 per cent. of proteids, 6 per cent. of inorganic salts, and 2·36 per cent. of water. This preparation is intended only as an addition to foods.

Mietose (Eiweiss und Fleisch Ext. Co., Altona, Hamburg).—A meat albumose preparation; an almost chemically pure albumose, which swells when in contact with water.

Fersan (Dr. H. Byk, Berlin).—A ferruginous paranucleo proteid, which contains 0·25 per cent. of phosphorus and 0·12 per cent. of iron in organic state of combination with 90 per cent. of albumin.

Alboferrin (Drs. Fritz and Sachsse, Vienna).—A ferro-phospho albumin preparation, containing 0·68 per cent. of iron, 0·32 per cent. of phosphorus, and 90·14 per cent. of albumin.

Triferrin (Knoll & Co., Ludwigshafen).—A ferric paranucleinate obtained by precipitating the phosphorus that has passed into solution during peptic digestion of casein by means of a ferric salt. It contains 22 per cent. of iron, 2·5 per cent. of phosphorus, and 9 per cent. of nitrogen.

Alcarnose (J. O. Riedel, Berlin).—An albumose preparation of mixed foods, containing 23·6 per cent. of albumoses, 55·3 per cent. of maltose, dextrin, and dextrose, 17·7 per cent. of emulsified fat, and 3·4 per cent. of nutrient salts. (Allegemein. Med. Cent. Zeit., 1899, 93).

Class II. Highly Nitrogenised Concentrated Foods. (a) *Soluble.*—Much attention has during recent years been attracted to the class of insoluble albumin preparations of the Tropon type, in which cheaper grades of raw albuminoid matter—as fish, refuse meat, dried blood, gluten, peas, lentils, and other vegetables—after treating with diluted acids, are deodorised and decolourised by means of such oxidising agents as hydrogen peroxide, or chlorine. This idea was originated by C. Cosineru, who in 1890 attempted to utilise blood albumin as a commercial nutrient by treating with alcohol containing a little acid, followed by chlorine, potassium permanganate, or hydrogen peroxide. At that time no market was found for this class of nutrients. During the last few years a demand has been created for a highly nourishing concentrated food within the financial reach of the masses, which has been met by members of this type.

Tropon (Tropon Werke, in Mülheim-on-Rhine.)—Proposed in 1890 by Prof. Finckler (Bonn), and prepared according to the patent, by removing from mixed albuminoid matter (1 part of animal to 2 parts of vegetable), such as fish, refuse meet, gluten, legumes &c., all gelatinous substances by extraction with boiling water, the insoluble residue is then treated with 10 per cent. of hydrogen peroxide and finally extracted with ether. All malodorous, coloured substances, bacteria, &c. are removed while the albumin molecule remains intact. Since 1893 the tropon patent has substituted nascent chlorine for hydrogen peroxide. Tropon contains 99 per cent. of pure albuminoid matter. A mixture of tropon with dextrinized flour is called Tropon-Sano. Iron Tropon contains 50 per cent. of Tropon and 2·5 per cent. of iron. The nutritive value of 1 pound of Tropon is stated to be equivalent to that of 5 pounds of beef.

Soson (Eiweiss und Fleisch Ext. Co., Altona, Hamburg)—An albuminoid nutrient, prepared from dried powdered meat in which boiling alcohol under pressure is employed for the extraction, in place of heating under ordinary conditions as recommended by Cosineru.

Carnigen.—An albumose diatetic containing 52 per cent. of albuminoids, 24 per cent. of meat extractive, 3·9 per cent. of salines and 9·9 per cent. of water. Of like nature are *Aliment Complet* (Groult), *Nutralbin* (Fletcher & Co.), a mixture of casein, meat fibrin, cacao and digestive ferments, and Oxine (Oxine Co., London), which is stated to be a "concentrated" food from flesh and vegetables.

Globon (Lilienfeld, Vienna).—Occupies an intermediate position between acid albumin and albumose, prepared by a process in which vegetables and animal paranucleins containing phosphorus and free alloxuric bases are subjected to a decomposition in which the paranucleinic acid becomes detached, while the albumin group remains (Lilienfeld). According to Kronfeld (Wiener Med. Wochenschr. 44·99). Globon is a product of the splitting up of casein. However the analysis of this food tallies closely with that of casein. A class of leaven extracts prepared after different patent processes, in which this waste material of the breweries has been utilized as a nutrient in view of its high content in nitrogenous matter and phosphates, is represented in the Belgian preparation called "Bois" (Eurostose) and the English "Carnos". These form agreeable tasting albumose products of the artificial yeast digestion.

Carnos.—Prepared according to the English patent. 284,348, of O. Overbeck, Grimsby, in which compressed yeast is boiled with water until its cell structure is completely destroyed, then, on cooling to 60° F., one-sixth to one-half part of germinating malt is added and digested for three hours at this temperature. Finally, the product is boiled for half-an-hour, adding sufficient milk of lime to neutralize and clear. The resulting fluid, which contains yeast cells and some malt, is filtered and concentrated.

Mutase (Chem. Fab., Weiler-ter-Meer, Uerdingen-on-Rhine).—A dextrinated meal prepared from leguminous plants and other vegetables by digestion with diluted acids or saline solutions. According to E. Koch (Merck's Report, 99—107) Mutase contains 60 per cent. of vegetable albumin, about 18 per cent. of nitrogenous extractive, 10 per cent. of saline matter, 10 per cent. of water, and 2 per cent. of phosphorous acid.

Sitogen (Sitogen Ext. Co., Loebau, Saxony).—A compound yeast extract which serves as a nutritive food, also as an addition to soups, according to Dr. Filsinger. Sitogen consists of 25·9 per cent. of water and 74·1 per cent. of dry extractive, of which 13·8 per cent. are inorganic salts, 11·84 per cent. of non-nitrogenous extractive, and 48·44 per cent. of nitrogenous matter. This latter contains 1·68 per cent. of albumoses, 0·12 per cent. of insoluble albuminates, 1·43 per cent. of ammonium salts, and 45·21 per cent. of meat bases.

Among preparations of exclusive vegetable origin are—

Plantose.—An aqueous extract of oil cakes resulting from the expression of rape-seed oil. The product contains 12 to 13 per cent. of nitrogen.

Roborat (H. Niemoelle., Gütersloh, Westf.)—A dextrinised albuminoid nutrient prepared from wheat, corn, and rice by precipitating the albuminoid matter from solution and drying. This preparation contains 10·6 per cent. of water, 79·2 per cent. crude proteids, 4·1 per cent. of ether extract, 4·4 per cent. of starch, 0·2 per cent. of fibre, 1·3 per cent. of ash, and 0·09 per cent. of lecithin phosphoric acid. Iron-, Kola-, Tannin and Creosote-Roborat are prepared.

Aleuromat (Niemoelier, Guetersloh).—A wheat gluten preparation containing 7·2 per cent. of moisture, 80·8 per cent. of crude proteids, 5·6 per cent. of ether extract, 6 per cent. of starch, 0·2 per cent. of fibre, 1·3 per cent. of ash, and 0·04 per cent. of lecithin phosphoric acid.

Energin.—A preparation consisting of the proteids or rice, prepared by treating the latter with alkalies and precipitating the dissolved proteid matter by neutralization with an acid. According to Wintgen dry energin contain, 92 per cent. of dry proteid substance, 5 per cent. of ether extractive, 0·74 per cent. of starch and 1·13 per cent. of ash.

Typical representatives of a class of prepared cereal foods are the American products, "*Force*" and "*Malta Vita*."

Force is prepared from carefully assorted and cleaned wheat, which is steeped in a malt wort for five to six hours at a temperature ranging from 55 to 65° C. The malt wort which is not absorbed is then drawn off, and the remaining soaked wheat is subjected to a process of steaming and cooking under pressure. This steamed or cooked whole wheat is then allowed to cool, dried, and sufficient salt added. After it is completely dried, the whole wheat is transferred to mechanical steel rollers, in which every individual grain is pressed so as to produce the flaky condition of the product. These flakes are then carried to an oven, in which they are toasted and roasted, so as to obtain the crispness, at the same time developing the aromatic bread flavour and producing partial conversion of the starch into dextrins. It is then directly transferred to packages, which are each filled automatically and also sealed and labelled by machine.

Malta-Vita is likewise made from whole wheat only. The difference in its method of preparation from the above seems to be that the grain is not steeped in malt extract, but after steaming and cooking a concentrated malt extract is added to the whole grains just before flaking. The product is then salted and toasted. The percentages of maltose, dextrins, and soluble carbohydrates present in the Malta-Vita exceed those of Force considerably.

Class II. (*B*) *Soluble Casein Derivatives.*—Salkowski was the first (1894) to call attention to casein as a nutritive, demonstrating its complete absorption in the intestinal canal and high nourishing qualities. Owing to the insolubility of casein, advantage is taken of its property of forming soluble salts with such alkalies as sodium bicarbonate and ammonia, also double salts with the phosphates, glycero-phosphates and citrates of sodium, potossium and calcium. The first of this class to be introduced was—

Eucasin (Magert and Ewers, Grunau, Berlin).—A casein-ammonia obtained by passing ammonia gas over dry and finely pulverised casein. 30—40 grms. of eucasin (which contains 95 per cent. of albuminoid matter) correspond to 24—32 grms. of albumin.

Nutrose (Hoechster Fabrik).—A casein-sodium which toward phenolphtalein is the acid sodium salt. According to Aufrecht, nutrose contains 65·2 per cent. of albumin, 10·5 per cent. of water, 4·15 per cent. of inorganic salts, and 20·15 per cent. of non-nitrogenous matter.

Plasmon (Plasmon Company of America).—The freshly precipitated casein of skimmed milk, after mixing with a just sufficient quantity of sodium bicarbonate, is kneaded and dried at 70 C. in an atmosphere of carbonic acid. Plasmon contains 10·7 per cent. of moisture, 7·2 per cent. of inorganics, 0·7 per cent. of milk fat, and 81·3 per cent. of protoids. The dry Plasmon contains about 90 per cent. of pure proteid.

Sanatogen (Bauer & Co., Berlin).—A glycero-phosphate of sodium casein which contains 95 per cent. of albumin, and 5 per cent. of sodium glycero-phosphate.

Calcium Caseinate (Gesellschft. diaetet. Prod., in Zürich).—A casein calcium-phosphate intended to compete with Bauer's Sanatogen. It possesses an objectionable odour.

Galactogen (Theile and Holzhausen, in Berleben).—A casein-alkali preparation.

Some casein preparations contain excessive quantities of alkali, which in view of the fact that they are taken in large doses extending over greater periods of time, are open to serious objections. In view of overcoming this objection Schering introduced—

Sanose (E. Schering, Berlin).—An albumin preparation containing casein 80 per cent., and albumose 20 per cent.

Tannocasum (G. Romijn).—A casein tannate obtained by dissolving 1 kilo of casein by aid of sodium carbonate in 10 litres of water, and after adding a solution of 700 grms. of tannin in 3 litres of water with 100 c.c. of formaldehyde, the mixture is supersaturated with dilute hydrochloric acid. The precipitate is collected, washed, and dried. This preparation is employed largely as an intestinal astringent.

Casumen (Protein).—An English preparation consisting of casein only.

Class III. Mixtures of albumin, fats, starches, and dextroses, popularly known as *Infant Foods.*—This class of foods is so well known that attention is called to only a few of the more important newer preparations as—

Odda (Schnelke and Mayer, Hamburg).—A new infant food prepared according to the directions of Prof. Mehring, chiefly distinguished by the replacement of the fat and difficult digestible casein of cow's milk, by the yolk of eggs and cacoa butter. This was suggested by the observation that the butter-fat of cow's milk contains about 10 per cent. of volatile fatty acids, while the fat of mother's milk contains only 1·5 per cent. The glycerides of these volatile fatty acids readily hydrolize in the stomach and the liberated acids cause irritation of the intestinal mucous surfaces. This preparation contains 14·5 per cent. of albumin, 6·5 per cent. of fat, 71·5 per cent. of carbohydrates, 0·4 per cent. of lecithin, 2·1 per cent. of inorganic salts, 1·1 per cent. of phosphoric acid and 5·4 per cent. of water.

Theinhardt's Hygiama.—A mixture of milk, flour, malt cocoa and sugar which contains 27 per cent. of albumin, 10 per cent. of fat, 60 per cent. of soluble carbohydrates, and 3·5 per cent of inorganic sults.

Eulactol (Nahrmittel Werke, Act.-gesellsch., Cologne).—A nutrient prepared from milk and vegetable albumin, containing albumin, fats, carbohydrates, and salts.

Enterorose (Gesellschaft für Diatetische Praeparate, Zuerich).—A preparation of vegetable albumin impregnated with an extract of beef and diastase. It contains 18 per cent. of vegetable albuminoids, 11 per cent. of fat, 3·8 per cent. of inorganic salts, and 59·5 per cent. of carbohydrates. The ratio between albumins, fat, and carbohydrates is the same in this preparation as in milk.

Belonging to the Theinhardt's type of food are the well known foods of Nestlé, Mellin, Horlick, and the Ideal. To the class of cereal foods belong the Imperial Granum, Ridge's Food, and Gerber's Food.

Tabular List of Manufacturing Firms.

A.-g. f. Anilinf. = Aktiengesellschaft für Anilinfabrikation, in Berlin.
Baseler Fab. = Baseler Chemische Fabrik, Basel.
Boehringer = C. F. Boehringer und Soehne, Fabrik chem. Producte, Waldhof b. Mannheim.
Chem. Fab., Ludwigshafen = Chemische Fabrik vormals Hoffmann, in Ludwigshafen.
Chem. Fab., Guestrow = Drs. Hillringhaus und Heilmann, Guestrow.
Erdmann, Leipzig = C. Erdmann, Leipzig, Lindenau.
Elberfelder Fabrik = Farbwerke vormals Fried. Bayer und Co., in Elberfeld.
Fritzsche, Hamburg = Fr. Fritzsche und Co., Hamburg.
Gans, W. = Pharmaceutische Institut, Ludwig Gans, Frankfurt a.-Main.
Henning, Berlin = Dr. G. F. Henning, Berlin, S.W., 48.
Hell and Co. = Hell und Co., Troppau, Silesia.
Heyden, Dresden = von Heyden, Chem. Fabrik, Dresden-, Radebeul.
Hoechster Fabrik = Farbwerke Meister, Lucius und Bruening, in Hoechst-on-Main.
Hoffmann, La Roche = F. Hoffmann, La Roche Co., Basel.
Helfenberg Akt.-gesell. = Chemische Fabrik, Helfenberg Aktiengesellschaft, in Helfenberg, Saxony.
Ichthyol Gesellsch. = Ichthyolgesellschaft, Hamburg.
Kalle and Co. = Kalle und Co., Biebrich-on-Rhine.
Knoll and Co. = Knoll und Co., Ludwigshafen-on-Rhine.
Lingner, Dresden = Lingner's Chem. Laboratorium, Dresden A.
Lehmann, Berlin = Berliner Capsule Fabrik, J. Lehmann, in Berlin.
Majert, Berlin = Majert und Ebers, Gruenau, Berlin.
Marquardt = Chemische Fabrik vormals M. Bevel, Bonn.
Merck = E. Merck, Darmstadt.
Moeller, Hamburg = Moeller und Linsert, Hamburg.
Rhenania Fabrik = Chemische Fabrik "Rhenania," Aachen.
Riedel = Chem. Fabrik J. D. Riedel, Berlin.
Schering, Berlin = Chemische Fabrik auf. Aktien vormals E. Schering, Berlin.
Schuetz, Gummersbach = Schuetz u. Dallmann, Gummersbach, Rheinland.
Valentiner, Leipzig = Valentiner u. Schwartz, Leipzig, Plagwitz.
Ver. Chem. Werke = Vereinigte Chemische Werke Aktiengesellschaft, in Charlottenburg, Berlin.
Zimmer, Frankfurt = Vereinigte Chininfabriken, Zimmer u. Co., Frankfurt-a.-Main.

Meeting held at Chemists' Club, on Nov. 20th, 1903.

DR. VIRGIL COBLENTZ IN THE CHAIR.

RARE-EARTH MORDANTS.

BY CHAS. BASKERVILLE, PH.D., F.C.S., AND
T. B. FOUST, B.S.

During the progress of a number of investigations of the chemistry of the rare earths, we have sought incidentally to utilise the by-products obtained in the manufacture of the Welsbach mantles. On reviewing patent and other literature of the rare earths and mordants, no mention of a patent for the use of rare earths as mordants has been found, nor any record of work along this line, either in the United States, England, France, or Germany, with the exception of one paper by Prud'homme, who wrote on "Mordants in Dyeing and the Theory of Mendeleeff" (Chemical News, **63**, 193). This work in no way influenced what is herewith reported. After the completion of the work, Waegner and Mueller published an article upon "The Use of the Rare Earth Metals in Dyeing" (Zeits. f. Farben- u. Textil-Chem., 1903, **15**, 290; see this Journal, 1903, 946).

The compounds of the rare earths used were praseodymium hydroxide, neodymium, lanthanum and praseodymium acetates and a mixture of the sulphates of these elements, so-called "pink-salts." They showed no marked value, although in the majority of cases slight differences were produced, and in a few the variation was very marked. The rare earth compounds, under the conditions of our experiments, possess no very valuable properties as mordants, although from the facts observed, indications were had that a stricter adherence to the application of mordant dyes and the use of the oxidising agents would furnish a larger number of instances of notable change. The application to silk and wool was undertaken to supplement the work on cotton, and only such work as would furnish comparative results was deemed necessary. In some cases the salts used showed mordanting action, but the colours produced were not of a bright shade, and not always very fast to washing. The rare earths can have little practical application as mordants, for the following reasons:—(1) because they do not possess the mordanting action to a degree which would allow competition with known mordants; (2) because the supply is somewhat limited, and would not admit of extended use; (3) their cost, which, even in the event of the first and second considerations being favourable, would bar their practical use extensively. Therefore, it is only a matter of theoretical interest that we note this property of the rare earths.

As far as possible, uniform conditions were preserved throughout in the experiments, and, where no favourable results were obtained, the conditions were varied. All the cotton used was in the form of yarn made into small hanks, and was thoroughly "wetted out" by boiling in a 4 per cent. solution of sodium carbonate, bleached with chloride of lime and wetted before dyeing. The dye baths were made up in quantity, and divided into smaller portions for application to the various mordants. The heating was carried out on a large water bath, which would accommodate all the baths at once, and the washing after treatment was made as nearly the same for each dye as possible. Mordanting with acetates was carried out in a 10 per cent. solution of the salts after treatment with an acetic acid bath. The cotton was boiled for two hours in this bath, drained, squeezed out, and dried in an air oven at 80° C. until practically all the acetic acid was driven off. This was determined by the odour. The remaining acid was not neutralised, as it was found that a precipitate was formed when neutralisation was attempted with 1 per cent. soda solution. Hence the dyeing was performed in baths made slightly acid with acetic acid. Mordanting was also tried by allowing the cotton to remain over night in the mordant bath, squeezing out, passing through a 10 per cent. soda solution and dyeing. Precipitation took place in the carbonate solution, and no results of value were obtained. Cotton was mordanted with a mixture of the rare earth sulphates, neodymium, praseodymium and lanthanum sulphates, by entering it into a saturated solution of the salts, and boiling for an hour and a half. In some instances during this boiling the nona-hydrated sulphates separated. The skeins were well squeezed and allowed to drain. No perceptible difference was observed when the mordanting was accomplished by allowing the yarn to remain in a cold solution over night. Praseodymium hydroxide was also suspended in cold water in which the cotton was allowed to remain overnight. No effort to use nitrites was made.

For the use of basic dyes, the treatment with tannic acid in connection with the rare earth sulphates was tried. The cotton was entered cold in a solution of tannic acid, just sufficient of the solution being used to cover the cotton; the temperature was then raised to 40° C., and maintained for two hours. It was then worked for 30 minutes in a cold, saturated solution of the rare earth sulphates, squeezed out and dried.

Only the rare-earth sulphates were used to mordant wool. The wool, after being thoroughly wetted by boiling in water for one and a half hours, was placed in a lukewarm bath with a mordant to which a little sulphuric acid had been added. The temperature was gradually raised to 100° C. during one hour and boiled for one and a half hours longer; the wool was removed from the bath and allowed to drain over night.

Silk was entered into the mordant cold, and allowed to stand over night, removed, squeezed, and rinsed slightly to remove excess of nitrate and passed into the dye bath. In every case an unmordanted skein was dyed to furnish a basis of comparison. The results obtained were largely negative. The following dye-stuffs were used:—Bismarck Brown, Malachite Green, Methyl Violet, Chrysoidin, Tropæolin, Alizarin Blue, Alizarin, Logwood, Eosin, Fuchsin, Aniline Red, Aniline Blue, and Diamantgelb.

It may be well to call attention, briefly, to those samples which showed most marked differences from the unmordanted skeins, mentioning the dyestuff and mordant used.

Malachite Green with neodymium acetate.
Malachite Green with lanthanum acetate.
Malachite Green with tannin and sulphates.
Malachite Green with praseodymium hydroxide.
Malachite Green with rare earth sulphates.
Chrysoidin with tannin and sulphates.
Chrysoidin with praseodymium hydroxide.
Tropæolin with rare earth sulphates.
Tropæolin with praseodymium hydroxide.
Alizarin Blue with tannin and sulphates.
Alizarin Blue with rare earth sulphates.
Alizarin with rare earth sulphates.
Logwood with neodymium acetate.
Logwood with rare earth sulphates.

In spite of the obstacles in dyeing small quantities, namely, the difficulties of working to obtain even dyeing, heating the baths uniformly, &c., the results obtained show that the salts used have not been without effect upon the dyes.

We have to thank the Welsbach Incandescent Lighting Co., Gloucester City, N.J., for providing the materials used in the above research, and permission to publish the same.

Sydney, N.S.W., Section.

Meeting held at Sydney, on December 16th, 1903.

PROF. LIVERSIDGE, F.R.S., IN THE CHAIR.

THE BACTERIAL ORIGIN OF THE VEGETABLE GUMS.—PART I.

BY R. GREIG SMITH, D.SC.

The vegetable gums until about a year ago were supposed to be the products of certain trees in an unhealthy or pathological condition, and beyond that really nothing was known regarding their origin. It is true that it had been claimed that certain moulds induced the plant to secrete the gum, and that bacteria had been observed in the slime-flux of certain trees, such as the oak, but a definite relation between the gum and a causative agent had not been brought forward. In 1901, Marshal Ward (Disease in Plants, London), said "beyond the fact that *gummosis* (gum-flux) is a pathological phenomenon, we know very little of the disease."

I began my researches into the origin of the gums with the belief that bacteria were responsible for their production. Many facts connected with the gum and its distribution pointed to a mycological formation, and among the moulds, yeasts, and bacteria, the latter were the most promising gum producers. I have contributed several papers upon my investigations to the proceedings of the Linnean Society of New South Wales, and in this paper I propose to collect such data as would appeal to the chemist who might have more than a passive interest in an important industry, and to whom my original papers may not be accessible.

The research began with the examination of two trees, one of which, *Acacia penninervis*, exuded a pale yellow gum, partly soluble in water; the other, *Acacia binervata*, yielded a product which varied from colourless to dark brown, and was entirely soluble in water. From the bark of the latter, a bacterium which I have named *Bacterium acaciæ*, was obtained in pure culture, and from the former two bacteria were isolated. One of them was *Bacterium acaciæ*, the other was named *Bacterium metarabinum.*

Many gum bacteria when removed from their natural habitat do not form their typical products readily, and both of these bacteria come under this category. In the ordinary media of the bacteriological laboratory they grew easily enough, but the formation of gum was suggestive rather than actual. Still, although the yield was small, sufficient was obtained to show that the bacteria were really gum-formers. The most suitable medium was one containing saccharose, potato juice, and agar, and this produced a luxuriant crop of cells with a small quantity of slime. Acting upon an observation that the tissues of the tree, adjoining a wound through which the gum oozed, were acid and contained tannin, I added tannin to the medium. Instead of a thin watery growth of bacterial cells in the plate cultivations, there was produced a luxuriant thick slime, which could easily be removed from the agar surface. The ready removal of the slime is an important point, for it must be remembered that agar-agar is allied to the vegetable gums, inasmuch as it is a pararabin, and if the slime could not be easily taken off it might become contaminated with fragments of agar. I have grown many different gums on this or similar tannin agar, and also, for purposes of comparison, in fluids, and in no case have I found any difference between the gums obtained from the solid or from the fluid cultures. No constituent capable of being detected is removed with the slimes. As an example of the luxuriance of the slime growth, it may be mentioned that in some cases 5 grms. have been scraped from the surface of 20 c.c. of agar medium in an ordinary 9 cm. Petri-dish.

The raw bacterial product is not a gum. It is a slime and consists of gum, together with bacterial cells and albuminoids, the latter of which are undoubtedly responsible for giving the gum a slimy consistency. Before proceeding to obtain the gum, the slime was freed from sugars by repeatedly coagulating its aqueous suspension with alcohol. After a repeated coagulation the slime was generally found to be free from saccharose and reducing sugars. In the second or subsequent coagulation it was sometimes necessary to add a few drops of a 10 per cent. solution of potassium chloride when the slime showed signs of being "milked" by the alcohol. Having been so far purified, the slime was ready for the separation of the gum. This was effected by heating or digesting the watery slime in the autoclave at a pressure of three atmospheres for a quarter of an hour. In some cases a longer digestion was necessary, in others the addition of a drop or two of dilute sulphuric acid was beneficial. The treatment coagulated the albuminoids which carried down the bacterial cells, leaving the gum dissolved in the clear supernatant liquid. In a few cases when the solution was faintly opalescent, aluminium hydroxide effected a clarification. This method of digestion not only enables the majority of the bacterial gums to be obtained from their slimes, but it also converts many of the insoluble vegetable and bacterial gums into soluble modifications. These, however, generally revert to their former insoluble condition upon desiccation. I thought the process was new, but recently I have found that the method is used commercially for the solution of the metarabin gums of the cherry and other fruit trees. (Andés, Gummi arabicum und dessen Surrogate, Leipzig, 1896, 41).

The solution of the bacterial gum when evaporated to dryness gave a clear transparent and brittle gum like a similarly treated solution of arabin from gum Arabic. When the thick gum mucilage was tested dropwise upon glass, as recommended by Maben, it gave the general reactions of gum acacia. The arabin obtained from the gum of the tree from which the bacteria had been isolated gave the same reactions. The bacterial and the natural gums gave furfural upon distillation with hydrochloric acid and furnished crystalline plates of mucic acid upon oxidation with dilute nitric acid. The filtrates from the mucic acid contained oxalic acid. Thus the bacterial gum gave the same reactions and the same decomposition products as the natural gum.

The vegetable gums constantly vary in their optical activity, as shown by many writers, and in view of the different conditions surrounding the birth of the natural and of the laboratory gum it seemed to be extremely improbable that the rotation of the two gum acids would be the same; upon examination, the rotatory power was found to be widely different, that of the natural acids being practically zero ($[\alpha]_D = + 0°\cdot9$) while the bacterial gum acids were dextrorotatory ($[\alpha]_D = + 43°$).

Although the two gums have been shown to possess many chemical properties in common, there remained the question of the identity of the products of hydrolysis. In identifying the sugars obtained from all the bacterial gums which I have prepared I have trusted entirely to the recognition of the osazones. By doing so I have been enabled to work upon a comparatively small quantity, for although I have said that the growth of slime upon the tannin media was luxuriant, yet as it contains but from 3 to 4 per cent. of total solids, it is evident that much slime would require to be grown in order to obtain a quantity of arabin sufficient for the recognition of the sugars by other methods. The preliminary experiments in the hydrolysis and detection of the sugars were made upon the natural gum, and a scheme was gradually elaborated. In the few cases in which bacterial gums have been examined by other investigators there have been obtained osazones, the melting points of which gave no clue to their identity, or else the author has affirmed that he did not have enough material to justify the purification of the osazone. A method for the purification of the osazones of the bacterial gums was apparently wanted and my investigation showed that it could be easily done.

The gum after being freed from adhering sugars was hydrolysed by boiling with 5 per cent. sulphuric acid for about five hours. This treatment, as a rule, converted the gum completely into reducing sugars. The so-called fractional hydrolysis (*i.e.*, heating the gum with 2 per cent. acid on the water-bath for 15 minutes), did not recommend itself, for not only the arabinan, but the gum complex as a whole was hydrolysed. I found it much quicker to hydrolyse the gum completely and to separate the osazones afterwards. This saved the separation of the unaltered gum and the double preparation and separation of the osazones. The completion of the hydrolysis was made evident by the absence of matter precipitable by alcohol and by the presence of reducing sugars in a small abstracted and neutralised portion.

The hydrolysed solution was neutralised with barium carbonate, filtered, evaporated, clarified with aluminium hydroxide and warmed upon the water-bath. Two c.c. of a recently prepared solution of phenylhydrazine acetate (phenylhydrazine, 4 c.c.; glacial acetic acid, 4 c.c.; water, 2 c.c.) were added, and the beaker was kept in the steam for half-an-hour. It was then rapidly filtered through a hot wet filter in order to remove a tarry deposit. To the filtrate another two or more c.c. of phenylhydrazine acetate solution were added and the heating continued for another hour and filtered as before. The filtrate upon cooling deposited the osazones. The bulk of the black tarry impurity and unaltered base were removed by the filtrations and the remainder was in most cases eliminated by percolating the dry osazones with ether. With some galactan gums this impurity was not entirely extracted by this simple method. The osazones had either to be precipitated by cooling a hot saturated alcoholic solution when the quantity was large, or the osazones were successively extracted with ether and cold water when the quantity was small.

The separation of the purified osazones of arabinose and galactose was accomplished by taking advantage of the fact that arabinose is more soluble in hot water and in alcohol than galactose. The mixed osazones were either treated with hot water and then with hot solutions of alcohol of increasing strengths, or they were completely dissolved in hot concentrated alcohol which was slowly evaporated, hot water being added to maintain the original volume. Both methods were fractional, and galactosazone was obtained at one end and arabinosazone at the other. The intermediate fractions consisted of mixtures of the two. The end products were found to be pure by microscopical examination, and by their inability to be resolved into fractions with differing melting points. In the microscopical examination, oil globules and amorphous particles were sought for; the presence of these would show that the purification of the osazone had not been complete. The intermediate fractions were either treated as before or they were grouped together before treatment according to their respective melting points. With arabinosazone and galactosazone a little experience enabled the operation to be quickly performed.

In the case of another slime which hydrolysed to galactose and a glucose, much the same treatment was followed in separating the osazones. By the gradual addition of strong alcohol, the galactosazone dissolved, leaving the glucosazone. Again, by the complete solution in hot strong alcohol and gradual addition of water, the glucosazone was made to precipitate before the galactosazone. Both methods depended upon the relatively greater solubility of galactosazone and insolubility of glucosazone in alcohol.

To return to the gum of *Bact. acaciæ*, it was found that it hydrolysed to a mixture of arabinose and galactose. The natural gum of *Acacia binervata* also hydrolysed to these sugars in apparently the same proportions. It has, therefore, been shown that the bacterial gum and the natural gum were chemically identical, and as the organism was found in the tree and in the places from which the gum was exuding, and furthermore as the fresh gum contains myriads of dead bacteria, it is to *Bact. acaciæ* that the origin of the gum must be ascribed.

The natural gum of the other tree, *Acacia penninervis*, consisted of a mixture of arabin and metarabin, or cerasin. Metarabin swells with water, forming gelatinous lumps which may slowly dissolve, or may not, according to the age of the gum. It is dissolved in the sap of the plant, and becomes insoluble when the gum dries. As I have already mentioned *Bact. acaciæ*, the arabin former, and another, *Bact. metarabinum*, were isolated from the tissues of the plant. *Bact. metarabinum* grew as stiff cohesive colonies upon ordinary media; the wrinkled appearance and leathery consistency of the colonies suggested the presence of an insoluble gum. Upon saccharose-potato-agar it grew as a thick slime, which, while not so thin as the slime of *Bact. acaciæ*, was still capable of being easily removed from the surface of the medium. Upon digestion in the autoclave, the slime yielded a solution of a gum which behaved to reagents like arabin; when the digestion was conducted with care, the gum was converted into the insoluble form upon drying or by treatment with alcohol. In this condition it swelled with water, forming an unfilterable jelly. The dehydration had converted the gum into a substance like metarabin, and, like a typical metarabin, it was insoluble in dilute alkali. Boiling dilute sulphuric acid hydrolysed it to arabinose and galactose. The metarabin of the natural gum behaved in precisely the same way. Thus the bacterium undoubtedly produced a metarabin gum, and to its activity must be ascribed the formation of the metarabin portion of the natural gum.

Concurrent with the formation of gum in solutions of saccharose, there was a production of carbon dioxide, ethyl alcohol, and acids. The carbon dioxide was small in amount, and was detected by aspirating the air in closed culture flasks through baryta water. The alcohol was also small in amount, and was obtained upon distilling a fluid culture containing chalk, after saponification with barium hydroxide. The acids as formed in fluid cultures containing chalk were found to be *l*-lactic and acetic, with traces of succinic, lauric, oxalic, and formic. The ratio of non-volatile to volatile acids was roughly three to one.

The method which I have found most useful for the detection of the bacterial acids is as follows:—A 20 or 30 days' culture containing chalk is decanted, and the fluid is evaporated down to small volume. Both fluid and residual chalk, &c., are acidified with dilute sulphuric acid, cooled and filtered. The calcium sulphate residues are added together, drained by means of the filter-pump, washed with a small quantity of water, and dried in the air, or in an incubator. The fluid, together with the washings from the residues, are extracted in an ether extraction apparatus such as that of Schoorl (this Journal, 1900, 567).

The dried calcium sulphate is ground to a rough powder and extracted either within a perforated tube in the same apparatus or else in a Soxhlet apparatus. The ethereal solutions are slowly distilled and the ether recovered. The residual solutions are exposed to the air until the odour of ether disappears. Hot water is added, and the insoluble acids that separate are removed by filtration and examined. As a rule, the insoluble acids are chiefly obtained from the calcium sulphate residue. The filtrates from the insoluble acids are added together and distilled in a current of steam until all the volatile acids have passed over, or until the distillate has a constant acidity. The volatile acids are then divided. One portion is neutralised with sodium hydrate, evaporated to small volume, and treated with silver nitrate to precipitate the acetic acid; the filtrate from the silver acetate is placed under observation for the blackening caused by formate. A portion of the second half of the volatile acids is tested for formic acid with mercuric chloride. The remainder is treated with an excess of calcium carbonate, evaporated to dryness, and extracted with strong alcohol. The bulk of the acetate and formate remains undissolved, and much of the butyrate is dissolved and may be recognised by the odour of the ethyl ester. The non-volatile acids are evaporated to small volume and allowed to crystallise overnight. The crystals of succinic acid are filtered off and tested. The filtrate is treated with an excess of calcium acetate and warmed, when the tartrate, citrate, and oxalate that may precipitate are separated by filtration. For their identification, see Schoorl (*loc. cit.*). To the filtrate an excess of milk of lime is added, and the solution is filtered. The residue contains the remainder of the succinic acid. The filtrate is evaporated to dryness and extracted with hot 70 per cent. alcohol. The extract contains calcium lactate, which is allowed to crystallise out.

It is interesting to note that both *Bact. acaciæ* and *Bact. metarabinum* produced the same acids during the fermentation of saccharose. Morphologically, the bacteria are very similar, and had the gums had an equal solubility it is possible that the cultural character of the organisms would have been identical. So much was I impressed with the idea that the one was a modification of the other that I subcultivated both bacteria at 30° and at 17° for four months, to see if an approximation would ensue, but no change was observed. If they had originally been one organism, long cultivation under neutral conditions had so fixed the characters that they had become definite producers of arabin and metarabin respectively.

I had an opportunity of investigating the gum-flux of other trees. The first of these was the gum-flux of the vine. Some vines in certain low-lying portions of a vineyard showed an exudation of gum upon the ends of branches that had been pruned in the previous season. The gum had thus been exposed to the winter's rains, and upon being tested was found to consist of metarabin. From the gum-bearing branches, I separated *Bact. acaciæ* and *Bact. metarabinum*. Had freshly exuded gum been obtainable it doubtless would have been found to consist, like the gum of *Acacia penninervis*, of arabin and metarabin, the products of both bacteria.

A sample of plum gum consisted of arabin and metarabin. The soft and fresh gum yielded a culture of *Bact. acaciæ*. *Bact. metarabinum* was not obtained, but as the organism is, on account of the insoluble nature of its gum, easily crowded out of the culture plates by the more diffusible *Bact. acaciæ*, the failure to obtain it does not indicate that the metarabin was the product of the organism that was found.

Bact. acaciæ was also separated from the tissues of gum-bearing red cedar, *Cedrela Australis*, and from the unknown stock of a Japanese date plum.

Two interesting cases that I examined were the fruits of the peach and the almond, both of which were exuding gum from insect punctures and cracks. The fresh gum taken from cavities within the fruits contained a few cells of *Dematium pullulans* and practically no living bacteria, although the microscopical examination of stained films showed that the gum was really a gum matrix in which were imbedded immense numbers of badly staining (*i.e.*, dead) bacteria. The gum had not been formed in the fruit but had been forced into it by the sap pressure; its place of formation had been the stem and branches where the sap is less acid than in the growing fruit. The acidity kills the bacteria that accompany the gum, but has little effect upon adventitious yeast-like moulds, such as *Dematium*, which thus become the only living inhabitants of the gum. The arabin-former, *Bact. acaciæ*, was found in the branches attached to the fruit, where it had produced the soluble constituent of partially soluble gum.

Massee has recorded that *Dematium pullulans* caused a gum-flux of the plum, and as there was the possibility that a similar claim might be made for the races that I found in the peach and almond gums I investigated the slime produced by the peach-race in saccharose media. The slime yielded a gum which, while soluble in the fluid cultures, easily became altered to an insoluble modification, which was soluble in dilute acid and insoluble in dilute alkali. The gum was not hydrolysed by boiling 5 per cent. sulphuric acid, but concentrated acid converted it into a mixture of arabinose and galactose. The gum was therefore a pararabin.

Hot dilute hydrochloric acid was employed to extract the slime from cultures of *Dematium* grown upon solid media, and it dissolved not only the pararabin but also a carbohydrate from the nucleic acid of the mould. This substance was easily hydrolysed to a mixture of glucose and a galactose. That it was not a constituent of the true slime was shown by its absence in the filtered fluid cultures. As the almond gum did not contain pararabin and as its presence is unknown in peach gum, it is evident that *Dematium pullulans* played no part in the formation of these gums.

In these two fruits as well as in the red cedar, I found an organism *Bact. persicæ*, which produced a gum. This hydrolysed to a mixture of arabinose and galactose, the latter preponderating. It was rather an insoluble gum, but when dissolved in dilute acid it was not readily precipitated by the addition of alcohol. This suggested a means of determining whether or not the bacterium contributed towards the gum-flux of the trees in which it occurred. Almond gum was treated with water and the arabin removed. The insoluble but swollen residue was dissolved in the autoclave. The solution of the gum was acidified with hydrochloric acid and treated with alcohol. The filtrate from the precipitated metarabic acid was neutralised with sodium hydroxide, when a small quantity of a gum was precipitated. This was dissolved in the autoclave and tested. It gave the same reactions as the gum of *Bact. persicæ*, so that this organism had contributed its quota towards the gum which exuded from the almond and probably also from the peach and cedar.

The acids which the bacterium formed from saccharose consisted of lactic and butyric, with traces of succinic, formic and acetic. Ethyl alcohol and carbon dioxide were also produced. The only positive coagulating agents that could be depended upon in testing the gum were neutral and basic lead acetates, baryta water, milk of lime, and alcohol.

We have already seen that when *Dematium pullulans* produces a ropiness of fluids, the viscosity is due to the presence of pararabin. This member of the arabin group occurs naturally mixed with arabin as an exudate from a species of Sterculia. With the object of discovering a pararabin bacterium, I examined the gummy exudation from *Sterculia diversifolia*, and found therein the arabin bacterium, *Bact. acaciæ*, which explained the presence of arabin in the gum. Associated with it there was another bacterium which produced a gum upon or in media containing saccharose, dextrose, levulose, galactose, mannite, or glycerin. Three races of the bacterium were obtained; these differed slightly in their cultural characters and in their optimum temperatures. The gums produced by them also differed in some of their chemical reactions, but all were constant in giving curdy precipitates with alcohol, baryta water, basic lead acetate, and ferric chloride. Copper sulphate, followed by potassium hydroxide, gave a blue compound which coagulated upon heating, like arabin and many other gums.

The gum had been obtained from slime which had formed upon saccharose-potato-agar as well as in saccharose-asparagine fluid. Upon desiccation, such as by drying at 100°, the gum was converted into an insoluble modification, which swelled with water. Dilute acid dissolved it readily, while the swollen carbohydrate was contracted, but not dissolved, by dilute alkali. The gum was not attacked by boiling 5 per cent. sulphuric acid, but treatment with concentrated and then dilute acid converted it into a mixture of arabinose and galactose. Thus, the bacterial product had the same solubility, the same resistance to hydrolysis, and gave the same products of hydrolysis as pararabin, which it undoubtedly was. The gum of Sterculia is, therefore, the product of *Bact. acaciæ* and an organism which I have named *Bact. pararabinum*. Like the arabin and metarabin bacteria, *Bact. pararabinum* does not secrete invertase, and thus may be distinguished from many other slime-forming bacteria. The acids formed from saccharose consisted of succinic, lauric, butyric, acetic, and formic; the ratio of volatile to non-volatile acids was, roughly, 1 : 10. Ethyl alcohol and carbon dioxide were also produced.

In concluding the first part of this paper, I have shown that bacteria inhabiting the tissues of gum-bearing trees can form arabin, metarabin, pararabin, and other gums; and since we must admit that the natural gums of these trees were produced by the bacteria, we must also admit the probability of all other gums of an arabin nature being produced by bacteria. To put it shortly, the arabin gums are bacterial gums. The tree is, as it were, a laboratory in which certain constituents of the sap are converted by bacteria into gum which either flows out from cracks or wounds or is carried with the sap into the developing fruit. Although I have not examined every kind of tree affected with gum-flux or trees in other climates, yet it will be agreed that enough has been done to show that the vegetable gums are bacterial and not higher plant products, and that the differences in the nature of the gums are due to the fact that they are produced by different bacteria. Differences in the physical nature of the same gums, such as the varieties of gum arabic, soluble wattle gums, &c., are probably due to differences in the (climatic) temperature of formation and the nature of the sap. It is known that the gum of one season differs optically from that of another, and a difference in season would undoubtedly influence the activity of the bacteria in certain directions.

Every susceptible tree does not produce gum, but it could be made to do so by an artificial infection, either with pure bacteria or with the fresh juice from a selected and affected tree. Furthermore all the branches of a tree may not be producing gum, and in such cases an artificial infection would augment the yield. Thus the world's supply of gum might be materially increased if the native gatherers could be instructed in the principles of plant infection, *i.e.*, how to sow bacteria and reap gum.

Obituary.

HARRY GRIMSHAW,

MEMBER OF COMMITTEE OF THE MANCHESTER SECTION OF THE SOCIETY OF CHEMICAL INDUSTRY.

Harry Grimshaw was born at Cheetham Hill, Manchester, in 1851, and received his scientific education in Owens College, which he entered in 1869. He studied chemistry under Sir Henry Roscoe and Prof. Schorlemmer, gaining the Dalton Chemical Scholarship and other distinctions, and finally being elected a demonstrator and assistant lecturer in chemistry. Later he commenced as a chemical manufacturer at Clayton, near Manchester, in company with his younger brother, and was also on the directorates of the Recovered Rubber Works, Ltd., and the United Rubber Co., Ltd. Since the formation of the Society of Chemical Industry, he has been an active member, and more especially in connection with its Manchester Section. Some 11 or 12 years ago he assisted in the formation of the Chemical Section of the Manchester Chamber of Commerce, afterwards acting as hon. secretary of the Section. H. Grimshaw always took a great interest in local government and affairs, and in 1881 was elected a member of the Bradford (Manchester) Local Board and of the Bradford School Board, and became in 1897 a representative of Bradford in the Manchester City Council; he was also a member of the Mersey and Irwell Joint Committee. Mr. H. Grimshaw has been a magistrate since 1892, and by his death the City of Manchester will sustain a severe loss, and particularly the districts he represented, wherein he was ever zealous in promoting the interests of the poor. Amongst his original scientific work may be enumerated the following:—In 1873, an investigation on Ethyl-amyl, read before the Chemical Society, on which occasion the late Sir Edw. Frankland said that "students would do well to look upon it as a pattern for research work"; 1875, on a crystalline basic calcium chloride; 1877, on Di-isopentyl or Diamyl; and 1879, Analysis of the Water of Thirlmere (subsequently taken to supply the City of Manchester). He died somewhat suddenly on Jan. 29th.

WALTER GEORGE McMILLAN,

SECRETARY OF THE INSTITUTION OF ELECTRICAL ENGINEERS, &C.

W. G. McMillan was born in January 1861, and received his education in King's College School and then in King's College, where he gained the Daniell Research Scholarship in 1880. His special study was metallurgy, though his long course as a valued abstractor, since 1882, upon the staff of this Journal has amply demonstrated the fact that his knowledge of science was both well founded and thoroughly comprehensive. After leaving King's College he wisely worked for about a year with an accountant in order to obtain an acquaintance with business methods. Then returning to the College, he became private assistant to Prof. Huntington, and in 1883 was appointed Demonstrator in his Metallurgical Department. Here he remained till 1888, when he was appointed for five years under the Indian Government as chemist and metallurgist to the Cossipore Ordnance Factories near Calcutta. Immediately on his return to England he was elected Lecturer in Metallurgy at Mason's College, Birmingham, and held the position till 1897, when he was appointed Secretary of the Institution of Electrical Engineers. W. G. McMillan has written two articles on Electro-Chemistry and Electro-Metallurgy for the supplement of the "Encyclopædia Britannica," a "Treatise on Electro-Metallurgy," and a translation of Dr. Borchers' "Electro-Metallurgy" in 1897.

Whilst in India he was Examiner in Chemistry at the Calcutta University. He was also Vice-President of the South Staffordshire Institute of Iron and Steel Works Managers in 1897, and the Examiner in Electro-Metallurgy for the City and Guilds of London Institute at the time of his death.

After partial recovery from an attack of pleurisy, he suddenly suffered a relapse, and died on Sunday night, Jan 31.

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I.—PLANT, APPARATUS AND MACHINERY.

Reaction-Towers and the Regulation of Temperature in them. H. Rabe. Zeits. angew. Chem., 1903, **16**, [19], 437—444; and 1904, **17**, [1], 8—9.

The first part of the paper is a review of modern practice. The demands made on the filling material are discussed, and the extent to which different materials meet them. It is found that with suitable filling material it is advantageous to increase the area of the tower and lessen its height; but the greater the horizontal section of the tower the more difficult it becomes to secure uniform distribution of the absorbing liquid. The author describes a distributor of his own, the action of which will be clear from the figures. A is the tower, and B its cover. The liquid entering by the sloping tube enters the vessels D and F (Fig. 1), which divide it into a number of small streams. These streams fall into the compartments J (Fig. 2), which communicate with the delivery troughs forming the revolving arms H; and the size of each compartment is proportional to the length of the connected trough, and hence to the circumference of the circle over which the water flowing into the cell and out by the trough is distributed. The whole is driven by an external motor, and secures a very even distribution of the liquid. The abstraction from the reacting gases and liquid of the heat produced by their reaction has always been a desirable thing to accomplish, for rise of temperature usually means imperfect reaction, and hence necessitates increase of tower-capacity and of volume of liquid to be handled. It has, however, presented difficulties, for the walls of the tower abstract and dissipate but very little heat, and tubes, when introduced, have usually served to collect the liquid and destroy its even distribution in the portions of the tower below them. The author has devised two plans of effecting cooling, the one in stoneware, the other in lead. The stoneware device consists of a circular drum, illustrated by Figs. 3 and 4, which is built as a section of the tower. Vertical tubes pass through the upper and lower faces of the drum. The upper face of the drum is divided into sections by slightly raised ridges, each section containing one of the vertical tubes; and each tube is provided with a loose cap pierced with holes at the sides. The whole of the liquid passing down the tower thus comes

Fig. 1.

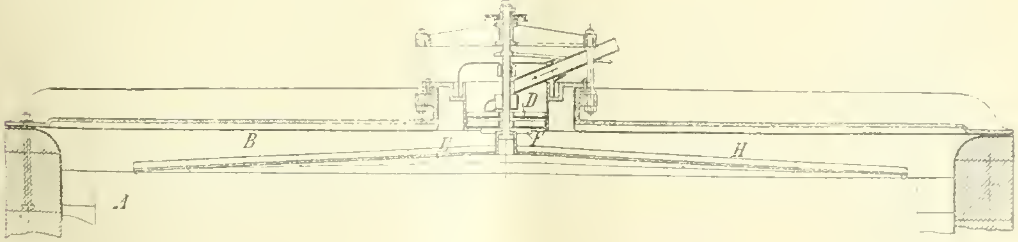


Fig. 2.

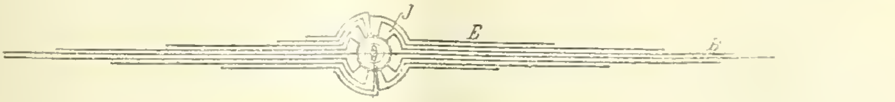
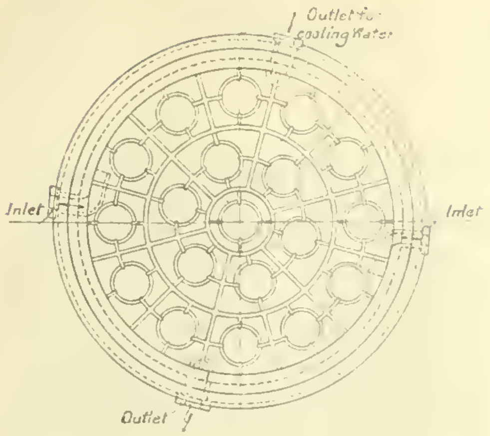


Fig. 3.



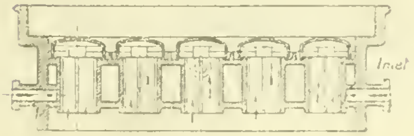


Fig. 4.

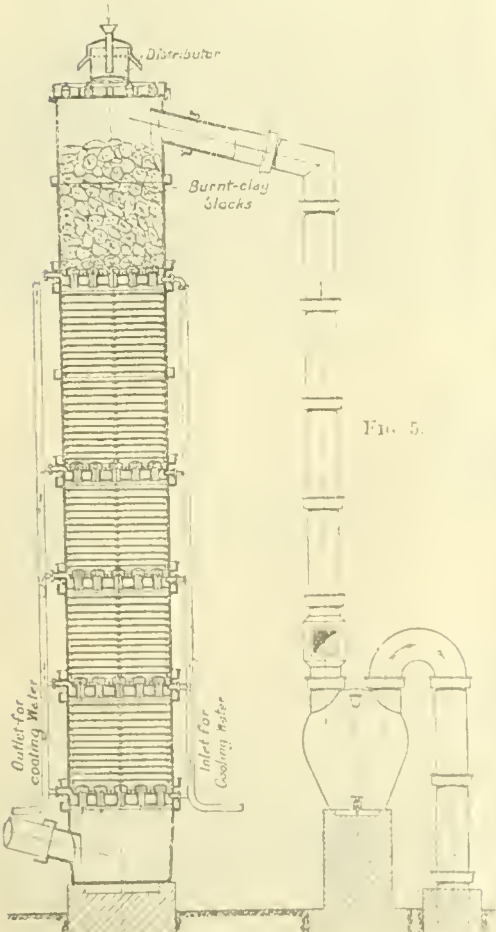


Fig. 5.

into contact with the stoneware drum, and the ridges and vertical tubes secure that the distribution of the liquid is not disturbed. Inflow and outflow tubes in the cylindrical sides of the drum are arranged for the passage of the cooling water. Any number of such drums can, of course, be intercalated throughout its height, as sections of the tower. The mode of doing so is indicated in Fig. 5. In the case of a leaden tower, horizontal leaden tubes, say 8 cm. diameter, are passed through the walls of the tower at regulated distances apart, say 18 cm., the whole set ending in a common reservoir at each end, so that a single inlet and outlet serve for the feed-water of the set. To secure even distribution of the fluid in the tower, each pipe is ribbed at intervals by bending round it strips of lead $\frac{1}{4}$ in. to $\frac{1}{3}$ in. square in section, and twisting and soldering the ends of each strip. In filling the tower, prisms of coke or other filling material are arranged so as to lead the liquid from any section of one tube to the corresponding section of the next. Soft lead can be used for these tubes if webs of ┬-section be passed through them to prevent sagging; and the weight of the tubes should be carried by an external framework, not by the lead of the tower. In an actual case, in which gases were to be dried in a tower 2·7 m. square and 8 m. high, by sulphuric acid of 1·7 sp. gr., both gas and acid entering at a temperature of 30° C., drying was very imperfect, because the heat of absorption raised the temperature to over 70° C. When, however, cooling tubes were introduced, the effluent gas was at 25° C., and well dried, though the amount of drying liquid had been reduced. Obviously, the subsequent removal of a given quantity of water in re-concentrating the used sulphuric acid is effected more economically from a small quantity of more dilute than from a large quantity of less dilute acid. The application of cooling tubes to the Gay-Lussac tower should effect a considerable economy, both in tower-space and in acid.—J. T. D.

English Patents.

Roller Crushing Mills ; Impts. in ——. The Edison Ore Milling Syndicate, Ltd., London. From T. A. Edison, Llewellyn Park, N.J. Eng. Pat. 2645, Feb. 4, 1903.

The crushing rolls consist of crushing plates attached to a roll centre or hub, made in two parts, which are secured together on opposite sides of an enlargement on the roll-shaft, so that movement along the shaft is prevented. One of the rolls may be laterally movable, and connected to its driving shaft by a non-circular "wobbler" or loose shaft. Details in the couplings connecting the rolls to the driving gear, and in the bearings and lubricating arrangements, are also claimed.—R. A.

Treatment of Animal, Vegetable, or Chemical Substances for the Purpose of Increasing their Solubility in Liquids. J. Maggi, Paris. Eng. Pat. 9002, April 21, 1903.

See Fr. Pat. 330,691 of 1903 ; this J., 1903, 1078.—T. F. B.

Preventing Explosions in Vessels Containing Inflammable Liquids ; Device for ——. R. Scheuffgen and Fabrik Explosionssicherer Gefässe G.m.b.H., Salzkotten, Westphalia. Eng. Pat. 25,547, Nov. 23, 1903.

The filling and discharge openings of the vessels are fitted with a number of perforated cylinders, one within another, and closed at the bottom, the perforations in the cylinders being displaced relatively to one another. The space between each pair of cylinders may be filled with fire-resisting material, such as asbestos, glass-wool, &c. (See also Eng. Pat. 2384 of 1901 ; this J., 1901, 974.)—R. A.

United States Patents.

Separator ; Centrifugal Liquid ——. A. B. Ayers, Lansing, Mich., Administrator of J. H. Ayers, deceased. U.S. Pat. 748,038, Dec. 29, 1903.

The separator is provided with a series of baffle-plates, of regular polygonal form, arranged in concentric order with chambers between the plates, and formed with horizontal slits or openings. The metal between the openings is bent at an angle to the plane of the plates, so that its lower edge extends outwards farther than its upper edge, thus causing a downward flow of the liquid passing through the openings. —R. A.

Vacuum Driers; Filling or Emptying Apparatus for ——. E. Passburg, Berlin. U.S. Pat. 748,411, Dec. 29, 1903. (See also Eng. Pats. 4126 of 1901 and 12,453 of 1902; this J., 1902, 458, and 1903, 708.)

The vacuum chamber is provided with automatic continuously-working filling and emptying devices, located respectively at the inlet and outlet of the chamber. Each of the devices consists of a number of pairs of suitable closing devices, with an intermediate chamber between each pair, and an air-sucking apparatus connected with each of these chambers.—R. A.

Drying Moist Material; Apparatus for ——. E. N. Trump, Syracuse, N.Y. U.S. Pat. 748,893, Jan. 5, 1904.

A closed system is formed through a series of chambers, one of which consists of a stack for the treatment of the material. The stack increases in cross-sectional area upwards, and is contracted at the top, the material to be treated being fed into it through suitable regulating means. The drying agent is forced upwards with a spiral motion through the stack, so that it not only holds the material under treatment in suspension, but also separates the finished from the unfinished material, this selective action being strengthened by the decreasing vertical velocity of the drying current, due to the construction of the stack. The finished material is received in a separating-chamber, from which the drying agent is returned to the stack. —R. A.

Treating Material; Process of ——. E. N. Trump, Syracuse, N.Y. U.S. Pat. 748,894, Jan. 5, 1904.

The claims relate mainly to the process carried on by the apparatus claimed in the preceding patent.—R. A.

[*Water*] *Distilling Apparatus.* Eva E. Stocker, Administratrix of J. Stocker, St. Louis, Mo., deceased. U.S. Pat. 748,564, Dec. 29, 1903.

This apparatus comprises a closed tank furnished with insulated walls, a condensing coil arranged within the tank and connected with the supply-pipe, a cooling tower within the coil, an evaporating chamber and a heating chamber located respectively at the top and the bottom of the tower, and a receiving tank beneath the coil. A communicating passage is provided between the heating and evaporating chambers, and a pipe leads from the top of the condensing coil to the heating-chamber.—R. A.

Filter-Press [*Pulp*]. E. B. Hack, Assignor to the American Filter Press Extraction Co., Denver, Colo. U.S. Pat. 749,140, Jan. 5, 1904.

The press is composed of distinct pulp-holding and filtering members, with a movable head or end, and tightening levers for acting on one of the head members. The members are provided with registering openings, forming longitudinal passages outside the pulp and filter chambers, each pulp-frame having a lateral channel for the introduction of pulp to the pulp-chambers. Provision is also made for the introduction of liquid and air, and for the discharge of the solutions after they have passed through the pulp. —R. A.

French Patent.

Distillation Apparatus. A. H. L. Gerhardt. Fr. Pat. 335,034, Sept. 4, 1903.

The apparatus is arranged for the continuous distillation of any liquid, such as benzol or water. Inside a vertical still is placed a steam heating-coil, provided with a drain pipe for the condensed water. The liquid to be distilled passes through a preheater, warmed by the hot vapours, and is admitted into the still through a pipe, the level being kept constant by means of a ball valve. The vapours generated, pass through the preheater, and are then condensed in a water-cooled spiral, and drawn off. A safety-valve—which may be of special design—is fixed to the preheater and if there is any sudden disengagement of gas from the crude preheated liquid, this gas is blown through a pipe into the still. At the same moment a ball valve closes the pipe admitting the crude liquid to the preheater, thus preventing the blown-off gas from again mixing with it. The apparatus is quite automatic in action.—L. F. G.

II.—FUEL, GAS, AND LIGHT.

Retort; Vertical [*Gas*] ——. W. King. J. Gas Lighting, 1904, **85**, [2122], 80—83.

In the Settle-Padfield experimental plant at Exeter, excellent results have been obtained from two and a half years' working of a vertical retort improvised out of old 16-in. circular retorts. The method of feeding is one of the most important features of the system. From the top of the retort rises a short 6-in. bored cylindrical tube, on which a conical hopper is fixed. A rod within the tube carries a fixed cone at the bottom and an adjustable one at the top, both having their apices pointing inwards. This constitutes the plunger, which works up and down smoothly within the tube, being actuated from above by a reversible worm and toothed-wheel gearing. The coal, in the form of slack, is fed into the conical hopper; and, as the plunger rises, the top cone rises from its seat and the coal drops into the annular space round the rod. On the descent of the plunger, when the lower cone passes the outlet of the cylinder, the charge slips into the retort, being directed towards the incandescent sides, and the gas is driven out rapidly. The charges are very small—about 6½ lb. at a time. During the charging there is no escape of flame and smoke. It is stated that no trouble is experienced from stoppage of the ascension pipe. From Somerset, Durham, and Yorkshire slacks, it is claimed, the yield of gas is over 13,000 cb. ft. per ton, against slightly over 10,000 cb. ft. with ordinary horizontal retorts; it is said that the tar is entirely got rid of, the large hard coke produced is more valuable than that obtained in horizontal retorts, and that the quality and quantity of the gas are well maintained hour by hour. A new bed of retorts has been constructed containing six circular retorts, three on each side, of 1 ft. 4 ins. top diameter, expanding to 1 ft. 9 ins. at the bottom. The vertical portion is 3½ ft. long, and the curved, inclined, discharge end is 4 ft. 9 ins. long. Ground space will be saved, as the charging is done mechanically from above, and drawing takes place by gravitation. It is calculated that the floor area required, in the case of 20-ft. horizontal retorts, is 103 sq. ft. per ton of coal carbonised, equal to 99 cb. ft. of gas per square foot, whereas the Exeter plant requires only 79 sq. ft. per ton, equal to 161 cb. ft. of gas per square foot. A definite opinion as to the capital cost and fuel account of the system is not yet justifiable; but it is urged that there will be savings in connection with stoking and drawing machinery and brickwork, and that not only is a lower temperature sufficient for carbonising by this system, but there is less brickwork and less coal to be heated up for a given yield of gas. The use of small coal or slack, instead of large coal, effects a large saving.—H. B.

Cyanogen; Recovery of ——, *by Bueb's Process at Hanover Gasworks.* Körting. J. f. Gasbeleuchtung, 1904, **47**, [3], 45—46.

At the Hanover gasworks, the gas, after removal of the tar and naphthalene, is passed through a standard washer having four chambers, the first three, which contain the absorbent liquor, being filled with wooden faggots, whilst the fourth is provided with rotating metallic discs, between which stirring chains are suspended. To prepare the washing liquor, a solution of ferrous sulphate, of 19°—20° B., is run into the fourth chamber, and the gas from the absorption chambers is passed through it until all the iron has been converted into sulphide. When cyanogen is found in the gas leaving the washer, the cyanogen mud from chamber 1 is pumped into a reservoir, the liquor from chamber 2 is pumped into chamber 1, that from 3 into 2, and the fresh sulphide liquor from 4 into 3. These changes are required every 18 to 24 hours. The cyanogen mud is

sold without further treatment; it contains about one-third of the ammonia in the coal. (See this J., 1903, 356.)
—H. B.

Sulphur in Coal and Coke; Rapid Method of Determining ——. J. D. Pennock and D. A. Morton. XXIII., page 131.

Mercury Vapour; Conductivity of —— [*Mercury Vapour Electric Lamp*]. P. C. Hewitt. XI. A., page 119.

ENGLISH PATENTS.

Briquettes; Manufacture of Fuel ——. M. Hecking, Dortmund, Germany. Eng. Pat. 1260, Feb. 23, 1903.

The binding material, preferably in a liquid state, is added to the fuel or combustibles "shortly before the completion of the heating in the heating apparatus." The apparatus suggested consists of a rotating cylinder, which can be heated, into one end of which the fuel is fed, and moves towards the discharging end by reason of the rotation, or by accessory mechanism. The binding material is supplied through a pipe, entering the discharge end of the cylinder, and is mixed with the combustible material by the rotation of the cylinder and its contents; the point at which the addition of the binding material takes place, depends upon the nature of the combustible, and the operation is not interrupted. Compare also Eng. Pat. 14,054, 1902; this Journal, 1902, 1126.—W. C. H.

Coke Ovens. F. J. Collin, Dortmund, Germany. Eng. Pat. 7487, March 31, 1903.

See Fr. Pat. 330,754 of 1903; this J., 1903, 1080.—T. F. B.

Gaseous Mixture which is as Dry as possible; Production, by means of Liquid Hydrocarbons, of a ——, *and Apparatus therefor.* L. Rüdemann, Paris. Eng. Pat. 23,166, Oct. 26, 1903.

The combustible gaseous mixture, derived from liquid hydrocarbons, is rendered as dry as possible, by removing all the moisture from the air required for the production of the mixture, before it enters the generator. The deposition of the moisture is effected by causing the air to flow over the exterior walls of the generator, for example, by enclosing this within a larger tube, and causing the air to pass through the latter, in the direction opposite to that taken by the hydrocarbon mixture. The air may also be supplied through a tube, provided with heat-conducting wings, placed in the upper part of the generator, where it is exposed to the reduced temperature, and also may be passed through chambers containing water-absorbing substances, such as "chloride of lime."—W. C. H.

Gas-Purifiers; Impts. in ——. R. Dempster and Sons, Ltd., and J. W. Broadhead, Elland, Yorkshire. Eng. Pat. 5910, March 14, 1903.

Gas purifiers are arranged in compact groups of four, in square or oblong formation, in such a manner as to leave a central space bounded by a portion of the inner wall of each purifier, this space containing the inlet and outlet valves and controlling gear of the purifiers.—H. B.

Electrodes for Arc Lamps; Manufacture of ——. A. Blondel, Paris. Eng. Pat. 23,262, Oct. 24, 1902.

Mineralised carbon electrodes are formed of carbon paste containing 10—70 per cent. of fluoride, oxide, carbide, or phosphate of calcium, to which is added from 3 to 25 per cent. of borate of barium, calcium, aluminium, or magnesium, with or without borates of alkali metals. By the use of the earthy borates, which is the main feature of the invention, it is claimed that irregularities in the light emission are prevented.—H. B.

UNITED STATES PATENT.

Gas [*Oil-Gas*]; *Apparatus for the Manufacture of* ——. R. Dempster, Marietta, Ohio. U.S. Pat. 748,933, Jan. 5, 1904.

See Eng. Pat. 16,764 of 1903; this J., 1904, 14.—T. F. B.

FRENCH PATENTS.

Agglutinant for Agglomerating Coal Dust; Manufacture of an ——. F. Hache. Fr. Pat. 334,782, Aug. 22, 1903.

According to this process, waste resinous products such as the heavy oils left in the distillation of tar, anthracene oils, petroleum, beech or oak tar, and resin, and similar hydrocarbons, are mixed and distilled. A composite oil is thus obtained, and an artificial resin, which may be mixed with coal dust and sold in the form of briquettes.
—L. F. G.

Briquettes; Manufacture of Coal ——. G. Quentin. Fr. Pat. 334,983, Sept. 1, 1903.

Coal dust is mixed with clay or loam in the proportion of 5 per cent. of clay to 94·5 per cent. of coal, and 0·5 per cent. of a strong glue or gum arabic solution in water, is added as an agglutinant. The briquettes are formed from the cold material.—L. F. G.

Briquettes; Manufacture of ——. (Mrs.) F. A. Merrill. Fr. Pat. 335,324, July 21, 1903.

See Eng. Pat. 16,127 of 1903; this J., 1903, 1079.—T. F. B.

Peat; Manufacture of Fuel from ——. J. B. Bessey. Fr. Pat. 335,097, Sept. 9, 1903. Under Internat. Conv., Sept. 9, 1902.

See Eng. Pat. 19,719 of 1902; this J., 1903, 943.—T. F. B.

Gas; Process and Apparatus for the Production of ——. H. S. Elworthy. Fr. Pat. 335,120, May 30, 1903. Under Internat. Conv., May 31, 1902.

See Eng. Pat. 12,461 of 1902; this J., 1903, 900.—T. F. B.

Alcohol; Carburisation of ——. F. Hache. Fr 334,783, Aug. 22, 1903.

Denatured alcohol is mixed with crude petroleum in about equal proportions by volume. The mixture is then distilled until the whole of the alcohol has passed over. The distillate is a homogeneous product, more luminous than pure alcohol, and does not produce noxious fumes nor greasy residues. The residues of distillation find a use in industry as agglutinants.—J. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum; Canadian ——. Bull. of the Imperial Inst. (Suppl. to Board of Trade J.), 1903, [4], 183—187.

The principal source of Canadian petroleum is the province of Ontario. The crude petroleum is a heavy, dark brown oil, having a very unpleasant odour, owing to the presence of sulphur compounds. The sp. gr. generally ranges from 0·804 to 0·808. On distillation in the laboratory the oil yields:—Naphtha (sp. gr. 0·735), 12·5; lamp oil (sp. gr. 0·820), 35·8; lubricating oil, 43·7 and hard paraffin, 3·0 per cent. On the large scale, however, in 1899, the yields of the different products were stated to be:—Benzine and naphtha, 1·6; lamp oil, 38·7; paraffin and heavy oils, 25·3; waste, 34·4 per cent. A specimen of petroleum from Westmoreland County, New Brunswick, having the sp. gr. 0·857, yielded:—Light petroleum (naphtha), 5·6; kerosene (lamp oil), 28·3; heavy oils and solid hydrocarbons, 58·2; and water, 7·9 per cent.—A. S.

Petroleum and Asphalt in the Islands of Pedernales, Pesquero, and del Plata, Venezuela. Hirzel. Chem. Rev. Fett- u. Harz-Ind., 1903, **10**, [12], 275—277.

The occurrence of extensive deposits of asphalt and petroleum in the islands named, which are off the Venezuelan coast, near the mouths of the Orinoco, has already been reported by R. Zuber. In the north-western part of Pedernales, near the coast, is a large deposit of solid asphalt named "La Brea," 1,000 metres long and on the average 60 metres wide, in which are a large number of crater-like depressions, containing a thick liquid asphalt of sp. gr. 1·01, from which bubbles of gaseous hydrocarbons continually arise. Deposits of asphalt and petroleum have also been met with in other parts of the island. A specimen of the liquid "crater asphalt" yielded on distillation: water, 4·5; oil of sp. gr. 0·870, 6·5; oil of sp. gr. 0·950, 25·1; and solid "pure asphalt," 60·9 per cent. In the author's opinion, it is evident that this liquid asphalt and also the solid asphalt have been formed from petroleum. In the island of Pesquero, petroleum is found in the upper sandstone layer and rises to the surface of the earth through fissures and cracks. This oil has the sp. gr. 0·918 at 15° C., and yields about 30 per cent. of illuminating oil.—A. S.

Petroleum from Trinidad. Bull. of the Imperial Inst. (Suppl. to Board of Trade J.), 1903, [4], 177—180.

Two specimens of petroleum have been examined. The first (A) was obtained from a well sunk at Guayaguayare in 1902 to a depth of over 1,000 ft.; it had been kept for some months. It consisted of a thick dark brown oil of sp. gr. 0·920 at 20° C. and flashing point (Abel-Pensky test) 21·5° C. On distillation it yielded: light petroleum (up to 150° C.), 11·1; kerosene (150°—270° C.), 38·0; heavy oil, 43·0; and coke (by difference), 7·9 per cent. The second specimen (B) was obtained from a natural spring, and consisted of a thick oil of a dark brown colour and exhibiting distinct fluorescence; its sp. gr. was 0·8686 at 20° C. and its flashing point (Abel-Pensky test) 71·6° C. On distillation it yielded: light petroleum (up to 150° C.), 0·2; kerosene (150°—300° C.), 70·0; heavy oil, 27·4; coke (by difference), 2·4 per cent. Both samples are stated to represent valuable commercial products, A resembling Russian rather than American petroleum, whilst B is similar to Canadian oil in its small yield of light petroleum, but contains more kerosene than the latter.—A. S.

Pitch, Natural, or Manjak, from Trinidad. Bull. of the Imperial Inst. (Suppl. to the Board of Trade J.), 1903, [4], 180—182.

The sample of manjak consisted of lumps of a black, somewhat lustrous mineral, more friable than good bituminous coal, which it resembled in general appearance. It contained: fixed carbon, 55·15; soluble matter, 40·92; ash, 3·55; and moisture, 0·38 per cent. It became soft at 220° C. On extracting with acetone and subsequently with chloroform, the following results were obtained: Acetone extract ("petrolene"), 12·06; chloroform extract ("asphaltene"), 83·19; insoluble residue, 4·75 per cent. The manjak is not suitable for the manufacture of black varnish or of paving asphalt, owing to its melting point being high in consequence of its low content of "petrolene." It is probable, however, that this defect might be remedied by incorporating a certain proportion of petroleum residuum with the manjak. (See also this J., 1899, 127, 738.)—A. S.

United States Patent.

Dry Distillation of Organic Substances; Apparatus for the Continual Charring and ——. H. C. Aminoff, Domnarfoet, Sweden, Assignor to A. C. Mark, Gothenburg. U.S. Pat. 748,457, Dec. 29, 1903.

The substances to be distilled are caused to ascend a long, inclined chamber, into the lower end of which a current of hot "gases" is introduced; the products of distillation are collected at the upper end of the chamber.—T. F. B.

French Patent.

Anthracene; Process of Purifying Crude ——. L. Scholvien. Fr. Pat. 335,013, Sept. 3, 1903.

Crude anthracene is melted at as low a temperature as possible (about 100° C.), cooled gradually to 50° C., and the portion which has separated out removed from the liquid portion. By this means it is said that a 45 per cent. anthracene is easily obtained.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

United States Patents.

Anthraquinone Dye, Blue [Anthracene Dyestuff], and Process of Making Same. E. Hepp and C. Hartmann, Assignors to Farbwerke vorm. Meister, Lucius und Brüning, Höchst a. M., Germany. U.S. Pat. 748,375, Dec. 29, 1903.

Aminohydroxyanthraquinones are treated with halogens, the halogen derivatives are treated with aromatic amines, and the condensation products are converted into sulphonic acids by sulphonating agents. The products are easily soluble in water, and dye unmordanted and chrome-mordanted wool in fast blue shades. The product obtained from 1·5-aminohydroxyanthraquinone by means of bromine, aniline, and feebly-fuming sulphuric acid is especially claimed.—E. F.

[Azo] Dyestuff and Process of Making Same; Dark Blue Wool ——. M. Hoffmann, Frankfort, Assignor to Cassella Colour Co., New York. U.S. Pat. 749,195, Jan. 12, 1904.

See Eng. Pat. 3182 of 1903; this J., 1904, 56.—T. F. B.

French Patents.

Bases [p-Nitraniline]; Manufacture of Aromatic ——. The Clayton Aniline Co. Fr. Pat. 335,204, Aug. 10, 1903. Under Internat. Conv., Nov. 2, 1902.

See Eng. Pat. 24,869 of 1902; this J., 1903, 1125.—T. F. B.

Anthraquinone Derivatives [Anthracene Dyestuffs]; Preparation of New ——. Soc. Anon. F. Bayer et Cie. Fr. Pat. 334,658, Aug. 17, 1903.

Purpurin-α-sulphonic acid is obtained by treating anthraquinone-α-sulphonic acid (see Fr. Pat. 333,144; this J., 1903, 1290) with very strong fuming sulphuric acid, and then saponifying the sulphuric ether of purpurin-α-sulphonic acid so obtained. The product dyes wool mordanted with alum in red, and chrome-mordanted wool in bluish-red shades.—E. F.

Coloured Products [Indophenols] resulting from the Condensation of Nitrosohydroxy Derivatives with Aromatic Amines; Manufacture of ——, *and also of Leucoindophenols derived therefrom.* Soc. pour l'Ind. Chim. à Bâle. First Addition, dated Aug. 22, 1903, to Fr. Pat. 330,388 of March 18, 1903. (See Eng. Pat. 7025 of 1903; this J., 1903, 861.)

According to the original patent, aromatic amines with a free para position are condensed with nitrosophenols or quinone chlorimides in presence of sulphuric acid. The sulphuric acid may be replaced by other mineral acids. The amines may be replaced by their neutral or acid salts in presence of a dissolving or diluting agent. The nitrosophenols and quinone chlorimides may be replaced by oxidation products obtained from the corresponding aminophenols by treatment with peroxides or electrolytic oxygen. —E. F.

Lakes [from Azo Dyestuffs] Fast to Light; Preparation of Reddish-Blue ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 328,128, Oct. 31, 1902.

See Eng. Pat. 23,830 of 1902; this J., 1903, 1055.—T. F. B.

Azo Dyestuff; Process for Preparing a Red ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 328,131, Nov. 4, 1902.

See U.S. Pat. 733,280 of 1903; this J., 1903, 946.—T. F. B.

Azo Dyestuff; Process of Manufacturing a Violet ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 328,137, Nov. 5, 1902.

See U.S. Pat. 737,967 of 1903; this J., 1903, 1082.—T. F. B.

Indoxyl [Indigo Dyestuffs] and its Homologues, Manufacture of ——. Cie. Paris. de Coul. d'Aniline. 1st Addition, dated Aug. 24, 1903, to Fr. Pat. 317,121 of Dec. 1, 1901 (this Journal, 1902, 967).

According to the original patent, aromatic organic compounds) containing the group R.N.CH_2.CO—— are treated at a high temperature with inorganic substances capable of decomposing water. It is found that these inorganic substances may be replaced by the hydrides of the metals of the alkalis or alkaline earths.—E. F.

Indoxyl and its Derivatives [Indigo Dyestuffs]. Badische Anilin und Soda Fabrik. Fr. Pat. 328,148, Nov. 21, 1902.

See Eng. Pat. 26,372 of 1902; this J., 1903, 1289.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Caruá [Caroá] and Makimbeira Fibres from Brazil. Bull. of the Imperial Inst. (Suppl. to Board of Trade J.), 1903, [4], 170.

Caruá, or more correctly Caroá fibre is obtained from the plant *Neoglaziovia variegata*, Mex., of the pine-apple order, *Bromeliaceæ*, which is common in the northern parts of the State of Bahia. The specimen examined had been prepared in a crude way by natives; it consisted of a white, fairly strong fibre containing little or no ligno-cellulose; it was valued at 10*l.*—13*l.* per ton, whilst a specimen of hand-made rope, probably prepared from selected fibre, was valued at 25*l.* per ton. The specimen of the fibre, after being cleaned by hackling, gave the following results:—Moisture, 8·4; ash, 3·1; loss on hydrolysis (*a*), 25·6; loss on hydrolysis (*b*), 33·7; loss on acid purification, 15·3; "loss on mercerisation, 23·5"; gain on nitration, 17·3; cellulose, 69·8 per cent.; length of ultimate fibre, 2—5 mm, A consignment of dressed Caruá fibre recently realised 31*l.* per ton. Makimbeira fibre is obtained from a plant closely allied to Caruá. The specimen of fibre examined, which had been prepared by natives, was valued at 13*l.* to 20*l.* per ton; it was too small to allow of chemical examination.
—A. S.

Fibre of Cryptostegia Grandiflora, from Madras. Bull. o the Imperial Inst. (Suppl. to Board of Trade J.), 1903, [4], 172.

The specimen examined consisted of a nearly white, fine, strong fibre, with a staple of average length, 16—20 inches, and resembling that of *Marsdenia tenacissima* (see this Journal, 1903, 1192). The fibre contains little or no ligno-cellulose, and persistently resists the action of alkali. It gave the following results on examination:—Moisture, 7·9; ash, 0·95; loss on hydrolysis (*a*), 5·2; loss on hydrolysis (*b*), 9·8; "loss on mercerising, 4·3"; loss on acid purification, 1·2; gain on nitration, 49·0; cellulose, 92·0 per cent.; length of ultimate fibre, 10—60, average, about 30 mm. It was valued at about 30*l.* per ton.—A. S.

Albumins; Action of Nitrous Acid upon ——. A. Pellizza. Rev. Gén. des Mat. Col., 1904, **8**, [85], 5—6.

In view of the doubts which have been expressed as to the correctness of Prud'homme's view that the wool molecule contains NH or NH_2 groups, and also of the uncertainty existing as to the constitution of albumins, the author examined the behaviour of various albumins to nitrous acid. Both classes of albumins, namely (1) the albumins proper, that is, albumins, globulins, caseins, and nucleo-albumins, and (2) the transformation derivatives of these, the albumoses and peptones, in the absence of light, and in the cold, react with nitrous acid. The products are yellow-coloured substances, which, when purified by washing with water and dilute alkali or alkali acetate solution, and dried, are fairly stable in a vacuum. They are decomposed by light and heat, and easily by moisture. The products obtained from the albumins of the second class are moderately soluble in water and in acid solutions. Those derived from the albumins of the first class dissolve in solutions of alkalis, and in the presence of the latter, without necessarily entering into solution, react with phenols and aromatic amines, giving thus with phenol yellow, with the naphthols red, and with the aminophenols and aminonaphthols brown-coloured compounds. These are slowly decolorised by energetic reducing agents. The compounds derived from the naphthols and the peptic or tryptic transformation products of the albumins are yellow, soluble in water, and fairly easily dialysable. Albumins rendered insoluble by treatment with formaldehyde react with nitrous acid like the corresponding unchanged albumins. Similarly, the albumin-azo-naphthol compounds are rendered insoluble by the action of formaldehyde. These facts are not in accordance with Benedicenti's theory that the albumin molecule contains amino or imino groups, which are acted upon by formaldehyde. The action of the latter reagent may be shown by printing a cotton tissue prepared with sodium-β-naphtholate with the yellow "nitroso" derivative of blood albumin, admixed with a sufficient quantity of alkali, the deep rose colour-lake being soluble in water as thus produced, but being rendered fast to washing by treatment with formaldehyde. (See also this Journal, 1888, 841; 1897, 405; 1893, 312; and 1899, 1015 and 1016.)—E. B.

Mordanting Wool with Chromium; Relative Reducing Powers of Various Assistants employed in ——. E. Schnabel. Färber-Zeit., 1903, **14**, [24], 433—435.

The reducing powers of the chief assistants employed in mordanting wool with chromium, as measured by the amounts required, in the absence of the wool fibre and during $1\frac{1}{2}$ hours at 212° C., to reduce 1 grm. of potassium bichromate, (*p*) in the presence of an excess of, and (*a*) in the absence of sulphuric acid, are respectively as follows:—Lignorosin ("concentrated"), (*p*) 0·668 grm., (*a*) 1·942 grm.; lignorosin (60 per cent. of the strength of the concentrated quality), (*p*) 1·114 grm., (*a*) 3·236 grm.; lactolin, (*p*) 0·799 grm., (*a*) 1·305 grm.; tartar (100 per cent.), (*p*) 0·609 gm., (*a*) 1·342 grm.; vegetalin, (*p*) 2·488 grm., (*a*) 4·524 grm.; lactic acid, (*p*) 0·699 grm., (*a*) 1·031 grm. (See also this Journal, 1900, 659; 1902, 339, 612, 769, and 1132; 1903, 91.)—E. B.

Formic Acid in Dyeing with Acid Dyestuffs; Use of ——. A. G. Green and A. B. Steven. J. Soc. Dyers and Colourists, 1904, **20**, [1], 6—8.

In dyeing the wool in cotton and wool unions with acid dyestuffs, with addition of sulphuric acid to the dye-bath, there is danger of the cotton becoming tendered. To obviate this, acetic acid is frequently employed instead of sulphuric. It is found, however, that colours so dyed are not so fast to perspiration, hot water, &c., as those dyed with addition of sulphuric acid. If formic acid be used instead of acetic, the dye-baths are much better exhausted, and the colours produced are very much faster to hot water. The use of formic acid is quite practicable, as it can now be obtained at a price almost the same as that of an equivalent amount of acetic acid.—A. B. S.

Gallotannic Acid; Detection of ——, on the Fibre.
A. Menger. XXIII., page 135.

English Patent.

Printing Cotton or other Vegetable Fibre with Indigo in Combination with other [Mordant] Colouring Matters. J. Y. Johnson, London. From Badische Anilin und Sodafabr., Ludwigshafen. Eng. Pat. 6094, March 16, 1903.

See Fr. Pat. 330,159 of 1903; this J., 1903, 1084.—T. F. B.

United States Patent.

Transferring and Printing [Designs on Fabrics]. J. E. Hesse and M. Paraf-Javal, Paris, Assignors to J. Diederichs, Lyons. U.S. Pat. 748,604, Jan. 5, 1904.

See Eng. Pat. 17,872 of 1899; this J., 1900, 899.—T. F. B.

French Patents.

Dyeing Cotton in Ribbons; Machines for ——. D. Mattei. Fr. Pat. 334,681, Aug. 18, 1903.

Mechanical details are described of a machine for dyeing ribbons of loose cotton, in which all the operations, including the transference of the material from one portion of the apparatus to another, are carried out mechanically. Modified forms of soaking and dyeing troughs are also described. —T. F. B.

Dyeing by Means of Sulphide Dyestuffs; Process of ——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 334,797, Aug. 22, 1903.

The oxidation, and consequent inequality of dyeing, which occurs when working with dye-baths containing leucosulphide dyestuffs and alkali sulphide, can be prevented by the addition to the dye-bath of animal or vegetable oils or fats. For instance, 8 kilos. of olive oil may be added to a dye-bath containing 2,000 litres.—T. F. B.

Dyeing by Means of Sulphide Dyestuffs; Process of ——. Soc. pour l'Ind. Chim. à Bâle. First Addition, dated Aug. 28, 1903, to Fr. Pat. 334,797 of Aug. 22, 1903. (See preceding abstract.)

In place of using vegetable oils or fats in the dye-bath, mineral oils or fats, fatty or aromatic hydrocarbons, or solutions of fats or oils in mineral oils or hydrocarbons, may be used. These fatty substances are preferably added to the dyestuff before it is dissolved, thus preventing oxidation during the dissolving.—T. F. B.

Tissues; Process for Rendering —— Waterproof. T. Luthringer. First Addition, dated Aug. 14, 1903, to Fr. Pat. 321,480, May 5, 1902. (See this J., 1903, 296.)

A modification of the apparatus described in the principal patent consists in connecting the impregnating chamber with the drying chamber by means of a short passage, through which the wet fabric passes; the drying chamber contains two rows of rollers, placed on different levels, the fabric passing alternately over one of the upper and one of the lower rollers, thus presenting a large surface to the drying atmosphere, and thus also expediting the process. —T. F. B.

Waterproofing Fabrics; Process of ——. T. Luthringer. Second Addition, dated Aug. 22, 1903, to Fr. Pat. 321,480, May 5, 1902. (See this J., 1903, 296.)

The drying chamber contains a false bottom, on which rest lumps of ice, alone or with suitable acids or salts, thus ensuring condensation of the carbon bisulphide vapour. —T. F. B.

Embossed Designs on all Kinds of Fabric; Process of "Fixing" ——. L. J. Chischin. Fr. Pat. 335,238, Aug. 29, 1903.

Embossed designs are "fixed" in fabrics, by impregnation or coating with a thin layer of collodion; this has also the effect of waterproofing the fabric.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

French Patent.

Wood; Process for Rendering ——, *more suitable for Absorbing Colours.* J. von Brenner. Fr. Pat. 334,663 Aug. 17, 1903.

After a preliminary treatment with superheated steam, wood is subjected to the action of sulphuric acid of 10—20° B. under pressure, after which the acid in the wood is neutralised by treatment with dilute alkali, and the salt thus formed removed by washing. Wood prepared in this manner is said to be readily and evenly coloured by any process.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Lead Sulphate; Solubility of ——, *in Hydrochloric Acid Solution of Stannous Chloride.* A. van Raalte. Zeits. anal. Chem., 1904, **43**, [21], 36—38.

De Jong (this J., 1902, 1473) states that lead sulphate is soluble in hydrochloric acid solution of stannous chloride. The author repeated de Jong's experiments, and found that solution of the lead sulphate is effected, not by the stannous chloride, but by the hydrochloric acid.—J. T. D.

Arsenates; Preparation of ——, *from Arsenious Acid and Metallic Peroxides.* O. Schairer. Chem.-Zeit., 1904, **28**, [2], 15.

Sodium orthoarsenate is readily obtained by adding excess of sodium peroxide to an ice-cold saturated solution of arsenious acid, gently warming, concentrating, and crystallising out. *Lead orthoarsenate* is formed when a mixture of lead dioxide and arsenic trioxide is slowly brought to a red heat; the melt is powdered and repeatedly extracted with boiling water to remove arsenious acid. *Barium orthoarsenate* is similarly obtained from barium peroxide and arsenic trioxide, the reaction setting in, on gentle heating, with some violence. Calcium, strontium, and manganese gave unsatisfactory results.—W. A. C.

Reaction Towers and the Regulation of Temperature in them. H. Rabe. I., page 109.

Vanadic Acid; Colour Reactions of ——, *with Ethenol (Vinyl Alcohol).* C. Matignon. XXIII., page 131.

Hypochlorous Acid; New Method for the Detection and Determination of ——. E. Klimenko. XXIII., page 132.

Ammonia; Gasometric and Gravimetric Methods for Determining ——. E. Riegler. XXIII., page 132.

Sulphides, Thiosulphates, and Haloids: Determination of —— [*in Mixtures of the Same*]. W. Feld. XXIII., page 132.

Bleaching Powder; Method of Determining Available Chlorine in ——. J. Pontius. XXIII., page 133.

Manganese Peroxide; Titration of ——. L. Débourdeaux. XXIII., page 133.

Halogens; Determination of ——, *in Organic Compounds. Case of Chlorine and Bromine.* H. Baubigny and G. Chavanne. XXIII., page 136.

English Patent.

Graphitic Substance; Separation of ——, *from Associated Rocky Matter or Gangue.* C. Kendall, Upper Norwood. Eng. Pat. 1309, Jan. 19, 1903.

The crushed graphite-containing substance is mixed with oil (kerosene or paraffin) and water in a suitable mixer, *e.g.*, a vertical cylinder containing a number of perforated discs placed horizontally, from which the mixture emerges in the form of a thin sheet (preferably annularly and horizontally), and at a considerable velocity, into a vessel initially filled with water, or water and oil. This vessel is of such a shape that it enables the water and gangue to pass off at an outlet near the bottom, whilst the oil, together with the graphite, flows off near the top into a settling tank or into a second mixer similar to the first. From the settling tank the mixture passes to a filter-press, which retains the graphite, and in which it may be washed with water to remove adhering oil, which is used over again. The gangue may be re-treated in the same way.—A. G. L.

United States Patents.

Sulphate of Aluminium; Drying ——. R. S. Perry and H. G. Schanche, Philadelphia, Pa. U.S. Pat. 748,525, Dec. 29, 1903.

The aluminium sulphate to be dried is subjected to a temperature slightly lower than the initial melting point, and as this point rises, the temperature is proportionately increased. Practically, the temperature to which the aluminium sulphate is subjected is gradually raised from 227 to about 320° F.—E. S.

Hydroxides or Oxides of Metals; Production of ——, by Electrolysis. F. F. Hunt, Assignor to Maas and Waldstein. U.S. Pat. 748,609, Jan. 5, 1904. XI. A., page 119.

French Patents.

Phosphates; Process of Converting ——, into Dicalcium Phosphate, Hydrated Calcium Sulphate, and Carbon Dioxide. P. De Wilde. First Addition, dated Aug. 11, 1903, to Fr. Pat. 333,344 of June 24, 1903; this J., 1903, 1348.

The acid used in dissolving phosphates and regenerated, as described in the main patent, contains calcium sulphate in notable proportion. To remove this, the regenerated acid is treated with the necessary amount of a suitable barium salt, in strong solution or in powder. The barium sulphate formed quickly settles, and is separated for use as "blanc fixe," whilst the purified acid is fit for re-use in dissolving phosphates. (See also Eng. Pat. 14,194 of 1903; this J., 1903, 1085.)—E. S.

Chrome Ironstone; Process of Disaggregating ——, preliminary to the Preparation of Potassium Chromate. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 334,713, Aug. 19, 1903.

Chrome ironstone in fine powder, mingled with a strong lye of potassium hydroxide, is heated, with abundant access of air, to 300°, rising to 500° C. The product is lixiviated with addition of lime, and the filtered solution is concentrated, to obtain solid potassium chromate, with recovery of the excess of the lye used. Compare Eng. Pats. 12,250 of 1901, and 5902 of 1903; this J., 1902, 548, and 1903, 950 respectively.—E. S.

Bichromates; Transformation of Chromates into ——, with Production of Alkali. Chem. Fabr. Griesheim Elektron. Fr. Pat. 334,685, Aug. 18, 1903. XI. A., page 119.

Copper Sulphate; Electrolytic Manufacture of ——. E. Lombard. Fr. Pat. 334,799, Aug. 27, 1903. XI. A., page 120.

Liquid Air; Manufacture of ——. J. Loumiet. First Addition, dated July 25, 1903, to Fr. Pat. 334,205, July 11, 1903. (See this J., 1904, 18.)

In the production of low temperatures, and especially in liquefying air, advantage is taken, in combination, of expansion of air at a moderately low temperature with external work; and of expansion, with or without external work, causing a further lowering of the temperature, down to that of liquid air. At least three expansion motors are used in series, these being connected by double serpentine tubes forming exchangers of temperature. A valve is interposed, as in the process described in the main patent, between the system of exchangers and motors, and the superposed bottles arranged for reception of the liquefied air.—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

English Patent.

Enamelling; Methods of and Apparatus for ——. J. C. Reed, Allegheny, Pa. Eng. Pat. 16,883, Aug. 1, 1903.

See Fr. Pat. 334,506 of 1903; this J., 1904, 63.—T. F. B.

United States Patent.

Ornamented or Lettered [Glass] Articles; Manufacturing ——. R. K. Duncan, Washington, Pa., Assignor to Duncan Chemical Co., Pa. U.S. Pat 748,850, Jan. 5 1904.

A compound obtained from lead oxide and boric acid is fused to the heated glass article before annealing. The fusion may be effected by the heat of the hot glass itself.
—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

English Patents.

Building Blocks, Slabs, and the like; Composition of ——. R. McAlpine, Glasgow. Eng. Pat. 25,321, Nov. 20, 1903.

Lump or ground "steel slag" is mixed with Portland or other cement in a semi-liquid condition; clinker, gravel, or sand may also be added. The mixture is moulded and dried as usual.—A. G. L.

Slags; Process and Means for the Treatment of Blast-Furnace and other ——. [Cement Manufacture.] H. Passow, Hamburg. Eng. Pat 28,256, Dec. 22, 1903.

See Fr. Pat. 328,533 of 1903; this J., 1903, 999.—T. F. B.

United States Patents.

Waterproofing and Finishing the Surface of Stone, Brick, or other Analogous Porous Material. N. Farnham, Chicago, Ill. U.S. Pat. 748,595, Jan. 5, 1904.

The waterproofing agent is applied to the heated porous material, the excess then being removed by directing a blast of sand and air against the surface.—A. G. L.

Hydraulic Cement; Process of Manufacturing ——. J. Gresly, Liesberg, Switzerland. U.S. Pat. 748,912, Jan. 5, 1904.

See Addition, of Jan. 28, 1903, to Fr. Pat. 325,661 of 1902; this J., 1903, 998.—T. F. B.

French Patents.

Marble, Onyx, Calcareous Stones, Natural Earths, Raw or Burnt; Process of Colouring ——. A. Boyeux and A. Mora. Fr. Pat. 328,132, Nov. 5, 1902.

See Eng. Pat. 27,804 of 1902; this J., 1903, 698.—T. F. B.

Fireproof Wood. J. L. Ferrell. Fr. Pat. 335,054, Sept. 5, 1903.

A composition suitable for fireproofing wood is obtained by adding to a solution of sodium silicate of 45° to 50° B., sufficient of a sodium chloride solution of 24° B. to coagulate it; caustic soda solution of 26° B. is then added until the precipitate is entirely redissolved. The liquid is diluted to a strength of 20° B., and is then ready for use. In order to render it clearer, a little strong solution of sodium silicate may be added to it; on the other hand, it can be thickened by the addition of precipitated calcium carbonate or of powdered magnesite. Whey may also be added to render it more penetrating, and at the same time semi-opaque.—A. G. L.

Fireproof Wood. J. L. Ferrell. Fr. Pat. 335,055, Sept. 5, 1903.

Wood is treated with a solution containing 280 grms. of aluminium sulphate and 15 grms. of oxalic acid per litre. The presence of the oxalic acid enables the inferior qualities of aluminium sulphate to be used, which, otherwise, owing to their containing iron, would discolour the wood in a short time.—A. G. L.

Cement; Artificial ——. E. L. Candlot. Fr. Pat. 334,705, Aug. 19, 1903.

From 5 to 10 per cent. of calcium sulphate is added to a mixture of 25 to 30 per cent. of clay and 75 to 70 per cent. of calcium carbonate, and the whole burnt at a moderate temperature. The calcium sulphate may be replaced by other sulphates. The setting and hardening of the cement so obtained are claimed to be very regular.
—A. G. L.

Cement; Process of Manufacturing ——, from Blast-Furnace Slag. C. Canaris, jun. Fr. Pat. 335,233, Aug. 28, 1903.

See Eng. Pat. 18,623 of 1903; this J., 1903, 1293.—T. F. B.

X.—METALLURGY.

Limestone in the Cupola ; Effect of Addition of ——. F. Wüst. Stahl u. Eisen, 1904, **24**, [1], 28—32.

The amount of limestone added to the charge varies enormously in the practice of different foundries. The theory is that the limestone serves to form slag with the ash of the coke, and hence the amount used should depend on the amount of that ash and the composition of the limestone itself. The limestone, moreover, serves to remove in the slag some of the sulphur of the coke, which otherwise might find its way into the metal. No published researches on this point exist, and the author gives the following results obtained by A. Sulzer-Grossmann at Winterthür. Charges of 500 kilos. of mixed pig-iron and 30 kilos. of coke were used, with amounts of limestone varying in 11 experiments from 0 to 10 kilos. ; the whole amount of metal melted in each experiment varied from 15,000 to 20,000 kilos., and the conditions were as nearly as possible the same in all the experiments, save the amounts of limestone used.

Composition of the Iron.—The manganese and phosphorus were scarcely affected ; the silicon varied somewhat irregularly ; but the sulphur diminished from 0·13—0·16 per cent. with 0—1 kilo., to 0·085 per cent. with 8—9 kilos. of limestone.

Composition of the Slag.—As the limestone increased, the lime in the slag increased, though somewhat irregularly, the iron and manganese slowly diminished, and the alumina showed great irregularities, perhaps through irregular action on the furnace-lining. The silica also diminished as the limestone increased ; but though the diminution was considerable, it was not regular, occasional rises taking place ; and the sulphur varied in a manner showing no connection with the amount of lime, of silica, or of manganese ; possibly the sulphur in the slag depends on physical causes, such as temperature and the viscosity or mobility of the melted slag.

Losses in the Slag.—Increase of limestone causes an increase in the percentage of iron and of manganese lost in the slag, but hardly affects that of the silicon ; the total loss of all three rises from 0·8 to 1·6 per cent. (The figures are much lower than those usually quoted in the handbooks : 3 to 6 per cent.) If the iron in the coke-ash be taken into account, about 0·1 per cent. would be taken off these figures.

Mechanical Properties of the Metal.—The resistance to shock rises till the limestone is 20 per cent. on the coke (6 kilos.), and then remains stationary. The resistance to bending steadily rises as the limestone increases, to a maximum at 8 kilos. The tensile strength increases to a maximum with a limestone charge of 6 kilos., and is but little influenced by further increase in the limestone. The resistance to compression is hardly influenced at all.

—J. T. D.

Ferromanganese Production : Composition of Slags of ——. F. Wittmann. Stahl u. Eisen, 1904, **24**, [1], 14—16.

It is generally agreed that in making ferromanganese a basic slag should be aimed at, but to this term different meanings are attached. Stoïchiometrically the slag is more basic as the oxygen of the acid bears a smaller proportion to that of the bases, but here alumina is often left out of consideration, from doubt whether it should be considered an acid or a base. Platz considers a slag more basic as the sum of the silica and alumina bears a smaller proportion to the sum of the other bases, whilst the furnace foreman will regard a viscous slag of high-melting point as basic. In ferromanganese work, however, the melting point of the slag is of less importance than its capacity for dissolving manganese oxide. But as the amount of manganese in the slag depends chiefly on the amount of coke used (in using plenty of coke a highly silicious slag can be obtained containing very little manganese, whilst with little coke a highly basic slag can take up much, as in making spiegel), the examination of the results of analysis of slags can yield no useful result, unless all the samples proceed from similar conditions of working (amount of coke, blast temperature, shape of furnace, &c). The following analyses, from a single furnace at different periods during nine years, fulfil this requirement :—

	Analysis.								Calculated Relations.					Observations.	
No.									Including MnO.		Excluding MnO.				
	Mn.	SiO_2.	Al_2O_3.	FeO.	CaO.	MgO.	BaO.	S.	$\frac{\text{Basic O}}{\text{Acid O}}$	$\frac{\Sigma RO}{SiO_2+Al_2O_3}$	$\frac{\text{Basic O}}{\text{Acid O}}$	$\frac{\Sigma RO}{SiO_2+Al_2O_3}$	Sum of CaO + MgO + BaO.	Obtained in making Ferro-manganese of % Mn.	Date.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		
1	23·33	29·02	7·05	0·48	37·03	1·89	..	0·67	1·30	1·74	0·96	1·09	38·92	80	Aug. 18[illegible]
2	22·25	29·70	8·33	0·72	34·30	2·05	1·51	0·77	1·26	1·60	0·94	1·01	37·86	70—75	Apr. 18[illegible]
3	21·09	30·15	7·97	0·56	34·43	3·00	1·88	0·79	1·24	1·60	0·95	1·05	39·31	55—60	July 1894.
4	19·69	29·55	8·91	0·29	37·30	2·05	1·10	0·96	1·30	1·57	1·01	1·06	40·45	80	Apr. 18[illegible]
5	19·18	30·25	6·78	0·52	39·14	2·34	0·19	0·90	1·23	1·65	0·96	1·14	41·67	50, 70, 80	Apr. 1891.
6	18·50	30·60	7·87	0·43	37·55	2·41	1·21	1·19	1·22	1·56	0·96	1·08	41·17	55—60	Apr. 18[illegible]
7	14·78	30·25	8·32	0·46	39·25	4·65	..	1·32	1·27	1·53	1·06	1·15	43·90	80	Oct. 18[illegible]
8	14·33	31·47	8·31	0·62	38·33	3·29	2·83	1·15	1·19	1·49	0·99	1·13	44·45	40	July 1891.
9	13·96	29·25	8·58	0·86	44·01	3·34	..	0·55	1·37	1·64	1·17	1·27	47·35	30—50	Aug. 18[illegible]
10	13·79	30·37	10·59	0·61	43·82	2·15	..	0·42	1·34	1·47	1·15	1·14	45·97	80	July 1889.
11	12·17	30·91	8·23	0·59	45·62	2·03	..	0·63	1·26	1·54	1·09	1·23	47·70	80	Jan. 1894.

These results, it will be seen, are arranged in descending order of manganese-content. Whether we examine the ratio of basic oxygen to acid oxygen, or of bases other than alumina to silica and alumina, and whether we include the manganous oxide or leave it out, there is no connection between any set of these figures and the decrease in manganese ; but the total percentage of alkaline-earth oxides is obviously complementary to that of manganese oxide, while the other figures in the analysis show that the diminution in manganese with increase in alkaline-earth oxides is not due to simple dilution of the whole slag by these oxides. On plotting the results with percentages of alkaline-earth oxides as abscissæ, and of manganese oxide as ordinates, the decrease of the latter with increase of the former up to about 45 per cent. is clearly shown. Further increase of the alkaline-earth oxides has practically no effect.—J. T. D.

Quartz Milling ; Notes on the Common Practice of ——, *on the Rand.* W. Beaver. J. Chem., Met. and Min. Soc. of South Africa, Nov. 1903, 217.

Of a sample passing through a screen of 500 mesh which had been used 90 hours, 0·473 remained on a perfect [illegible] mesh ; from a broken screen just before changing, 1·2[illegible] per cent. remained on a 500 mesh, 0·533 per cent. on a 400, 0·109 per cent. on a 300, and 0·011 per cent. on a 200. Screens should be changed before reaching that stage. Great care should be taken in dressing the plates, as also while changing screens, to prevent amalgam getting into the tailings.—J. H. C.

Molybdenum Ores; Utilisation of ——. J. W. Wells. Bull. of the Imperial Inst. (Suppl. to Board of Trade J.), 1903, [4], 213.

The author's method for the concentration of molybdenum ores is based upon the fact that molybdenite, when passed between rolls, does not become pulverised, but forms flakes. A specimen of ore containing 50 per cent. of pyrrhotite, 10 per cent. of pyrites, and 6·5 per cent. of molybdenite, together with mica, quartz, &c., was passed between rolls and then screened, first through a sieve with a 0·2-in. mesh, and then through one with a 0·1-in. mesh. There remained on the first screen 1·4 per cent. and on the second 1·54 per cent. of the material treated, in the form of a concentrate containing about 55 per cent. of molybdenite and 45 per cent. of mica. This concentrate, when treated in a Wetherill magnetic separator, yielded an ore containing from 90 to 91 per cent. of molybdenite.—A. S.

Blast-Furnace Gas as the Sole Source of Power for a Modern Metallurgical Works. K. Gruber. Stahl u. Eisen, 1904, **24**, [1], 9–14; [2], 89–93.

After referring to the great progress which has already been made, especially in Germany, in the use of blast-furnace gas for heating and power purposes, the author states, as the result of a series of calculations, that not only can the whole of the power- and heating-gas required in a metallurgical works be obtained by the rational employment of furnace gases, but that there will still be an amount of gas in excess that can be applied to other industrial purposes.—A. S.

Tungsten in Tungsten Steel and Ferrotungsten; Determination of ——. E. Kuklin. XXIII., page 134.

Amalgams of Platinum; Behaviour of ——, towards Nitric Acid. N. Tarugi. XXIII., page 131.

English Patents.

Iron and Steel; Process of Treating ——, with Carbides. E. Engels, Düsseldorf, Germany. Eng. Pat. 25,932, Nov. 27, 1903.

Iron or steel in the solid (not molten) state, is treated with a carbide, such as silicon carbide, and a decomposable alkali salt, such as sodium sulphate, and reaction is induced by heating.—E. S.

Iron and Steel; Treatment of ——. C. Koller, Salgstarjan, Hungary. Eng. Pat. 28,178, Dec. 20, 1902.

Molten pig iron or steel is run into a lined vessel, mounted on a vertical shaft, to which rapid rotation is imparted by suitable machinery. The vessel is tightly covered. Under the centrifugal action, the oxides contained in the iron float to the surface of the fused mass, and may be removed as scum when the vessel is brought to rest.—E. S.

Iron, Steel, and their Alloys; Manufacture and Refining of ——. J. B. de Alzugaray, London. Eng. Pat. 1562, Jan. 22, 1903.

See Fr. Pat. 333,382 of 1903; this J., 1903, 1353.—T. F. B.

Iron and Steel; Production of ——. A. G. Bloxam, London. From La Soc. Electro - Métall. Française, Forges. Eng. Pat. 7027, March 26, 1903.

See Addition, of July 10, 1903, to Fr. Pat. 328,350 of 1903; this J., 1904, 25.—T. F. B.

Iron and Steel; Manufacture of Malleable ——, and Apparatus therefor. F. E. Young, Canton, Ohio. Eng. Pat. 8101, April 7, 1903.

See U.S. Pat. 724,770 of 1903; this J., 1903, 557.—T. F. B.

Refractory Ores [Lead-Zinc]; Treatment of ——. E. H. Miller, London. Eng. Pat. 20,465, Sept. 19, 1902.

The ore is made into dry blocks with stated proportions of silicious matter and pitch with or without lime, according to the silver contents; and the blocks are loosely packed in a furnace, to admit of air-spaces, and the layers are sprinkled with lime. The temperature is gradually raised until the reduced zinc distils over, and is collected. The lead and silver contents of the ore are found in the residue in the metallic state, and are recovered thence by melting out.—E. S.

Furnace or Kiln for Burning Ore Briquettes. G. Gröndal, Djursholm, Sweden. Eng. Pat. 23,764, Nov. 2, 1903.

The furnace is of the channel type, for receiving trucks carrying briquettes to be heated by gas, and consists of a compartment for preliminary heating, a cooling compartment, and a burning chamber of a somewhat greater height, situated between these compartments. There are channels in the walls and roof for passage of a part of the air for combustion, interconnected, and communicating with one or more openings in the wall of the gas inlet to the burning chamber. The compartment for preliminary heating is of greater height than the cooling compartment. See Fr. Pat. 330,763, 1903; this J. 1903, 1091.—E. S.

Ores; Separation of the Metallic Constituents of ——, from Gangue [by the Oil Process]. A. E. Cattermole, London. Eng. Pat. 26,295, Nov. 28, 1902.

The crushed ore is mixed with water, oil, and an emulsifying agent, such as soap, the proportion of oil used being only sufficient to produce granules with the metalliferous contents of the ore. Under these conditions, the oil-carrying particles sink, and are thus separable. The oil used, is recovered by the further use of an emulsifying agent, preferably with addition of a small proportion of a free alkali. When, as in many gold ores and slimes, the metalliferous particles are associated with much gangue, the desired agglomeration is facilitated by the introduction of coarser metalliferous matter, such as the coarser concentrates, which act as centres of granulation.
—E. S.

Ores: Classification of the Metallic Constituents of —— [by the Oil Process]. A. E. Cattermole, London. Eng. Pat. 26,296, Nov. 28, 1902.

After agglomeration of the metalliferous constituents of ores by oil, &c., as described in the preceding patent, advantage is taken of the varying affinity for oil of, for instance, particles of copper pyrites, galena, and blende, to effect a fractional separation by the use of successively stronger emulsifying or "breaking down" solutions, particulars of the adaptation of which to different conditions are given. An "up-current" or other separating device is used for removing the freed mineral from the more resisting granules (metalliferous), and a series of mechanical separators is used to recover the emulsion for subsequent application. The separated minerals may be drained, or treated in centrifugal apparatus, for closer recovery of the oil and other products.—E. S.

Zinc; Manufacture of ——. A. Kunze and K. Danziger, both of Kattowitz, Germany. Eng. Pat. 5016, March 4, 1903.

Blende zinc ores containing iron pyrites are moistened and exposed to the air for several weeks, with application of heat, which may be by means of underlying flues. Under these conditions, it is stated that the pyrites oxidises, and the oxidised products may be removed by washing, leaving the blende practically unaffected. Or, if the pyrites be not wholly oxidised, it becomes disintegrated and easily removable.—E. S.

United States Patents.

Case-Hardening Compound. J. Cadotte, Suncook, N.H. U.S. Pat. 748,842, Jan. 5, 1904.

The dry compound is composed of two parts each of "white calcined plaster" and of potassium ferrocyanide, with one part of lampblack, all by weight.—E. S.

Steel and Ingot Iron ; Manufacture of ——. B. Talbot, Leeds, England, and P. Gredt, Luxemburg, Germany, Assignors to the Continuous Metal Refining Co., Philadelphia, Pa. U.S. Pat. 749,115, Jan. 5, 1904.

The impure metal is blown in a converter, a portion of the charge is run off, and from the remainder of the charge the phosphorus is removed by lime and blowing ; the slag thus produced is then removed, oxides are added to the bath and a further charge of impure metal, when the combined charge is blown.—E. S.

Briquettes [from Fine Ores]. W. Huffelmann, Duisburg, Germany. U.S. Pat. 748,739, Jan. 5, 1904.

See Eng. Pat. 10,618 of 1903 ; this J., 1903, 1051.—T. F. B.

French Patents.

Cast Iron ; Refining ——, *by Pulverisation.* H. Harmet. Fr. Pat. 334,892, Aug. 28, 1903.

The molten iron to be refined is run into a basin lined with refractory material, and having, at the side and near the bottom, an outlet inclined slightly downwards, and wider at the inner end. The metal flows from this opening in a jet, encompassed by a blast of heated air from a tuyère the outlet of which forms an annular opening surrounding the sides of the passage for the metal, which is thus dispersed as a spray, assuming a conical shape, and "pulverised" into innumerable minute globules exposed to the action of the air. The metallic spray is projected into a suitably packed receptacle, at the bottom of which the purified iron or steel collects, and whence it may be tapped. —E. S.

Heavy Metals ; Process of Extracting ——, *by the Use of Chlorine [from Sulphide Ores, &c.].* Soc. Allgem. Elektro-Metallurg. Fr. Pat. 334,941, Aug. 31, 1903.

Finely-powdered ores or mattes containing sulphur are mixed with iron oxide and agitated in a solution of calcium chloride whilst chlorine is passed through. The sulphuric acid formed by oxidation of the sulphur is thus precipitated as calcium sulphate, with liberation of hydrochloric acid, which dissolves the iron oxide, forming ferric chloride. Air is blown through the solution in the presence of fresh ore or matte, whereby any ferrous chloride present is decomposed, with separation of ferrous hydroxide. Claim is also made for the recovery of the chlorine, which may be used to dissolve other portions of ore or metals.—E. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Mercury Vapour ; Conductivity of —— *[Mercury Vapour Electric Lamp].* P. C. Hewitt. Electrician, 1904, 52, [1338], 447—449.

The author made a number of experiments on the conductivity of mercury vapour, taking precautions to obtain results not vitiated by effects due to the terminals or electrodes. The results obtained are given in a series of curve-diagrams, in which the influence of the density (pressure) of the vapour, the diameter of the lamp or tube containing the vapour, and the strength of the current, upon the drop in volts per unit length of the column of vapour is shown. It was found that the voltage required to maintain an electric current in mercury vapour is directly proportional to the density of the latter, and that it decreases as the diameter of the lamp increases. The resistance decreases with increase of current. The light-efficiency of mercury vapour varies with the density of the latter. On passing a current through the vapour at a very low density, practically no light is visible, but the light-efficiency increases with the density of the vapour up to a certain limit, after which it again decreases. If another gas is present with the mercury vapour, the current is usually selective, and gives the spectrum of mercury, but the resistance is materially altered. By the application of magnetic force transversely, the resistance is increased remarkably when the density of the vapour is low, but at higher densities the effect is not very marked. The author states that the relation of the conductivity of mercury vapour to the physical conditions under which the electric current through the vapour is maintained, appears to be, broadly speaking, generally true for all gases and vapours. (See U.S. Pats. 690,952 and 690,953 ; this J., 1902, 465, 466.) —A. S.

Alkaline-Earth Metals ; Electrolytic Separation of ——. A. Coehn and W. Kettembeil. XXIII., page 134.

English Patent.

Electrodes for Accumulators. A. Meygret, Paris. Eng. Pat. 1676, Jan. 23, 1903.

The electrode is composed of a series of small sheets of lead, lead and antimony, or other suitable metal or alloy, joined together at one extremity by means of a common support, either directly in the casting, or in the stamping out, or by soldering together. The electrode is covered with oxide of lead, dipped into tetra-acetate of cellulose, and then dried in the air. A protective and elastic envelope, not acted on by the electrolyte, is thus obtained, which is afterwards rendered porous by perforations made in the form of small holes or cuts.—B. N.

United States Patents.

Electrodes for Storage Batteries ; Method of Producing ——. F. A. Feldkamp, Newark, N.J., Assignor to Electra Manufacturing Co., New Jersey. U.S. Pat. 748,940, Jan. 5, 1904.

The electrode is produced by subjecting a porous material to the action of a salt or salts of lead, and then chemically reducing the same ; or a reducing agent in fine particles, such as zinc, may be incorporated with the porous material previously to subjecting to the action of the lead salt. The porous material may be carbonised, and may be applied to a conducting plate, for instance, by sewing it fast to the plate.—B. N.

Hydroxides and Oxides of Metals by Electrolysis ; Production of ——. F. F. Hunt, New Brighton, N.Y., Assignor to Maas and Waldstein, New York. U.S. Pat. 748,609, Jan. 5, 1904.

The electrodes are made from the metal the hydroxide or oxide of which is required, as, for instance, tin, each electrode being used as anode and cathode, alternately, at suitable intervals. The electrolyte consists of a solution of a salt of an alkali or alkaline earth, such as common salt, the acid radicle of which combines with the anode to form a soluble metallic salt, and the latter reacts with the alkali formed at the cathode, producing the desired hydroxide or oxide, and simultaneously re-forming the salt used as the electrolyte. —B. N.

Alkali Chlorides ; Apparatus for the Electrolytic Decomposition of ——. J. J. Rink, Elsinore, Denmark. U.S. Pat. 748,985, Jan. 5, 1904.

See Eng. Pat. 5718 of 1902 ; this J., 1902, 913.—T. F. B.

Manure ; [Electrical] Process of Manufacturing ——, *from Apatite.* W. Palmaer. U.S. Pat. 748,523, Dec. 29, 1903. XV., page 124.

French Patents.

Electrodes for Electrolysis ; Process of Manufacture of ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 334,684, Aug. 18, 1903.

The residues from pyrites burners, or any other forms of oxide of iron in a sufficiently pure state, are melted in an electric furnace, whereby the substance is made into a good conductor. The melted mass is cooled in moulds of any required form.—B. N.

Bichromates, with Production of Alkali [Electrolytic] ; Process of Transformation of Chromates into ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 334,685, Aug. 18, 1903.

This process is carried out electrolytically by placing a saturated solution of chromate in both the anode and cathode chambers, these being separated by a suitable diaphragm. An anode must be used which is not attacked, such as lead or platinum, and a cathode, such as iron, which will not reduce the chromate. The whole of the chromate is converted into bichromate, and the volume of the cathode chamber is such that the alkali has a strength of 100 grms. per litre when the conversion of chromate into bichromate is complete.—B. N.

Copper Sulphate ; Electrolytic Manufacture of ——. E. Lombard. Fr. Pat. 334,799, Aug. 27, 1903.

The invention relates to a process for the electrolytic manufacture of sulphate of copper, useful for replenishing the baths used in electrotyping. Electrodes of copper are used, the anode being placed in water acidulated with sulphuric acid, and the cathode in a porous vessel containing sulphuric acid or a saturated solution of a sulphate of a metal other than copper. Diffusion of the copper sulphate through the diaphragm towards the cathode is thus prevented. A special diaphragm may be used, consisting of two porous vessels, with an annular space between, filled with sulphuric acid of 53° B., the inner vessel containing dilute sulphuric acid and a copper cathode ; the two vessels, together with a copper anode, are immersed in water acidulated with sulphuric acid.
—B. N.

Amines, Fatty and Aromatic ; Process of Producing ——, by Electrolytic Reduction. P. Knudsen. Fr. Pat. 334,726, July 2, 1903.

Fatty and aromatic amines are produced by the electrolytic reduction of condensation products of aldehydes with ammonia or amines. *Ethylamine* is prepared by reducing ethylideneamine, obtained by the condensation of aldehyde-ammonia over sulphuric acid (Délépine) ; 30 grms. of ethylideneamine, mixed with 120 c.c. of sulphuric acid of 41° B., at a temperature below 0° C., is electrolysed, in the cathode compartment of a cell, with lead cathode, the anode being of lead in sulphuric acid contained in a porous vessel ; eight hours with a current of six ampères is sufficient, the temperature being kept below 10°—12° C. ; the ethylamine is obtained by distilling the product with excess of caustic soda. *Diethylamine* is prepared by electrolysing the sulphuric acid solution of the product of condensation of ethylamine and acetaldehyde. By subjecting to electrolysis the product of the action of methylamine on benzaldehyde, *methylbenzylamine* is obtained, while *methylaniline* is obtained by a similar treatment of anhydroformaldehyde-aniline.—T. F. B.

(*B.*)—ELECTRO-METALLURGY.

Gold and Silver ; Electrolytic Precipitation of —— , from Cyanide Solutions. E. M. Hamilton. J. Chem. Met. and Min. Soc. of South Africa, Nov. 1903, 209—216.

The cyanide plant at Minas Prietas, Sonora, Mexico, has a capacity of 9,000 tons per month, 40 per cent. slimes and 60 per cent. sands. Single treatment is adopted, using mechanical stirrers and centrifugal pumps for agitation. Each dwt. of gold obtained carries 1 oz. of silver with some copper. The precipitation plant consists of (6) boxes, 30 ft. long, 10 ft. wide, and 5 ft. deep, divided into 12 compartments, each having 18 anodes and 17 cathodes. The current is supplied by (2) Siemens-Halske dynamos having a capacity of 250 ampères and 30 volts, the current density being from 0·2—0·25 ampère per sq. ft. of anode surface. The anode is made of sheet lead coated with peroxide, and is not enclosed in any way. The precipitate is a fine slime, which readily falls to the bottom of the box ; the cathodes are of tin-plate. By the newest arrangement, they can be cleaned without removal. Both cathodes and anodes are practically indestructible. In a series of experiments made under varying working conditions to determine the current efficiency, using a current density of 0·3 ampère per sq. ft. for slime solutions and 0·55 ampère for sand solutions, the non-effective ampèrage varied from 86—95 per cent. of the total. The cyanide "regenerated" by the passage of the current amounted to 0·35 lb. for each ton of sand treated, and 0·94 lb. per ton of slimes, or an average of 0·58 lb. ; the theoretical quantity, supposing no water to be decomposed, is 0·93 lb. ; the cyanide consumption averaged 2·5—3·0 lb. per ton of ore. When ores are treated without previous amalgamation, the regeneration of cyanide is lessened. The gold precipitate contains much lime, and it is suggested that the addition of a little caustic potash to the solution, and the use of a current of lower density, would lessen this.—J. H. C.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Fats and Waxes ; Vegetable ——, of Indo-China. M. Lemarié. Bull. of the Imperial Inst. (Suppl. to Board of Trade J.) 1903, [4], 206—212.

Dika Butter.—This fat, which is also known as "oba" or wild mango oil, is obtained from the seed-kernels of *Irvingia Barteri* by boiling them with water and then subjecting them to pressure : yield, 60—65 per cent. It is a white fat, with a sweet odour and pleasant taste ; on keeping, it becomes yellow and rancid ; it is readily saponified, and is used in the manufacture of candles, and as a substitute for cocoa-nut oil in the manufacture of marine soap. The fat has the following characters :—Sp. gr. at 15° C., 0·820(?) ; m. pt., 30°—32° C. ; saponification value, 173 ; iodine value, 30·9—31·3 ; free fatty acids, 4—10 per cent. It contains the glycerides of lauric, palmitic, and myristic acids.

Irvingia Butter.—This fat, known by the natives as "cây-cây," is obtained from the seed-kernels of *Irvingia malayana*, the candle-tree of Indo-China : yield, 52·0—56·7 per cent. It melts at 37·5°—38° C., and solidifies at 35·5°—36° C., and is completely saponified by alkalis, yielding a white nacreous soap which is readily soluble in alcohol.

Chinese Vegetable Tallow.—The seeds of *Sapium sebiferum*, known locally as "cây-sôi," consist of 60 per cent. of shell and 31 per cent. of kernels. From the shells, by heating with steam, 29·5 per cent. of "pi-yu," a white solid fat, is obtained having the sp. gr. 0·918 at 15° C., and m. pt. 44·5° C. From the kernels, by expression, is obtained 59·5 per cent. of "tsé-iéou," or "ting-yu," a liquid oil which possesses drying properties, and is used as an illuminant and in the manufacture of varnish. "Mou-iéou" is a mixture of "pi-yu" and "ting-yu" obtained from the whole seeds ; it has the sp. gr. 0·915 at 15° C., and m. pt. 35° C., and is slightly acid, owing to the presence of propionic acid. Both "mou-iéou" and "pi-yu" are sold as Chinese vegetable tallow—a product used in the manufacture of candles.

Chaulmoogra, or Gynocard Oil.—This oil is obtained from "krebao" seed, known by the Chinese as "ta-fung-tze," the product of one or more species of *Hydrocarpus* of the natural order *Bixineæ.* By expression the seeds yield 30 per cent. of oil, which melts at 17° C., whilst by extraction with ether, 50—52 per cent. of oil, melting at 14° C., is obtained. The freshly-prepared oil is white, odourless, and tasteless, but oil which has been kept, or which has been extracted from old seeds, has a light brown colour and an odour resembling that of bird-lime. The oil is used for medicinal purposes in Indo-China and Siam.

Japan Wax.—The most important sources of this product are *Rhus succedanea* and *R. vernicifera.* When the wax is prepared from the fruit by expression, the last traces left in the press residues are extracted by adding about 10 per cent. of oil of perilla, or "ye goma" (this J. 1903, 806), and again submitting the wax to pressure. The presence of the oil of perilla is the cause of the varying hardness of commercial Japan wax. The wax melts at 53°—54° C., and solidifies at 40·5°—41° C. The crude wax has the sp. gr. 1·006 ; the bleached wax, 0·97 —0·980 ; it consists chiefly of palmitin, together with small amounts of the glycerides of volatile fatty acids.

Fats derived from the Dipterocarpeæ.—Borneo tallow from the seed-kernels of *Shorea aptera* (Burk.) an *Isoptera borneensis* (Scheff.) contains about 95 per cen of saponifiable fats (stearin and olein) ; it is used by th natives for culinary purposes, in England as a lubrican and in Manila for the manufacture of candles. Piney o

Malabar tallow, from the seeds of *Vateria indica*, is tasteless and inodorous, and has a consistence between that of stearin and wax. It contains about 2 per cent. of a volatile oil, which can be extracted by alcohol; the tallow, after removal of this oil, consists of 75 per cent. of palmitin and 25 per cent. of olein. The tallow has the following characters:—Sp. gr. at 15° C., 0·915; m. pt., 40° C.; solidifying point, 30·5° C.; saponification value, 191·9; m. pt. of fatty acids, 57° C.; solidifying point of fatty acids, 55° C. Candles made of Piney tallow burn steadily and emit an agreeable aromatic odour.

Fats derived from the Lauraceæ.—"Lalreu" tallow, or "undung," is obtained from the seeds of *Tetranthera laurifolia*, Jacq. ("bói-lói"); it is used in the manufacture of candles. *T. citrata*, Nees., *T. glabraria*, Nees., and *T. Roxburghii*, Bl., yield similar products. "Vegetable butter" or the pulp of the "advocate pear," the fruit of *Persea gratissima*, yields on expression a large percentage of oil, which is used as an illuminant and for the manufacture of soap. "Tangkallah" fat is obtained from the seeds of *Cylicodaphne sebifera*, Bl.; yield, 40—45 per cent. It melts at 45° C., and contains 85 per cent. of laurostearin and 14 per cent. of olein. It is used in the manufacture of soap and candles. It is stated that the seeds produced annually by one tree yield sufficient fat for the manufacture of 500 candles.—A. S.

Plants which contain in their Seeds an Enzyme capable of Decomposing Fats into Glycerin and Fatty Acids. S. Fokin. J. russ. phys.-chem. Ges., **35**, 831—835. Chem. Centr., 1903, **2**, [26], 1451.

The author found that the most active seeds, superior even to castor-oil seeds, were those of *Chelidonium majus*; the seeds of *Taraxacum vulgare*, *Brunella vulgaris*, *Cynoglossom*, *Aquilegia vulgaris*, and *Aconitum Lycoctonum* had a distinctly weaker action. (See also this J., 1902, 1541; 1903, 67, 639, 873, 1094.)—A. S.

Linseed Oil from Boiled Oils: Differentiation of ——. J. Lewkowitsch. XXIII., page 136.

Sperm Oil; Examination of ——. L. M. Nash. XXIII., page 136.

Cod-liver Oil and its Adulterants; Tests for ——. E. H. Gane. XXIII., page 136.

Soaps; Method of Grading ——, *according to their Detergent Power.* H. W. Hillyer. XXIII., page 137.

Soaps; Determination of Small Proportions of Sodium Hydroxide and Carbonate in ——. P. Heermann. XXIII., page 134.

United States Patents.

Lubricant; Process of Making ——. S. A. Smith, Providence, R.I., U.S.A. U.S. Pat. 748,317, Dec. 29, 1903.

A mixture of antimony trioxide and air-slaked lime is finely powdered and added to an oil of heavy gravity, the whole being subsequently mixed with an oil of lighter gravity.—C. A. M.

Fat-like Substance; Process of Making ——. O. Liebreich, Berlin. U.S. Pat. 748,511, Dec. 29, 1903.

See Ger. Pat. 136,917 of 1900; this J., 1903, 149.—C. A. M.

French Patent

Soap containing Lemon Juice. G. Giraudet and A. Neuberger. Fr. Pat. 334,916, Aug. 29, 1903.

Fresh filtered lemon juice is mixed with an alcoholic solution of oil of lemon and citric acid, and sufficient starch added to form a paste, which is dried and incorporated with ordinary soap in a suitable proportion. Claim is made for the use of starch as a vehicle for fruit juices and essential oils in general.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

English Patent.

White Lead; Manufacture of ——. J. H. Montgomery, St. Louis. Eng. Pat. 15,742, July 16, 1903. Under Internat. Conv., July 19, 1902.

See Fr. Pat. 333,851 of 1903; this J., 1904, 26.—T. F. B.

United States Patent.

Protecting Ironwork: Material for ——, *and Method of Preparing the same.* W. O. Emery, Crawfordsville, Ind., U.S.A. U.S. Pat. 748,270, Dec. 29, 1903.

A clear, highly viscous material, consisting of calcium and sodium silicates and calcium aluminate, is prepared by fluxing at a white heat a mixture of quicklime, quartz, felspar, alumina, and sodium sulphate. This is powdered, and incorporated with melted asphalt.—M. J. S.

French Patents.

White Oil-Paint; New ——, *and Process of Making it.* Farbwerke W. A. Hospelt. Fr. Pat. 334,835, Aug. 25, 1903.

Lead oxychloride is produced by the trituration of lead oxide with sodium chloride or any other chloride. The mass is then treated with sulphuric acid until it exhibits a neutral or feebly acid reaction. The product is pressed and dried, and ground with oil and a siccative.—M. J. S.

White Lead and Zinc White; Substitute for ——. C. Gendre. Fr. Pat. 334,917, Aug. 29, 1903.

A mixture of randanite (fossil meal), barytes, and asbestos, is calcined and reduced to powder.—M. J. S.

Lithopone Resistant to Light and Atmospheric Influences; Process of Manufacturing ——. Chem. Fabr. Marienhütte. Fr. Pat. 334,944, Aug. 31, 1903.

The tendency of lithopone to darken on exposure to sunlight is found not to be exhibited by products from the manufacture of which chlorides have been entirely excluded. Crude zinc sulphate is therefore purified from iron and manganese by heating with a permanganate and an alkali, and the solution is further purified by treatment with zinc powder and copper sulphate, after which it is employed for the manufacture of lithopone in the usual manner.—M. J. S.

Pigment [Barium Sulphate and Zinc Sulphide]; Process of Making a ——. W. J. Armbruster and J. Morton. Fr. Pat. 335,115, Sept. 10, 1903.

See U.S. Pat. 740,072 of 1903; this J., 1903, 1200.—T. F. B.

Pigment [Barium Carbonate and Zinc Sulphide]; Process of Making a ——. W. J. Armbruster and J. Morton. Fr. Pat. 335,358, Sept. 10, 1903.

See U.S. Pat. 740,073 of 1903; this J., 1903, 1200.—T. F. B.

(*B.*)—RESINS, VARNISHES.

French Patents.

Linseed-Oil Varnish; Substitute for ——. M. S. Muller and C. Klee. Fr. Pat. 334,923, Aug. 29, 1903.

This varnish is especially intended for use with zinc white, to which it imparts a covering power rivalling that of white lead. Thirty-two parts of zinc white are incorporated with 1,000 parts of melted rosin, and the mixture is cooled and crushed. A separate mixture is made of 100,000 parts of petroleum oil (pétrole), 1,300 parts of lysol, 35 parts of nitrobenzene, and 4,000—5,000 parts of pure water. Then 460 parts of the first are heated with 455 parts of the second mixture, and the "acide d'abiétine," which rises to the surface, is removed by a perforated skimmer. Lastly, 100 parts of poppy-seed oil, or other drying oil, are added.—M. J. S.

Varnish; Coloured ——. L. Leroy and P. E. Leroy. Fr. Pat. 334,992, Sept. 2, 1903.

A SOLUBLE silicate is mixed with any pigment or colouring matter.—M. J. S.

Linoleum; Substitute for ——. E. V. Clausen. Fr. Pat. 335,243, Aug. 31, 1903. Under Internat. Conv., Oct. 22, 1902.

SEE Eng. Pat. 19,233 of 1903; this J. 1903, 1358.—T. F. B.

(C.)—INDIA-RUBBER.

Sulphur; Determination of ——, *by Eschka's Method* [*in Vulcanised Rubber*]. O. Pfeiffer. XXIII., page 132.

FRENCH PATENT.

Caoutchouc; Manufacture of Artificial ——. L. L. A. Seguin and J. F. G. de Roussy de Sales. Fr. Pat. 334,833, Aug. 25, 1903.

TAR, or any hydrocarbon containing the "isomers of caoutchouc," is acidified with an acid, such as boric or hydriodic, capable of "eliminating nitrogen" from it. The mixture is then seeded with "particles of caoutchouc" or "other appropriate ferment," and is maintained at 60° C. in an oxidising atmosphere free from nitrogen. After some time the whole mass will have become converted into "a viscous solution of caoutchouc" of an amber colour.
—M. J. S.

XIV.—TANNING; LEATHER, GLUE, SIZE.

Extraction of Tanning Materials; Influence of Chlorides and Sulphates present in Natural Waters upon the ——. E. Nihoul and L. van de Putte. Bull. de l'Assoc. belge des Chim., 1903, **17**, [10].

A CONTINUATION of previous work on the influence of various salts present in tannery water (see this Journal, 1901, 1005). A record is given of the results obtained by extracting oak-bark, pine-bark, and sumac with artificial hard waters in comparison with distilled water. The quantities of salts used were such as are to be found in natural waters, *viz.*, 0·005 grm., 0·050 grm., 0·150 grm., 0·400 grm., 0·500 grm., and 1·000 grm. of chlorine per 1000 as the sodium, magnesium and calcium compounds respectively, and 0·0309 grm., 0·0445 grm., 0·1056 grm., 0·2700 grm., and 0·3383 grm. of sulphuric acid (calculated as SO_3) per 1000 in combination with the same bases. In the adjoining table the results obtained with the smallest and greatest proportion of each salt on each material are given.

In many instances the smallest quantities of salts have little appreciable influence, whilst the largest quantities produce most marked effects, *e.g.*, of calcium chloride on oak and sumac (where 50 per cent. of the tannin disappears), and of magnesium chloride on the organic non-tannins of all three materials. The following are the more important conclusions to be drawn.

Influence of Chlorides.—Chlorides have a marked destructive effect on the tannin, and the losses observed with natural water may be almost completely ascribed to their influence. Thus a natural water containing 0·4655 grm. of chlorine per 1000, all as calcium chloride, caused a loss of 4·80 per cent. of tannin in the case of pine bark, whilst the artificial water, with 0·500 grm. of chlorine, lost 4·88 per cent. The influence upon extraction is of a double nature; part due to the base and part to the tanning matter. Oak tannin is wasted approximately in proportion to the concentration of the salt solution, and nearly the same is true of sumac, whilst pine bark shows great irregularities. As regards the destructive influence of the various chlorides, this in some instances appears to increase with the molecular weight of the salt used.

Influence of Sulphates.—Combined sulphuric acid has an even greater destructive influence than combined chlorine, pine bark and oak bark being more sensitive than sumac. The relation between the loss in tannin and the quantity of salt dissolved, whilst being of a similar character for each tanning material and each salt, shows greater variations than the analogous relation when chlorides are concerned.

These results further show that the evil effects of hard waters are not altogether avoided by chemical softening processes. Salts of sodium are not only not harmless, but in some cases, as in that of pine bark, produce more loss than the calcium or magnesium compounds, so that a naturally

*Table showing:—(A) the Percentage Composition of Oak Bark, Pine Bark, and Sumac when Extracted with Distilled Water. (B) The alteration (loss or gain in units of the Composition) when extracted with Artificial Hard Waters (Chlorides and Sulphates).**

	Total Extract.	Ash of Total Extract.	Organic Extract.	Non-tannin Total.	Ash of Non-tannin.
OAK BARK.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
(A) Distilled water.......	20·1	0·9	19·2	5·3	0·7
(B) Sodium chloride	+ 1·2 to + 4·8	+ 0·0 to + 5·8	+ 1·2 to − 1·0	+ 1·3 to + 7·8	+ 0·0 to + 4·6
Calcium chloride.....	+ 0·1 to + 10·8	+ 0·0 to + 9·8	+ 0·1 to + 1·0	+ 0·2 to + 16·4	+ 0·0 to + 8·1
Magnesium chloride .	+ 0·1 to + 8·1	+ 0·1 to + 5·8	− to + 2·3	+ 0·1 to + 13·1	+ 0·0 to + 3·9
Sodium sulphate.....	+ 0·7 to + 3·9	− 0·1 to + 3·5	+ 0·8 to + 0·4	+ 0·8 to + 5·8	− 0·1 to + 2·9
Calcium sulphate	+ 0·2 to + 1·2	+ 0·2 to + 2·5	− 0·0 to − 1·3	+ 1·1 to + 5·0	+ 0·2 to + 2·2
Magnesium sulphate.	+ 0·6 to + 3·1	+ 0·3 to + 2·7	+ 0·3 to + 0·4	+ 1·0 to + 5·9	+ 0·3 to + 2·0
PINE BARK.					
(A) Distilled water.......	27·6	0·3	27·3	4·5	0·2
(B) Sodium chloride	0·3 to 17·7	+ 0·7 to + 17·3	− 0·4 to + 0·4	+ 0·8 to + 21·0	+ 0·5 to + 15·5
Calcium chloride.....	+ 0·5 to + 17·8	+ 0·3 to + 15·9	+ 0·1 to + 1·9	+ 1·4 to + 21·9	+ 0·3 to + 15·3
Magnesium chloride .	+ 0·4 to + 18·3	+ 0·0 to + 4·1	+ 0·4 to + 14·3	+ 0·5 to + 21·6	+ 0·0 to + 2·4
Sodium sulphate.....	+ 0·5 to 3·3	+ 0·6 to + 5·7	− 0·1 to − 2·4	+ 1·1 to + 7·3	+ 0·5 to + 5·0
Calcium sulphate	0·5 to − 2·5	+ 0·3 to + 3·9	+ 0·2 to − 1·4	+ 1·2 to + 5·9	+ 0·3 to + 3·6
Magnesium sulphate.	+ 0·3 to + 1·4	+ 0·2 to + 4·2	+ 0·1 to − 12·8	+ 1·1 to + 5·4	+ 0·1 to + 3·5
SUMAC.					
(A) Distilled water.......	35·5	2·5	33·0	16·6	2·5
(B) Sodium chloride	+ 0·8 to + 17·6	+ 0·2 to + 14·4	+ 0·6 to + 3·2	+ 0·9 to + 20·1	+ 0·1 to + 12·8
Calcium chloride	0·0 to + 13·4	0·6 to + 13·3	− 0·5 to + 0·1	+ 0·3 to + 19·7	+ 0·2 to + 10·1
Magnesium chloride .	+ 0·0 to + 18·8	+ 0·1 to + 7·0	− 0·0 to + 11·8	+ 0·1 to + 20·3	+ 0·1 to + 6·0
Sodium sulphate.....	0·8 to + 4·8	0·2 to + 4·8	+ 0·6 to 0·0	0·8 to + 6·5	+ 0·2 to + 4·7
Calcium sulphate	+ 0·4 to + 2·5	+ 0·1 to + 3·5	+ 0·3 to − 1·0	− 1·0 to + 5·5	+ 0·1 to + 3·4
Magnesium sulphate.	+ 0·2 to − 1·5	+ 0·1 to + 3·0	+ 0·1 to − 1·5	+ 0·8 to + 4·0	+ 0·1 to + 2·9

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* NOTE.—The chloride waters contained 0·005, 0·050, 0·150, 0·400, 0·500, and 1·000 grm. of chlorine per 1000. The sulphate waters contained 0·309, 0·0445, 0·156, 0·270, and 0·3383 grm. of SO_3 per 1000. The original tables give the results for all these waters to two places of decimals. In the above table only the first and last in each case are recorded to one decimal place.

The oak contained 10·5 per cent. water; the pine bark 12·5 per cent.; and the sumac 8·7 per cent.

——	Organic Non-tannin.	Total fixed by Hide.	Mineral Matter fixed by Hide.	Tannin.	Insoluble Matter.
Oak Bark.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
(A) Distilled water	4·5	14·8	0·1	14·7	69·5
(B) Sodium chloride	+ 1·3 to + 3·2	− 0·1 to − 3·0	+ 0·0 to + 1·2	− 0·1 to − 4·2	− 1·2 to − 4·8
Calcium chloride.....	+ 0·2 to + 8·2	− 0·0 to − 7·6	+ 0·0 to + 1·7	− 0·1 to − 7·2	− 0·1 to − 10·8
Magnesium chloride .	+ 0·1 to + 9·2	− 0·0 to − 5·0	+ 0·0 to + 1·9	− 0·1 to − 5·9	− 0·1 to − 8·13
Sodium sulphate.....	+ 0·9 to + 2·9	− 0·1 to − 1·9	+ 0·0 to + 0·6	− 0·2 to − 2·5	− 0·7 to − 4·0
Calcium sulphate	+ 0·9 to + 2·8	− 0·9 to − 3·8	+ 0·0 to + 0·3	− 0·9 to − 4·1	− 0·2 to − 1·2
Magnesium sulphate.	+ 0·7 to + 3·8	− 0·1 to − 2.8	+ 0·1 to + 0·6	− 0·4 to − 3·4	− 0·6 to − 3·1
Pine Bark.					
(A) Distilled water	[illegible]·3	23·1	0·1	23·0	70·9
(B) Sodium chloride	+ 0·3 to + 5·5	− 0·5 to − 3·4	+ 0·2 to + 1·7	− 0·7 to − 5·1	0·3 to 17·7
Calcium chloride.....	+ 1·0 to + 6·6	− 0·9 to − 4·4	—— to + 1·6	− 0·9 to − 4·7	− 0·5 to 17·8
Magnesium chloride .	+ 0·5 to + 22·2	− 0·1 to − 6·3	+ 0·0 to + 1·6	− 0·1 to − 8·0	0·4 to − 18·3
Sodium sulphate.....	+ 0·6 to + 2·3	− 0·6 to − 4·0	+ 0·1 to + 0·7	− 0·7 to − 4·7	− 0·5 to − 3·3
Calcium sulphate	+ 0·9 to + 2·2	− 0·7 to − 3·5	+ 0·0 to + 0·3	− 0·7 to − 3·6	− 0·5 to − 2·5
Magnesium sulphate .	+ 1·0 to + 1·9	− 0·8 to − 1·0	+ 0·1 to + 0·7	− 0·9 to − 4·7	− 0·3 to − 1·4
Sumac.					
(A) Distilled water.......	14·2	18·9	0·0	18·9	55·8
(B) Sodium chloride	+ 0·8 to + 7·3	− 0·1 to − 2·7	+ 0·1 to + 1·6	− 0·2 to − 4·1	+ 0·8 to 17·6
Calcium chloride.....	+ 0·1 to + 9·6	− 0·2 to − 6·3	+ 0·1 to + 3·2	− 0·6 to − 9·5	− 0·0 to − 13·4
Magnesium chloride .	− 0·0 to + 14·3	− 0·0 to − 1·7	—— to + 1·0	− 0·0 to − 2·5	− 0·0 to − 18·8
Sodium sulphate.....	+ 0·6 to + 1·9	− 0·1 to − 1·7	+ 0·0 to + 0·1	− 0·1 to − 1·8	+ 0·7 to − 4·9
Calcium sulphate	+ 0·9 to + 2·1	− 0·6 to − 3·0	0·0 to + 0·1	− 0·6 to − 3·1	− 0·4 to − 2·5
Magnesium sulphate.	− 0·7 to + 1·1	0·6 to − 2·7	0·0 to + 0·1	− 0·6 to − 2·7	− 0·2 to − 1·5

soft water is of greater advantage than hitherto imagined. The column of figures showing the amount of mineral matter fixed by the hide, indicates an important interaction between the saline constituents and the tanning matters. Soluble molecular compounds are formed, capable of absorption by the hide substance, or, alternatively, the tannin combines with the salt base, and free acid is liberated. Both suppositions are possible, and the latter especially, in view of the distinct effect of sodium sulphate on pine-bark liquor. The practical conclusions of this are (*a*) that owing to this fixation of mineral matter the ash of leather will vary in amount according to the water used in manufacture, and analysts must allow a certain latitude in the matter; and (*b*) the discovery of sulphuric acid in leather when none has been employed in the manufacture can be explained by the presence of sulphates in the tannery water.—R. L. J.

Mangrove Bark as a Tanning Material. J. Paessler. Collegium, 1904, [91], 15—16.

Pieces of hide were tanned in mangrove bark liquors (*a* for about two weeks in liquors of 4° Bé. density. One half were then washed till the water was no longer coloured, and then air-dried, and analysed. The other half were (*b*) further tanned for six months in liquors strengthened up to 6° Bé., washed, dried, and analysed as before. Similar tests were made with an oak tannage, and the results calculated to 18 per cent. of moisture were as follows:—

——	Mangrove Bark. (*a*)	Mangrove Bark. (*b*)	Oak.
	Per Cent.	Per Cent.	Per Cent.
Water	18·0	18·0	18·0
Ash	0·2	0·2	0·7
Fat	0·4	0·6	0·7
Soluble constituents:—			
Tannin substance.......	5·1 } 5·5	4·3 } 4·8	3·4 } 6·0
Non-tannin substance...	0·4 }	0·5 }	2·6 }
Leather substance:—			
Tannin	32·2	32·4	30·2
Hide substance	43·7	44·0	44·[illegible]
	100·0	100·0	100·0
Total fixed tannin in the leather..................	37·3	36·7	33·6
Yields of leather per 100 parts of hide substance..........	228·9	227·3	225·0
Fixed tannin per 100 parts of hide substance	74·0	73·6	67·8

The leather was thus fully tanned in a fortnight, and the results are rather better with mangrove than with oak.
—R. L. J.

Sulphuric Acid in Leather; Determination of ——. M. C. Lamb and J. W. Lamb. XXIII., page 134.

English Patents.

Hides; Process and Compound for Unhairing ——. J. Mellinger, Baltimore, U.S.A. Eng. Pat. 22,442, Oct. 17, 1903.

Soda lye, containing 30·22 per cent. of caustic soda (100 lb.), soda lye as above but saturated with hydrogen sulphide (200 lb.), and commercial ammonium carbonate of the composition "$NH_4 + 20·3CO_2$" (100 lb.) are mixed, dissolved in warm water (500 gallons), heated to 60° F., and allowed to stand. The hides are soaked in cold water for 12 hours, suspended in the above liquor, and the loosened hair and epidermis is washed off in water. Heavy hides require immersion for 2—3 hours, and skins 10—30 minutes, according to substance.—R. L. J.

United States Patents.

Clarifying Liquors [Glue Solutions]; Method of ——. E. R. Hewitt, Garden City, N.Y., U.S.A. U.S. Pat. 748,865, Jan. 5, 1904.

Solutions, such as glue, which are slightly acid, are neutralised by addition of a suitable base so as to form a fine precipitate. Aqueous sulphurous acid and the lime salts of bones are then added, and the mixture is again neutralised so that a readily separable sludge is obtained.
—R. L. J.

Glue from Hides: Manufacture of ——. E. R. Hewitt, Garden City, N.Y., U.S.A. U.S. Pat. 748,866, Jan. 5, 1904.

The hides are treated with a cold aqueous solution of sulphurous acid containing calcium phosphate and calcium sulphite (*i.e.*, two acid salts which precipitate when neutralised), washed, dissolved in hot water, neutralised, and the precipitate is settled out. If necessary the hot neutral solution is further treated with a little of the original pickling solution and again neutralised to induce a second precipitation.—R. L. J.

Horn-like Material from Raw Skins; Process of Preparing ——. E. Jetter, Erfurt. U.S. Pat. 7[illegible],297, Jan. 12, 1904.

See Fr. Pat. 330,006 of 1903; this J., 1903, 1056.—T. F. B.

XV.—MANURES, Etc.

Flax Cultivation; Manurial Experiments in ——. Bull. of the Imperial Inst. (Suppl. to Bd. of Trade J.), 1903, [4], 188—200.

The results of the experiments, which extended over two seasons, are shown in the following table:—

Nature of Manure and Amount of Dressing per Acre.	Average yield of Retted Flax Straw per Acre.	Average yield of Scutched Flax per Acre.		Value of the Scutched Flax from 1 Acre.			Cost of Manure per Acre.		
1901.	Lb.	St.	lb.	£	*s.*	*d.*	£	*s.*	*d.*
Unmanured	3574	40	5	16	2	8		..	
Superphosphate (5 cwt.)	3149	37	12	14	11	7	0	11	10
Kainite (5 cwt.)	3699	43	7	17	4	5	0	12	6
Superphosphate (3 cwt.) + kainite (3 cwt.)	3619	38	13	15	7	8	0	14	7
Superphosphate (3 cwt.) + kainite (3 cwt.) + ammonium sulphate (½ cwt.)	3535	38	2	15	0	7	1	0	7
Unmanured	3659	44	2	17	13	9		..	
Potassium chloride (1 cwt.)	3942	49	4	19	11	2	0	12	0
1902.*									
Unmanured	3211	36	5	14	17	3		..	
Kainite (5 cwt.)	3326	36	5	14	16	0	0	15	0
Potassium chloride (1¼ cwt.)	3169	37	1	15	5	7	0	12	6
Sodium chloride (4 cwt.)	2951	33	10	13	12	9½	0	4	9½
Superphosphate (3 cwt.) + kainite (3 cwt.)	3214	35	8	14	9	9½	0	17	1
Superphosphate (3 cwt.) + kainite (3 cwt.) + ammonium sulphate (¾ cwt.)	3496	34	3	13	18	2¾	1	3	0¾
Rape meal (5 cwt.)	3300	31	5	12	15	11	1	7	6
Basic slag (5 cwt.)	3114	32	8	13	11	9½	0	13	1½

* In the 1902 results the value of the tow is included in that of the scutched flax.

The most notable result is the effect of fertilisers containing potash in increasing the yield of flax fibre. Although with the other manures the average results were unsatisfactory, yet in individual cases the results were good.—A. S.

United States Patent.

Manure; [Electrical] Process of Manufacturing ——, *from Apatite.* W. Palmaer, Stockholm. U.S. Pat. 748,523, Dec. 29, 1903.

A solution containing sodium chlorate, or sodium perchlorate, or a mixture of these with foreign salts, is electrolysed, and the acid solution formed at the anode is used to act upon a mineral phosphate in a separate vessel. To the solution thus obtained, the alkaline solution formed at the cathode during the electrolysis is added, to precipitate dicalcium hydrogen phosphate. Compare U.S. Pat. 707,886, 1902; this Journal, 1902, 1189.—E. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar Cane; Deterioration of Cut ——. Bull. of the Imperial Inst. (Suppl. to Board of Trade J.), 1903, [4], 212.

Experiments have been made to determine the rapidity with which the sucrose in sugar canes is converted into invert sugar after the canes are cut. The results obtained with five varieties of sugar cane, *viz.*, "White Manilla," "Purple Cheribon," "Manila," "Dikchan," and "Rukhra," are shown in the following table, the figures being the per cent. of loss on the total sugar present:—

	Days after Cutting.			
	1.	2.	3.	4.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Total loss of available sucrose	2·7	8·0	21·4	32·1
Daily loss of available sucrose	2·7	5·3	13·4	10·7

These results show that in the first two days the loss is relatively small, but after three days, more than one-fifth of the available sugar has disappeared. The conclusion is drawn that the canes should be received at the factory not later than 24—36 hours after cutting.—A. S.

Starch; Reversion and Coagulation of ——. L. Maquenne, A. Fernbach, and J. Wolff. Comptes rend., 1904, **138**, i, [1], 49—51.

Attention is called to the difference between the amylocellulose which is obtained on the spontaneous reversion of starch, and which can still be saccharified by diastase, and the coagulum formed by treating starch with a small quantity of malt extract; this coagulum is incapable of saccharification by diastase. Amylocellulose may be recognised by treating it for a short time with potassium hydroxide, then adding a slight excess of hydrochloric acid and a few drops of iodine solution, which gives a blue coloration. It is found that the formation of amylocellulose is much more rapid in the coagulum obtained by the action of amylo coagulase on starch paste heated at 120° C. for 15 minutes, or at 100° for 30 minutes, or liquefied by heating at 130° for 2 hours, than it is in the spontaneous reversion of the starch paste. If, however, the coagulum is examined immediately after its formation, very little amylocellulose is detected, but the amount increases, and may finally constitute as much as one half of the total coagulated matter.—T. H. P.

Fehling's Solution; Sodium Sulphide as an Indicator with —— *[Determination of Reducing Sugars].* L. Beulaggue. XXIII., page 137.

Nitrates in Liquids charged with Organic Matters [Beetroot Juices, &c.]; Determination of Traces of ——. A. Paguoul. XXIII., page 135.

United States Patent.

Saccharine Juices; Process of Defecating ——. W. C. Salisbury, Assignor to A. J. Kramper, both of Dakota, Neb. U. S. Pat. 748,313, Dec. 29, 1903.

Saccharine juices and syrups are clarified and bleached by treating them with powdered alum in the proportion of 1 oz. of alum to 100 galls. of juice, and then boiling the juice, with agitation, for about an hour, and skimming off the impurities separated by the action of the alum during boiling and agitation.—J. F. B.

Sugar; Process of Making ——. W. C. Salisbury, Assignor to A. J. Kramper, both of Dakota, Neb. U.S. Pat. 748,314, Dec. 29, 1903.

One hundred gallons of juice, prepared from saccharine substances, are treated, whilst boiling, with 1 oz. of powdered alum and ½ oz. of sodium bicarbonate (with or without the addition of 4 oz. of sugar for each gallon of juice). The juice is boiled, stirred, and skimmed for about one hour, the resulting syrup is then cooled slightly and 1 oz. of a "suitable extract" is added thereto.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Fermentation; Theory of ——. *Nutrition of Yeast with Sugar.* A. Richter. Zeits. angew. Chem., 1904, **17**, [2], 55—56; from Centralbl. f. Bakt. u. Parasitenk., II., **11**, 438.

The author has previously shown that yeast is capable of decomposing all the sugar present in a liquid before it attacks the nitrogenous substances, provided that it is fed with very small quantities of pepsin at the same time. Further experiments show that in the development of yeast in a medium containing fermentable material, the latter is decomposed quite independently both of the decomposition of the nutrient solution and of the presence of other nutrient matter. The whole process is shown to be of an enzymic nature, thus confirming Buchner's theory.—T. H. P.

Fermented Liquids; Origin of the Amyl Alcohol in ——. B. Rayman and K. Kries. Woch. f. Brau., 1904, **21**, [2], 25—27.

In a series of investigations on the by-products of alcoholic fermentation (this Journal, 1896, 465), the authors determined that amyl alcohol was produced by pure-cultivated yeasts quite apart from any contamination with bacteria, but failed to establish the conditions necessary for its production. It has now been definitely ascertained that the formation of amyl alcohol by pure yeast is not attributable to the unfavourable physiological condition of the yeast cells. It has also been found that pure-cultivated distillery yeast produces no amyl alcohol in artificial glucose media, but that if barley malt worts be employed, amyl alcohol is found amongst the products of fermentation. It was consequently inferred that the amyl alcohol is not a product of the fermentation of hexoses, but of those carbohydrates of the wort which accompany the hexoses and which belong to the class of "furfuroids," prepared by Tollens by the acid hydrolysis of brewers' grains. A series of experiments was therefore made in which glucose solutions containing peptone and nutrient salts were fermented with pure cultures of *S. cerevisiæ L.*, due precautions being taken to exclude bacteria. Some of these fermentations were allowed to proceed for periods up to three years, and the products consequently contained ammonia, organic bases, and sulphur compounds. Apart from such decomposition products there were formed in most cases formic acid, valeric acid, acetaldehyde, ethyl alcohol, glycerin, and succinic acid, but never amyl alcohol. Beet-juice, fermented for 36 days, likewise yielded no amyl alcohol. On the other hand, a wort prepared from raw barley saccharified by malt, fermented for 11 months, and a wort prepared from brewers' grains by Tollens' method, and containing the "furfuroids," yielded acetaldehyde and ethyl alcohol together with large quantities of amyl alcohol.—J. F. B.

Dissimilar Fermentations in Tuns filled with Wort of the same Brewing. Vogel. Zeits. ges. Brauw., 1904, 27, [2], 23—24.

In large breweries the wort from a single brewing is frequently distributed between two or three fermentation tuns, and it is by no means rare to find that the different portions ferment in a totally different manner. The author enumerates some of the possible causes of such dissimilarities in fermentation. The position of the tuns may be such as to cause large variations in the temperatures of the wort fermenting in them; some tuns may be close to a door or ventilating shaft and thus be exposed to draughts, others may be close to a stove or heating arrangement and so become unevenly heated. The pitching yeast given to each tun may vary in consistency, and irregularities may occur in making up and measuring out the pitching yeast. A very frequent cause of dissimilar fermentation lies in variations of the quantity of absorbed oxygen in the wort. If a check occur on the cooler, the collecting tank of the latter becomes nearly empty, and the wort, as it is drawn off into the tuns, may form a vortex, sucking in bubbles of air; then, later, the collecting tank fills up again and the wort runs away without air. Also, if hose pipe be used for filling the tuns, it may sometimes dip to the bottom and at other times merely rest on the edge of the tun; it is generally advisable to fix a "swan's neck" pipe to the edge of the tun at a constant height and to attach the hose to this. Again, the pitching temperature in the different tuns may vary, owing to irregular control of the temperature of the wort as it leaves the cooler. Other irregularities of fermentation may be caused by some of the tuns being lacquered and others not; they may also depend on the shape of the tuns and the height to which they are filled. The last tun filled generally receives more than its share of cooler-dregs and rinsings of the plant; on the other hand, if the pipes, &c., be infected, most of the infecting growths will be washed through into the first tun filled, the second and third being only moderately contaminated.—J. F. B.

Brewing by the Infusion Method. P. Petit. Ann. de la Brasserie, 1903, 6, [24], 553—556.

To obtain a beer of low attenuation, which, when fined, will give a good secondary fermentation and satisfactory head without the necessity for added sugar, it is essential to retard saccharification by quickly raising the temperature of the mash to 65°—68° C. At the same time, in order to secure the solution of head-forming nitrogenous constituents, it is desirable to carry on the preliminary mashing in the machine at 40°—45° C. The author states that either of the following methods of mashing will give satisfactory results:—100 kilos. of malt are mashed in the machine with 150 litres of water at 65° C., and the mixture is run into the mash tun containing 130 litres of hot liquor "at 90° C." The temperature of the mash will be about 62° C., which is then raised to 73°—75° C. with boiling water. After a short rest the wort is drawn off and the grains are sparged. In the second method, 100 kilos. of malt are mashed with 100 litres of water in the machine, so as to attain a temperature of about 45° C. By introducing hot liquor above and below, the temperature is raised to 65°—68° C. in 10 minutes, and is then slowly brought up to 75° C., the mash being afterwards left for 10—15 minutes at about 68° C. By means of a steam coil in the mash tun, a saving may be effected in the quantity of hot water required for heating the mash. In such case, one-third of the thick mash from the machine (temperature 40° C.) may be run into the hot liquid in the mash tun, so as to obtain a temperature of 65° C. At the end of 10 minutes, steam is turned on, and the temperature raised to 90° C., whereupon the rest of the thick mash is added, reducing the temperature to 63° C., the whole being then slowly raised to 75° C. This arrangement also permits the use of raw grain, without any additional apparatus being required.—C. S.

Disinfection and Disinfectants in Brewing. H. Will. Zeits. ges. Brauw., 1903, 26, [51], 865—871; [52], 886—891.

Sodium Carbonate.—The chief value of sodium carbonate solution consists in its power of loosening and dissolving dried impurities. It should be used of 10 per cent. strength, boiling hot, and allowed to act on the vessels for at least half an hour and at a temperature not below 80° C.

Calcium Hydroxide (Slaked Lime).—The action is similar to that of sodium carbonate, but where contamination is more than moderate, the application of lime should be preceded by a thorough scrubbing. The effect will be greater if the dressing be prevented from drying too quickly. Quicklime has proved very useful when strewed on damp floors.

Bleaching Powder.—In the form of a solution containing 1 per cent. of active chlorine, this substance is useful for washing the walls and floors of fermenting cellars and malthouses, as well as fermenting vessels that have become mouldy owing to damp storage. There does not seem to be any risk of unfavourably affecting the taste or smell of the beer, provided the above concentration is not exceeded and the vessels, &c., are well washed afterwards.

Antiformin.—This preparation consists of sodium hypochlorite and caustic soda, the active ingredient being the chlorine, of which over 4 per cent. is liberated on treatment with hydrochloric acid. The author classes it among the best disinfectants available for brewery work. It rapidly softens organic impurities and facilitates their removal by scouring, in addition to its oxidising action, and it also dissolves incrustration. The germicidal power is high, and a 5 per cent. solution is sufficient for most purposes. It is used cold, and may be safely applied to varnished surfaces with a brush, provided care is taken to prevent prolonged contact.

Sulphur Dioxide.—Though good results are obtained with this gas, it cannot penetrate to a sufficient depth through a contaminating deposit of yeast to act effectually thereon.

Calcium Bisulphite.—The disagreeable effects of this disinfectant on the operator may be diminished by diluting the solution to a strength of 10 grms. of sulphur dioxide per litre (one part of the average commercial article to six parts of water). For destroying mould it is superior to bleaching powder, and it also keeps better than the latter.

Hydrofluoric Acid.—This is an excellent disinfectant, and is equal to antiformin in germicidal power. A 1 per cent. solution is sufficient, and this will not attack the varnish on vats. Its caustic action, however, even when in a very dilute condition, militates against its extensive use.

Ammonium Bifluoride.—A 5 per cent. solution forms a very strong germicide, and even one of 2 per cent. strength is powerful. It ranks next to antiformin, to which it is superior in retarding vegetation. The solution does not injure the skin, is inodorous, and does not liberate vapour. Hose pipes may be cleaned by scrubbing, followed by immersion for 12—24 hours in a 0·4 per cent. solution of this salt contained in a closed vessel. The treatment is repeated once a fortnight, and the old solution may be used for washing floors, flushing drains, &c. Vats and other vessels are scrubbed and then well brushed over with a 3 per cent. solution of the bifluoride, which is left to act for at least three hours. Wooden buckets, &c., must be used, since the 3 per cent. solution attacks metal.

Montanin (Hydrofluosilicic Acid).—A solution containing 1·5 per cent. of the acid ranks between microsol and antigermin as a germicide, and also retards vegetation. It does not attack varnish, and has little effect on the skin.

Microsol.—This preparation varies in properties, but seems to depend for its action mainly on the presence of copper sulphate. A 2 per cent. solution (in exceptional cases 3—4 per cent.) is suitable for washing the inside of storage casks. It may be also mixed with milk of lime for whitewashing.

Antinonnin (Potassium Orthodinitrocresol).—Damp walls may be made dry by applying a hot 1—2 per cent. solution of this preparation, after a good scrubbing with hot water, a second application being given in three days' time. When dry the wall is brushed over with white lime mixed with the same solution. The strength is doubled if large quantities of mould fungi are present.

Antigermin.—This preparation is a copper salt of a weak organic acid. It is said to be soluble in 200 parts of water, and is applied after mixing in hot water and stirring up the mixture. Its power of retarding vegetation is still greater than that of either antinonnin or microsol, and the low solubility prolongs the antiseptic action. Mixed with a 2 per cent. solution of lime and applied as a double or triple coating to walls, it dries them and eliminates mould fungi; but, like antinonnin, it cannot be used for utensils that are to come in contact with wort, beer, or yeast.

Formaldehyde.—In addition to its disinfectant properties formaldehyde constitutes the best deodoriser for fusty cellars. It has also been used for sterilising pure-culture yeast plant. One objection, however, to its employment is its injurious effect on the mucous membrane.—C. S.

Beer; Resin Turbidity in ——. H. Will. Zeits. ges. Brauw., 1904, 24, [3], 29—30.

Turbidity of beer due to resins is a very rare occurrence; it is generally attributed to the separation of resins extracted from the hops. The author, however, cannot admit that hop resins are present in the beer in such quantities as to cause a visible turbidity. The small quantity which fails to settle out with the yeast is found in the sediments from the lager casks. The author has recently examined a number of samples of beer, more or less turbid, and possessing a distinct flavour of pitch. The microscopic examination of these turbid samples showed that the turbidity was caused solely by the presence of globules of resin. On applying pressure to the cover-glass it was found that these globules varied in consistency, as if the resin were dissolved in some solvent in varying proportions. The globules were separated by centrifugalising some of the beer; they were then placed on a gypsum plate to remove most of the water, and moistened with a reagent composed of a mixture of 5 c.c. of acetic anhydride and one or two drops of concentrated sulphuric acid. A violet coloration was thus developed—a conclusive proof that the turbidity was caused, not by hop resins, but by rosin derived from the pitch lining of the casks. It is not yet clear how this pitch is absorbed by the beer, but it is very probably due to overheating when coating the casks, and the consequent formation of rosin oil, which appears as a bluish iridescent layer over the surface of the pitch after cooling. The microscopic appearance of the centrifugalised rosin particles may vary from characteristic globules, through intermediate forms, to roundish, indefinitely shaped particles, which tend to adhere in masses, and have a shrunken, honeycombed appearance, ranging from colourless to yellowish-brown.

—J. F. B.

Starch in Barley and Malt; Method for the Rapid Determination of ——. H. T. Brown and J. H. Millar. XXIII., page 137.

Tartaric Acid; Characteristic Reaction of Free ——. [*Detection of Tartaric Acid in Wines.*] D. Ganassini. XXIII., page 136.

English Patent.

Malt, Barley, and the like; Roasting ——, *for Colouring and Flavouring Stout and Ales.* G. Valentine, Dublin. Eng. Pat. 28,834, Dec. 31, 1902.

The grain is roasted in an hermetically closed, revolving cylinder, provided with an internal cylindrical water-condenser, and with a right- and left-handed screw for mixing. The vapours produced are condensed by the internal cold surface and reabsorbed by the grain, thereby swelling it and preventing carbonisation. The uncondensed gases are led away through a pipe, with a valve and universal joint, to receivers, where they can be measured and absorbed by a fresh charge of grain for subsequent roasting. If the water in the condenser be insufficient to control the temperature of the roasting grain, water may be admitted to the centre of the mass in the roaster. The roasting may safely be conducted at a temperature of 460° F.—J. F. B.

United States Patents.

Brewing; Process of ——. H. E. Frees, Assignor to Wahl and Henius, Chicago. U.S. Pat. 746,320, Dec. 8, 1903.

Claim is made, in brewing beer, for the process of removing from corn its soluble oil, consisting in mixing with the ground corn an alkaline earth (such as lime) and water, and cooking the mixture, thereby reducing the soluble-oil contents to an insoluble soap, mashing the cereal, drawing off the wort, and intercepting the soap in the grains from which the wort is separated.—T. H. P.

Brewers' Apparatus. A. L. Neubert and S. T. Wiedenbeck, Minneapolis, Minn. U.S. Pat. 749,087, Jan. 5, 1904.

The brewing vessel consists of a casing provided with a charging opening surrounded by an overflow flange; means are provided for admitting steam, air, and water to the top of the casing, and for admitting steam and air near the bottom of the casing, below a perforated false bottom. This false bottom is made up of sectors, and a series of agitator arms is carried by a vertical shaft in the casing, the lowermost arms being constructed to sweep the perforated plate and keep the holes clear. The discharge pipe from the bottom of the casing below the perforated plate is conducted upwards, and communicates by one branch with a cooler and by another branch with a strainer tub, which discharges into a "grant," which in its turn has a discharge pipe leading back into the opening in the top of the casing.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

English Patent.

Vegetable Foodstuffs; Process for obtaining the Assimilable Phospho-organic Matter from ——. S. Posternak, Paris. Eng. Pat. 24,692, Nov. 13, 1903.

Instead of the mineral acids specified in Eng. Pat. 18,910 of 1902 (see Fr. Pat. 318,311; this Journal, 1902, 1464) the oil cake may be extracted by solutions of some of the more powerful organic acids, which dissolve insoluble alkaline-earth salts and react towards Congo red like mineral acids. The impure extracts or precipitates containing the phospho-organic compounds may be purified by the action of oxidising agents, such as permanganates, chlorine, &c., which have no action upon the compounds in question. The free phospho-organic acid may be extracted from aqueous solutions by a mixture of ether and alcohol, or it may be precipitated by means of a metallic or earthy base, the metal being subsequently precipitated by an acid with which it yields an insoluble salt. The free phospho-organic acid has a composition corresponding to the formula $C_2P_2H_8O_9$; it is tetrabasic, and is split up on heating with mineral acids at 130° C. into phosphoric acid and "inosite." Its salts and double salts are also claimed. —J. F. B.

United States Patents.

Synthetic-Milk Compound, and Process of Producing same. W. A. Hall. U.S. Pat. 746,502, Dec. 8, 1903.

The compound described consists of casein, an alkali (for instance, sodium bicarbonate), calcium chloride, and milk-sugar, with or without a butter-fat; the constituents are mixed together in various proportions.—T. H. P.

Yeast Extracts; Process of Preparing Alimentary ——. M. Elb, Dresden. U.S. Pat. 748,711, Jan. 5, 1904.

See Eng. Pat. 13,097 of 1901; this J., 1902, 924.—T. F. B.

French Patent.

Animal Blood; Desiccation of ——. G. Tauer. Fr. Pat. 334,902, Aug. 28, 1903.

Unclotted blood, or clotted blood suitably pulped, is treated with an oxide, hydroxide, or metallic salt, *e.g.*, with 1—3 per cent. of lime, so as to form a jelly. The albuminoids are then precipitated by acidulation with very dilute mineral acid, with agitation. The mass is then pressed and dried. If desired, the mixture may be heated before precipitation or pressing.—J. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

Water-Pipes; Peculiar Destruction of ——. M. Freund. Zeits. angew. Chem., 1904, **17**, [2], 45—48.

The author gives analyses of curious dark grey graphite-like masses formed in the walls of iron water-pipes situate near an electric tramway in Frankfort-on-the-Maine; the formation of these masses, which were soft enough to be scratched by the finger-nail and readily cut with a knife, proceeded from the exterior to the interior of the pipes, and it was found that they all lie on a straight line. The result of the analysis was as follows:—Free iron, 10·4; ferrous phosphate, $Fe_3P_2O_8$, 37·1; ferrous silicate, $FeSiO_3$, 44·0; and carbon, 8·1 per cent. Comparison of the material with the unaltered iron of the pipes shows that the phosphoric acid and silica have their origin in the phosphorus and silicon contained in the iron, and are not at all derived from the surrounding soil. That this substance is the result of an electrolytic action in presence of moist soil was shown experimentally.—T. H. P.

United States Patent.

Water; Apparatus for the Removal of Sulphuric Acid from ——. H. Reisert, Cologne, Germany. U.S. Pat. 748,308, Dec. 29, 1903.

A funnel-shaped vessel, constituting a "barium-carbonate bath," and contained within an outer vessel, is provided centrally with a tube admitting the water to be purified to near its bottom, whence it passes upwardly through filtering material at the top, and overflows into the containing vessel, which latter receives from an elevated reservoir a regulated supply of saturated lime water for the removal of calcium and magnesium bicarbonates from the water which flows into the vessel from the overflow described. (Compare U.S. Pat. 713,800, 1902; this J., 1902, 1550.)—E. S.

XIX.—PAPER, PASTEBOARD, Etc.

Tissue Paper; Sulphite Wood Pulp for ——. Wochenbl. f. Papierfabr., 1904, **35**, [3], 162—163.

The successful preparation of tissue paper from wood pulp depends mainly on the quality of the raw material. The only pulp suitable is a well-boiled, tough cellulose, free from splinters and resin, which has been so thoroughly washed that the lime and boiling liquor are completely removed. Pulp which still contains some of the boiling liquor makes satisfactory work on the machine almost impossible, owing to the sticking of the paper to the press-rolls. It is not essential for ordinary grades of tissue paper that the pulp should be of an easy bleaching variety, provided it be perfectly boiled and washed. Bad washing causes a slimy deposit to collect on the wire and felts, especially the top felt, thus preventing proper couching and pressing. Resin specks and splinters produce holes in the paper; it is also impossible to make a well-closed tissue paper with good "rattle" from brittle, badly boiled pulp. It is not possible to prepare the sulphite pulp to make papers corresponding with several different samples; if samples have to be worked to, other kinds of cellulose must be mixed in, in order to produce the desired variations. The better classes of tissue papers require an admixture of rag pulp.—J. F. B.

Cotton-Rag Paper; Knots in ——. P. Papier-Zeit., 1904, **29**, [6], 181.

Commenting on a sheet of unsized cotton-rag paper which contained a large number of knots, the writer remarks that the clotting of the pulp in this manner is caused by too violent agitation either in the stuff-chests or as it is fed on to the machine. With cotton pulps the circumferential speed of the stirrer in the stuff-chest must not exceed 1 metre in 6½ seconds. The stirrer must not present broad, flat surfaces to the pulp, but all its parts must be wedge-shaped, so as to cut through the stuff. The blades of the stirrer should be sloped off, so as to prevent the deposition of the fibres. Should the diameter of the chest be so large that the pulp is not properly kept in suspension at so low a speed, boards about 8 inches wide should be fixed to the stirrer-arms not quite horizontally, but with a slope to an angle of 40°. If this be not sufficient, stirrers with four arms should be provided. Similar knots may also be produced by the too violent action of the stirrer connected with the paper-machine for mixing the pulp with the "back-water." A few of the knots present in the paper in question were derived from the knotted stitches in the rags, which are not reduced in the beaters. These knots are only to be avoided by picking out the stitches from the rags, or, preferably, by using an efficient knotter with slits 0·3 mm. in width.—J. F. B.

Paper; Re-manufacture of Waste ——, in America. R. K. Wochenbl. f. Papierfabr., 1904, **35**, [2], 86—89.

The re-manufacture of waste paper has assumed enormous proportions in America, especially in the New England States. After a preliminary sorting and dusting, the paper is boiled with sodium carbonate solution. This treatment is distinctly better than those in which soap solutions, ready formed, are employed, since a direct reaction takes place between the soda and the saponifiable constituents of the printing ink. The lamp-black is thus set free and becomes incorporated with the soap solution at the moment of saponification. Thus emulsified, the carbon is easily removed in the subsequent washing process. The pulp is then bleached and a fine white "stuff" containing 8—10 per cent. of ash and possessing excellent paper-making properties results. This material is mixed with a small percentage of wood cellulose and the desired amount of loading. It runs on the machine with extreme ease and, considering its strength, at a high speed. The resulting paper possesses exceptional opacity and elasticity—properties which assure for it a large demand amongst the printers. Samples of this paper compared by the writer with paper prepared from new materials [poplar pulp] were pronounced to be better than the latter, both on account of the properties mentioned above and on account of its structure and surface. Most of the American magazines are stated to be printed on re-manufactured paper, and to this fact their well-known superiority is largely attributable. —J. F. B.

United States Patents.

Paper, and Process of Making same. E. H. Fowler and G. N. Hoover, Washington, D.C. U.S. Pat. 748,179, Dec. 29, 1903.

Paper is impregnated, either in the unfinished or finished state, with a solution of glycerin, alcohol, and water. —J. F. B.

Paper from Old Newspapers, Books, Magazines, &c.; Process of Making ——. W. B. Meixell and T. Holt, Sayre, Pa., Assignors to S. Thorp, Elmira, N.Y., and H. L. Towner and F. K. Stephens, Sayre, Pa. U.S. Pat. 748,968, Jan. 5, 1904.

Printed waste-paper is reduced to a pulp and treated, with or without heat, with a solution of a compound consisting of soda, margaric acid, oleic acid, water, and earthy matter. The pulp is finally washed to remove the carbon and colouring matters, and made into paper.—J. F. B.

Gelatinous Product, and Process of Producing same; Insoluble ——. H. V. Dunham, New York, Assignor to Casein Co. of America, New Jersey. U.S. Pat. 748,708, Jan. 5, 1904.

A substitute for albumin is made by adding 3 parts of hexamethylenetetramine to a solution of 17 parts of "ordinary dry commercial gelatinous substance" in 40 parts of water; the mixture is evaporated to dryness and the product subjected to the action of steam, at about 180° F., for about half an hour. Compare U.S. Pat. 695,198 of 1902; this Journal, 1902, 547.—T. F. B.

Casein-Cellulose Composition, and Process of Producing same. H. V. Dunham, New York, Assignor to Casein Co. of America, New Jersey. U.S. Pat. 748,709, Jan. 5, 1904.

A product resembling celluloid is obtained by mixing together solutions of casein and nitrocellulose in a common solvent, *e.g.*, glacial acetic acid; camphor, or other substance used in the manufacture of celluloid, may also be added to the mixture.—T. F. B.

French Patent.

Paper and Similar Substances; Treatment of ——, to Render them Tougher and more Impervious. Vellumoid Paper Co. Fr. Pat. 335,376, Sept. 18, 1903.

See U.S. Pat. 740,006 of 1903; this J., 1903, 1115.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Rare Earths; Bismuth as an Agent of Separation in the Series of ——. G. Urbain and H. Lacombe. Comptes rend., 1904, **138**, [2], 84—85. (See this J., 1903, 1365.)

The authors find that bismuth, in fractionating, lies between samarium and europium, and thus divides two series. Europium may be considered as the first member of the yttrium series. The authors have based a new method of separation on the following considerations: When a series of isomorphous salts gives uncrystallisable mother-liquors, the latter retain a quantity of crystallisable salt depending on the amount of uncrystallisable compounds they contain; and, similarly, a considerable amount of crystallisable salts will, in crystallising, take down with them a sensible amount of an uncrystallisable salt present in relatively small quantity, and still more of a very soluble crystallisable salt. Thus the uncrystallisable mother-liquors of the double magnesium nitrates retain a certain amount of gadolinium salts. By adding to these a quantity of bismuth magnesium nitrate and crystallising, the gadolinium compounds are partially removed with the bismuth salt, and can be completely removed by repetitions of the treatment. The separation of these salts from the bismuth is, of course, an easy and straightforward operation. A similar process serves to eliminate gadolinium from crude yttrium compounds in which it occurs in small amount.—J. T. D.

Silver, Colloïdal, Pure; Preparation and Properties of ——. A. Chassevant. Bull. Soc. Chim., 1904, **31**, [1], 11.

Colloïdal silver was prepared by the method of Schneider (Ber., 1890, **25**, 1281) by mixing 500 c.c. of 10 per cent. silver nitrate solution, with a solution composed of 500 c.c. of 30 per cent. ferrous sulphate solution and 1,700 c.c. of a solution containing 280 grms. of crystalline sodium citrate. The precipitate thus obtained was collected on the filter pump, re-dissolved in water, and precipitated with twice its volume of alcohol (95 per cent.), the bluish-black precipitate thus obtained being in the soloïd condition. It was filtered out by means of a Chamberland filter. The dry residue was then dissolved off by placing the cylinder in a test-tube containing water. The blocked cylinder appears to act as a dialyser. Solutions of pure colloidal silver have no tendency to precipitate in a geloïd state. Although, in the presence of the mother solution, the silver assumes the insoluble black geloïd form in a few hours, if it be purified from all electrolytic salts, it may be kept for several weeks in the soluble soloid condition. The presence of alcohol, however, retards the influence of the salts in this direction. Colloidal silver, after the addition of alcohol, may be kept for a considerable time, even in the presence of an excess of crystalloïds, without passing into the geloïd state, as it would quickly do in the absence of alcohol. This method of precipitation has been applied to the purification of colloidal silver, which, after two treatments, gave 96·59 per cent. of Ag. This purified product is precipitated in the geloid form by various electrolytes. If its solution be evaporated *in vacuo*, or if the deposit on the Chamberland cylinders be dried, ordinary metallic silver results. The aqueous solution of the soloid form is very stable, and the precipitate on the porcelain may even be preserved in strong alcohol; it is soluble in alcohol, but only in the presence of water, being insoluble in absolute alcohol. It is readily soluble in glycerin, sp. gr. 1·264, and forms organo-soloïds, as indicated by Schneider. After the addition of other colloid substances, such as gum, gelatin, or soda solution of acid-albumose, the mixture may be evaporated *in vacuo*, in the cold, without affecting the physical condition of the silver, which retains its colloidal state and its solubility in water.—J. O. B.

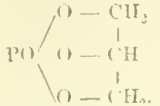
Collodion-Cotton of the German Pharmacopœia. C. Jene. Chem.-Zeit., 1904, **28**, [6], 61.

The author has determined the nitrogen-content of collodion-cotton prepared according to the German Pharmacopœia, and finds it to be on the average 11·9 per cent. The percentage composition of the acid mixture prescribed is 17·43 HNO_3.65·0 H_2SO_4, 17·57 H_2O. The spent acid contains 11·5—12·5 per cent. of HNO_3. The author has never been able, following the directions of the Pharmacopœia, to obtain a preparation completely soluble in a mixture of 1 part of alcohol and 7 parts of ether. As this appears to be the experience of others also, the author suggests that the Pharmacopœial directions should be revised.—J. T. D.

Phosphoric Esters of Glycerol. P. Carré. Comptes rend., 1904, **138**, i, [1], 47—49.

The di- and tri-phosphoric esters of glycerol are hydrolysed by cold water giving ordinary glycerophosphoric acid. The transformation is rapid in the case of the tri-ester but slow with the di-compound; boiling facilitates the reaction greatly but gives rise to a certain amount of free phosphoric acid. Pure glycerophosphoric acid may be obtained in solution by the action of hydrogen sulphide on the lead salt suspended in boiling water, but when the solution is evaporated in a vacuum over sulphuric acid, decomposition begins to take place when the liquid attains the composition, $2PO(OH)_2.OC_3H_5(OH)_2 + H_2O$. The unstable di-phosphoric ester formed by the fixation of two molecules of glycerol on one of phosphoric acid, has not been isolated.

The tri-ester can be readily isolated as a hard, spongy mass, which can be powdered and is insoluble in the ordinary solvents; it has the constitution—



—T. H. P.

Tannalbin; Official Method for the Preparation of and Tests for ——. Supplement to the Dutch Pharmacopœia: through Pharm. Centralhalle, 1903, **44**, [27], 413.

Twenty parts of egg albumin are dissolved in 200 parts of water and filtered; 13 parts of tannin are added to the filtrate; the precipitate formed is collected on a cloth, washed with 200 parts of water, pressed, dried at 30° C., and rubbed to powder. This powder is heated for six hours between 115—120° C. The following are the official tests for tannalbin:—1 grm. is digested at 40° C. for three hours with a solution of 0·25 grm. of pepsin in 100 c.c. of water and 1 c.c. of hydrochloric acid. The insoluble residue, after washing with water and drying, gives the weight A. Another 1 grm. of the tannalbin is similarly treated with a solution of 1·5 grm. of sodium carbonate in 100 c.c. of water; the insoluble residue is washed, dried, and weighed, as before, giving the weight B. The difference between the weights A and B should be not less than 0·2 grm. When reduced to ash, tannalbin should not give more than 1 per cent. of residue.—J. O. B.

Quinine Tannate (*Tasteless*). Supplement to the Dutch Pharmacopœia; through Pharm. Post, 1903, **36**, [41], 583.

Seven grms. of quinine sulphate are dissolved in 14 grms. of alcohol 95—96 per cent., by the heat of the waterbath, and a similar alcoholic solution of tannin, 24 grms., is added with constant stirring. The mixture is then warmed in a covered vessel until it becomes homogeneous. It is then poured into 200 c.c. of water. After occasional stirring, the mixture is allowed to stand for the precipitate to assume a pulverulent condition; it is then collected, pressed, dried at normal temperatures by exposure to air, powdered, and again dried at a temperature not exceeding 30° C. The resulting powder should contain 9·5 per cent. of quinine.—J. O. B.

Geum urbanum [*Wood Avens*]; *Essential Oil of* ——. E. Bourquelot and H. Hérissey. Soc. Pharm. de Paris; through J. Pharm. Chim., 1903, [6], **18**, 369.

The authors find that this essential oil, which was first recorded in 1818 by Tromsdorff, and its resemblance to clove oil indicated in 1844 by A. Buchner, does not occur in the fresh plant, but is developed by the hydrolysing action of a ferment on a glucoside. The fresh plant bruised and macerated for 12 hours in water, gives a small amount of essential oil with a clove-like odour and which contained eugenol. The alcoholic extract obtained by boiling the root with alcohol, of 95 per cent. strength, gives an odourless aqueous solution, which, however, developes a marked clove-like odour when treated with the specific ferment, the glucoside furnishing the oil being split up, so as to yield eugenol, whilst the optical rotation of the solution is deviated from the left to the right.—J. O. B.

Tartaric Acid; Detection of ——, *in Citric Acid.* O. v. Spindler. XXII., page 136.

Formaldehyde; Determination of ——. C. Kippenberger. XXIII., page 138.

Quinine Sulphate; Detection of allied Alkaloids in ——. XXIII., page 136.

United States Patent.

Oxalates [*from Formates*]; *Process of Making* ——. F. Rieche and O. Saame, Assignors to R. Koepp & Co., Oestrich, Rheingau. U.S. Pat. 748,791, Jan. 5, 1904.

See Fr. Pat. 331,408 of 1903; this J., 1903, 1147.—T. F. B.

Acetyl-p-Cresotinic Acid. B. R. Seifert, Assignor to Chem. Fabr. von Heyden, Act.-Ges., Radebeul. U.S. Pat. 749,634, Jan. 12, 1904.

See Eng. Pat. 18,279 of 1903; this J., 1903, 1306.—T. F. B.

French Patents.

Alkaloids from Liquid Vegetable Extracts; Apparatus for Extracting ——. E. Belot. Fr. Pat. 334,937, Aug. 31, 1903.

The apparatus in which the extraction takes place is a long horizontal vessel, divided by vertical walls into a number of compartments. The vegetable extract, *e.g.*, tobacco juice, containing the free alkaloid, is fed in at one corner of the vessel, whilst the non-miscible extracting medium, *e.g.* petroleum spirit, is fed in at the corner diagonally opposite. The two liquids are made to take a zigzag course horizontally through the compartments in counter-currents, whilst circulating pumps, attached to each compartment, withdraw liquor from the bottom, and deliver it again at the top, so that it flows down over zigzag screens arranged in each compartment. In this way a systematic extraction of the alkaloid is effected. The petroleum spirit, charged with alkaloid, is then passed into a separate vessel where it is agitated with dilute acid, and deprived of its alkaloid, the regenerated solvent being returned to the storage tank.

—J. F. B.

Soap containing Lemon Juice. G. Giraudet and A. Neuberger. Fr. Pat. 334,916, Aug. 29, 1903. XII., page 121.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

"Mariotype" and "Ozotype" Processes; Theory of the ——. T. Manly. Phot. J., 1903, **43**, 301.

It is a well-known fact that when a film of gelatin impregnated with potassium bichromate is exposed to light in a practically but not chemically dry state, the gelatin becomes insoluble in water. In the presence of organic matter, light reduces part of the $2CrO_3$ in the salt, yielding $Cr_2O_3 + O_3$. As the bichromate is always in excess, one or more molecules of chromic acid unite with the chromium oxide, forming $Cr_2O_3(CrO_3)n$; while the oxygen liberated combines with the gelatin. The author adduces analogical evidence to show that neither this oxygen, nor the CrO_3 attached to the Cr_2O_3, should play any part in rendering the gelatin insoluble; but that the nascent Cr_2O_3 forms a definite combination with the gelatin which is insoluble. This hypothesis renders it possible to understand the "continuating action of light." When a chemically damp bichromated gelatin plate has been exposed, there is an image composed of $Cr_2O_3CrO_3$ lying in a film containing excess of bichromate and sufficient moisture to make the CrO_3 soluble. This dissolved CrO_3 diffuses through the film, attacks the gelatin that is still soluble, tans it, is reduced to Cr_2O_3, and, as before, immediately withdraws a molecule of CrO_3 from the bichromate, which acts like its predecessor. Thus, where a primary image in chromium is produced, which is afterwards converted into the substance that forms the final print, it is of the utmost importance to preserve the CrO_3; but in ordinary "carbon printing," where the pigmented film holds the sensitive salt, the acid oxide in the complex $Cr_2O_3CrO_3$ is of little or no value. In the *Mariotype Process*, in which well-sized paper coated with bichromate (only) and dried, is exposed till a faint image is visible, and then brought into contact for some 10 hours with a film of bichromated "carbon tissue" which has not been insolated, the CrO_3, or the continuating action of light, is the chief factor concerned.

The Ozotype Process.—In this process also the CrO_3 is the principal reagent, but here it is utilised in making the finished picture, whereas in mariotype it simply starts the action. Neglecting preservatives, &c., the ozotype process is worked by applying a mixture of a manganous salt and a bichromate to paper, and exposing under a negative when dry. The effect of light is to produce $Cr_2O_3(CrO_3)n$ as before, together with manganous chromate (and potassium sulphate as by-product), and the result is that 2 molecules of CrO_3 are set free instead of one. When exposure is complete, the print is washed in such fashion that the CrO_3 is not removed, and it is then brought into close contact with a modified form of carbon tissue, which has been soaked in a weak solution of an acid and a reducing agent (*e.g.*, hydrochloric acid and ferrous sulphate, or acetic acid and quinol). During this operation the 2 molecules of CrO_3 are reduced to one of Cr_2O_3, the ferrous being oxidised to ferric sulphate, and the result is that two of the most energetic tanning agents known are produced in the film. If the quinol (hydroquinone) bath be employed, the acetic acid perhaps liberates the CrO_3, which then yields Cr_2O_3 and quinone, the latter having no action. This liquid is less rapid in its effect than the former, but it may be accelerated by the addition of copper sulphate, which presumably behaves as a catalyser. Mariotype, therefore, depends on the continuating action of light, the CrO_3 derived from the image being reduced by contact with the gelatin, a process which is slow and uncertain, requires the film to be kept moist, and involves the danger of all the bichromate being decomposed and all the gelatin (even in undesirable portions of the picture) becoming insoluble. In ozotype there is no continuation, for all the bichromate is washed away, and the CrO_3 is reduced by a specific reagent, which acts more quickly and satisfactorily. Most metallic chromates (except those of barium and lead) are soluble in bichromate solutions, and perhaps this is the reason why an organic film containing bichromate is insensitive when wet; for a solid and insoluble image of chromium chromate cannot be formed in a solution which dissolves it. Some authorities hold that because a solution of chromium chromate produced by boiling potassium bichromate with grape sugar has only a small effect in rendering gelatin insoluble, oxygen must play a part in the tanning operation; but when the chromate is produced in this manner, it probably consists of $Cr_2O_33CrO_3$, *i.e.*, it contains an excess of its acid constituent, which retards the tanning; while when it is formed by exposure to light it is very basic, *e.g.*, $3Cr_2O_32CrO_3$, and it is the basic radicle that converts the gelatin into an insoluble body.—F. H. L.

Emulsion [*for Process Work*]; *Collodion* ——. Von Hübl. Atel. des Photographen. Brit. J. Phot., 1904, **51**, [2281], 66—67.

The collodion emulsions generally used for process work are, as a rule, sensitized by means of silver salts which increase the colour-sensitising action of any dyestuff. The silver salts of the eosin group of dyestuffs have been employed for this purpose, either alone or in ammoniacal solution. Emulsions prepared in this way have, however, low sensitiveness. Another method consists in treating the plate with a solution of the dyestuff, and, just before exposure, immersing it in a dilute silver nitrate solution. These methods, however, all produce plates, which have a tendency to fog, on account of the presence of soluble silver compounds. The author points out that a dyestuff can only sensitize when it stains the silver bromide of the emulsion, and circumstances which increase or reduce the staining power of the dyestuff will raise or lower the colour-sensitising action. Soluble bromides reduce and finally destroy the staining power of dyestuffs, and consequently are to be avoided, but soluble chlorides have no harmful effects in this direction, therefore it appeared that an emulsion containing silver chloride and silver bromide, and made with a slight excess of chloride, would give satisfactory results. In presence of ammonia, fine-grained bromide emulsions are easily obtained; but, in presence of acids, coarse-grained silver bromide is formed. The following method of preparation was found to give an emulsion of very fine grain and fairly sensitive, containing excess of soluble chloride.—A solution of 50 grms. of silver nitrate in 50 c.c. of ammonia solution (sp. gr. 0·91) to which 100 c.c. of 95 per cent. alcohol has been added, is mixed in the dark with 700 c.c. of a 4 per cent. solution of "celloidin-collodion" in ether-alcohol (1:2). To this is added gradually a solution of 27 grms. of ammonium bromide in 40 c.c. of water, to which is added 100 c.c. of alcohol and 15 c.c. of a lithium chloride solution, made by dissolving 10 grms. of lithium chloride in 10 c.c. of water, adding 90 c.c. of alcohol and filtering. The emulsion is agitated thoroughly and allowed to stand for two or three hours, when it is precipitated by the gradual addition of 300 c.c. of water, with constant agitation, poured into 3 litres of water, and, when settled, washed by decantation, dried as far as possible, and dissolved in a mixture of 350—450 c.c. of alcohol and 400—550 c.c. of ether. The emulsion is about twice as sensitive as a wet collodion plate, and gives gradation similar to that obtained on platinotype paper. Addition of a soluble silver salt does not increase its sensitiveness. Addition of a chromate gives increased contrasts, but reduced sensitiveness. Staining with eosin, however, has the same effect on the contrasts without affecting the speed of the emulsion.

—T. F. B.

English Patent.

Photographic Pictures in Natural Colours; Means for and Method of Printing ——. E. W. Butler, London. Eng. Pat. 8260, April 9, 1903.

A gelatin film is stained with a suitable dyestuff and then sensitised with a soluble bichromate, printed on from a negative and developed in water. The dyestuff must not be affected by the sensitising agent, and must not be too soluble in water. For three-colour work, Fuchsin, Naphthol Yellow and Thion Blue are well suited. The positives may be made separately and then superimposed, or the first colour-positive may be coated with gelatin, stained with the second colour, sensitised and printed in the manner described, and the process repeated for the third colour-positive.—T. F. B.

French Patents.

Developing Photographic Plates and Papers in Daylight, dispensing with a Dark Lamp; Process for ——. Soc. Anon. Prod. Photographiques A. Lumière et ses fils. Fr. Pat. 334,915, Sept. 1, 1903.

Sodium sulphite is mixed with some substance which gives a coloured solution which will absorb actinic rays; this may either be a substance whose aqueous solution is a suitable colour, or one which gives a colour in presence of sodium sulphite. Thus, of the former, Tartrazine, aminoazobenzene, Croceïn Scarlet 3 B, &c. give suitably coloured solutions, but these all give more or less of a colour to the film or paper. Of the latter class of substance, however, picric acid and picrates give, in presence of sodium sulphite, orange-red solutions which absorb actinic rays; picrates, when used in this way, give no stain on the film. The method claimed may, thus, consist of substituting for the sodium sulphite in the developer a mixture of sodium sulphite, 2 parts, magnesium picrate, 1 part.

—T. F. B.

Archetypes; Transformation of Silver Bromide Negatives into ——. M. Barricelli and C. Levi. Fr. Pat. 335,352, Sept. 7, 1903.

See Eng. Pat. 19,434 of 1903; this J., 1903, 1307.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

English Patent.

Explosives; Manufacture of ——. C. E. Bichel, Hamburg. Eng. Pat. 5,791, March 12, 1903.

See Addition, of March 6, 1903, to Fr. Pat. 327,868 of 1902; this J., 1903, 1064.—T. F. B.

United States Patent.

Smokeless Powder Composition. H. Maxim, Brooklyn, U.S.A. U.S. Pat. 748,200, Dec. 29, 1903.

This process for making a smokeless powder composition consists in gelatinising soluble pyroxylin in a solvent which does not dissolve trinitrocellulose, adding a solution of the latter, and precipitating the same in the paste in the act of incorporating the two mixtures. The finished explosive should contain 75 per cent. of soluble nitrocellulose. (Compare Eng. Pat. 13,157 of 1903; this J., 1903, 963.)

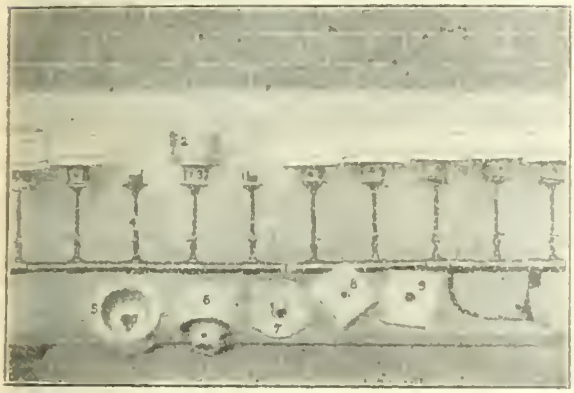
—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Muffles of Graphite or Asbestos. J. M. Pickle and C. B. Williams. J. Amer. Chem. Soc., 1903, **25**, [12], 1277—1280.

Simple muffles for ash determinations, volatilisations, &c., can be readily constructed in the laboratory from asbestos board of about 0·6 c.m. in thickness. The piece cut to the right size is saturated with water, rolled around a cylinder of suitable size, and left to dry. The bottom, in which is a smaller cylinder (with a side hole) fitting on to an Argand burner, is then fixed in, and the whole muffle wired together. The accompanying figure shows a battery of such muffles fitted to Argand burners on the same gas supply-pipe; 7 represents a graphite lid with a small hole under the handle, and 8 and 9 top and bottom views of lids consisting of asbestos board, aluminium plate, and platinum riveted together. For long continued daily use these muffles are not sufficiently durable, nor are they so when constructed of copper coated inside and out with asbestos. When made of graphite, however, coated with asbestos, they have proved perfectly satisfactory in this respect.—C. A. M.



INORGANIC—QUALITATIVE.

Amalgams of Platinum; Behaviour of ——, towards Nitric Acid. N. Tarugi. Gaz. chim. ital., 33, [2], 171—186. Chem. Centr., 1903, **2**, [26], 1475.

According to the author, the process of Knoevenagel and Ebler (this J., 1902, 1296) is not only not an improvement on the ordinary analytical method, but it also opens the way to further sources of error. The separation of bismuth, platinum, and gold by the method cited is not complete. Further, by boiling for a short time, the arsenates are reduced to arsenites, and as such interfere with the reduction of the gold or platinum salts by the hydrazine. Another important source of error is to be found in the fact that when mercury is present, its power of forming amalgams must be taken into account. For instance, platinum behaves quite differently towards nitric acid according to whether mercury is present or not. From a mixture (or amalgam) containing 4·64 per cent. of platinum and 95·35 per cent. of mercury, 99·94 per cent. of the platinum is dissolved by nitric acid; from one containing 38·70 of platinum and 61·20 of mercury, only 29·9 per cent.; and from one containing 90·69 of platinum and 9·30 of mercury, only 4·7 per cent. On the other hand, from a mixture of 91·11 per cent. of mercury and 8·88 per cent. of platinum, 1 per cent. of the mercury is left undissolved by nitric acid; from one containing 62·13 of mercury and 37·86 of platinum, 11·87 per cent.; and from one containing 17·02 of mercury and 82·97 of platinum, as much as 99·5 per cent. Microscopic examination showed that the products obtained by the simultaneous reduction of platinum and mercury salts are amalgams. On the contrary, by the reduction of mixed gold and mercury salts by hydrazine, no amalgams are formed.—A. S.

Vanadic Acid; Colour-reactions of ——, with Ethenol (Vinyl Alcohol). C. Matignon. Comptes rend., 1904, **138**, [2], 82—84.

Ammonium *m*-vanadate solution gives with tannin a blue precipitate or coloration, according to the concentration of the solution. The colour can be detected in a solution containing 2 cb. mm. of vanadium pentoxide per litre. A similar coloration is given by gallic acid, pyrogallol, and (less sensitive) catechol, but not by quinol, resorcinol, phloroglucinol, nor guaiacol. In all cases, the colour vanishes on heating the liquid, and reappears on cooling. The addition of ether frequently, but not always, increases considerably the delicacy of the reaction with pyrogallol, and the author has traced this effect to the small amounts of ethenol contained in some, but not in all, commercial samples of ether. By partial evaporation of an "active" ether, thus concentrating the ethenol in the residue, the "activity" of the residue is raised, and the coloration is obtainable with a solution containing 0·02 cb. mm. of vanadium pentoxide per litre. An inactive ether can be rendered active by passing through it a current of ozonised oxygen, and then leaving it at rest for some months. Ferric salts and chromates, which also give colorations with the reagent, must be removed before testing for vanadates.—J. T. D.

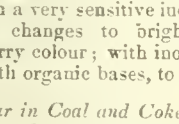
INORGANIC—QUANTITATIVE.

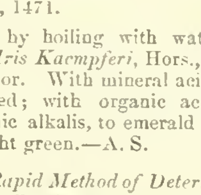
Extract from Iris Blossoms as an Indicator. A. Ossendowsky. J. russ. phys.-chem. Ges., **35**, 845—846. Chem. Centr., 1903, **2**, [26], 1471.

The violet solution obtained by boiling with water the blossoms of the Japanese iris, *Iris Kaempferi*, Hors., is said to form a very sensitive indicator. With mineral acids, the colour changes to bright red; with organic acids, to raspberry colour; with inorganic alkalis, to emerald green; and with organic bases, to bright green.—A. S.

Sulphur in Coal and Coke; Rapid Method of Determining ——. J. D. Pennock and D. A. Morton. J. Amer. Chem. Soc., 1903, **25**, [12], 1265—1269.

This method is essentially a combination of Sundstrom's process of oxidation with sodium peroxide (this J., 1903, 381) and of Andrews' volumetric method of determining sulphur. About 16 grms. of sodium peroxide and 0·7 grm. of coal (or 11·5 grms. of sodium peroxide, and 0·7 grm. of coke) are thoroughly mixed in the crucible by means of a spatula. The crucible (see figure) is made of soft steel, nickel plated, and has a small hole ($\frac{1}{4}$ in. diameter at top, and $\frac{3}{32}$ in. at the bottom) in the lid for the introduction of a hot wire. The thickness of the walls is $\frac{1}{32}$ in., and the capacity of the crucible about 40 c.c. A suitable stand can be made from a sheet of aluminium cut as shown by the heavy lines in the diagram, and the four points marked A, and the corners B, bent downwards. The covered crucible is placed on the stand in a 20-oz. beaker containing sufficient water to reach about half way up the outside of the crucible, and the contents ignited by the introduction of a red-hot iron wire through the hole. After about three minutes the stand is removed, and the crucible turned over into the water and subsequently washed out and withdrawn. The solution is acidified with hydrochloric acid and boiled, then treated with ammonia in slight excess, vigorously boiled for a minute, and mixed with 15 c.c. of barium chromate

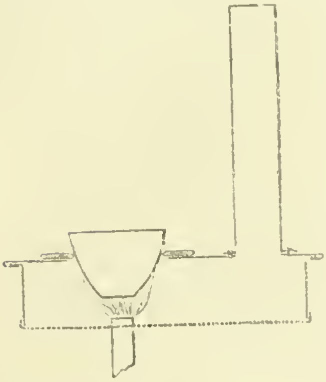




solution (prepared by dissolving 23 grms. of pure barium chromate in a mixture of 80 c.c. of strong hydrochloric acid and 920 c.c. of water). The boiling solution is then diluted to 200 c.c., a very slight excess of ammonia added, and the liquid again boiled for one or two minutes. The precipitated barium sulphate is then filtered off and washed twice with 20 to 30 c.c. of hot water. About 1 grm. of potassium iodide is added to the filtrate which is then cooled to 30° C. and titrated with N/10 sodium thiosulphate solution, the number of c.c. required multiplied by the factor 0·153 giving the required percentage of sulphur. The results obtained in more than 1,000 determinations by this method have shown that it is accurate to within a few hundredths of a per cent., whilst two or three complete determinations can be made in an hour. Typical results obtained by this and by Eschka's method (this J., 1891, 952, and 1893, 465) are given in the paper.—C. A. M.

Sulphur; Determination of ——, by Eschka's Method. O. Pfeiffer. Chem.-Zeit., 1904, **28**, [4], 38.

In order to obtain results by the Eschka method not vitiated by the presence of sulphur compounds in the products of combustion of coal gas, the author uses the device shown in the accompanying figure. It consists essentially of a box of thin sheet iron, open at the bottom, which is placed over the ring of a tripod. Two holes are provided for the insertion of the crucible and of a chimney respectively. An asbestos ring is placed round the crucible, and the joint is rendered air-tight by means of soluble glass (sodium silicate). In a blank experiment with this arrangement, in which a quantity of the Eschka oxidising mixture was heated in the crucible for eight hours, no sulphur was absorbed. The author has obtained good results with the Eschka method in the determination of the vulcanisation sulphur in india-rubber.—A. S.



Phosphoric Oxide; Calculation of Amount of ——, in Magnesium Pyrophosphate. T. Kämpfer. Zeits. anal. Chem., 1894, **43**, [1].

A 25 page supplement to this issue, giving the amount of phosphorus pentoxide corresponding to each 1/10 mgrm. of magnesium pyrophosphate, from 0·0001 grm. to 0·4000 grm. —J. T. D.

Hypochlorous Acid; New Method for the Detection and Determination of ——. E. Klimenko. Zeits. anal. Chem., 1903, **42**, 718—724.

As is well known, a solution of hypochlorous acid acidified with hydrochloric acid liberates iodine from potassium iodide, the amount of liberated iodine being proportional to the quantity of hypochlorous acid; the reaction is represented by the equation—$HClO + HCl + 2KI = H_2O + 2KCl + I_2$. If, however, potassium iodide be added to a solution of hypochlorous acid containing no hydrochloric acid, only one atom of iodine is liberated, that is, one-half the quantity. The addition of hydrochloric acid causes the other half to be set free. This fact forms the basis of the method described, the reaction being particularly useful for the determination of hypochlorous acid in solutions containing free chlorine. A known volume of the solution is treated with potassium iodide solution and the liberated iodine titrated with a standard solution of sodium thiosulphate. The quantity of the latter used gives the iodine set free by the chlorine and hypochlorous acid. The titrated solution is then acidified with hydrochloric acid, when a further amount of iodine is liberated corresponding to one-half the hypochlorous acid present. This is also titrated. The iodine due to chlorine may then be calculated from the two titrations. Should there be no further liberation of iodine on acidifying the solution after the first titration, no hypochlorous acid is present. The solution of potassium iodide employed should not be more than 8 per cent. in strength.—W. P. S.

Ammonia; Gasometric and Gravimetric Methods for Determining ——. E. Riegler. Zeits. anal. Chem., 1903, **42**, 677—686.

Both methods depend upon the fact that ammonia, or its salts, form ammonium tri-iodate when treated with excess of iodic acid. This tri-iodate is insoluble in dilute alcohol, the equation showing its formation being—$NH_4Cl + 3HIO_3 = NH_4.H_2(IO_3)_3 + HCl$. By acting on ammonium tri-iodate with hydrazine sulphate, nitrogen is liberated according to the equation—$2[NH_4.H_2(IO_3)_3] + 9N_2H_4.H_2SO_4 = (NH_4)_2SO_4 + 8H_2SO_4 + 6HI + 18H_2O + 9N_2$. The details of the gasometric method are as follows: 5 c.c. of a 20 per cent. iodic acid solution are placed in a small Erlenmeyer flask, 10 c.c. of the ammonia solution containing not more than 0·014 grm. of NH_3, are added, and finally 25 c.c. of 95 per cent. alcohol. The flask is closed, well shaken, and allowed to stand for one hour. The crystalline precipitate is then collected on a small filter and washed with 95 per cent. alcohol until free from iodic acid. The filter and its contents are now pressed between blotting-paper to remove most of the alcohol, and then transferred to the evolution flask of an apparatus where the treatment with hydrazine sulphate is carried out (see this J., 1902, 73). 50 c.c. of a 2 per cent. solution of the latter will be found sufficient. The volume of nitrogen liberated is read off and calculated to normal temperature and pressure. 1 c.c. of nitrogen at 0° C. and 760 m.m. pressure corresponds to 0·17 mgrm. of ammonia, or 1 mgrm. of nitrogen to 0·1351 mgrm. of ammonia. According to the gravimetric method, a quantity of iodic acid, corresponding to about 30 times the amount of ammonia to be determined, is dissolved in 15 c.c. of water, the ammonia solution is added and also 30 c.c. of 95 per cent. alcohol. After shaking, the mixture is allowed to stand for two hours in a closed flask. The precipitate is then collected on a tared filter, washed with 95 per cent. alcohol and dried in a desiccator over sulphuric acid. The weight of the precipitate obtained is multiplied by the factor 0·0314 to give the amount of ammonia in grms.—W. P. S.

Sulphides Thiosulphates and Haloids; Determination of ——, [in Mixtures of the same]. W. Feld. Zeits. anal. Chem., 1903, **42**, 708—711.

When only sulphides and haloids are present, a portion of the sample is distilled with the addition of magnesium sulphate in a current of carbon dioxide. A suitable apparatus is described in this J., 1903, 1186. The liberated hydrogen sulphide is collected as it distils over in a known quantity of standard iodine solution. The halogen salts remaining in the distillation flask are then precipitated with silver solution as usual. An alternative method is to precipitate both haloid and sulphide with an excess of standard silver solution, dilute to a known volume, and determine the excess of silver in the solution. The total precipitate is then distilled with hydrochloric acid and some sheet aluminium in a current of carbon dioxide, the hydrogen sulphide formed being collected in standard iodine solution. The difference between the total silver in the precipitate and the amount present as sulphide gives the quantity of silver combined with the haloids. Should the substance under examination contain sulphides, thiosulphates, and haloids, a portion is boiled with the addition of mercuric oxide. All the sulphur compounds are precipitated as mercuric sulphide. Alkaline solutions must be previously treated with magnesium sulphate and acid solutions with magnesium oxide. The mercuric sulphide is filtered off, and the haloids determined in the filtrate. A separate portion of the substance is taken for the determination of the sulphur compounds (see this J., 1903, 1186). If ammonium salts be present, a preliminary distillation with magnesium oxide is necessary before determining the haloids.—W. P. S.

Alkali Iodates and Chlorates; Reduction of ——, by Hydrazine Sulphate. M. Schlötter. Zeits. anorg. Chem., 1904, **38**, [2], 184—190.

Alkali iodates are rapidly and quantitatively reduced to iodides by the action of hydrazine sulphate. The reaction appears to proceed in two stages, represented by the equations—

$$5(N_2H_4.H_2SO_4) + 4HIO_3 =$$
$$5N_2 + 12H_2O + 5H_2SO_4 + 4I;$$

$$4I + NH_2.NH_2 = 4HI + N_2.$$

Alkali chlorates are also quantitatively reduced to chlorides by the action of hydrazine sulphate, but in this case, it is necessary to boil the mixed solutions for two to three hours. (See also this J., 1904, 36.)—A. S.

Bleaching Powder, Method of determining Available Chlorine in ——. J. Pontius. Chem.-Zeit., 1904, **28**, [6], 59—60.

Weigh off 7·1 grms. of bleach, triturate with water in the usual way, dilute to 1 litre, and use for titration 50 c.c. (= 0·355 grm.). Weigh or measure roughly 3 grms. of sodium bicarbonate into a flask, and pour upon it the measured volume of bleach solution from the pipette, so as to mix thoroughly. Add 1—2 c.c. of starch paste, and then from a burette run in N/10 potassium iodide solution, shaking well after each addition. The first portions of iodide produce a red-brown coloration, which rapidly disappears. As the titration approaches the end, the red-brown colour becomes more blue, and at the last each drop strikes a strong blue colour, which completely disappears on shaking. When the next drop fails to produce this coloration, but gives only a permanent faint light-blue tint, the titration is ended. The solution of the bleach, the decomposition by sodium bicarbonate, and the titration, are represented by the equations—

$$6CaOCl_2 = 3CaCl_2 + 3Ca(OCl)_2;$$

$$3CaCl_2 + 3Ca(OCl)_2 + 6NaHCO_3 =$$
$$6CaCO_3 + 6NaCl + 6HOCl;$$

$$6HOCl + 6NaHCO_3 + 2KI =$$
$$2KIO_3 + 6NaCl + 6CO_2 + 6H_2O;$$

so that one-sixth molecule ($\frac{166}{6} = 27 \cdot 667$ grms.) of potassium iodide is equivalent to one atom of chlorine. The suspended calcium carbonate does not interfere with the reaction. If pure potassium iodide is not at hand, from which an accurately decinormal solution can be prepared directly, the solution is best standardised by comparison with an accurate Penot solution on a sample of bleach. For rapid work, the titration can be carried out in the mortar, weighing off 1 grm. of the bleach, and using an empirical solution (7·7935 grm. per litre) of iodide, such that 1 c.c. = 0·01 grm. of chlorine. In this case, care must be taken that none of the pasty bleach sticks to the sides of the mortar, and thus fails to enter into reaction. The method is available for bleaching liquids; but if these contain alkali hydroxide or carbonate, boric acid must be added—an excess of this does no harm. The bleach solution has no action on the starch during the time occupied in the titration. The one necessary precaution is to have excess of sodium bicarbonate present.—J. T. D.

Manganese Peroxide; Titration of ——. L. Débourdeaux. Comptes rend., 1904, **138**, [2], 88—89.

The substance (0·75—1·0 grm.) is dissolved in 50 c.c. of a solution containing 40 grms. of crystallised oxalic acid and 120 c.c. of strong sulphuric acid in the litre, the flask being connected to a reflux condenser so as to avoid concentration when the liquid is heated. The resulting solution is diluted to 200 c.c., and 50 c.c. of the oxalic-sulphuric solution are also diluted to 200 c.c. The oxalic acid in 150 c.c. of each is determined by permanganate, and from the difference the amount of peroxide is calculated. In the remaining 50 c.c. of each, the free acid is titrated by standard ammonia solution, using fluoresceïn as an indicator. The difference gives the amount of acid (which can of course be calculated into hydrochloric acid) needed for solution. The process is rapid, and needs little continuous attention; the two determinations are made on one portion of the substance; carbonates do not interfere, and it suppresses errors occurring in the hydrochloric acid method, from the titration of the hydrochloric acid needed with the ammoniacal copper sulphate, from incomplete absorption of chlorine, and from free iodine arising from the decomposition of the potassium iodide. The oxalic-sulphuric solution containing manganese, prepared for the determination of nitric acid by the author's method (this J., 1903, 883) can be used for this titration also.—J. T. D.

Antimony and Tin; Separation of ——, by means of Oxalic Acid. F. Henz. Zeits. anorg. Chem., 37, 1. Analyst, 1904, **29**, [334], 13—14.

The author, having been unable to effect a complete separation of these metals by Clarke's method as modified by Rössing (Zeits. anal. Chem., **41**, 1), has devised the following method, in which hydrogen peroxide is employed for a preliminary oxidation:—The sulphide solution, containing not more than 0·3 grm. of the alloy, is mixed with 6 grms. of pure potassium hydroxide, and 3 grms. of tartaric acid, and decolorised by means of hydrogen peroxide solution (30 per cent.). The liquid is next boiled for a short time, allowed to cool slightly, and then treated with a hot solution of 15 grms. of oxalic acid. It is again boiled for 10 minutes, after which a current of hydrogen sulphide is introduced, the solution being kept boiling. Fifteen minutes after the first signs of precipitation of the antimony, the liquid, the volume of which is about 80 to 100 c.c., is diluted to 250 c.c. with boiling water. After 15 minutes longer the boiling is stopped, though the current of gas is still continued for 10 minutes more. The precipitate is now collected on a weighed Gooch's crucible, and washed with a boiling 1 per cent. solution of oxalic acid (twice) and then with very dilute boiling acetic acid, both solutions being also saturated with hydrogen sulphide. The Gooch's crucible is then placed in a tube, through which is drawn a current of dry carbon dioxide, the tube being meanwhile heated first at 100°—130° C. until the precipitate is dry, and then at 300° C. until it has been completely converted into the sulphide, Sb_2S_3. The heating is preferably done with the aid of a small drying oven, in which is placed the part of the tube containing the crucible. A perforated rubber cork was found the best means of closing the larger end of the tube, a Rose's crucible lid being used to protect it from radiant heat. The author has found this method more satisfactory than electrolytic methods or conversion of the sulphide into tetroxide. The tin in the filtrate is best determined electrolytically after concentration of the solution. Suitable conditions are:—Voltage, 2 to 3; amperage, 0·2 to 0·3; and temperature, 60° to 80° C. After 6 hours, 5 c.c. of sulphuric acid (1 : 1) are added, and the electrolysis continued for 18 hours longer. Under these conditions the tin is completely separated as an adherent deposit. In test experiments the results were slightly too low for tin, but were nearly theoretical in the case of antimony. When tin is obtained as a sulphide in an analysis, it may be dissolved by means of ammonium hydrogen oxalate and the solution electrolysed, a little dilute sulphuric acid being added after a few hours, as described above.
—C. A. M.

Aluminium; Application of the Reducing Power of ——, in Quantitative Analysis. N. Tarugi. Gazz. chim. ital., 1903, **33**, [2], 223. Chem.-Zeit., 1904, **28**, [3], Rep. 4.

If a piece of pure aluminium foil be introduced into a solution of silver nitrate acidified with sulphuric acid and the whole heated to boiling, the silver is quantitatively precipitated as metal in the course of two to three hours, and can be filtered off, washed, dried and, weighed. The precipitation of metallic copper from copper sulphate solution, under similar conditions, is not complete.—A. S.

Persulphate; Quantitative Separations by means of ——. G. v. Knorre. Zeits. anal. Chem., 1904, **43**, [1], 1—14. (See v. Knorre, this J., 1902, 72; 1903, 1104. Dittrich and Hassel, this J., 1902, 1414; 1903, 46, 230; Baubigny, this J., 1903, 45, 381, 823, 864.)

The author had previously found that manganese peroxide, precipitated by persulphate from manganese solutions containing other metals, always carried down with it small amounts of the oxides of these metals. Dittrich and Hassel, on the other hand, state that by taking certain precautions the precipitated manganese peroxide is obtained perfectly pure, and they recommend the method as a means of separating manganese from these other metals. The author has very carefully repeated Dittrich and Hassel's experiments, adhering rigidly to the detailed conditions described by them, and has found that in the case of every metal used (copper, zinc, calcium, nickel, magnesium), except chromium, some of the oxide was carried down with the manganese peroxide. Even when the precipitate was washed with boiling 2 per cent. nitric acid, the co-precipitated oxide was not removed. Moreover, the results were not worse when the author's method of precipitating (heating the cold mixture of test-liquid and persulphate on gauze over a flame, and boiling for 5 or 6 minutes) was used, than when Dittrich and Hassel's (heating up in a water-bath, and keeping there for 2—3 hours) was used. Baubigny, too, has found that alkalis, when their salts are present, go down with the peroxide; and he also finds precipitation to be complete after 20—25 minutes on the water-bath. In the case of chromium (as Salinger first proved, in work undertaken at the author's suggestion) the separation from manganese is perfect. When the mixed manganese and chromium salts are heated to boiling in acid solution with persulphate, the chromium is completely converted into chromic acid, and this, having no basic character, has no tendency to precipitate with the manganese peroxide; the chromic acid can be washed out completely by cold water. In a separation by this method the author found 0·6058 grm. instead of 0·6055 grm. of Mn_3O_4, and 0·2774 grm. instead of 0·2772 grm. of Cr_2O_3.—J. T. D.

Tungsten in Tungsten Steel and Ferrotungsten; Determination of ——. E. Kuklin. Stahl u. Eisen, 1904, **24**, [1], 27.

The method is based on the facts that metatungstic acid, liberated from tungstates by acids in presence of phosphoric acid, is reduced by zinc to tungsten dioxide, WO_2, which is then reconverted into WO_3 by permanganate. Two grams of steel are dissolved in one volume of sulphuric acid (sp. gr. 1·84), one volume of phosphoric acid (sp. gr. 1·70), and six volumes of water, adding from time to time 3 c.c. of permanganate solution, so as to maintain a rose-coloration in the liquid, and warming at the end to complete the solution. The cooled liquid is brought into a measuring flask, and half of it used for the titration. To this is added 200 c.c. of 1 : 3 sulphuric acid and 40 grms. of zinc turnings, and the solution is heated. When it is port wine coloured, it is allowed to cool in a stream of carbon dioxide, filtered to separate the excess of zinc, and titrated with permanganate. In the other half of the solution the iron is determined by Reinhardt's method, or by stannous chloride and iodide; and the difference between the two titrations gives the tungsten. Ferrotungsten (0·5 grm.) is heated in a platinum crucible with fused ammonium nitrate, the nitrate destroyed by heating, and the remaining oxides fused with potassium-sodium carbonate. The fused mass is dissolved in water, treated with the acid mixture as above, and titrated. Or the ferrotungsten may be fused with sodium bisulphate, the melt dissolved in water, sodium carbonate added, then the acid mixture as above, and the operation continued as for tungsten steel.—J. T. D.

Alkaline-Earth Metals; Electrolytic Separation of ——. A. Coehn and W. Kettembeil. Zeits. anorg. Chem., 1904, **38**, [2], 198—212.

The authors have previously shown (this Journal, 1901, 1221) that the E.M.F. required for the deposition of certain metals (zinc, cadmium, silver, copper, and iron) can be reduced by using a mercury cathode, with which the metal deposited forms an amalgam. They now find that by making use of this fact, the electrolytic separation of the alkaline-earth metals can be effected. Saturated solutions of barium, strontium, and calcium chlorides were electrolysed at 15°—18° C., in a glass dish, 6 cm. in diameter and 3 cm. high, using a mercury cathode with a surface of about 28 sq. cm., and a platinum wire spiral as anode. It was found that the E.M.F. at which amalgam was first formed was 0·2 volt lower in the case of barium than of strontium, and 0·25 volt lower in the case of strontium than of calcium. Electrolytic tests with solutions containing both barium and strontium chlorides gave the following results:—

E.M.F.	Time.	Barium present.	Barium found.	Difference.
Volts.	Mins.	Grms.	Grms.	Per Cent.
2·02—2·08	180	0·1362	0·1379	+ 1·25
2·00—2·14	250	0·1362	0·1362	± 0·0
2·00—1·90	225	0·2781	0·2782	+ 0·03
1·95	155	0·2781	0·2790	+ 0·3
1·75—1·85	180	0·2781	0·2788	+ 0·3

The method also gives satisfactory results for the separation of barium and calcium, and of strontium and calcium.
—A. S.

Soaps; Determination of Small Proportions of Sodium Hydroxide and Carbonate in ——. P. Heermann. Chem.-Zeit., 1904, **28**, [5], 53; [6], 60—61.

The best methods for determining sodium hydroxide are:—(1) Salt out the soap from dilute aqueous solution, filter, precipitate the carbonate from the filtrate by means of barium chloride, and titrate the hydroxide with acid and phenolphthaleïn. The large amount of sodium chloride present affects the titration, and needs a correction, which bears a serious proportion to the total amount of hydroxide present, and the indication is not very sharp. The barium chloride method is, however, better. (2) Dissolve 5—10 grms. of the soap in 250 c.c. of freshly boiled water, and add 10—15 c.c. of barium chloride solution (300 grms. per litre) which has been neutralised by addition of N/10 sodium hydroxide solution to incipient reddening of phenolphthaleïn. Warm till the precipitate of barium soap and barium carbonate collects together, collect it on the end of a rod, pour off the clear liquid, wash the precipitate on the rod and on the sides of the beaker a few times, and titrate the clear liquid at once. The titration is sharp, is not interfered with by the excess of barium chloride, and may be carried out with either sulphuric or hydrochloric acid. Sodium carbonate may be determined in either of two ways: (3) Determine the hydroxide as in (1) above; then repeat on another portion, not precipitating with barium chloride, but titrating the total alkali, using Methyl Orange as indicator. The difference between (3) and (1) represents the carbonate. (4) Dry the soap in shavings, dissolve in absolute alcohol, completely carbonate the alkali by passing carbon dioxide through the solution, filter, thoroughly wash the sodium carbonate on the filter with absolute alcohol, dissolve it in hot water, and titrate with acid and Methyl Orange. The difference between (4) and (2) gives the carbonate. This is the better method of the two. In the qualitative search for free alkali in soaps, mercuric chloride is in general (though not in the case of resin soaps) more sensitive than mercuric nitrate.—J. T. D.

Sulphuric Acid in Leather; Determination of ——. M. C. Lamb and J. W. Lamb. Leather Trades Rev., 1904, [930], 25—27.

The authors describe an indirect and volumetric method for the determination of free sulphuric acid in leather. Two similar quantities are oxidised, the free acid being previously fixed with a base in one portion only. The residues are dissolved, the sulphuric acid is precipitated as benzidine sulphate, and this is titrated with standard alkali, the difference in titre being a measure of the free acid in the leather.

(*a*) *Total Free and Combined Acid.*—The shredded leather (5 grms.) is dissolved in a flask on the water-bath by pure caustic soda solution (25 c.c. of 10 per cent. strength), and sufficient water to cover the material. The liquid is then made acid to phenolphthaleïn with strong hydrochloric acid (20—25 c.c.), filtered, and, with the washings, evaporated to dryness in a platinum dish. The contents are ignited, dissolved in a little weak hydrochloric acid (30 c.c. of normal solution), diluted, filtered if necessary, the filtrate treated with benzidine hydrochloride solution (see this

Journal, 1903, 883, 925, 1104), 200 c.c., and the mixture allowed to stand for 15—20 minutes. It is then filtered at the pump, on a porcelain disc, with two well-fitting papers, the flask being rinsed out by means of the filtrate, which should also be tested for complete precipitation. The precipitate is washed with 10 c.c. of water twice (the last should be neutral to litmus), and transferred, together with the filter paper, to a flask, and there broken down in water (50 c.c.) by violent agitation of the flask when stoppered. The contents are now titrated with N/10 caustic soda solution, using phenolphthalein as indicator, and when apparently just alkaline, heated to 50°—60° C.; the faint alkalinity is restored by further titration, and again after boiling, the total volume (*a*) of N/10 alkali being recorded.

(*b*) *Combined Acid only.*—Another portion of the leather (5 grms.) is gently coked in a platinum dish, the carbon is burnt off in a stream of oxygen gas at a minimum temperature to avoid loss of sulphates, and the residual ash is strongly ignited over the blow-pipe for five minutes. It is then dissolved in weak hydrochloric acid, the solution filtered, and the sulphuric acid determined as in *a*. If b = the number of c.c. of N/10 caustic soda solution required, then $(a - b) \times 0{\cdot}098$ = percentage amount of free sulphuric acid in the leather.

Preparation of Benzidine Hydrochloride.—Commercial benzidine (12·5 grms.) is ground up in a mortar with water (50 c.c.), transferred with hot water to a litre flask, and after addition of strong hydrochloric acid (15 c.c.) made up to the mark. This solution is filtered and diluted to 5 litres for use as reagent, of which 100 c.c. precipitates about 0·1 grm. of sulphuric acid, representing 2 per cent of acid in 5 grms. of leather.—R. L. J.

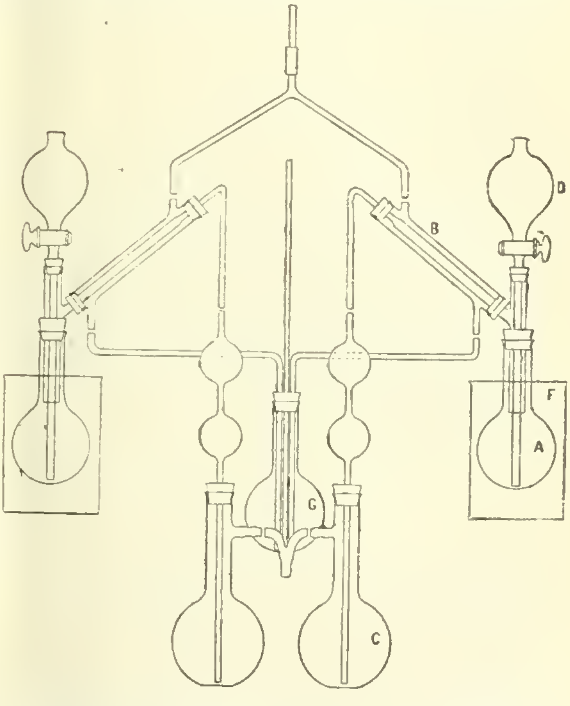
Nitrates; Determination of Traces of ——, in Liquids charged with Organic Matters. A. Pagnoul. Bull. de l'Assoc. des Chim. de Sucr. et de Dist., 1903, **21**, [6], 602—608.

The reagents required are: solution of basic lead acetate; animal charcoal in impalpable powder and absolutely freed from traces of nitrates by being heated in a closed platinum crucible to a red heat; an alkaline solution of potassium permanganate, made by dissolving in hot water 10 grms. of sodium hydroxide and 40 of permanganate, and making up to a litre; Grandval and Lajoux's reagent, obtained by dissolving in the cold 10 grms. of crystallised phenol in 70 c.c. of pure sulphuric acid. The comparison tint is prepared as follows:—A quantity of sodium nitrate solution, equal to 1 mgrm. of nitrogen, is introduced into a 100-c.c. flask and made up to the mark; 10 c.c. of this are evaporated to dryness in a porcelain dish and 15 drops of the phenol reagent stirred in, then ammonia added drop by drop until the yellow coloration due to ammonium picrate is persistent. This represents 1 mgrm. of nitric nitrogen per litre. Several solutions are prepared in sealed tubes for making comparisons. In making determinations in beetroot juice or pulp, lead acetate is added and the measured solution filtered. An aliquot portion is taken and boiled with the alkaline permanganate, which is added until a pink coloration remains, when a little animal charcoal is added. The cold colourless solution, now free from organic matter, is made up to a definite volume, filtered, and treated as when making the standards. With juice from a beetroot distillery the author found 27 mgrms. per 100 c.c., in fresh pulp 21, and in molasses 62 mgrms. Leaves of plants should be first dried at 100°—110° C. to separate the nitrates.—L. J. de W.

Ammonia and Asparagine; Determination of by the Sachsse-Schloesing-Longi Method. H. T. Brown and J. H. Millar. Trans. of the Guiness Research Lab., 1903, **1**, [1], 25—29.

The distillation of ammonia from solutions containing other nitrogenous matters capable of forming ammonia (*e.g.*, amides and amino acids) must be effected in presence of magnesia and at temperatures not exceeding 40° C., under reduced pressure. The authors have devised a modification of Longi's apparatus for conducting this distillation, whereby certain defects of the latter are corrected. The improved apparatus is shown in the figure, in duplicate form. A is a flask of about 600 c.c. capacity, having a wide glass tube passing through a caoutchouc plug. Above the plug a side-piece is fused into the tube, and continued so as to form the inner tube of an inclined reflux condenser, B. Its further end is then bent downwards and connected with a tube having two bulbs and dipping into a large flask, C, containing standard sulphuric acid. The neck of the flask C is connected with the water-pump. D is a tap-funnel for introducing the liquid into the distillation flask, and F is a water-bath, which maintains the desired temperature of distillation. The flask G belongs to a system which keeps the condenser B supplied with warm water at such a temperature that the inner tube is always kept dry, so that no condensation and return of ammonia can take place. Magnesia suspended in water is placed in the flask A, the liquid to be distilled is introduced by the funnel D and the pressure in the whole apparatus is reduced to 10 mm.; the contents of the flask can then be boiled to dryness, if desired, at a temperature of 35° C. In this apparatus, from pure ammonium chloride, ammonia corresponding to 99 per cent. of the salt was distilled. In a mixture of ammonium chloride, asparagine, and aspartic acid, the ammonium chloride found amounted to 96·5 per cent. of the quantity added. In the determination of asparagine, the amidic nitrogen must first be converted into ammonia by hydrolysis with acid. For this purpose it is preferable to boil the asparagine with hydrochloric acid (10 c.c. of strong acid diluted to 100 c.c.) for 2—6 hours. The results obtained on subsequent distillation with magnesia are constantly too low, and must be increased by 5 per cent. Alternatively, hydrolysis may be effected by boiling with 5 per cent. oxalic acid for 10 hours, in which case the results are to be increased by 10 per cent.

—J. F. B.



ORGANIC—QUALITATIVE.

Gallotannic Acid; Detection of ——, on the Fibre. A. Menger. Färber-Zeit., 1903, **14**, [24], 435—436.

A small portion of the textile material is boiled for a very short time with a 5—10 per cent. solution of caustic soda. The solution is divided into two parts, one of which is cooled, the other being again heated to boiling. The appearances of the two parts are then compared. In the absence of any dyestuff which may affect the result, the presence of gallotannic acid is indicated by the distinct reddish colour of that part of the solution which has been heated for a short time only, conjointly with the absence of colour from, or mere pale yellow colour of, that portion which has been heated for a longer time. Catechutannic acid gives with the alkali solution a reddish coloration, which is not altered by boiling.—E. B.

Sperm Oil; Examination of ——. L. M. Nash. Analyst, 1904, **29**, [334], 3—4.

The residue left on saponification of sperm oil is soluble in absolute alcohol, whereas mineral oils are practically insoluble. But since mineral oils are soluble in a mixture of ethyl alcohol and alcohols from sperm oil, the test affords no proof of the freedom of a sample of sperm oil from mineral oils. By substituting rectified spirit for absolute alcohol as the solvent, a much smaller proportion of mineral oil is dissolved, as is shown in the following results, obtained with a sample of American lubricating oil of sp. gr. 0·905 :—

Absolute Alcohol.	Sperm Alcohols added.	Temperature.	Mineral Oil dissolved by Absolute Alcohol.	Mineral Oil dissolved by Rectified Spirit (Sp. Gr. 0·845).
Volumes.	Volumes.	° F.	Volumes.	Volumes.
100	0	70	2	Trace
100	4	70	4	Trace
100	10	70	8	1
100	40	70	100	18
100	40	100	175	20
100	100	70	Any amount	100

—C. A. M.

Linseed Oil from Boiled Oils; Differentiation of ——. J. Lewkowitsch. Analyst, 1904, **29**, [334], 2.

The author's experiments on the determination of the amount of insoluble bromides yielded by the glycerides (this Journal, 1899, 77; 1903, 595) have confirmed his conclusion that the test can be used to differentiate between drying oils and those boiled either with or without driers. He gives a table showing the yields of bromides, together with the specific gravities and iodine values of different specimens of oil, from which the following results are selected as typical :—

Oil.	Specific Gravity.	Iodine Value.	Insoluble Bromide.
			Per cent.
1. Linseed oil	0·9308	186·4	24·17
2. Pale boiled oil	0·9429	171·0	20·97
3. Double boiled oil	0·9449	169·96	13·03
4. Linseed oil heated to 600° F......	0·9354	176·3	8·44
5. Linseed oil blown at 120° C. for 10 hours.	0·9460	166·6	23·16
6. Ozonised oil	0·9310	180·1	36·26—36·34
7. "Thin" lithographic varnish	0·9691	125·3	2·09
8. "Medium" " "	0·9693	121·9	0·95
9. Burnt " "	..	102·69	None

The yields of bromide given by No. 6 (derived from Baltic oil) and some other linseed oils were remarkably high, as were also the iodine values of the fresh oils. In the author's opinion some of his experiments with good drying oils furnish additional evidence against the assumption that there is a direct ratio between the iodine value and oxygen absorption of oils.—C. A. M.

Cod-Liver Oil and its Adulterants; Tests for ——. E. H. Gane. Amer. Pharm. Assoc.; through Amer. J. Pharm., 1903, **75**, [9], 430.

The following tests are suggested as indicating a pure oil :—Half an ounce of the oil in a test-tube should remain perfectly clear when immersed in ice for two hours. One fluid drachm of the oil is saponified by boiling with alcoholic potash solution; the soap solution is diluted with 2 fluid ounces of water and heated to expel the alcohol. The fatty acids are then liberated by an excess of hydrochloric acid, and their odour noted. Twenty drops of the oil are placed in a watch glass, and 5 drops of strong nitric acid added. On well stirring together, the oil, if pure, gives a rose-red tint, changing, in half an hour, to lemon-yellow.—J. O. B.

Tartaric Acid; Characteristic Reaction of Free ——. D. Ganassini. Boll. Chim. Farm., **42**, 513—516. Chem. Centr., 1903, **2**, [26], 1476.

Free tartaric acid can be distinguished from formic, acetic, propionic, butyric, valeric, oxalic, succinic, malic and citric acids by the following reaction. The solution, free from mineral acids, is treated with a somewhat larger amount of minium, Pb_3O_4, than corresponds to the quantity of tartaric acid present, the mixture is heated to boiling for a short time, decanted or filtered, a small quantity of a 2 per cent. solution of potassium thiocyanate added to the clear liquid, the mixture heated to boiling and then allowed to stand, when even in the case of a 1 per cent. solution of tartaric acid, the liquid gradually darkens owing to the deposition of lead sulphide. The reaction can be used for the detection of tartaric acid in wines, a brownish-violet precipitate being produced.—A. S.

Tartaric Acid; Detection of ——, *in Citric Acid.* O. v. Spindler. Chem.-Zeit., 1904, **28**, [2], 15.

Denigès' reaction for citric acid (see this Journal, 1898, 802) is thus modified :—0·5 grm. of the acid is dissolved in 10 c.c. of water, 2 c.c. of mercuric sulphate solution (5 grms. of mercuric oxide, 20 c.c. of concentrated sulphuric acid, 80 c.c. of water) are added, and the whole is brought to boiling; 2 c.c. of a 0·5 per cent. solution of potassium bichromate are then added. On cooling, pure citric acid deposits a light yellow precipitate of varying composition; should tartaric acid be present, the liquid becomes dirty brown, carbon dioxide is evolved, and the filtrate has a green colour. The above method serves to detect 5 per cent. of tartaric acid with ease; if the quantity be less, it is well to carry out a blank test with pure citric acid.—W. A. C.

Formaldehyde; Reactions with ——. C. Goldschmidt. Chem.-Zeit., 1904, **28**, [6], 59.

Formaldehyde and dimethylaniline in alcoholic solution yield after standing for some days, laminae of tetramethyldiaminodiphenylmethane. Formaldehyde, methyldiphenylamine, and hydrochloric acid yield an anhydro-alcohol of high melting-point, insoluble in the usual solvents, which slowly turns blue in the air, and yields a blue resin on treatment with oxidising agents. Methyldiphenylamine and formaldehyde heated in alcoholic solution with a couple of drops of hydrochloric acid, yield an oil, which speedily solidifies; while when methylaniline is substituted for methyldiphenylamine a crystalline precipitate is formed, from which two substances can be separated, one soluble in alcohol, m. pt. 63° C., the other insoluble, m. pt. 180° C.
—J. T. D.

Quinine Sulphate; Detection of Allied Alkaloids in ——. Supplement to Dutch Pharmacopœia; through Pharm Post, 1903, **36**, [41], 583.

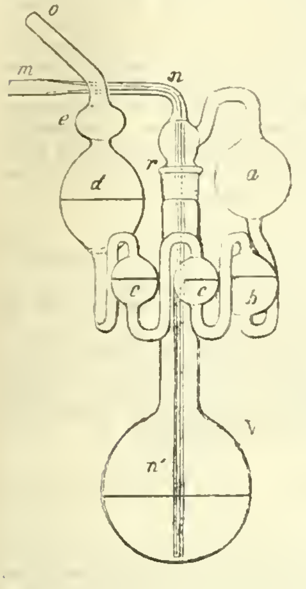
0·75 grm. of the salt, well dried at 100° C., is dissolved in 40 c.c. of boiling water with the aid of a trace of sulphuric acid, so that the solution barely changes the colour of red litmus paper. After adding 6 c.c. of a 10 per cent. solution of neutral potassium chromate and thoroughly cooling, the precipitate is filtered out through glass wool. The clear filtrate thus obtained should not give any opalescence or flocculent precipitate on the addition of 10 drops of caustic soda solution, even after standing for 24 hours.—J. O. B.

ORGANIC—QUANTITATIVE.

Halogens; Determination of ——, *in Organic Compounds.* H. Baubigny and G. Chavanne. Comptes rend., 1904, **138**, [2], 85—87.

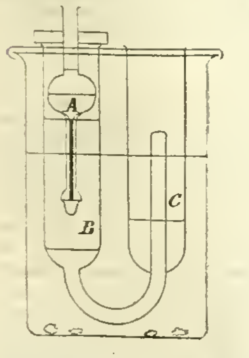
The authors have devised an apparatus for determining chlorine or bromine by their method (this J., 1903, 761) of combustion by sulphuric and chromic acids. The apparatus is shown in the figure; it is made of stout glass, and the tubes *m n* and *o c* touch, and can be tied together.

so that the whole apparatus may be shaken without fear of fracture. About 25 c.c. of alkaline solution of sodium sulphite are introduced into the bulbs through o, and the end m of $m\ n$ is closed by a cork. The sulphochromic mixture is poured into the flask, the substance in its little glass tube dropped in, and the flask at once closed by the stopper carrying the condensing bulbs. The flask is at first warmed or cooled according to the rapidity of the reaction; but action must never be allowed to become violent, and the combustion should last 30 or 40 minutes. Towards the end, the flask is heated in a paraffin bath, in which it is hung by a string, and the temperature is gradually raised to 135°—140° C. When action is over, air is blown through $m\ n\ n'$ till all chlorine or bromine is expelled from the flask; the condenser is removed, the tube $n\ n'$ washed with a jet of water, and the sulphite solution emptied through a and the stopper into a long-necked flask which has been brought up over the tube $n\ n'$ and the stopper. Two or three washings with 30 or 40 c.c. of water introduced by o serve to rinse the condenser thoroughly, and the chlorine or bromine in the liquid is then determined by any of the usual methods. Obviously, a separation of chlorine from bromine cannot be thus effected, though either or both of them can be separated from iodine.—J. T. D.



Soaps; Method of Grading ——, as to their Detergent Power. H. W. Hillyer. J. Amer. Chem. Soc., 1903, **25**, [12], 1256—1265.

In a previous communication (J. Amer. Chem. Soc., **25**, 511, 524) the author showed that when a solution of soap is allowed to fall in drops beneath the surface of an oil, the number of drops formed from a given volume of the solution depends on the amount of soap present, and is also a measure of the emulsifying (detergent) power of that solution. In the present paper he recommends this test as a means of forming some opinion as to the detergent properties of different soaps in hot or cold water. As a standard for the hot test, 1 grm. of neutral sodium palmitate (prepared from 36 c.c. of $N/10$ sodium hydroxide solution and 0·921 grm. of palmitic acid), is dissolved in 200 c.c. of hot water, and portions of 10, 20, 30, and 40 c.c. respectively of this solution diluted to 50 c.c. with boiling water, and tested in the apparatus. The essential part of the latter is a pipette, A, with capillary outlet of about 0·45 mm., opening from a flat horizontal surface of about 10 mm. in diameter. The pipette holds 5 c.c., and has a spherical body; the internal diameter of the stem is 3 mm. The receptacle for the oil may be a test tube, but it is preferable to use a vessel of the form, B, C, so as to obtain a more nearly constant pressure. It is immersed in a covered beaker containing water which is kept boiling. In using the apparatus, 2 or 3 c.c. of water are introduced into B, followed by 20 c.c. of kerosene, the pipette is rinsed out twice with the given soap solution, then filled, its point placed in the kerosene, and the number of drops formed in falling from the mark on the pipette counted. The numbers of drops given by each of the diluted boiling standard solutions, with the standard kerosene oil, are then plotted in a curve in which the ordinates represent percentages of the standard, and the abscissæ the numbers of drops corresponding to those percentages. Unknown samples of soap are tested in the same way, and the results referred to sodium palmitate as a standard. Thus, if 0·5 grm. of a commercial soap be dissolved in 100 c.c. of water, and the solution tested at the boiling point, it may be stated that the sample yields the same number of drops as a solution of sodium palmitate containing x per cent. of the standard, or that with hot water it has as great a detergent power as a soap containing x per cent. of sodium palmitate. In testing cold water soaps a solution of 1 grm. of sodium oleate in 200 parts of freshly-boiled distilled water is taken as the standard (= 100 per cent.). Fractional standards are prepared as before, each being diluted with cold freshly-boiled water, tested in the same way, as far as possible at a standard temperature, and the results plotted as a curve. In the actual test, 0·5 grm. of a sample of soap in shavings is mixed with 100 c.c. of freshly-boiled cold water, and allowed to stand over night, then filtered, and the filtrate stirred and tested as before. The hot test will give results concordant within 1 per cent. with successive samples, and much closer in duplicate determinations with the same sample, whilst the cold test gives figures, agreeing within 4 or 5 per cent. in the case of the most slimy products. A table of the results given by commercial soaps is shown, and it is pointed out that these confirm in some cases the relative values assigned by the makers to their products. The author considers that this method will afford the manufacturer a better means of judging a soap, and of determining the effect on its detergent power of variations in the composition.—C. A. M.



Fehling's Solution; Sodium Sulphide as an Indicator with ——[Determination of Reducing Sugars]. L. Beulaygue. Comptes rend., 1904, **138**, i, [1], 51—53.

Sodium sulphide (10 per cent. solution) serves as a very convenient indicator in the volumetric estimation of reducing sugars by means of Fehling's solution. The latter, mixed with double its volume of water, is heated to boiling in a porcelain dish and the sugar solution gradually run in from a burette. When the end point is approached, a drop of the liquid is removed from the dish by means of a glass rod and is placed on the upper surface of two filter papers, the first of which filters off the cuprous oxide so that only the clear liquid reaches the lower paper. The moistened part of the latter is then touched with a drop of the sodium sulphide solution, which gives a black spot if unreduced copper salt is still present. When very little of the copper remains unreduced, the coloration produced by the sulphide changes to brown, and at the end point it disappears altogether. This method of working is a very sensitive one, especially if the moist spot be viewed by transmitted light. In the preliminary determination of the strength of the Fehling's solution, it is also necessary to work in the way described above.—T. H. P.

Starch in Barley and Malt; Method for the Rapid Determination of ——. H. T. Brown and J. H. Millar. Trans. of the Guiness Research Lab., 1903, **1**, [1], 79—91.

The two methods hitherto available for the determination of starch in barley and malt, *viz.*, O'Sullivan's "maltose and dextrin" method and the method of fermentation, require several days. The authors have therefore devised the following rapid method, which is based on cupric reduction only, so that the tedious extraction of the optically active amylans, the weak point of the O'Sullivan method, can be dispensed with, since it has been proved that this class of bodies yields no reducing sugar on treatment with malt diastase. The grain is first ground to the finest possible powder in a Maerker mill, a weighed quantity of about 5 grms. is then placed in a paper extraction thimble. About 80 c.c. of alcohol, sp. gr. 0·920, are placed in the extraction flask, which is preferably made of copper, and conditions are thus established which ensure the continuous extraction of the meal by alcohol of 0·900 sp. gr. About 0·5 grm. of high-melting paraffin should be placed in the flask to prevent frothing. Extraction is conducted for three hours in the case of barley, and for nine hours in the case of malt, by which treatment all cupric-reducing bodies and all nitrogenous bodies soluble in alcohol are removed. The meal is then transferred to a beaker with about 100 c.c. of water and the mash is thoroughly boiled. After cooling to 57° C., 10 c.c. of an active malt-extract are added and conversion is allowed to proceed for one hour. The solution is boiled and filtered, the residue washed, and the filtrate diluted to 200 c.c. after cooling. The cupric-reducing power is then determined under the standard conditions laid down by Brown, Morris, and Millar (J. Chem. Soc., 1897, 94), and the maltose is calculated from Table XI. (*loc. cit.*, p. 100) after correction for the reducing power of the malt-extract. This method depends on the conversion of the starch to the point known as the "No. 8 equation" of Brown and Heron, according to which 84·4 parts of maltose correspond to 100 parts of starch. The attainment of this point depends, however, on the converting power of the malt-extract, and the factor is only accurate when the extract is prepared from a malt kiln-dried at 50°—52° C., and possessing a diastatic power of 80° on Lintner's scale. If the malt employed have a lower diastatic power the starch equivalent of the maltose produced at the final stage must be determined by a control experiment with pure starch.—J. F. B.

Formaldehyde; Determination of ——. C. Kippenberger. Zeits. anal. Chem., 1903, **42**, 686—696.

Attention is drawn to a series of errors in the method given in the German Pharmacopœia for the determination of formaldehyde. It is there directed to mix 5 c.c. of the formaldehyde solution with 20 c.c. of water and 10 c.c. of ammonia solution (German Pharm. strength), allow the mixture to stand in a closed vessel for one hour, then to add 20 c.c. of N/1 hydrochloric acid solution, and titrate the excess of acid with N/1 potassium hydroxide solution, using rosolic acid as indicator. The author shows that this indicator gives unreliable results should the ammonia solution contain carbonate, which is nearly always the case. Further, the hexamethylenetetramine formed is not a stable body. It undergoes partial decomposition in the presence of acids, neutralising a portion of the latter. Although it is also possible for this substance to be decomposed by alkalis, this does not come into consideration under the conditions of the above process. A sample of formaldehyde solution gave 36·74 per cent. of formaldehyde, using rosolic acid as indicator. With methyl orange, 28·46 per cent. was obtained, the latter figure closely agreeing with that obtained by a different method—conversion of the formaldehyde into trisulphomethylene.—W. P. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Hydrogen Peroxide; Radio-activity of ——. O. Dony-Hénault. Bull. de l'Assoc. Belge des Chim., 1903, **17**, [10], 365—373.

Experiments were made to ascertain the relationship between the radio-activity of hydrogen peroxide, and its rate of dissociation into water and oxygen. The rate of dissociation diminishes when the temperature is lowered, and it was found that the radio-activity was also lowered, care being taken in all these experiments to keep the sensitised surface itself at a uniform temperature by means of melting ice. On the other hand acceleration or modification of the dissociation rate by means of catalytic agents such as mercury and platinum, or by chemical agents which affect the stability of hydrogen peroxide solutions, *e.g.*, sulphuric acid, alcohol, or alkalis, neither accelerate nor modify the intensity of radio-activity. The loss of radio-activity noticed when the temperature falls, can not therefore be explained by the diminished rate of dissociation. Contrary to the opinion of Graetz, the radiations of hydrogen peroxide cannot reproduce hydrogen peroxide from the vapours present in the atmosphere, so that the analogy with the Becquerel rays which ozonise oxygen is much weakened; whilst the influence of temperature on the two kinds of radiation points to an essential difference between them.—R. L. J.

Chemical Action of Light. G. Ciamician and P. Silber. Ber., 1903, **36**, [17], 4266—4272.

On allowing a shallow dish containing finely-powdered stilbene to remain for nearly a year in a dessicator, it was found that the walls of the latter, and more especially those parts of them subjected to direct sunlight, became covered with long, acicular crystals of benzoic acid; mixed with the acid was an amorphous, resinous substance, also occurring in the residual, unaltered stilbene. The authors explain this change as due to the desiccator not being quite closed and so allowing the entrance of oxygen which united with the stilbene giving a peroxide.—T. H. P.

Dinitrobenzylideneaniline; Action of Light on ——. F. Sachs and E. Sichel. Ber., 1904, **36**, [17], 4373—4377.

On subjecting a solution of 8 grms. of 2:4-dinitrobenzylidene-aniline in cold benzene, placed between the walls of a double-walled, sealed glass cylinder, for four weeks (in July) to the action of direct sunlight, it was found to yield: (1) 0·3 grm. of a substance separating from its nitrobenzene solution in pale yellow needles, and (2) about 3 grms. of *o*-benzeneazo-*p*-nitrobenzanilide $[(CO.NH.C_6H_5):(N:N.C_6H_5):(NO_2) = 1:2:4]$.—T. H. P.

Oxidation caused by Manganese; Influence of Albuminoïd Substances on ——. A. Trillat. Comptes rend., 1904, **138**, [2], 94—96.

If weak solution of albumin from white of egg be added to the gallic acid and alkaline manganese solution described in a previous paper (this Journal, 1903, 1371), the oxidising action on the gallic acid is greatly increased, especially in the early stages. Increase of albumin accelerates the action up to a certain point (about 0·1 per cent. of the whole). The effect of paralysing agents is very marked. Other albuminoids and colloids have given very variable results. Albumin tends to prevent the precipitation of manganese salts by an alkali, and as it has been found that the activity of certain soluble substances lessens as they approach their point of coagulation or separation, so possibly the retention of the manganese oxide in the colloidal condition accounts for the increased activity caused by the albumin. The association of metallic salt, base, and colloid, like albumin, is exactly what is found in nature.—J. T. D.

New Books.

A Systematic Survey of the Organic Colouring Matters. Founded on the German of Drs. G. Schultz and P. Julius. Second Edition, revised throughout and greatly enlarged. By Arthur G. Green, Professor of Tinctorial Chemistry at the Yorkshire College, Leeds, &c. Macmillan and Co., Ltd., London and New York. 1904. Price 21*s*.

Large 8vo, almost 4to, volume, containing preface and introduction, list of abbreviations, and tabulated subject-matter filling 269 pages. At the close are alphabetical indexes of "Raw and Intermediate Products" and of "Colouring Matters." Of the portion introductory to the tables (Raw Products, or Section I.), this is subdivided as follows:—(i.) Coal Tar. (ii.) Intermediate Products, consisting of Nitro Compounds; Sulphonic Acids of Hydrocarbons; Carboxylic Acids of Hydrocarbons; Primary Amines and their Sulphonic Carboxylic Acids; Secondary and Tertiary Amines and their Derivatives; Diamines and their Sulphonic Acids; Primary Amines and Diamines used in the Preparation of Substantive Cotton Colours; Phenols and their Sulphonic and Carboxylic Acids; Amidophenols and their Derivatives; Halogen Compounds; Aldehydes, Ketones and Quinones; Diazo and Azo Compounds; Compounds of the Fatty Series. Section II., Colouring

Matters. The tables, here extending from page 74 to 268, contain 711 dyestuffs, and these are treated under the following headings:—"Commercial Names"; "Scientific Names"; "Empirical Formulæ"; "Constitutional Formulæ"; "Methods of Preparation"; "Year of Discovery"; "Discoverer, Patents, Literature"; "Behaviour with Reagents. Shade and Dyeing Properties and Method of Employment." The work concludes with an Alphabetical Index to Section I. and also an Alphabetical Index to Section II.

Gas Undertakings. Return relating to all authorised Gas Undertakings in the United Kingdom other than those of Local Authorities, for the year ended the 31st December, 1902. 331. Eyre and Spottiswoode, London. Price 9*d.*

This is an annual return issued by the Board of Trade, containing statistics as to the operation of the various gas companies in the United Kingdom. The present return deals with 454 authorised undertakings, with a total authorised share capital of 74,319,363*l.*, and supplying 2,197,987 consumers. During the year ended 31st December 1902, the receipts of these companies amounted to 17,205,092*l.*, and their expenditure to 13,167,186*l.* 8,520,004 tons of coal were carbonised during the year, and 99,676,048 cb. ft. of gas made.

Gas Undertakings (Local Authorities). Returns relating to all authorised Gas Undertakings in the United Kingdom belonging to Local Authorities for the year ended the 25th March, 1903. 330. Eyre and Spottiswoode, London. Price 5½*d.*

This return shows that during the year ended the 25th March 1903, 256 local authorities were engaged in the manufacture of gas for lighting purposes, &c. The quantity of gas made in 1902-3 was 60,902,739 cb. ft., coal to the extent of 5,589,215 tons being used. The number of consumers supplied with gas was 1,970,738, and in addition, 294,828 public lamps were lighted by gas manufactured by local authorities.

Trade Report.

I.—GENERAL.

Preferential and Reciprocal Trade Act in New Zealand.

Bd. of Trade J., Jan. 14, 1904.

The "Preferential and Reciprocal Trade Act, 1903" (No. 78 of 1903) came into force on Nov. 16 last; it provides for the levying of duty on certain articles imported into New Zealand and not the produce or manufacture of some part of the British dominions, in addition to the ordinary tariff duties in force. The following are examples:—

Cement: an amount equal to the duty payable under the tariff. Candles; china, porcelain, &c; cream of tartar; earthenware, &c.; glass and glassware; various kinds of paper; plate and plated ware: an amount equal to one half the duty payable under the tariff. Printing paper:—a customs duty equal to 20 per cent. of the value for duty as defined by the "Customs Laws Consolidation Act, 1882."

American Chemical and Allied Mineral Trades in 1903.

Eng. and Mining J., Jan 7, 1904.

Cyanide.—Apart from a good home demand, a fair export trade was done with Mexico, South America, and Canada, at rather low prices. With a domestic production of about 2,500,000 lb., the United States imports annually between 3,000,000 lb. and 4,000,000 lb. from Great Britain and Germany. Market prices have felt the anxiety of foreign makers to unload heavy stocks accumulated in recent years. Importers at New York quoted 19·5 to 21 cents per lb., and probably took some large contracts at less, although there is a duty of 12·5 per cent. *ad valorem* on potassium cyanide and 25 per cent. on sodium cyanide.

Bleaching Powder.—Consumption has been large, notwithstanding labour troubles in certain important industries. The imports of foreign bleach into the United States in 1903, paying a duty of 0·02 cent per pound, amounted to 109,003,234 lb., of which Great Britain furnished 88,744,166 lb., or 81·4 per cent. Compared with 1902, the total imports show a decrease of 3,371,244 lb., or 3 per cent. Re-exports were 779,826 lb., as against 198,794 lb. in 1902, the difference indicating that the domestic production and quality of bleach is improving, particularly in the central west. Foreign prime bleach sold in New York in the early months of the year at 1·75 dols. per 100 lb., but in September free offerings of varied test brands were made as low as 85 cents. The extreme monthly average prices were 1·42 dols. in February, and 1·01 dols. in October, making 1·187 dols. for the year. Domestic prime bleach touched 1·25 dols. f.o.b. works in February, and 75 cents for off-test in May and later; the year's average was 1·107 dols. Contracts for 1904 delivery at seaboard have been taken at 1·25 dols. per 100 lb. for prime British and American, and 1·20 dols. for Continental brands. Lower grades have been booked at a discount.

Copper Sulphate.—There were imports of British blue vitriol in the face of a 0·5 cent per lb. duty, a loss of 62·8 per cent. to 8,355 long tons in domestic exports, and a further reduction of 20·5 per cent. to 17,309 tons in production, owing partly to the disastrous fire at the works of the Nichols Chemical Company. Better prices obtained in 1903, as a result of a higher market for copper and of the centralisation of the trade. The best prices were reported in February—May, 5·875 dols. per 100 lb. being touched in April; the lowest was 4·125 dols. in January. The extreme monthly average prices were 4·37 dols. in January, and 5·54 dols. in March, making 4·87 dols. for the year. Frequently the British article sold below the domestic, but on the whole both brands maintained a satisfactory level.

Arsenic.—The United States is the largest consumer in the world, importing annually fully 6,000,000 lb. of white arsenic, metallic arsenic, and arsenic sulphides from Europe and Canada. Recently importers booked contracts for white arsenic at an average of 2·975 cents per lb. for French, 3·125 cents for Spanish and German, and 3·25 cents for British, f.o.b. New York. In January there were sales as low as 2·75 cents to 3·125 cents, according to brand, and, summed up, the year's prices have been less than in 1902, owing to competition. Red arsenic, imported from Germany, was also weak, receding from 6·75 to 7 cents per lb., in January, to 6·375 to 6·50 cents later.

Sulphuric Acid.—The heavy consumption, especially by the fertiliser and petroleum industries, with the friendly relations among the larger eastern acid-makers, has resulted in satisfactory market prices. Contract deliveries in 1903 and 1904 in New York and vicinity have been quoted on the basis of 1·05 dols. per 100 lb. for 60° acid in carboys, and 18 dols. to 20 dols. per ton in bulk; 1·20 dols. per 100 lb. for 66° in carboys, and 21 dols. to 23 dols. per ton in bulk; and 13·50 dols. to 14·50 dols. per ton for bulk chamber, or 50° acid. In other parts of the country, especially in the central west, where acid is made chiefly as a by-product in treating zinc sulphide ores, lower prices have been received, but the eastern market is practically free from this competition.

Nitric Acid.—The continued strength in the raw material market is reflected in the prices for nitric acid, for this or next year, which are 4·37½ dols. per 100 lb. for 36° in carboys delivered in New York and vicinity, 4·75 dols. for 38°, 5 dols. for 40°, and 5·37½ dols. for 42°. Consumption is good.

Oxalic Acid.—Only occasionally was the market unsettled by a pressure to sell on the part of importers, and during the flurry quotations at New York dropped to 5 dols. to 5·12½ dols. per 100 lb. At other times the market was firm at 5·25 dols. to 5·50 dols. Contracts for 1904 delivery were booked in October and later at 5 dols. for German and British, and 5·25 dols. to 5·50 dols. for Norwegian. The annual imports into the United States are something between 5,678,000 and 5,700,000 pounds.

Hydrochloric Acid.—Buying by consumers has been about up to the average in the past year, and prices have been remunerative to the producer. The average quotations at New York for 1903 and 1904 deliveries are 1·50 dols. per 100 lb. for 18° acid, 1·60 dols. for 20°, and 1·75 dols. for 22°.

Sulphur and Pyrites.—The production of sulphur in the United States during 1903 is estimated at 13,500 short tons, valued at 262,175 dols., as compared with 8,336 short tons, valued at 220,560 dols. in 1902. The greater part of the output was obtained from the mines of the Union Sulphur Company, near Lake Charles, Calcasieu parish, La., the balance coming from the mines of the Utah Sulphur Company in Beaver county, Utah, and those of the Nevada Sulphur Company at Rabbit Hole Springs, near Humboldt county, Nev. Although the production of domestic sulphur in the United States has never exceeded 1 per cent. of the total consumption, it is noteworthy that the output from the domestic mines during 1903 is the largest ever recorded, which indicates that the development of this branch of the mineral industry is of good promise. During 1903 the total consumption in the United States of sulphur from domestic and foreign sources, together with the sulphur content of pyrites used for the manufacture of sulphuric acid (including both domestic and foreign product) aggregated 472,662 long tons as compared with 481,830 tons for 1902. The details of the supply are given in the subjoined table, the imports for December being estimated :

——	1902.	1903.
	Long Tons.	Long Tons.
Sulphur, domestic	7,443	12,054
Sulphur, foreign (net imports)	174,939	185,796
Sulphur content of domestic pyrites	102,689	88,636
Sulphur content of foreign pyrites	196,759	186,176
Total consumption	481,830	472,662

Prices have ruled high, and until the deposits in Mexico and Alaska, optioned to Americans, are developed actively the Anglo-Sicilian Sulphur Company, which controls 85 per cent. of the output in Sicily, will continue to dictate prices. New York importers booked shipping contracts for Sicilian sulphur at an average of 22·75 dols. per ton in January and 21·75 dols. in June, or 22·25 dols. for the year for best unmixed seconds, which is only 75 cents more than the average price in Sicily, plus the freight of 1·84 dols. per ton. Best thirds sold in New York in January at an average of 20·75 dols., and in November at 21·50 dols., making 21·20 dols. for the year, which is only 40 cents more than the Sicilian delivery price at Atlantic ports. Re-sales have been made on spot at higher prices, but taken as a whole the margin of profit for importers has been rather small. A 7 per cent. decrease in the demand for pyrites this year has naturally affected prices somewhat, but as sellers usually make long-time contracts with consumers the transient market is seldom disturbed. Ocean freight rates from Spain, averaging from 9*s.* 6*d.* to 12*s.* 6*d.* per ton also had some influence on the market, while the heavier imports of Pilley's Island pyrites attracted no little attention. Spanish pyrites, containing from 43 to 51 per cent. of sulphur, sold at 10 to 13·5 cents per unit for lump, and 9 to 11·5 cents for fines. Domestic ore, carrying from 42 to 44 per cent. of sulphur, brought an average of 5 dols. per ton for lump, and 10 cents per unit for fines, f.o.b. Atlantic coast mines.

Nitrate of Soda.—An increased consumption, higher market prices, comparatively lower ocean freight rates from South American ports, and the adjustment of the *quotas* of exports from Chile for the third year (April 1, 1903, to March 31, 1904), at 32,500,000 qtls. give hope for continued prosperity. Earnings of the *oficinas* are large, and it is also noteworthy that on the year's exports of 1,405,143 long tons the Chilian Government has collected about 17,823,640 dols., besides enriching its treasury from the sales of mineral-bearing land in Tarapaca and Toco.

Saltpetre.—The consumption in 1903 has been the largest recorded, imports into the United States amounting to 13,552,059 lb. Crude saltpetre sold in New York at 3·30 dols. to 3·75 dols. per 100 lb. for immediate delivery, and at 3·25 dols to 3·60 dols. for future shipment. The refined quality brought 4 dols. to 4·50 dols. per 100 pounds.

Zinc Oxide and White Lead.—Labour troubles in the building trades interfered somewhat with the domestic market and reacted on the production of white lead. A larger export trade encouraged the output of zinc white. American dry white lead sold in New York at 4·50 to 5·75 cents per lb., according to quality and time of delivery, while extra dry zinc oxide brought 4·375 to 4·75 cents. Foreign brands sold proportionately higher than the domestic, owing to the duty of 2·875 cents per lb. on white lead, 1 cent per lb. on dry zinc white, and 1·75 cents in oil.

Phosphates.—The production of all classes of phosphates in the United States in 1903, estimated below at 1,477,401 long tons, is somewhat less than the previous year, owing to a curtailed demand, as indicated by the shipments given.

——	Production.	Shipments.	
		Domestic.	Foreign.
Florida hard rock	488,750	1,000	466,819
Land pebble	285,188	149,008	153,563
Peace river	49,985	49,985	..
Total, Florida	773,923	199,993	620,382
Tennessee	422,889	313,008	117,387
South Carolina	280,789	218,227	40,929
Total, United States	1,477,601	731,228	778,698
Total, 1902	1,487,471	782,455	821,515

It is worthy of comment that, although 52·8 per cent. of the production was sent abroad, the proportion is less than 1902. Our best customers were Germany and Belgium for hard rock, and Italy, France, and Great Britain for land pebble. A surprising feature is the continued large imports of phosphates from Belgium and other countries, which in 1903 amounted to about 136,531 tons, and were used principally as "fillers" for artificial fertilisers.

British Guiana ; Trade of ——. (Year Ended 31st March, 1903.)

Bd. of Trade J., Jan. 28, 1904.

The following tables, showing the total value of the imports and exports of certain articles into and from British Guiana during the financial year ended 31st March last, as compared with the preceding year, are compiled from the report of the Comptroller of Customs at Georgetown on the Customs statistics of the Colony for the year 1902—1903:—

Imports.

——	Year ended 31st March	
	1902.	1903.
	Dols.	Dols.
Metals and metal manufactures (includes machinery, hardware, and cutlery)	761,000	656,000
Manures	445,000	528,000
Beverages (includes malt liquors, wines, and spirits)	178,000	181,000
Oils, petroleum and other	143,000	161,000
Coal and coke	125,000	111,000
Leather manufactures	122,000	139,000

Exports of Colonial Produce.

——	Year ended 31st March	
	1902.	1903.
	Dols.	Dols.
Sugar	4,983,000	5,002,000
Gold	1,788,000	1,790,000
Rum	772,000	651,000
Balata	144,000	195,000
Molasses	21,000	59,000

II.—FUEL, GAS, AND LIGHT.

Gas; Illuminating Power and Purity of ——. Committee of Enquiry.

Bd. of Trade J., Jan. 28, 1904.

The President of the Board of Trade has appointed the following gentlemen, *viz.*, the Lord Rayleigh, F.R.S. (Chairman): Sir Wm. de W. Abney, K.C.B., F.R.S.; Robert Farquharson, Esq., M.D., M.P.: William King, Esq.; and J. Fletcher Moulton, Esq., K.C., M.P., to be a Committee to enquire and report as to the statutory requirements relating to the illuminating power and purity of gas supplied by the Metropolitan Gas Companies, and as to the methods now adopted for testing the same, and whether any alteration is desirable in such requirements or methods, and, if so, whether any consequential alteration should be made in the standard price of gas.

Mr. Herbert C. Honey, of the Board of Trade, has been appointed Secretary to the Committee.

IV.—COLOURING MATTERS, Etc.

Alizarin Blue G. W.: U.S. Customs Decision.

Dec. 31, 1903.

Merchandise named as above, which on analysis was shown to be made from alizarin or anthracene, was decided by the Board of General Appraisers to be free of duty under paragraph 469 of the present Tariff Act, as a "dye derived from alizarin or anthracene."—R. W. M.

VII.—ACIDS, ALKALIS, Etc.

Bromine Production of U.S. in 1903.

J. Struthers. Eng. and Mining J., Jan. 7, 1904.

The production of bromine in the United States during 1903, including the quantity of bromine contained in potassium bromide, amounted to 603,500 lb., valued at 172,000 dols., as compared with 513,890 lb., valued at 128,472 dols., in 1902. The price of bromine during 1903 has been very erratic, beginning the year at 25 cents per lb., and going to as high as 40 cents for a few lots in July and August; toward the end of the year it has been quoted at 30 cents. The average for the entire year may be taken at 28·5 cents per lb. The world's production of bromine continues to be controlled by the associated American producers and by the Leopoldshall-Stassfurt Convention, the latter association continuing operative for several years to come. There has been very little, if any, change in the bromine industry in the United States during 1903. More than one-half of the total output was furnished by Michigan, which contributed approximately 270,000 lb. in the form of potassium bromide, and 56,500 lb. in the form of liquid bromine (total 326,500 lb.), as compared with the respective quantities of 165,000 and 61,462 lb. (total 226,462 lb.) for the year 1902.

Sulphur; Canadian ——.

Chem. and Druggist, Jan. 16, 1904.

It is reported that sulphur deposits have been discovered in the Steep Rock Lake district. The deposits of pyrites are said to carry from 40 to 45 per cent. of sulphur suitable for sulphuric acid manufacture.

X.—METALLURGY.

Kolar Gold Field, India.

A. M. Smith. Trans. Inst. of Min. and Met., Jan. 21, 1904.

The Kolar goldfield, though one of the smallest in the world, is one of the richest—if not the richest—in point of gold production. Up to September last it had yielded no less than 16 millions sterling in gold, of which 6 millions has been paid in dividends, while the annual output has now reached 2¼ millions. The industry gives employment to some 20,000 mining men, hundreds of whom are from this country. The two chief lodes or reefs on the Kolar goldfield are known as the Champion lode and the Oriental lode. These run parallel to one another, about 4,000 ft. apart, and both of them occur in the eastern half of the schistose belt. Profitable mining operations have hitherto been carried on only on the Champion lode, which is not auriferous, in a paying sense, throughout. Very rich patches occur in places, to which the name of "shoots" has been given. These shoots all crop out at the surface, and have a well-defined pitch to the north. As a rule, there are old native workings where the shoots crop out, and the old workers have gone down in some places as deep as 300 ft. Between the shoots there is much reef matter that does not pay to mine; hence the endeavour, on all the mines, to find the "shoots" of ore. As much as six millions sterling in gold has been taken out of a single "shoot." It is generally agreed (1) that the auriferous rocks form a narrow band, from 1 to 4 miles wide from east to west, and some 40 miles long; (2) that the auriferous rocks are bent into a synclinal fold, with a north and south axis; (3) that the auriferous quartz reefs occur about the middle of the schist band, and are parallel to the layers of the schist, and hence strike north and south; (4) that the Champion lode, which occurs on the east central portion of the belt, dips west at an angle of from 45° to 60°. As the Champion lode occurs about the middle of the schist band, and as its dip is coincident with the bedding of the schists (an angle of 45°), it is clear that it will not extend downwards in depth indefinitely.—J. H. C.

Mercury in 1903.

A. S. Pickering. Chem. and Druggist, Jan. 16, 1904.

The following tables show the business done in the United Kingdom in mercury during 1903 and past years:—

——	Imports.	Exports.	Highest. Price.	Lowest Price.
	Bottles.	Bottles.	£ s. d.	£ s. d.
1903	34,886	18,846	8 15 0	8 5 0
1902	33,192	19,519	8 17 6	8 14 6
1901	35,341	26,863	9 2 6	8 17 6
1900	32,725	25,869	9 12 6	9 2 6
1899	51,696	32,239	9 12 6	7 15 0
1898	54,563	34,014	7 15 0	6 16 0
1897	54,734	39,768	7 7 6	6 9 6
1896	47,159	35,211	7 6 0	6 5 6
1895	49,654	36,827	7 8 6	6 7 6
1894	51,251	43,598	6 14 0	5 7 0

It will be noted from the above figures that the exports are the lowest since 1894, but as a matter of fact they are the lowest for 23 years.

India; Minerals in ——.

Indian Geological Survey. Through Bd. of Trade J., Jan. 14, 1904.

Chromite.—Chrome-iron deposits were investigated in the Peshin and Zhob districts, Baluchistan. One of the most promising localities occurs about two miles east of Khanozai, in the Peshin district, where a vein-like mass about 400 feet long, with an average breadth of 5 feet, was investigated. The vein consists of almost pure ore of great richness. An analysis made in the laboratory of the Department gave over 54 per cent. of chromium sesquioxide, and some parts of the vein show an even higher percentage. The locality is connected by an excellent road with Khanai railway station, 17 miles distant.

Fire-clay.—The deposits noticed near Jowai, Assam, were, at the request of the Chief Commissioner, re-examined and sampled for testing. The tests showed that the material forms excellent fire-bricks, capable of standing a great heat.

Iron and Manganese.—In connection with the Dhar Forest Survey, the rich iron ore deposits received some attention, but it is stated that the main and, at present, insuperable difficulty in connection with the development of these ores on a large scale is the absence of mineral fuel. The manganese ores, which are also widely distributed in the same district, are to be the subject of a special report to the Dhar Durbar.

Lead.—A lode of galena discovered in Dargoti State was examined north-east of Simla; the opinion expressed, supported by assays, is that the ore-body is neither rich enough nor large enough for successful exploitation.

Petroleum.—Regarding the investigation of a possible oil field near Pakoku district, Upper Burma, northward, the report says:—"The structure is that of a productive oil field, and it is possible that a remunerative supply of oil could be obtained, although, owing to the formation, the oil will not be obtainable at the pressure which gives rise to the flowing wells of Yenangyat."

Mineral and Metal Production of the United States in 1903.

Eng. and Mining J., Jan. 7, 1904.

The following table gives the figures for the estimated production of minerals and metals in 1903 in the United States, with values; the figures for 1902 are added for comparison:—

	1902.			1903.		
		Value at Place of Production.			Value at Place of Production.	
	Quantity.	Total.	Per Metric Ton.	Quantity.	Total.	Per Metric Ton.
Non-metallic:	Metric Tons.	Dols.	Dols.	Metric Tons.	Dols.	Dols.
Arsenic, white	1,227	81,180	66·16	535	35,400	66·16
Bauxite	27,759	121,465	4·38	41,351	179,080	4·33
Bromine	233	128,472	551·39	274	172,000	627·74
Carborundum	1,697	374.150	220·48	2,145	472,400	220·44
Cement, natural hydraulic	1,236,110	4,087,692	3·31	1,115,849	3,480,000	3·12
„ Portland	2,831,942	16,637,500	5·88	3,274,971	20,900,000	6·38
Coal, anthracite	37,604,343	83,002,229	2·20	66,578,971	150,449,500	2·26
„ bituminous, including cannel	234,807,388	285,909,509	1·22	257,104,863	334,056,024	1·30
Coke	22,271,614	55,237,500	2·48	22,861,217	56,700,000	2·48
Cobalt, oxide, from foreign ores	Kg. 7,775	38,736	Kg. 4·98	Kg. 8,528	42,300	Kg. 4·96
Copper sulphate	22,119	2,028.563	91·71	17,588	1,628,516	92·60
Copperas	17,948	118,474	6·60	18,779	134,550	7·17
Crushed steel	333	51,450	154·50	343	52,850	154·08
Fluorspar	24,609	143,520	5·83	26,581	149,500	5·62
Graphite, crystalline	1,895	153.147	80·80	1,895	154,549	81·56
„ artificial	Kg. 1,060,996	110,700	Kg. 0·10	Kg. 879,071	160,479	Kg. 0·18
Iron ore	35,190,299	64,769,546	1·84	32,111,239	52,149,157	1·63
Lead, white	104,011	11,978,172	115·16	102,241	12,228,024	119·60
„ red	10,586	1,262,712	119·28	11,158	1,385,900	124·21
„ orange mineral	787	138,349	175·79	907	168,000	185·23
Limestone flux	9,644,931	5,504,252	0·59	9,661,947	5,507,310	0·57
Litharge	11,571	1,299,443	112·30	11,240	1,326,800	118·04
Phosphate rock	1,488,103	4,636,516	3·12	1,501,243	5,328,018	3·55
Pyrites	231,849	971,796	4·19	200,122	778,031	3·88
Sulphur	7,562	220,560	29·03	12,247	262.175	21·42
Zinc, white	46,929	4,023,299	85·73	54,259	5,005,394	92·25
„ ore, exported	49,582	1,449,104	29·23	34,125	932,724	27·33
„ lead	3,629	225,000	62·00	4,082	253,125	62·00
Total non-metallic		544,702,836			654,091,806	
Metallic:						
Aluminium	Kg. 3,312,258	2,284,590	Kg. 0·69	Kg. 3,401,976	2,325,000	Kg. 0·68
Antimony	3,230	634,506	196·44	3,161	535,486	169·40
Copper	277,064	71,072,586	256·55	304,309	88,334,770	299·66
Gold	Kg. 120,369	79,992,800	Kg. 664·60	Kg. 111,992	74,425,340	Kg. 664·60
Iron, pig	18,106,448	303,156,995	16·74	18,229,925	265,554,032	14·57
Lead	254,489	22,829,043	89·70	262,206	24,492,402	93·41
Nickel, from foreign ores	Kg. 4,713,544	4,520,293	Kg. 0·96	Kg. 5,080,287	4,872,000	Kg. 0·96
Platinum	..	1,814	Kg. 620·17	..	..	..
Mercury	1,195	1,500,142	1,255·35	1,010	1,295,083	1,282·26
Silver	Kg. 1,726,229	29,415,000	Kg. 16·77	Kg. 1,757,943	30,520,688	Kg. 17·36
Zinc	143,552	15,317,342	106·70	141,811	16,882,344	119·05
Total metallic		530,725,111			509,037,145	

XII.—FATS, FATTY OILS, Etc.

Cod-Liver Oil; Norwegian ——.

U.S. Cons. Rep., No. 1843, Jan. 6, 1904.

The best Norwegian oil is extracted from the fat livers of the cod in the early part of the winter fisheries in the Lofoten Islands. The livers at this time—in January, February, and a part of March—are, as a rule, light-coloured, plump, and very rich in oil, which is extracted, after careful sorting of the livers, with simple machinery, by steam. The product is clear, nearly tasteless, and without smell. The islands present many advantages over other places for the production of pure oil. The average annual catch of cod in the islands is 30,000,000. Unlike other districts in the country, the cod at this time of the year is about the only kind of fish caught, so there is less opportunity for mixing the livers from cod with those from inferior fish, such as coalfish or pollock, ling, haddock, and others. Oil from these is darker, contains less fat, and its medicinal properties are of less value. The year 1903 was an exceptional one as regards the Norwegian winter cod fisheries. In ordinary years the shoals of fish arrive in the beginning of January, but this year no fish whatever appeared before the middle or first part of March, and they were then found to be in such poor condition that only a very insignificant quantity of oil was produced—only 3,000 barrels against 30,000 barrels in ordinary years. The quality of the 1903 output was also, as a rule, poor. It is estimated that in ordinary years the livers of 4,500 cod are required to produce a barrel of 30 galls., or 100 kilos., of medicinal oil, while 40,000 livers were required the present year (1903) to produce the same quantity. Prices for the best quality of medicinal oil f. o. b. Christiania have for the last three years been as follows:—In 1901, 56 kroner per barrel; 1902, 130 kroner per barrel; 1903, 400 kroner per barrel—all in wood-covered tin barrels of 30 gallons, price including barrel. Considerable apprehension is felt that the conditions ruling the Lofoten fisheries in 1903 will also make themselves felt in 1904. The first small shoals of winter cod arrive the latter part of December on the banks along the coast as far south as Bergen; the larger shoals arrive later. The Lofoten fisheries terminate in the latter part of April and the fish gradually work farther north and last appear in great numbers on the banks at Finmarken as late as June, after which they disappear till next season.

Cotton-Seed Oil Imports at Trieste.

Bd. of Trade J., Jan. 21, 1904.

The import of cotton-seed oil at Trieste during 1903 has been higher than the average of the last ten years. Prices varied: in July, from *2l.* 9*s.* 2*d.* to 2*l.* 10*s.*; and in December, from 2*l.* 2*s.* 10*d.* to 2*l.* 8*s.* 8*d.* per 100 kilos. The following table shows the quantity imported during the last two years :—

From—	1902.		1903.	
	Barrels.	Met. Tons.	Barrels.	Met. Tons.
England	11,987	2,258·1	12,764	2,424·9
America	39,093	7,427·4	64,869	12,324·9
Other countries	6,481	1,206·2	3,408	647·2
Total imported .	57,561	10,891·7	81,041	15,397·0

XIII. A.—PIGMENTS, PAINTS, Etc.

Hematite; Spanish ——, for the United States.

U.S. Cons. Reps., No. 1844, *Jan.* 7, 1904.

A vein of rich hematite ore, suitable for paint for ironwork, has been discovered near the city of Jaen, in Spain, and has been worked during the past year; much of the output has found ready sale in the United States. The mine is 100 miles from Malaga, but the ore is brought there by rail and prepared for shipment, both in its crude state and refined, at a plant on the outskirts of this city.

Enamel; White ——: U.S. Customs Decision.

Dec. 30, 1903.

A white paint consisting of zinc white, linseed oil, and varnish, variously described as enamel white, white bath enamel, and Japan white, was assessed for duty as "varnish," at 35 per cent. *ad valorem* under paragraph 53, and as "paint," at 30 per cent. *ad valorem* under paragraph 58 of the present Tariff Act. The importer claimed it to be dutiable at $1\frac{3}{4}$ cents per lb. under paragraph 57, as "white paint, ground in oil." A former decision of the Board of General Appraisers was against the importer, on the ground that the addition of varnish advanced the article beyond the condition of a pigment containing zinc ground in oil. On appeal to the Circuit Court, the action of the Board was reversed, and the claim of the importer sustained on the ground that the addition of varnish does not affect the character of the mixture as a paint. Following this decision, the Board decided that the article was properly dutiable at $1\frac{3}{4}$ cents per lb.—R. W. M.

XVI.—SUGAR, STARCH, Etc.

Sugar; Drawback on Certain Foreign ——, in the United Kingdom.

Bd. of Trade J., Jan. 21, 1904.

The Board of Customs have recently issued a general rder (No. 2 of 1904) directing that drawback is in future o be allowed on duty-paid foreign sugar which has underone a process of crushing and colouring in the United Kingdom. The conditions to be observed for obtaining this rawback are similar to those applicable in the case of astor and icing sugar (see this J., 1902, 438).

Saccharin and Analogous Products; Importation of ——, into Spain Prohibited.

Bd. of Trade J., Jan. 21, 1904.

A Spanish law dated 24th December, 1903, prohibits e importation, manufacture, and sale of saccharin and analogous products, and of alimentary substances, beverages, and all articles which contain saccharin and analogous products, as well as mixtures of glucose and sugar. An exception is made in the case of saccharin and similar products imported for medicinal purposes; such importations must, however, be effected through the Custom houses specially designated for the purpose.

XVII.—BREWING, WINES, SPIRITS, Etc.

Denatured Spirit in Germany; Retail Price of ——.

Zeits. Spiritusind., 1904, 27, [2], 9.

The *Centrale für Spiritusverwerthung* (this J., 1902, 513) has notified an increase of the price of denatured spirit, but it is stated that the rise is not of sufficient amount to interfere with the healthy development of the application of spirit to technical purposes. The use of spirit for illuminating purposes is still profitable, even with a wholesale price of 25 m. per hectolitre for 90 per cent., and of 28 m. per hectolitre for 95 per cent. denatured spirit. The application of denatured spirit to technical purposes will, however, be seriously retarded if, following the usual tendency, the retail price be increased to a greater extent than corresponds to the rise of the wholesale price, and individual distillers are urged to use their influence to prevent any such excessive rise of the retail price.—A. S.

XX.—FINE CHEMICALS, Etc.

Aceto-Salicylic Acid: Australian Customs Decision.

Dec. 12, 1903.

Aceto-salicylic acid ("aspirin") was decided to be free of duty as a "drug," and not subject to 20 per cent. *ad val.* import duty as a "substitute for salicylic acid."

Tincture of Cannabis Indica: U.S. Customs Decision.

An alcoholic tincture of *Cannabis indica* of the strength used by homœopathic physicians was decided by the Board of General Appraisers to be dutiable at 55 cents per lb. as a "medicinal preparation containing alcohol," under paragraph 57 of the present Tariff Act, and not at 60 cents per lb. and 45 per cent. *ad val.*, under paragraph 2, as an "alcoholic compound" as assessed for duty.—R. W. M.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.], "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 1694. Morgan Crucible Co., Ltd., and Fox. Muffles. Jan. 22.

„ 1695. Morgan Crucible Co., Ltd., and Fox. Manufacture of cupels. Jan. 22.

„ 1975. Voiry and Fresnaye. Process and apparatus for the distillation, separation, or extraction in a closed vessel of volatile liquids only, or such as are contained in non-volatile substances. [Fr. Appl., March 27, 1903.]* Jan. 26.

[A.] 1997. Tetlow. Separators. [U.S. Appl., March 9, 1903.]* Jan. 26.

„ 1999. Shaw. Apparatus for cooking, concentrating, and evaporating liquids. Jan. 26.

„ 2002. Hauberg. Centrifugal balancing separators. Jan. 26.

„ 2171. Cossor. Means for gauging the quantity or density of liquids contained in tanks. Jan. 28.

„ 2211. Lawrence. Construction of trays for filter-presses. Jan. 29.

C.S.] 2264 (1903). Thompson (Anderson). Presses. Feb. 3.

„ 7520 (1903). Haddan (Edson). Evaporating apparatus. Feb. 3.

„ 20,049 (1903). Howorth (Eyde and Birkeland). Method of producing powerful chemical reactions in gases or gas mixtures, and apparatus therefor. Feb. 3.

„ 23,230 (1903). Cummer. Method of and apparatus for filtering liquids. Jan. 27.

„ 24,415 (1903). Niclausse. Separating liquids of different density. Feb. 3.

„ 25,059 (1903). Haddan (Edson Reduction Machinery Co.). Drying apparatus. Jan. 27.

„ 28,022 (1903). Howorth (E. Bazzi and Co.). Emulsifying apparatus. Feb. 3.

II.—FUEL, GAS, AND LIGHT.

[A.] 1365. Talbot. Regenerative furnaces. Jan. 19.

„ 1393. Johnson (Deutsche Continental Gas Ges., and Bueb). Manufacture of coal-gas. Jan. 19.

„ 1591. Shiels. Production of combustible vapour or gas. Jan. 21.

„ 1628. Zohrab. Mode and apparatus for the production of dry peat and peat charcoal. Jan. 22.

„ 1676. Blondel. Processes of manufacturing electrodes for arc lamps. [Fr. Appl., Feb. 5, 1903.]* Jan. 22.

„ 1738. Whitfield. Process and apparatus for the manufacture of combustible gas from peat, &c. Jan. 23.

„ 1825. Everitt and Redman. Extraction of tar and other impurities from illuminating gas. Jan. 25.

„ 1877. Birrell. Furnaces. Jan. 25.

„ 1887. Hoffman and Clark. Artificial fuel.* Jan. 25.

„ 2001. Duttenhofer. Manufacture of illuminating gas. Jan. 26.

„ 2199. Hollis and Bentley. Gas producers. Jan. 29.

„ 2240. Capitaine. Purifying the gas of gas producers.* Jan. 29.

„ 2268. MacGregor and Pearson. Apparatus for the manufacture of peat fuel. Jan. 29.

„ 2303. Johnson. Manufacture of air-gas. Jan. 30.

„ 2358. Peters. *See under* VII.

[C.S.] 4019 (1903). Banke and Fuchs. Process and apparatus for generating water-gas. Feb. 3.

„ 5496 (1903). Miess. Apparatus for the production of explosive mixtures by means of oil. Feb. 3.

„ 21,968 (1903). Höring and Mjöen. Method and apparatus for coking hydrous-bituminous combustibles. Feb. 3.

„ 23,583 (1903). Wigelius and Laurell. Production of gas for motive power and like purposes. Feb. 3.

„ 24,815 (1903). Maisch. Manufacture of incandescent mantles. Jan. 27.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 1881. Schulze and Chem. Fabr. Ladenburg. Manufacture of *m*-cresol from crude cresol. Jan. 25.

„ 2102. Coulson. Method of solidifying tar. Jan. 25.

[C.S.] 4431 (1903). Adiassewich. Method of treating stale oil and similar substances. Jan. 27.

„ 13,185 (1903). Van Wirkner. Process for the manufacture of pitch. Jan. 27.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 1389. Newton (Bayer and Co.). Manufacture and production of new colour lakes. Jan. 19.

„ 1502. Rowland. Aniline dyeing compound.* Jan. 20.

„ 1581. Lake (Oehler). Manufacture of colouring matters. Jan. 21.

„ 2265. Newton (Bayer and Co.). Manufacture and production of a new azo colouring matter and of colour lakes therefrom. Jan. 29.

[C.S.] 5328 (1903). Bury and Gerland. Manufacture of soluble indigo. Jan. 27.

„ 7395 (1903). Johnson (Badische Anilin und Soda Fabr.). Purification of indigo. Jan. 27.

„ 27,630 (1903). Imray (Soc. Chem. Ind. in Basle). Manufacture of new substantive tetrazo dyestuffs. Feb. 3.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 1285. Slacke and Courtney. Manufacture of waterproof paper or fabric. Jan. 18.

„ 1334. Pope, Hübner, and Brandt. Treating or finishing woven fabrics or paper to render embossing, moiré, or other effects produced thereon more permanent. Jan. 19.

„ 1646. Cuny-de-Pierron (Ulrich). Washing blue. Jan. 22.

„ 1840. Christiani. Colour printing. Jan. 25.

„ 1867. Johnson (Badische Anilin und Sodafabr.). Discharge of halogenated indigo colouring matters. Jan. 25.

„ 1930. Murray. Waterproofed textile fabrics and other materials, and methods and means employed in waterproofing them. Jan. 26.

„ 1935. Morton. Printed pile fabrics. Jan. 26.

„ 2027. Renard. Ornamenting fabrics. Jan. 27.

„ 2167. Castle. *See under* XIV.

[C.S.] 1407 (1903). Rudometoff. Multicolour printing mechanism. Jan. 27.

„ 1583 (1903). Rolffs. Polychrome printing on calico and other materials. Jan. 27.

„ 9724 (1903). Jardin. Process of bleaching flax, hemp, cotton, jute, ramie, straw, &c. Jan. 27.

„ 14,125 (1903). Dargue, Dargue, and Barker. Apparatus for dyeing, mordanting, or washing fibrous materials. Feb. 3.

„ 14,200 (1903). Rovira. Continuous bleaching apparatus. Jan. 27.

„ 22,697 (1903). Haddan (Oliva). *See under* XIV.

„ 27,426 (1903). Caffall. Process of treating surfaces for waterproofing and preservative purposes. Jan. 27.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc

[A.] 2385. Epstein. Process of dyeing chrome-tanne leather. Jan. 30.

[C.S.] 5594 (1903). Lake (Chem.-Tech. Fabr. Dr. Alb. R. W. Brand and Co.). Process for colouring and hardening natural stone; applicable also to organic material, such as ivory or the like. Jan. 27.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 1232. Fitton, Priestley, and Brook. Soda for washing and other domestic purposes. Jan. 18.

„ 1452. Grossmann. Method of manufacturing alkali nitrates. Jan. 20.

„ 1630. Macknight. Process of treating soot for the recovery of ammonia and other products, and apparatus used therein. Jan. 22.

„ 1684. Pearson. Process of fixing atmospheric nitrogen. Jan. 22.

„ 2284. Lake (Fallows). Production of phosphoric acid.* Jan. 29.

„ 2358. Peters. Process for utilising the waste ends of carbons from arc lamps.* Jan. 30.

[C.S.] 1755 (1903). Garroway. Manufacture of sulphuric anhydride. Feb. 3.

„ 4625 (1903). Gin. Manufacture of sulphate of copper. Jan. 27.

„ 24,639 (1903). Parkes. Production of Glauber salts, ferrous carbonate, ferrous hydrate, and ammonia from nitre cake. Feb. 3.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 1933. Marzin. Ceramic printing and the like. Jan. 26.

[C.S.] 4031 (1903). Shenstone. Furnaces for use in the manufacture of silica glass. Jan. 27.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 1339. Reid. Construction of and method of firing kilns for use in firing bricks, tiles, pipes, and other earthenware goods. Jan. 19.

„ 1695. Morgan Crucible Co., Ltd., and Fox. *See under* I.

„ 1776. Butterfield. The making of macadamised roads and the like, and solutions to be employed therein. Jan. 23.

„ 1941. Wilkins. Cement for iron and steel castings and such like. Jan. 20.

[C.S.] 5594 (1903). Lake. *See under* VI.

„ 11,802 (1903). Staab. Water-resisting mortar or cement. Feb. 3.

„ 27,928 (1903). Farnham. Waterproofing bricks, stone, and the like porous materials. Jan. 27.

„ 28,248 (1903). Zimmer. Compositions for the preservation of wood and other materials. Feb. 3.

X.—METALLURGY.

[A.] 1251. Alzugaray. Extraction of metals from their ores. Jan. 18.

„ 1252. Alzugaray. The making of iron and steel. Jan. 18.

„ 1323. Sharp and Raine. Utilisation of scrap iron and steel. Jan. 19.

„ 1551. Alzugaray. Manufacture of iron, steel, and their alloys. Jan. 21.

„ 1556. Malzac. Process for treating the silicated ores (simple or complex) of nickel. Jan. 21.

„ 1700. Richardson and James. Processes for smelting and refining metals, and apparatus therefor. Jan. 22.

[A.] 1767. Ganelin and Accumulatoren Fabr., Act.-Ges. Process for extracting metals, such as lead and silver, from ores. Jan. 23.

„ 1842. Engels. Process for treating steel and armour plates.* Jan. 25.

„ 1849. Wynne. Machinery for crushing ores and minerals. Jan. 25.

„ 1888. King. Apparatus for the reception, removal, and utilisation of slag produced from the smelting of ores. Jan. 25.

„ 1890. Kurzwernhart. Siemens' regenerative furnaces.* Jan. 25.

„ 1941. Wilkins. *See under* IX.

„ 2187. Atha. Treating scrap sheet steel, and recarbonising the same.* Jan. 28.

„ 2273. Hadfield. Manufacture of magnetic material. [U.S. Appl., June 12, 1903.]* Jan. 29.

„ 2278. Collins. Manufacture of briquettes for metallurgical or other purposes. Jan. 29.

[C.S.] 2574 (1903). Mechwart, Coltri et Cie. *See under* XI.

„ 3475 (1903). Quambusch. Furnace for use in iron and steel manufacture and the like. Feb. 3.

„ 5597 (1903). Marks (Lamargese). Processes for case-hardening iron and steel. Jan. 27.

„ 6283 (1903). Gröndal. Reducing iron ore to iron sponge, and furnaces therefor. Jan. 27.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 1588. Fenny (Fabr. Elect. Zünder Ges. m. b. H.). Dry cells. Jan. 21.

„ 1599. Ryffel. Galvanic batteries.* Jan. 21.

„ 1711. Ekstromer, and Ekstromer Accumulator Co., Ltd. Secondary batteries. Jan. 22.

„ 2152. Raschen, Clayton, and the United Alkali Co., Ltd. Electrolytic cells. Jan. 28.

[C.S.] 23,389 (1902). Schauli and Loewenstein. Galvanic dry cell. Feb. 3.

„ 2574 (1903). Mechwart, Coltri et Cie. Electrolytic process for the direct extraction of metals from ores, &c., and for the precipitation of the metals from the solutions, and apparatus therefor. Jan. 27.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 1303. Parziale. Manufacture of soap.* Jan. 18.

„ 1947. Stanley and The Fish Oil and Guano Co., Ltd. Treatment of fish offal. Jan. 26.

„ 2081. Töllner. Process for the manufacture of a substitute for cod-liver oil.* Jan. 27.

„ 2343. Falck. Process of manufacturing hard alcoholic soaps.* Jan. 30.

[C.S.] 2265 (1903). Thompson (Anderson). Process of expressing oils. Feb. 3.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

[A.] 1646. Cuny-de-Pierron (Ulrich). *See under* V.

„ 2376. Hérisson. Manufacture of paints or pigments. Jan. 30.

[C.S.] 17,956 (1903). Fischer. Manufacture of lithopone Feb. 3.

(*B.*)—Resins, Varnishes.

[A.] 1327. Phillips. Process for the recovery of shellac from hats and other material. Jan. 19.

(*C.*)—India-Rubber.

[A.] 1726. McCraith. Substances suitable for replacing or in conjunction with caoutchouc. Jan. 23.

XIV.—TANNING; LEATHER, GLUE, SIZE, Etc.

[A.] 1477. Schneider. Manufacture of glue and gelatine. Jan. 20.

„ 2167. Castle. Manufacture and waterproofing of leather, leather cloths, and all kinds of animal and vegetable fabrics. Jan. 28.

[C.S.] 1049 (1903). Arledter. Adhesives, and the process of manufacturing the same. Jan. 27.

„ 5594 (1903). Lake. *See under* VI.

„ 6191 (1903). Clark (Vaughan Machine Co.). Machines for treating hides, skins, and leather. Feb. 3.

„ 22,697 (1903). Haddan (Oliva). Manufacture of glue or size especially adapted for the warp threads of fabrics. Feb. 3.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 1797. Sulzen. Apparatus for making malt and for treating other similar materials.* Jan. 23.

[C.S.] 23,456 (1902). Macardle. Brewing. Feb. 3.

„ 2986 (1903). Driancourt. Apparatus for use in the manufacture of wines and the like. Feb. 3.

„ 4872 (1903). Southby. Brewing beer, and apparatus therefor. Jan. 27.

„ 25,582 (1903). De Meulemeester. Rapid extraction of the wort contained in the malt of breweries, distilleries, and similar industries. Feb. 3.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—Foods.

[A.] 1958. Goyard. Process for pasteurising milk.* Jan. 26.

„ 2065. Hatmaker. Dry milk, and process for obtaining same. Jan. 27.

(*B.*)—Sanitation; Water Purification.

[C.S.] 24,054 (1903). Ostwald. Process for utilising and disposing of town refuse, and apparatus therefor. Feb. 3.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 1257. Beadle and Sindall. Drying or heating paper, paper pulp, and other materials. Jan. 18.

„ 1285. Slacke and Courtney. *See under* V.

„ 1334. Pope, Hübner, and Brandt. *See under* V.

„ 1857. Hawke. Manufacture of sensitised copying papers. Jan. 25.

„ 2357. Howorth (Soc. Franc. de la Viscose). Apparatus for treating viscose. Jan. 30.

[C.S.] 26,149 (1903). Horteloup. Manufacture of paper pulp. Feb. 3.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[C.S.] 3543 (1903). Wetter (Heine and Co.). Terpene alcohols and artificial perfumes. Feb. 3.

„ 25,695 (1903). Verley. Manufacture of new compounds derived from citrylidene acetic acid, its nitrile and esters. Feb. 3.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 1857. Hawke. *See under* XIX.

„ 1927. Harrison. Photographic dry plates. Jan. 26.

„ 2369. McLaren. Photo-lithography. Jan. 30.

„ 2370. McLaren. Photo-lithography. Jan. 30.

[C.S.] 7163 (1903). Mills (Soc. Anon. Plaques et Papiers Phot., A. Lumière et ses fils). Preparation and employment of a new substance as a photographic developer. Feb. 3.

„ 27,059 (1902). Beckwith and Carten. Photographic films. Jan. 27.

„ 27,831 (1903). Meir. Sensitised cards for the production of picture post-cards, &c. Jan. 27.

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Messrs. W. Macnab and A. E. Leighton. "The Products and Relative Temperature of Combustion of some Smokeless Powders."

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Notices.

INTERNAL TRANSPORT.

The question of internal transport has been engaging more and more attention in recent years, and the demand for greater facilities for cheap transport has taken the concrete form of efforts to improve our canal system. The subjoined report of a committee of the Society specially appointed to consider this subject, shows the actual incidence of railway freights, irrespective of distance, on the chemical industry. Other industries and interests might be dealt with in a similar manner, with a view to bringing the importance of this question under the notice of members of Parliament and His Majesty's Government.

REPORT OF THE SUB-COMMITTEE ON INTERNAL TRANSPORT.

This Committee was appointed to collect from Members of the Society information showing the incidence of railway freights upon the chemical and allied industries. Questions were sent out to all Members as follows:—

(1) What goods do you manufacture?

(2) What is the total amount paid by you directly or indirectly for carriage within Great Britain of your raw materials to your manufactory, expressed per ton of finished products?

(3) What is the average amount paid per ton of finished product for carriage within Great Britain to the consumer, the retailer, or to the port of shipment?

(4) What is the average sale price per ton of your finished products?

(5) Do you make any use of inland waterways; and, if so, for what proportion of your total carriage?

From these questions it was expected that the proportion of freight charge to the selling value of the goods would be established for the classes of goods in which the Society is interested, as well as the extent to which canals are utilized, and possibly the effect upon railway freights should the utilization of canals be further developed.

The total number of replies received was 72; of these 26 were practically useless, owing to insufficiency of the replies, 24 were from makers of heavy chemicals, 3 from paper makers, 2 from glass makers, 3 from glucose makers, 2 from bleachers and dyers, 3 from tanners, 9 miscellaneous.

The firms giving replies may be fairly taken as thoroughly representative of their respective trades. In a large number of cases, however, the inward freight calculated on the finished product is not given. In summarizing, therefore, it will be necessary to separate the complete from the partially complete returns, and in dealing with these two classes it will be advisable to divide them into (1) Heavy Chemicals, (2) Allied Industries; the latter including all the other classes of manufacture mentioned above. The summary consists of tables, in which are given (A) value of goods per ton, (B) percentage of freight on value of goods, (C) percentage utilization of canals, and are as follows:—

COMPLETE RETURNS.

(R.M.C. means "Raw Materials chiefly by canal.")

(1) *Heavy Chemicals.*

—	A.	B.	C.
	£ *s.* *d.*	Per Cent.	Per Cent.
1	39 0 0	2½	Nil
2	7 10 0	4	R.M.C.
3	15 0 0	5⅓	1
4	39 17 0	5·8	25
5	10 0 0	6½	49
6	3 6 4	8½	5
7	4 8 2	10	1
8	30 0 0	10	1
9	6 10 0	11½	5
10	3 7 3	13½	Nil
11	4 7 0	15	25
12	4 17 6	17	13
13	2 8 0	19·8	R.M.C.
14	2 5 0	23	Nil

(2) *Other Articles.*

—	A.	B.	C.
	£ *s.* *d.*	Per Cent.	Per Cent.
1	120 0 0	0·5	Nil
2	112 0 0	2·6	33
3	110 0 0	3·2	R.M.C.
4	14 10 0	4	20
5	107 10 0	4·2	20
6	14 10 0	6	30
7	72 14 8	7	6
8	13 0 0	8	Nil
9	13 10 0	8	5
10	12 0 0	9	Nil
11	16 0 0	14	18
12	10 0 0	15	Nil
13	8 0 0	25	"

RETURNS WHERE ONLY OUTWARD FREIGHT IS GIVEN.

(1) *Heavy Chemicals.*

1	20 0 0	2·2	R.M.C.
2	20 0 0	2½	Nil
3	60 0 0	3·3	"
4	6 0 0	5½	"
5	2 15 0	6	"
6	4 10 0	6	"
7	9 0 0	8	22
8	4 0 0	10½	R.M.C.
9	8 10 0	11½	Nil

(2) *Other Articles.*

1	180 0 0	1	Nil
2	10 15 0	3	"
3	26 0 0	4	"
4	10 10 0	7	40
5	20 0 0	7	40
6	1 13 0	15	Nil
7	5 6 9	23	"

As would naturally be expected, the burden of freight is highest on the cheaper articles, and the articles under the value of 5*l.* per ton bear a burden varying from 8½ per cent. to 23 per cent. of the value.

These totals are irrespective of distance, and, as we may fairly assume that each works has a certain amount of short distance trade where it has the advantage of position over competitors, it follows that, in the really competitive areas, the burden of freight exceeds the average figure, bringing the range of the figures where competition is keenest to from 15—30 per cent. As compared with cheap freights from continental ports, this is an extremely heavy burden, and a serious handicap to Lancashire manufacturers wishing to send goods to London or Newcastle, or to the two latter wishing to send goods to Lancashire.

No deductions can be drawn from the figures collected as to the effect of the utilisation of canals upon railway freights, but this may be due to the fact that a large proportion of the canals are in the hands of the railway companies.

Whether the railway companies can be expected to carry at appreciably lower rates is doubtful, but, as proved by the experience of Germany, Belgium, France, and the United States, heavy articles can be carried much more cheaply by canal, if the latter be only brought up to date.

The whole weight of the Society should be brought to bear on the subject, and similar bodies of manufacturers should be invited to investigate the incidence of railway freight in their trades.

To emphasize the importance of this question, it is worth noting that halving the burden of freights in competitive areas would afford relief to manufacturers of from 7½ to 15 per cent. of the selling price.

ANNUAL GENERAL MEETING, NEW YORK, 1904.

The Annual General Meeting will be held in New York City on Thursday, Sept. 8th, and following days. Members who contemplate attending are requested to communicate with the General Secretary as soon as possible, in order that suitable travelling arrangements may be made. A programme appears in the Jan. 30 issue of the Journal.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

List of Members Elected

23rd FEBRUARY 1904.

Allen, T. E., c/o American Aristotype Co., Jamestown, N.Y., U.S.A., Chemist.

Alton, L. A., "Dungarvan," Putney Heath, S.W., Chemist.

Andrews, G. D., 7, Old Ford Road, London, N.E., Chemist.

Archdale, W., 21, Oldham Road, Miles Platting, Manchester, Manager of Chemical Works.

Baron, W. B., Manchester Steam Users' Association, 9, Mount Street, Manchester, Chemist.

Benn, R. H. D., 16, Springfield Avenue, Westmount, Montreal, Canada, Analytical Chemist.

Bowden, T., 201, Heights Lane, Rochdale, Dyer's Chemist.

Braman, W. W., State College, Pennsylvania, U.S.A., Assistant.

Coblentz, L., 122, Broderick Street, San Francisco, Cal., U.S.A., Chemist.

Cochran, C. B., 514, S. High Street, West Chester, Pa., U.S.A., Teacher of Chemistry.

Culmer, H. H., 6200, Madison Avenue, Chicago, Ill., U.S.A., Chemist and Tar Distiller.

Catts, Henry E., 55, Fulton Street, New York City, U.S.A., Technical Chemist.

Davidson, R., c/o Dalgety and Co., Ltd., 15, Bent Street, Sydney, N.S.W., Australia, Chemist.

Dubois, N. A., 407, Euclid Avenue, Syracuse, N.Y., U.S.A., Instructor in Chemistry.

Duncan, W. W., 406, Massachusetts Avenue, Boston, Mass., U.S.A., Chemist.

Finch, M. L., Vitriol and Chemical Works, Cattledown, Plymouth, Chairman of Directors.

Finn, C. P., Farnley Iron Works, Farnley, Leeds, Technical Chemist.

Glendinning, T. A., 31, Garthland Drive, Dennistoun, Glasgow, Brewery Chemist.

Gotthelf, A. H., Hastings on Hudson, N.Y., U.S.A., Chemist.

Gray, Jas., Box 5, Fordsburg, Johannesburg, Transvaal, Chemist.

Gresty, J. E., 135, Oxford Street, Manchester, Chemical Engineer.

Hadley, Geo., 58, Halesowen Street, Blackheath, Staffs., Spelter Works Manager.

Henshaw, P. B., 3, Dobbin Hill, Endcliffe, Sheffield, Steel Chemist.

Holden, N. N., c/o Messrs. Hardman and Holden, Miles Platting, Manchester, Manufacturing Chemist.

Holgate, Arthur, Rigby Street Mills, Liverpool, Corn Miller.

Hopewell, F., 86, Youville Square, Montreal, Canada, Manager.

Howell, W. L., c/o Appraiser's Office, Custom House, New Orleans, La., U.S.A., Chemist.

Huntzinger, A., 3, Egerton Road, Chorlton-cum-Hardy, near Manchester, Chemist and Colourist.

Johnston, Thomas J., 4, Garrioch Drive, Kelvinside North, Glasgow, Chemist.

Jordan, Stanley, 100, William Street, New York City, U.S.A., Importer of Chemicals.

Lancey, Darragh de, Great Barrington, Mass., U.S.A., Secretary and Assistant General Manager.

Lessing, Dr. Rudolf, The Gas Light and Coke Co., Ltd., Tar and Liquor Works, Beckton, E., Chemist.

Loveland, James W., 8, Kenwood Street, West Somerville, Mass., U.S.A., Superintendent of Soap Works.

Mackintosh, J. C., Canada Iron Furnace Co., Midland, Ontario, Canada, Chemist.

Merry, John B., Ashfield, Ash Lane, Hough Green, near Widnes, Works Chemist.

Moore, G. J., jun., c/o National Brewers' Academy, 39, South William Street, New York City, U.S.A., Analytical Chemist.

Morson, Thomas D., c/o T. Morson and Son, Summerfield Works, Ponder's End, N., Chemist.

Nicholson, Wilfred, Hunslet Chemical Works, Leeds, Chemical Manufacturer.

Norris, Cassius W., 612, Commerce Street, Milwaukee, Wis., U.S.A., Tannery Chemist.

Oberländer, Dr. Otto, 62, Delaunay's Road, Crumpsall, Manchester, Technical Chemist.

Owen, Halsall, Newholme, Latchford, Warrington, Engineer.

Perrott, Bert, County School, Neath, Glamorgan, Demonstrator in Chemistry.

Pickup, Edgar H., 348, Great Clowes Street, Higher Broughton, Manchester, Calico Printer.

Prichard, N. B., Capelton, Quebec, Canada, Chemical Engineer.

Rademacher, Dr. Ferdinand, Prag Carolinenthal, Austria, Chemical Manufacturer.

Ray, William, 65, Wellington Road, Fallowfield, Manchester, Colourist.

Rowley, E. W., Chemical Laboratory, Loco. Department, N.E.R., Gateshead-on-Tyne, Analytical Chemist.

Seligman, Richard, c/o Messrs. J. and W. Seligman, Mills Buildings, New York City, U.S.A., Chemist.

Skerten, William B., 25, Broad Street, New York City, U.S.A., Chemical Accountant.

Standfast, J. T., c/o Messrs. Burt, Boulton, and Heywood, Ltd., Selzaete, Belgium, Chemist.

Thurston, Azor, Grand Rapids, Ohio, U.S.A., Chemist.

Tickle, Thos., 83, Queen Street, Exeter, Analyst.

Trautwein, Alfred P., Carbondale, Pa., U.S.A., President.

Turner, Owen, Park Tower, Ipswich, Tanner and Currier.

Walther, Wm., Holzapfel's Compositions Co., Ltd., Heworth Shore, Felling-on-Tyne, Chemist and Works Manager.

Whatmough, Dr. William H., Woodleigh, Cheadle, Cheshire, Chemist.

Wieler, Eric E., 4, Palatine Road, Withington, Manchester, Chemical Merchant.

Wigg, Chas. E., Rockshaw, Merstham, Surrey, Electrical Engineer.

Williams, John T., Glenbrook Avenue, Stamford, Conn., U.S.A.

Williams, Naboth, 28, Rolleston Street, Warrington, Technical Chemist.

Woolcott, G. H., 26, Birdhurst Road, Croydon, Brewer's Chemist.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

Biggart, Wm. L ; all communications to Woodbine, Bridge of Weir, N.B.

Borland, C. R., l/o Oakland, N.J.; P.O. Box 24, Concord Junction, Mass., U.S.A., Powder Manufacturer.

Burls, H. T., l/o Lewisham; c/o H. S. King and Co., 65, Cornhill, London, E.C.

Burton, Alf.: all communications to 42, Front Street West, Toronto, Canada.

Campbell, And.; all communications to Burma Oil Works, Dunneedaw, Rangoon, Burma.

Church, E. D., jun., l/o 65; 63, Wall Street, New York City, U.S.A.

Clark, Edm., l/o Flushing: Board of Health, Sixth Avenue and 55th Street, New York City, U.S.A.

Davis, A. C.; Journals to 2, Downing Grove, Cambridge.

Duguid, Jas., l/o Highbury; 10, Godliman Street, London, E.C.

Fahrig, Dr. Ernst, l/o Orono; 3615, Locust Street, Philadelphia, Pa., U.S.A.

Fairhall, E. J.; communications to 29, Winsham Grove, Clapham Common, S.W.; Journals as before.

Hawkins, H., l/o Boston; Concord Junction, Mass., U.S.A.

Macara, Thos.; Journals to Thrushgrove Works, Paisley, N.B.

McDougall, Isaac S., l/o Didsbury; The Orchard, Hale, near Manchester.

McDougall, Isaac, jun., l/o Didsbury; The Orchard, Hale, near Manchester.

McKechnie, R. D., l/o Carnoustie; c/o The British Explosives Syndicate, Ltd., Pitsea, Essex.

Millen, J. D., l/o Sydney; Mount Bischoff Smelting Works, Launceston, Tasmania.

Molesworth, F. H., l/o Petersham; 46, West Street, North Sydney, N.S.W.

Nakayama, T., l/o U.S.A.; c/o Fuji Paper Co., Sanjikkenbori, Tokyo, Japan.

Paine, Aug. G.; Journals to 41, Park Road, New York City, U.S.A.

Perry, Robt. S., Journals to Station D, Philadelphia, Pa., U.S.A.

Russell, T. A., l/o Grenville Street; Queen's Hotel, Toronto, Canada.

Smith, And. T.; communications to c/o Castner-Kellner Alkali Co., Ltd., 43, Castle Street, Liverpool, General Manager.

Smith, Ewing; Journals temporarily to 19, Queen Street, Perth, N.B.

Smith, F. Gurney; all communications to 7, Luxemburg Gardens, Brook Green, W.

Smith, J. Kent, l/o Hoole; 32, Hough Green, Chester.

Thompson, G. W., l/o Adams Street; 129, York Street, Brooklyn, N.Y., U.S.A.

Toch, Max., l/o New York; 52, 9th Street, Long Island City, N.Y., U.S.A.

Tocher, J. F., l/o 1; 5, Chapel Street, Peterhead, N.B.

Torrey, C. A., jun., l/o Lynnfield; 17, Park Vale, Brookline, Mass., U.S.A.

Tucker, Alex. E., l/o Paradise Street; Norwich Union Chambers, Congreve Street, Birmingham.

Voorhees, L. A., l/o 259; Box 55, New Brunswick, N.J., U.S.A.

Warren, Fiske, l/o 220; 161, Devonshire Street, Boston, Mass., U.S.A.

London Section.

Meeting held at Burlington House, on Monday, January 4th, 1904.

MR. WALTER F. REID IN THE CHAIR.

RAPID ESTIMATION OF MERCURY BY MEANS OF HYPOPHOSPHOROUS ACID.

BY B. F. HOWARD.

Introductory.—For some reason the estimation of mercury by methods of reduction has never replaced, or even competed with the well-established method of distillation. This may be partially accounted for by the highly unsatisfactory results which are often obtained by the use of certain reducing agents. Stannous chloride, for instance, is not at all a suitable reducing agent for the estimation of mercurial salts, as the reduction takes place very slowly and is apt to give variable results. Vanino and Freubert (Ber., 1897, **30**, 2808, and this J., 1898, 72) state that phosphorous acid after 12 hours' standing in the cold completely reduces mercuric chloride to calomel. Warming causes the formation of metallic mercury; in the presence of hydrogen peroxide, however, the precipitated calomel remains unchanged, and the reaction is complete in a few minutes. The calomel is filtered, washed and dried at 105° C. and weighed as such. In another paper (Ber., **30**, 2000; this J., 1897, 1043) the same authors state:—"If hypophosphorous acid be added to a solution of mercuric chloride in sufficient quantity, the whole of the mercury is rapidly precipitated as calomel. Should the acid be in excess, the metallic mercury is precipitated, but this can be prevented by the addition of hydrogen peroxide." J. R. Thompson (this J., 1897, 263) recommends the use of hypophosphorous acid in the following manner. The salt is dissolved in hydrochloric acid, and potassium hypophosphite is added, calomel being obtained and the mercury being estimated as such. He recommends this method for analysing ammonio-mercuric chloride, and quotes some results obtained from different samples of this salt. To most analysts who purpose using reduction methods for the estimation of mercury, it would seem more satisfactory to make use of a reducing agent which would readily reduce the mercury salt to the metallic state, so that it could be obtained as a metallic bead, and weighed as such, instead of being weighed as mercurous chloride, as the previously mentioned chemists suggest. Hypophosphorus acid when used in considerable excess will be found to answer this purpose very well. With the following common commercial salts of mercury it has been found to give a rapid reduction, and to enable the whole estimation to be performed in a period varying between 1 hour and $1\frac{1}{2}$ hours: calomel or mercurous chloride, corrosive sublimate or mercuric chloride, ammonio-mercuric chloride, $HgClNH_2$, mercuric nitrate and mercuric oxide. Its use could doubtless be successfully applied to most of the other well known salts of mercury. The process has proved especially useful when a rapid estimation is desired, for, as is well known, the distillation method cannot easily be carried out in less than three hours. This method may also be employed for determining the strength of solutions of mercuric chloride and nitrate of mercury. These can be estimated very rapidly, as the mercury is precipitated in metallic form on the addition of hypophosphorous acid to the solutions. This process compares favourably with the ordinary distillation method, for it has practically no sources of error which are not equally prominent in both methods. It cannot, however, be applied to the estimation of mercuric iodide.

Experimental.—The estimations using mercurous chloride were at first carried out in the following manner:—An amount between 0·75 and 1·5 grm. was weighed into a small porcelain dish, and hypophosphorous acid of sp. gr. 1·136, at the rate of 5 c.c. to 1 grm. of mercuric chloride run into the basin and stirred up with the salt. The dish was then warmed on a steam bath and the contents stirred gently. After five minutes the mercury was all deposited in a fine black powder; in 15 to 20 minutes the reduction was complete, and a clean globule of metallic mercury obtained. In the first series of experiments, this globule was washed free from acid with water, then with alcohol and ether, and, to complete drying, was placed on a steam bath in a previously weighed glass capsule, and afterwards weighed. The sample contained 0·078 per cent. of water. The theoretical percentage of mercury in mercurous chloride is 84·96, or, with 0·078 per cent. of water, 84·88 per cent.; the amount of mercury found by experiment was 83·24 and 83·32 per cent. The low results were due, no doubt, to the small floating particles of mercury being washed away, and to the volatisation of metallic mercury during the final drying. In order to remedy these defects, various modifications of procedure were tried, of which the following gave most satisfactory results.

A small filter-paper was washed with hypophosphorous acid, alcohol, and ether, dried in the oven, and weighed in a weighing bottle. This paper was then used to filter all the washings of the mercury globule, and was afterwards dried, returned to its weighing bottle, and re-weighed. In this way all the small floating particles of mercury were included in the total weight of mercury obtained. The globule, after being thoroughly washed with water, alcohol, and ether, was placed in its glass capsule in a desiccator before weighing, so that no loss could occur at this stage through volatisation.

The amount of hypophosphorous acid, sp. gr. 1·136, required for 1 grm. of the mercurous chloride was increased from 5 c.c. to 10 c.c. With the above modifications, fairly concordant results were obtained, five consecutive estimations of the same sample giving the following results :—

Expt. No.	Weight of Hg_2Cl_2 taken.	Percentage of Hg found.	Percentage of Water in Sample.	Theoretical Percentage of Hg.	Corrected for this Sample.
	Grms.				
7	0·9890	84·18	0·0784	84·96	84·88
8	1·2175	84·27	0·0784	84·96	84·88
9	1·0077	84·45	0·0784	84·96	84·88
10	1·1443	84·23	0·0784	84·96	84·88
11	0·9154	84·41	0·0784	84·96	84·88

The lowness of these results may be accounted for in two ways:—(1) The extremely volatile nature of the floating particles of freshly precipitated mercury at the temperature of the water bath. (2) The comparatively large quantity of the residual mercury which was in the form of a film on the tared filter paper. The average weight of film was 0·00352 grms., or about 0·4 per cent. of total mercury. In order to obviate these sources of error, the next series of experiments was conducted somewhat differently. A larger amount of the mercurous chloride was used for the estimation, but not so great an excess of hypophosphorous acid. It was found that the reduction was just as rapid, and the total amount of floating particles did not increase. The process was carried out in a lipped glass capsule of about 100 c.c. capacity. The washings were very carefully decanted off, so that all the particles of mercury remained behind in the basin. After washing with water, alcohol, and ether, the basin and its contents was placed in a desiccator for some hours and then weighed. It was found that no appreciable quantity of mercury was washed out, better results accordingly being obtained. Apparently the accuracy of these determinations depends largely on the quantity of the mercury salt used, for the greater the original weight the more the sources of error were reduced. Care must be exercised to wash out the excess of hypophosphorous acid before adding alcohol, for the acid contains traces of lime, which are precipitated by alcohol and remain with the mercury.

The following results were obtained with the above modifications :—

Expt. No.	Grms. of Hg_2Cl_2.	Grms. of Hg obtained.	Percentage of Hg found.	Theoretical Percentage of Hg, corrected for Moisture in Sample.
12	5·3343	4·5172	84·68	84·88
13	6·1481	5·2098	84·74	84·88
14	8·3474	7·0816	84·84	84·88

These figures show that the method is quite reliable for the estimation of calomel, provided that the following conditions are observed :—(1) At least 5 grms. of the salt should be used for the estimation. (2) The last traces of hypophosphorous acid should be washed completely away from the globule before alcohol is added. (3) The floating particles must be allowed to settle before the washings are decanted off.

Ammonio-Mercuric Chloride, $HgClNH_2$.—The reduction appeared to be just as rapid and easy as in the case of calomel. The blackening took place immediately on adding the acid, and metallic beads were obtained after about 15 minutes' warming on the water-bath. On experimenting with small quantities (1·6 to 2·5 grms.) low results were obtained. The following are three typical results obtained by using small quantities :—

Amount of $HgClNH_2$.	Weight of Hg.	Percentage of Hg.	Percentage of Hg in $HgClNH_2$.
Grms.			
1·5167	1·1705	77·17	79·68
2·0849	1·6082	77·14	
2·3289	1·8085	77·32	

This salt of mercury has invariably been found to give results from 1 per cent. to 2 per cent. lower than the calculated amount of mercury (compare J. R. Thompson, this J., 1897, 263). A further estimation, carried out with a larger quantity of this salt, confirmed the previous results. The discrepancy between the amount of mercury obtained by the analysis of this ammonio-mercuric chloride and that required by theory is fully accounted for by the presence of ammonium chloride, traces of this being found in all commercial samples of the salt.

Mercuric Nitrate (Impure).—The crude nitrate must be mixed with some cold water before adding the acid, and this should be diluted and added slowly in order to avoid the action taking place too violently. If the strong hypophosphorous acid is added direct to the nitrate, the reduction takes place with explosive violence, occasioning loss.

There is considerable variation in the results recorded in the following table, but this is due to the exceedingly variable composition of the mixture which was analysed. It will be observed that the results of the estimations of each sample agree fairly closely.

Sample.	Experiment.	Water used.	Hg obtained.	Hg.
		Grms.	Grms.	Per Cent.
A	1	12·9600	9·7588	75·3
	2	12·9600	10·0440	77·5
B	1	12·9600	11·1326	85·90
	2	12·9602	11·1261	85·85
C	1	12·9600	10·0369	77·6
	2	12·9600	10·0068	73·0

Mercuric Oxide, HgO.—Hypophosphorous acid may be used for the estimation of mercury in this salt. As in the case of the nitrate, the reduction is very rapid, in fact almost explosively so, consequently water must be added both to the oxide and to the acid before mixing them. A slight variation was made on the former procedure. All the washings from the mercury bead were kept in a beaker, and any mercury in suspension settled to the bottom. The supernatant liquor was decanted off and the residual mercury was washed and placed with the globule in the capsule dish.

Six consecutive estimations of a sample of commercial mercuric oxide gave the following results :—

Experiment No.	Grms. of HgO taken.	Grms. of Hg obtained.	Percentage of Hg in sample.
1	3·0724	2·8485	92·06
2	3·5356	3·2440	91·75
3	4·5272	4·1455	91·57
4	3·1886	2·9030	91·04
5	3·2678	2·9851	91·04
6	2·1202	1·9387	91·44

Mercuric Chloride.—The analysis of mercuric chloride by this method proved satisfactory. On the addition of the acid (in the proportion of 2 c.c. of acid to 1 grm. $HgCl_2$) a white flocculent precipitate of calomel is deposited, but on adding more water and stirring and warming this is rapidly reduced to metallic mercury, a clean globule being obtained in about 10 minutes.

The following results were obtained :—

Estimation. No.	Grms. of $HgCl_2$ used.	Grms. of Hg obtained.	Percentage of Hg found.
1	3·0439	2·2363	73·46
2	3·1983	2·3589	73·75
3	3·4822	2·5651	73·67
4	2·4703	1·8192	73·72
5	1·9548	1·4390	73·66
6	2·1792	1·6053	73·66

The calculated amount of mercury in mercuric chloride is 74·07 per cent.

The difference between the theoretical and experimental result may be attributed, as before, to the volatilisation of floating particles of freshly reduced mercury while in the water bath. This would, however, be a fair constant experimental error, and could be allowed for.

Mercuric Iodide. — The estimation of this salt by reduction methods is attended with considerable difficulty, owing to the formation of hydriodic acid, which, acting on the mercury, forms the soluble mercurous iodide and so prevents a complete reduction. Various modifications were tried, but this difficulty could not be altogether removed, and consequently unreliable results were obtained.

Experiment A.—2·1996 grms. of the salt were acted upon direct with 25 c.c. of the acid (sp. gr. 1·136), and, on warming, part of the mercury was deposited, *viz.*, 0·7848 grm. On adding water to the acid liquor and boiling, a further quantity of 0·202 grm. of mercury was precipitated. The total weight of mercury deposited was 0·9153 grm., equal to 41·62 per cent. The calculated yield is 44·12 per cent. of mercury.

Experiment B.—A smaller excess of acid was used, 3·2977 grms. being treated with 15 c.c. of the acid. The first deposit of mercury was 1·0830 grm., and the second 0·0871 grm. Total Hg = 1·1701 grm. = 35·5 per cent.

Experiment C.—The salt 0·9393 grm. of mercuric iodide was dissolved in potassium iodide and 30 c.c. of hypophosphorous acid added. Weight of mercury obtained = 0·2356 grm.; therefore percentage of Hg = 25·08 per cent.

Experiment D.—The salt was intimately mixed with zinc dust in a large excess; both were finely powdered together, stirred with water, and warmed on a water-bath. A zinc-mercury amalgam was readily formed under these conditions. This was washed with water to remove the soluble zinc iodide; the zinc was eliminated by warming with 50 per cent. sulphuric acid. Considerable difficulty was experienced in getting rid of the last traces of zinc, the operation requiring prolonged treatment with sulphuric acid for a period of several days. The mercury bead (which even then was not quite free from zinc) was washed with alcohol and ether, and weighed. Salt taken, 2·3708 grms.; Hg obtained, 1·2302 grm.; yield = 51·04 per cent. Hg.

Experiment E.—The salt was several times evaporated to dryness on a water bath in the presence of strong nitric acid, and the residue treated with hypophosphorous acid as before. Weight of salt, 2·0940 grms. Weight of mercury obtained, 0·7065 grms.; yield = 33·74 per cent. In this case the conversion of iodide into nitrate and the liberation of the iodine was not complete, and some of the iodine remaining behind as hydriodic acid or iodic acid, prevented the complete precipitation of the mercury.

In all these cases, the failure of the estimation may be attributed to the difficulty of removing all the iodine in the mercuric iodide. Unless a suitable "iodine carrier" can be found, the estimation of this salt by reduction methods is not possible.

The above results show that the method can be applied to the estimation of several salts of mercury for the purpose of rapid analysis. Rough commercial salts which contain unsoluble impurities, such as dirt, sand, &c., must be dissolved in hydrochloric acid and filtered before the mercury is reduced to the metallic state. This should always be done when the globule of mercury obtained by the direct action of hypophosphorous acid on the solid is not perfectly clean and bright. In this manner the method may be found applicable to the analysis of pure and impure salts of mercury.

Discussion.

Mr. Thomas Tyrer congratulated the author on his useful paper. The differences between the results by this method and theory were somewhat large, but it was not always possible to have close accuracy with that rapidity which was sometimes essential for rapid checking in manufacture. The author had demonstrated that, whatever the defects of the method, the results were comparable. Hundreds of analyses, by this method, had been made in his firm's laboratory, and the results were practically identical with Mr. Howard's, and, making the average allowance for each salt, accurate working figures were obtainable. He used the hypophosphorous acid method first, about 1893 or 1894, and he could not account for any discrepancies except on the ground of the volatility of mercury. He was somewhat surprised, on looking into an old edition of Fresenius, to find it stated that there was no danger from volatility, and yet results were given of some experiments which indicated that the volatility of mercury under some conditions was 0·0004. C. T. Bennett refers to this method in the Pharmaceutical Journal, [4], **11**, 575, with confirmatory results. With regard to the ammonio-chloride salt, its absorbent character should be remembered, and for close results the air-dried salt should be treated. In the assay of red iodide of mercury the copper method of the Pharmacopœia was almost as unreliable as the usual lime method. He never got anything like the theoretical 43·5 to 44·0 per cent. of mercury. Very disappointing results were obtained by the use of zinc, arising undoubtedly from the causes already referred to. Magnesium dust was suggested by his assistant, Mr. Gosling. The operative conditions were much the same as for zinc, with equal rapidity in operation. There was a more violent action at first, but, with obvious precautions, loss from that cause could be avoided. The results would compare well with theory, and were certainly more encouraging than with zinc dust. The results were 41·29, 41·8, 41·31, and 41·28 per cent., instead of 32 and 33 per cent. by the zinc method. It should, however, be stated that a trace of mercury was found in the supernatant liquid, but not enough to account for the whole deficiency. There was no danger of amalgamation. He agreed with the author as to the treatment by the hypophosphorous method of mixed mercurial residues containing sand and all sorts of substances, but he found that it was best to treat the whole together carefully and after washing on a tared filter, drying, and weighing, to heat in a crucible and volatilise the mercury.

Mr. D. A. Sutherland said he had analysed many hundreds of samples of mercury ores, and never took longer than 40 minutes, and often not more than 15. He had never made an estimation of mercuric chloride, mercurous chloride, or ammonial mercuric chloride in this way, but he had of mercuric oxide, and constantly of sulphide or cinnabar and other ores occasionally containing as much as 82 per cent. or nearly 90 per cent. of mercury. The process, although apparently not well known, was simple: it only required a special crucible lid of pure gold. One grm. of the ore to be analysed is weighed into an ordinary Berlin crucible and 5 grms. of litharge stirred in. A gold lid, so constructed that the central portion can hold water, is fitted to the crucible. The crucible is heated by a Bunsen burner, and the mercury volatilised on to the lid. In five or ten minutes the lid and adhering mercury can be weighed. He saw no reason why iodide of mercury should not be estimated in this way. If any sample presented special difficulty he should reduce the mercury to sulphide, or in some other way get it in a form in which it could be treated in a crucible.

Dr. L. F. Guttmann remarked that, with reference to the estimation of mercuric iodide, Mr. Howard said that he evaporated with nitric acid and obtained low results. He had found the same, and had attributed it to the volatility of the mercury salt.

Mr. D. A. Louis said the author had devised a very careful and accurate process for the estimation of mercury, which took some 48 hours. He had been in mercury mines, where he had estimated sulphides, chlorides, and other combinations of mercury, within a quarter of an hour or so. Although he regarded the use of the gold lid described by Mr. Sutherland as preferable, yet in its absence he had successfully used a sovereign for the purpose. The presence of organic matter did not affect the determinations. Even mercuric ointment could be easily estimated by the method.

Mr. W. T. Burgess cited the following proof of the volatility of mercury at the ordinary laboratory temperatures. For many years, where he was working with mercury he had some shelves on which chemicals were kept, and he noticed that, although they were several yards away from the mercury table, the stoppers and tops of bottles containing iodine, no matter how often they were cleaned, always had a thin coating of iodide of mercury on them. He could easily scrape off sufficient iodide to show the characteristic change of colour on heating.

Dr. Divers said that this determination of mercury as metal was a case well illustrating the advisability of seeking greater accuracy by working on larger quantities than usual when the doing so was not counter-indicated. Having had some experience in the collection of precipitated mercury for weighing, he could confirm the author's experience that loss of mercury in the finely-divided state was difficult to avoid, and that its amount depended upon the mode of working, and very little upon the quantity of mercury worked upon. He could recommend, for rapidity and simplicity, the washing of a globule of mercury upon a porous tile or a few layers of filter paper. The volatility of mercury with steam was such that any mercurous salt, soluble or insoluble, boiled with water gave off metallic mercury. A paper on this subject, by a Japanese chemist, Mr. Hada, had been published in the Journal of the Chemical Society for 1896. This chemist had also shown (J. Chem. Soc., 1895) that the first product of the action of a hypophosphite upon mercuric or mercurous nitrate in solution is to form a black double salt, mercurous nitrate hypophosphite, $HgH_2PO_2.HgNO_3.H_2O$. The speaker believed that the presence of any considerable quantity of acid other than hypophosphorous acid would prove to be undesirable by delaying reduction of the mercury, since that was markedly the case when the reducing agent was sulphur dioxide. Ammonio-mercuric chloride, or "white precipitate," would rarely give accurately the calculated percentage of mercury, since it is liable to contain a little additional ammonium chloride and also minute quantities of the half-hydrated dimercurammonium chloride, $2NHg_2Cl.H_2O$, described by André in 1889, and again by Prof. Ray, of Calcutta, in 1902. The failure to fully reduce mercuric iodide dissolved in potassium iodide may be attributed to the immediate reconversion of mercurous iodide into mercuric iodide by this salt, which would continuously undo the work of the hypophosphorous acid.

Mr. C. G. Cresswell asked what steps were taken to ascertain whether the mercurial salts contained the calculated percentages. It was quite possible that some of the results might be quite correct, although they did not agree with the calculated percentages, if the salts contained some unknown impurity.

Mr. B. F. Howard, in reply, said a number of suggestions and criticisms on this method had been made, and he thought he agreed with nearly all, and thanked the members for their various suggestions. There was no doubt using a lid or gold dish as suggested would answer in the case of these mercurial salts just as well as in ores containing mercury. As the amount of mercury obtained was very small, there was more possibility of error in the weighing. He failed to see why there should not be a great difference between the volatility of freshly precipitated floating particles of mercury and a homogeneous bead or globule of the same metal. He was obliged to Mr. Tyrer for his suggestion about the use of magnesium dust to make an amalgam; it would probably be a more convenient way than the zinc method. Washing on filter paper would undoubtedly be better than by decantation.

The Chairman said, with regard to the volatility of mercury, that it was considerable even below the boiling point of water; mercury was even volatile in the heat of the sun. They were much indebted to Mr. Howard for this interesting paper, which bore testimony to much careful research. If all manufacturers were to work out the details of their business in a similar manner they would have no need to fear foreign competition. He hoped this would not be the last paper which Mr. Howard would contribute to their proceedings.

THE DETERMINATION OF MOISTURE IN NITROGLYCERIN EXPLOSIVES.

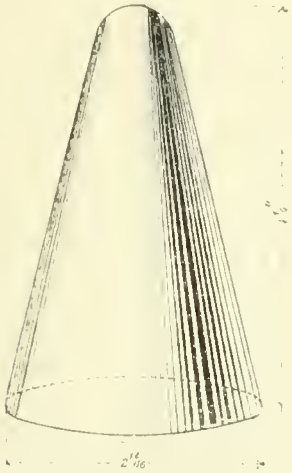
BY ARTHUR MARSHALL, F.I.C., F.C.S.

The difficulty in making this estimation is due to the fact that nitroglycerin is decidedly volatile at the temperatures required to drive off the moisture. At the same time, the determination is of great importance, especially in the case of propulsive explosives, such as cordite, because the velocity and pressure developed in the gun are affected by the amount of acetone and water left in the powder. Moreover, as nitroglycerin itself can only be estimated in the explosive by difference, it is impossible to ascertain the exact percentage present, unless all the other constituents, including moisture, can be accurately estimated. A method, in which the escape of the nitroglycerin is effectively prevented, was first devised by Mr. L. W. Dupré, when he was working at the Royal Gunpowder Factory, Waltham Abbey. In his method, which he published in the "Chemiker-Zeitung," 1901, 540, 2 grms. of the finely-ground sample were weighed on to a watch glass, which was then placed in an aluminium dish, and covered with a weighed glass cone 6 ins. high and $3\frac{1}{4}$ ins. in diameter at the bottom. The dish was placed over a hole in the top of a boiling water-bath, and was left there for an hour or until the weight was constant. The apparatus was then taken off the bath and allowed to cool in the air, after which the watch-glass and the cone were placed separately in dessicators, and finally weighed. The loss in weight was taken to accurately represent the moisture. The nitroglycerin driven off from the powder was entirely condensed again upon the glass cone, as was clearly shown by the fact that continued heating caused no further loss of weight.

The most apparent objection to this method is that the weight of the apparatus, 50 or 60 grms., was out of all proportion to the loss of weight, which was frequently less than a milligramme. From variations in the atmospheric conditions the glass cone might gain or lose in weight to at least an equal extent.

The matter being in this state, acting under the directions of Major F. L. Nathan, R.A., Superintendent of the Royal Gunpowder Factory, I carried out a long series of experiments and determinations during the years 1901 and 1902, with the object of devising a better test to be applied not only to cordite having the composition then exclusively used (nitroglycerin, 58; guncotton, 37; mineral jelly, 5 parts).

but also to mixtures containing larger proportions of guncotton. It may appear an easy matter to devise a satisfactory test, but it was found that unless certain precautions were taken, the results obtained were inaccurate, and the sources of error in some cases were only discovered by series of estimations extending over months.



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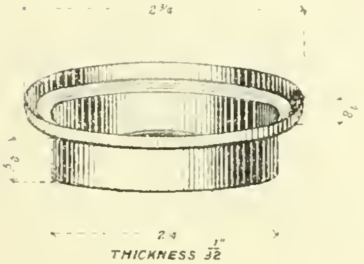


A

The form of apparatus that has finally been adopted is shown in the figure. It consists of an aluminium dish, A, having the dimensions shown, and the glass cone B, weighing not more than 30 grms. The cordite or other explosive is prepared in the manner laid down for the Abel heat test; that is to say, it is ground in a small mill, and that portion is selected which passes through a sieve having holes of the size of No. 8 wire gauge, but not through one with holes No. 14 wire gauge. Of this material 5 grms. are weighed into the aluminium dish A. This is covered with cone B, and the whole is accurately weighed, and is then placed upon a metal plate heated by steam from a water-bath. It is left upon the bath until all the moisture has been driven off, then it is allowed to cool for about half an hour in a desiccator and is weighed. The loss of weight gives accurately the moisture in the sample. For cordite of the original composition one hour's heating is sufficient to entirely drive off the moisture; for modified cordite, containing 65 per cent. of guncotton, two hours is enough provided that there be not more than 1·3 per cent. of moisture present. If the proportion of nitrocellulose be higher a longer heating is necessary. Table I. gives a few of the results that have been obtained.

A few words may be added regarding some of the details of the method. The aluminium dish must not be shallower than shown in the figure, for if the distance between the substance and the edge of the glass cone be less than half an inch, some nitroglycerin will be lost. Again, the sample must not be ground finer than as stated, else some of the moisture will be lost in the grinding and sieving operations, and the results will be too low. In order to be able to drive off all the moisture in the times mentioned, it is essential that the glass cone shall not fit too closely on to the aluminium dish, consequently the horizontal ledge round the top of the dish should be bent, so as to render it slightly untrue, and leave a clearance of about 0·02 in. in some places. If these few simple precautions be taken, the method will be found to be very accurate and expeditious and in all respects satisfactory. Duplicate determinations do not differ by more than 0·01 per cent.

TABLE I.

Explosive.	Composition.			Per Cent. Loss in		
	Nitroglycerin.	Nitrocellulose.	Mineral Jelly.	One Hour.	Two Hours.	Three Hours.
Cordite, Mark I.	58	37	5	0·18	0·19	..
				0·30	0·31	..
				0·21	0·21	..
Cordite, M.D. ..	30	65	5	1·08	1·20	1·21
				..	1·28	1·29
				..	1·18	1·20
Foreign powder	40	60	..	0·46	0·47	..
	40	60	..	0·57	0·57	..
	50	50	..	0·42	0·42	..
Blasting gelatin	92	8	..	0·14	0·13	..
Dynamite......	75	Kieselguhr 25	..	0·22	0·23	..

In conclusion, I have to thank Major Nathan for giving me permission to publish these results, and Dr. R. Robertson and the chemical staff of the Royal Gunpowder Factory for assistance given during the work.

The method has been officially adopted to govern the supply of "Cordite, M.D."

DISCUSSION.

Mr. OSCAR GUTTMANN said they had to thank the Government authorities, and especially Major Nathan, for the readiness with which they published some of their methods and results. He should not like to say anything offhand about a method which had been adopted officially as a standard for taking over deliveries of cordite, because it must be assumed that the authorities at Woolwich or Waltham Abbey would not have adopted it without most careful and searching examination; nevertheless he might be permitted to express a preliminary doubt as to its accuracy. He felt that doubt when Mr. L. W. Dupré published the method in the "Chemiker Zeitung," and it was not removed after Mr. Marshall's explanation. The reason was obvious, when Mr. Marshall told them the dimensions of the aluminium tray had to be absolutely the same, or the results would vary, and that the sample, when prepared for analysis, must pass through a standard sieve, because, if ground finer, low results might be obtained. In the case of cordite, they were testing a colloidal explosive which, in some cases, was as hard as wood, and in others as plastic as india-rubber, and yet by heating for two hours all the moisture was eliminated from grains of the large size stated. It had never been possible, by any means adopted in drying rooms, to remove only the moisture at a temperature, for example, of 40° C. When a material of this description was exposed to the temperature of boiling water, Mr. Marshall told them that all the nitroglycerin, as well as water and acetone, was driven off in the space of two hours. With the size of the grains between Nos. 8 and 14 wire gauge, this was, in his opinion, impossible. With regard to driving out the water through the fine aperture between the sides and the lid, and not allowing the nitroglycerin to escape, he again had some little doubt. He pointed out, about 26 years ago, that the volatility of nitroglycerin at the temperature of 40° C. was such that you lost 10 per cent. out of dynamite within a day. He failed to see why some nitroglycerin vapours should not pass out by way of the rim just as much as the water vapour. Until he had made further experiments with the test he would not express a definite opinion, but he thought he was justified in raising these doubts.

Mr. G. W. MACDONALD thought Mr. Guttmann had misunderstood what Mr. Marshall said with respect to driving out the nitroglycerin. He had carried out a great number of tests with this apparatus exactly of the same dimensions, from details kindly supplied by Major Nathan. The whole of the nitroglycerin was not driven off. About 0·36 per cent., after two hours, was condensed on the cone, and after about three hours, something like 0·6 per cent. In reply to the Chairman, Mr. Macdonald said he meant the percentage in the whole explosive calculated on the 5 grms. taken. If the explosive were removed from the aluminium tray, and the cone, containing the condensed nitroglycerin, replaced, and subjected to a further heating of three hours, no appreciable loss of condensed nitroglycerin could be observed.

Mr. Oscar Guttmann asked if Mr. Marshall or Mr. Macdonald could give some further explanation of the method employed, because at present he was not sure he understood what happened. Were they to understand that the nitroglycerin, acetone, and water were driven off, the water and acetone removed and the nitroglycerin condensed, or were they both got out of the substance, and the substance only weighed?

Mr. Stanley Fox said he was disappointed that no mention had been made of the test as applied to nitroglycerin blasting powders, *i.e.*, gelatines, gelignite, &c. With regard to the test described by the author, he had found it accurate, and the results were concordant. He regarded it as answering perfectly the purpose for which it was intended, *viz.*, of ensuring cordite to be free from volatile matter down to a certain standard limit, which limit had been most carefully determined by the authorities at Waltham Abbey and Woolwich, who had in view the effect of volatile matter on the ballistics of the powder and on its physical and chemical stability. The test was carried out in precisely the same way day after day, and in the same standard apparatus. He dissented from Mr. Guttmann that there was any discrepancy in the method of sifting and preparing the samples for testing, except that in the operation of grinding, when the energy of working the mill, being converted into heat, affected the moisture in cordite by eliminating a certain amount of the residual water and acetone. It was difficult to understand precisely where the water went. Undoubtedly nitroglycerin was condensed in the cone, but where did the water and acetone go? He did not believe for one moment that it escaped *in toto* underneath the glass. Whilst agreeing that the test was quite satisfactory for guidance in the factory, he still considered that, from a purely scientific point of view, it was open to improvement.

Dr. Robertson said this test had now been in use for a considerable time in his laboratory at the Royal Gunpowder Factory, and had given every satisfaction. He did not see much difficulty in the mechanism of the test. In the first place, there was a certain amount of confusion in the use of the term "moisture." Moisture in explosive work included much more than water. A better term would be "volatile matter." There was no difficulty in imagining that acetone vapour would escape between the glass cone and the aluminium dish. The water might escape in the same way, or, if it were condensed along with the nitroglycerin in the glass cone it would be removed when the cone was placed in the desiccator. The volatility of nitroglycerin was well known, as also was its easy condensability. If a large U-tube, containing 100 grms. of ground cordite, were placed in a boiling water bath, and a current of air passed through the tube and its contents, the nitroglycerin that was carried over was condensed at the point where the side tube of the U-tube passed over the water-bath. It was impossible to find, even at a very short distance from the U-tube, any considerable trace of nitroglycerin. This result led Mr. L. W. Dupre to devise the test of which the one under discussion is a modification. This experiment answered the question raised by Mr. Guttmann with regard to the possibility of the nitroglycerine vapour escaping between the cone and the dish, even if that were not already disposed of by the results given in the paper on the effect of the continued heating of powder in the apparatus described by the author.

Mr. H. A. Tauresen asked whether Mr. Marshall had tried drying carbonite containing as much as 4 or 5 per cent. of moisture; also whether, alluding to Mr. Guttmann's remarks, Mr. Guttmann could tell him of any better test than Dupré's for quick factory work.

The Chairman said that at first sight the apparatus appeared to him to be not altogether the most accurate method of getting rid of the moisture. He was not quite clear that he understood correctly how the moisture escaped.

Mr. de Mosenthal said he thought it was pretty clear that there were two kinds of evaporation, evaporation sideways and evaporation upwards. The former carried away the acetone and the nitroglycerin went upwards and settled in the cone. This was placed in the desiccator, and the moisture was consequently removed, so that nitroglycerin alone remained. That was how he understood it.

The Chairman said, he was glad Mr. de Mosenthal had given such an ingenious explanation, which, as he understood it, was that the different constituents in the explosive were, as it were, ear-marked and sent out in different directions as required. To sum it up, he understood the bulk of the moisture got out at the joint between the aluminium disc and the glass; in fact, the edges of the vessel were bent a little. He was inclined to think that that was not the most scientific way of going to work, but it might act in practice fairly well. It had been very well said when a method of this kind was designed for testing, uniformity of results was wanted by observers and workers in different places. A test might appear to be a little crude at first, and not designed on the most elaborate and scientific lines, yet possibly it would work well in practice, provided of course there were not sources of error in it, which would render it inapplicable for the purpose for which it was intended. He thought, in this case, there was one such source of error, because the very initial operation prescribed, rendered an accurate estimation of moisture absolutely impossible. If cordite of different diameters was ground in a mill, the very operation of grinding was a good method of drying it. If the percentage of moisture in the explosive as it was exploded in the gun or rifle was to be determined, the material must be taken as it was without any preliminary loss of the constituent, which was to be estimated. Another point which he could not quite understand, was why the nitroglycerin should all be condensed on the cone, and not the moisture. On looking at the apparatus, it was apparent that the nitroglycerin had not been equally condensed. Round the edges there were slight indications of air currents, and that might have affected the nitroglycerine percentage as well as the moisture. As he understood the operation, any nitroglycerin which had escaped would be considered as moisture. They all knew, as Mr. Guttmann had pointed out, that nitroglycerin was very volatile at the temperature employed in the analysis. It was quite clear there must be a loss of nitroglycerin, and he thought that should be estimated and allowed for.

The Chairman then proposed a vote of thanks to Mr. Marshall, and also to Major Nathan for allowing this paper to be read. It was one of considerable importance, and had given rise to a very interesting discussion. As there seemed to be a difference of opinion as to the accuracy of the method, and the way in which the action took place he hoped that further tests would be made, and they might, perhaps, have another communication on the subject.

Mr. Marshall, in reply, assured Mr. Guttmann that this method had been thoroughly tested, not only at Waltham Abbey by Dr. Robertson, by himself, and other chemists, but independently by Dr. Kellner at Woolwich, and Dr. Dupré in London, and they had found it very satisfactory. With regard to the standardisation of the apparatus, some of the dimensions were of great importance, but others were not of the same importance; in fact one could get identical results with apparatus varying very much from the particular one illustrated. There must, however, be at least half an inch between the powder and the edge of the glass, or the loss of nitroglycerin would become perceptible. There must also be a slight clearance at one or two points round the rim. Slight variations made no appreciable difference. The most important point raised, perhaps, was what happened to the nitroglycerin, and moisture. The Chairman said nitroglycerin was very volatile on the water-bath. He should not say it was very volatile; it was volatile, but only slightly as compared with other substances. Here were three substances—water, acetone, and nitroglycerin. No accurate determination had been made of the vapour pressure of nitroglycerin so far as he knew, but he thought he was not far out in saying that at 70° C., the actual temperature of the explosive inside the dish, the vapour tension of acetone was at least 1,000 times as great as that of nitroglycerin. Consequently the acetone and the water from the explosive in the dish would come away about 1,000 times as fast as the nitroglycerin. Of the small quantity of nitroglycerin that was given off practically the whole was deposited again upon the cool glass cone. Meanwhile the water and acetone gradually escaped under the edge of the cove. A slight interchange of air also went on between the outer atmosphere and the space inside the apparatus; this was sufficient to remove the moisture but not to carry off more than about 0·01 per cent. of nitroglycerin, as calculated on the weight of material taken. Some speakers had failed to see the necessity of grinding the sample to grains of a certain size. In the case of powders of large size they might in their undivided state be heated for weeks without giving up the whole of the acetone and water they contained. But if the sample were ground up it gave off its moisture at a temperature of 70° C., in an hour or two. The greater the proportion of nitroglycerin in the sample the more readily did the moisture come off. On the other hand the substance tended to lose these volatile products during the process of grinding. This loss would of course be much more considerable in the case of very finely divided material, than when it was in grains of appreciable size. It was, therefore, necessary to select by means of a set of sieves that portion, which was sufficiently finely divided to readily give off its moisture during the test, but not so fine as to lose an appreciable amount of moisture during the grinding. A considerable number of experiments had been carried out at Waltham Abbey, the results of which indicated, that if the operations were carried out as stated in the paper the loss of moisture from this cause was quite inconsiderable. He had not had any experience in the analysis of carbonite, but he had tested other explosives containing as much as 4 or 5 per cent. of moisture. The results were quite satisfactory, it was only necessary to prolong the heating somewhat. Some figures obtained with one or two different blasting explosives would be found in the paper. Mr. de Mosenthal's remarks were evidently not intended to be taken seriously.

ADDITIONAL NOTE BY MR. ARTHUR MARSHALL.

Because this test is simple and because the method of carrying it out has been carefully laid down, it has been supposed by some of the speakers in the discussion that it is only of an empirical nature and does not give the true moisture in a nitroglycerin explosive. In my endeavour to treat the matter in a thoroughly scientific manner I have perhaps led my hearers to suppose that there is considerable liability to error. This is not the case. Every analytical method is more or less inaccurate, but the one here described is not more so than at least nine-tenths of those upon which the analyst is in the habit of placing absolute reliance. For instance, in the determination of sulphuric acid by precipitation as barium sulphate, it is well known that there are many sources of error, yet the method is not regarded as "unscientific." This moisture estimation will compare favourably with the barium sulphate method as regards accuracy. The scientific method of treating an analytical process consists, not in shutting one's eyes to the possibilities of errors, but in thorough investigation of them, and careful avoidance of them based upon this investigation, and also, if possible, in comparison with standard methods. In the case of the test under consideration it is unfortunate that there is no reliable independent method with which the results can be compared. There is no other method known which yields even approximately accurate figures. It, therefore, only remains to examine carefully the various possible sources of error. This has been done very exhaustively.

Errors may be of two kinds, experimental and systematic. The former would cause the results of duplicate tests to differ one from another. That the method is not liable to inaccuracies of this kind may be clearly seen from Table II., in which are given the results of four determinations carried out upon the same sample.

TABLE II.

	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Loss after two hours' heating.	1·26	1·26	1·28	1·28
Loss after three hours' heating.	1·29	1·28	1·29	1·29

In the case of another sample, determinations were made with varying quantities of powder. The following were the results:—

TABLE III.

Quantity taken.	Moisture found.
3 grammes	1·47 per cent.
4 "	1·49 "
5 "	1·47 "

Many similar series of figures might be cited.

If there be any error in the method it must therefore be a systematic one, that is an error which would make the results uniformly too high or too low. There are only three ways in which a systematic error can here occur: (1) there may be a loss of nitroglycerin or other matter during the course of the determination, (2) there may be some moisture remaining in the explosive at the end of the test, or (3) there may be a loss of moisture during the grinding and sifting. I will now proceed to show there is no appreciable error from any of these causes.

1. That the continuous loss of nitroglycerin is very minute is clearly shown by the fact that the diminution of weight after the first hour or two is extremely small, as may be seen from the figures quoted in Tables I., II., and III. This is brought out even more clearly in the following tests, in which the heating was continued up to 20 hours:—

TABLE IV.

	Per Cent.	Per Cent.
Loss in 2½ hours	1·43	1·49
" 4 "	1·47	1·49
" 20 "	1·55	1·61

These and many other results indicate that the loss of nitroglycerin is only about 0·006 per cent. per hour.

There remains, however, a bare possibility that in the early stages of the drying, the moisture and air expelled from the apparatus may carry away with them an appreciable quantity of nitroglycerin. If, now, it can be proved that a considerable percentage of moisture can be driven off from a sample of explosive under the conditions laid down, without diminishing the dry weight of the substance, it must be admitted that the accuracy of the method as regards this source of error is fully demonstrated. Three separate experiments were carried out on these lines. In the first case, 5 grms. of cordite, M.D., were weighed out, and the moisture was determined in the usual manner; then 0·04 grm. (0·8 per cent.) of a mixture of equal volumes of acetone and water was sprayed on to the explosive. The glass cone was then placed over the dish again, and the whole was heated on the water-bath as usual. After two hours' heating, it was found that the weight of the cordite was only 0·004 per cent. less than the previous dry weight. A further heating of one hour produced a loss of only 0·02 per cent. more.

The second experiment was similar, except that in this case 0·1 grm. (2 per cent.) of a mixture of two parts acetone to one part water was added in drops. The final weight, after four hours' heating, was 0·03 per cent. less than the original dry weight. In the third experiment, 5 per cent. of moisture was added, and here, again, there was no appreciable loss of nitroglycerin.

These results were entirely satisfactory, as they clearly showed that the moisture does not carry away with it a weighable quantity of nitroglycerin. On the contrary, the loss of weight was less than 0·01 per cent. per hour during the heating. In order, however, to place the matter upon a more scientific basis, the actual vapour tension of nitroglycerin was determined at 70° C., the temperature of the explosive in the moisture test apparatus. Some nitroglycerin was introduced into a small gas-washing bulb, which was immersed for about five hours in a water bath maintained at 70° C., whilst a known volume of air was bubbled slowly through. The exit tube of the bulb was connected with a piece of glass tubing, the upper part of which was cool enough to condense, practically, the whole of the nitroglycerin evaporated. Both this tube and the bulb were weighed before and after the experiment. It was found that the bulb had lost 0·0013 grm., whereas the tube had gained 0·0011 grm. The former figure is slightly too high, because the nitroglycerin towards the end of the time was beginning to decompose to a very slight extent. On the other hand, the latter figure must be somewhat too low, because, even at the lower temperature of the tube, nitroglycerin must still have a slight vapour tension. We may, therefore, take the quantity of nitroglycerin evaporated at 0·0012 grm. The volume of the air drawn through was 1,850 c.c., measured at 13·5° C. Calculating from the formula—

$$p = \frac{gT}{mv}$$

It is found that at 70° C. nitroglycerin has a vapour tension of 0·0051 cm. of mercury, that is to say, the volatility of nitroglycerin is almost exactly equal to that of mercury. In order to test the method and apparatus the vapour tension of mercury was at 70° C. determined in precisely the same manner. The quantity of air drawn through was 1450 c.c., measured at 18° C. The weight of mercury evaporated was 0·0009 grm. Hence the vapour tension is calculated to be 0·0056 cm., which figure agrees satisfactorily with that given by Ramsay and Young, 0·0052 cm. The vapour pressures of nitroglycerin and mercury being equal, and the molecular weights of the two vapours (227 and 200 respectively) being not very different, it necessarily follows that rules laid down for the prevention of loss of the one substance may be applied to the other. The vapour pressure of nitroglycerin being known it is possible to calculate the quantity that will be carried away by the moisture expelled in the test. The volume of the moisture from 5 grms. of cordite would seldom exceed 50 c.c. as measured in the gaseous state. This even if completely saturated with nitroglycerin would carry away less than 0·00004 grm. of it, or 0·0008 per cent. as calculated on the powder.

A rough estimate may also be made of the minimum volume of air that circulates between the interior of the moisture apparatus and outer space. The loss of nitroglycerin is usually 0·0002 to 0·0005 grm. per hour, whence it is calculated that in spite of the narrowness of the interval between the glass cone and the aluminium dish not less than 300 to 800 c.c. of air enter and leave during each hour of heating.

2. That none but the minutest trace of moisture remains in the explosives at the end of the test is sufficiently proved by the figures already quoted. It has been shown that the loss from the ground nitroglycerin explosive after the first two or three hours is very small and quite uniform. Everyone who has had any experience of the drying of collodial substances knows that they lose their moisture at first rapidly and then gradually more and more slowly until all the moisture has been expelled. There is no evidence of any diminishing loss of this kind after the first two or three hours. There are undoubtedly other explosives that would not be dried within the period mentioned, but nitroglycerin explosives fortunately give up their moisture with comparative ease.

3. Loss of moisture during grinding and sifting. In order to ascertain whether any appreciable error arises in these processes some cordite of small size was submitted to the test without preliminary grinding and parallel determinations were carried out with material prepared in the usual way. It was, of course, necessary to prolong the heating in order to drive the whole of the moisture out of the unground cords.

TABLE V.

—	Cordite, Mark I.		Cordite, M.D.	
	Ground.	Unground.	Ground.	Unground.
Loss in 2½ hours' heating....	0·24	0·17	..	..
„ 4 „ „	0·24	0·22	0·44	0·45
„ 5 „ „	0·26	0·23	0·45	0·47
„ after 16 additional hours in desiccator and 1½ hours further heating..	..	..	0·45	0·47

Another sample of the same cordite, M.D., gave the following results:—

TABLE VI.

—	Ground.	Unground.
Loss in 5 hours' heating	0·42	0·41
„ 6 „ „	0·44	0·42

With a cordite, M.D., containing a larger proportion of moisture, the results were equally satisfactory.

TABLE VII.

—	Ground.	Unground.
Loss in 5½ hours' heating	1·09	1·06
„ 6½ „ „	1·11	1·10
„ after 16 additional hours in desiccator.	1·12	1·11
„ „ 1 „ hour heating	1·13	1·12

It is quite evident from these figures that the loss of moisture during grinding and sifting is very minute.

All possible sources of error have now been examined experimentally, and in every case it has been shown that the inaccuracy does not exceed a few hundredths per cent. Any attempt to obtain a higher degree of accuracy than this must necessarily be in vain, as it is not possible to take a sample from a large batch of explosive, which shall represent the main bulk absolutely. However much care be exercised in the sampling the difference between duplicate samples will considerably exceed any possible error of this method of analysis.

The general accuracy of the test is further demonstrated by the fact, that the same results can be obtained with very different apparatus, provided of course that attention be paid to the few points mentioned in the paper. Some determinations were made using an ordinary glass funnel instead of the cone shown in the figure. The stem was plugged with glass wool and the funnel was inverted over the dish. Parallel determinations were also made using an aluminium dish half an inch larger in diameter than the one shown in the figure. This was covered also with a funnel of suitable size. The following figures were obtained with the three modifications of the apparatus:—

TABLE VIII.

—	Cone.	Funnel.	Large Dish and Funnel.
	Per Cent.	Per Cent.	Per Cent.
Moisture found	1·20 1·20	1·20 1·21	1·19 1·18

From the various figures which have been quoted it is perfectly evident that the method gives reliable and accurate result.

Meeting held at Burlington House, on Monday, February 1st, 1904.

MR. WALTER F. REID IN THE CHAIR.

A *RÉSUMÉ* OF THE REPORT, MINUTES OF EVIDENCE, AND APPENDICES OF THE ROYAL COMMISSION ON ARSENICAL POISONING.

BY JULIAN L. BAKER.

The final report of the Commission was published on December 3rd, 1903, and the two volumes of minutes of evidence and appendices on December 23rd, 1903. The publication is no ordinary blue book, for it contains many new experimental facts and data. Exhaustive investigations have been carried out by experienced physiologists on the different questions relating to the effect of arsenic on human beings and animals, and by chemists on the detection of arsenic in the various food and food materials. Analytical methods have been elaborated, which are now in daily use in many laboratories. The mass of data collected by the Commission, and the valuable conclusions deduced therefrom, may possibly be lost sight of by chemists and others when the immediate cause which led to the appointment of the Commission becomes a matter of history. Bearing this in mind, the London Committee felt that some steps should be taken to present the members of the Section and the Society with a condensed account of the chemical matters dealt with by the Commission. This is the more appropriate when it is borne in mind that a joint committee was appointed by the Society of Public Analysts and this Society to investigate the methods for the estimation of small quantities of arsenic. This Committee presented its report to the Commission, and the recommendations contained therein received the cordial appreciation of the Commissioners.

My endeavour will be to describe the ground covered by the report, my remarks for the most part being confined to the chemical and analytical matters submitted to the Commission. In a few cases I have ventured to submit criticisms.

PART I.

Observations regarding the Epidemic of Arsenical Poisoning in 1900, and the Medical and Public Health Aspects of the Evidence received regarding Arsenic in Beer and Food.

The epidemic of arsenical poisoning which occurred at the latter end of 1900, and which led to the appointment of the Royal Commission, was very soon traced to Bostock's brewing sugar. The total number of persons who suffered from the epidemic was over 6,000, and at least 70 fatal cases were attributed to poisoning by arsenic in beer. This does not represent the total number of fatal cases, for deaths occurring before the discovery of the cause of the outbreak were frequently certified as due to other diseases.

The evidence relating to the symptoms of poisoning due to arsenic in beer during the epidemic is very comprehensive, and the Commissioners point out that it should form valuable material for reference and comparison in future cases or future outbreaks, where the possibility of arsenical poisoning calls for consideration.

A considerable proportion of the beer brewed in some parts of the country before 1900 contained certain quantities of arsenic, which was no doubt derived from malt and from brewing sugar. The evidence shows that malt has been liable to arsenical contamination in much greater degree when the fuel used in the kiln has been gas coke than when other forms of malting fuel, such as oven coke or anthracite, have been employed. In the south of England the use of gas coke previous to 1901 had never been common, but in certain parts of the North and the Midlands, and in Manchester and Liverpool, gas coke was constantly employed at the maltings supplying various breweries. The greater prevalence of alcoholic neuritis among beer drinkers in Manchester and Liverpool before 1900, when compared, for example, with London and the South, is probably due to the degree to which the beer was contaminated by arsenic derived from malt.

In January and February 1902 an outbreak of arsenical poisoning occurred at Halifax, resulting in the death of three persons. Suspicion fell on the beer, and this when examined was found to contain 1/10th to 1/16th of a grain of arsenious acid per gallon. Careful inquiry revealed that the beers in question had been contaminated by arsenic derived from the malt used in their preparation. In nearly all cases there was evidence that the malt had been dried over local gas coke. This outbreak was highly instructive to the Commission, for all the Halifax cases were characterised by peripheral neuritis, which, taken by itself, was hardly to be distinguished from "alcoholic neuritis." The Halifax beers associated with the outbreak must have been typical in respect of arsenic of a large class of beers prepared before the 1900 epidemic from arsenical malt.

It was suggested by certain witnesses that the contaminated beer might contain some organic compound of arsenic with a toxic action differing from that of arsenious oxide. Although some witnesses expressed the opinion that such organic compounds were present, no direct evidence was brought forward bearing on this point.

The susceptibility of the individual to arsenic varies greatly, and this was very marked in the epidemic of 1900, for large numbers of people must have been drinking beer, much of which was contaminated by arsenic to a high degree, in considerable quantities over several months without any apparent bad result. In this connection the experiment carried out by Prof. Delepine on the effect of administering varying quantities of arsenic to rats are very interesting. He found that minute quantities of arsenic could be administered over comparatively long periods before detrimental results appeared, so long as the animal was well fed; whereas in rats under identical conditions, but on restricted diet, the deleterious effects of the arsenic were much sooner apparent. The association of arsenic and beer appeared to increase the resistance of the rats by improving nutrition.

The physical effect of arsenic on the human system was inquired into at considerable length, and the evidence showed the correctness of the generally accepted view that arsenic is a poison which, as a rule, is eliminated comparatively rapidly from the body. The clinical data obtained during the epidemic showed, however, that arsenic can only be termed a "non-cumulative" poison in a restricted and comparative sense. When small quantities of arsenic are taken over long periods, accumulation occurs in certain tissues. Many cases admitted to hospital in 1900 continued to show increasing signs of poisoning for weeks after beer had been discontinued.

Important observations have been made regarding the numerous ways in which arsenic may be eliminated from the body. Arsenic was detected in sweat, in the epidermic scales which are freely shed in the condition known as keratosis, in nails, and in hair. The fact of arsenic being excreted by hair attracted the attention of the Commission, for it was possible that the elimination of arsenic in this manner might prove important in instances (such as supposed alcoholic neuritis) where it was desirable to ascertain whether a patient had lately been taking arsenic, either as a contamination of food or beer, or medicinally. Samples of hair were obtained from patients who had taken arsenic in known amounts over known periods of time, together with suitable controls, and were submitted to analysis by Mr. R. F. Wood Smith. The method of analysis used was destruction of the organic matter of the hair, and estimation of arsenic in the inorganic residue by the Marsh-Berzelius process. About 2 grms. of the hair to be tested were weighed and transferred to a Jena flask of 250 c.c. capacity. Upon the hair were then poured about 30 c.c. of strong nitric acid and 4 c.c. of strong sulphuric acid. The contents of the flask were warmed, and when the first violence of the oxidation had subsided the temperature was raised and the liquor thoroughly boiled. After continued boiling the liquor darkens, more nitric acid is added, a point being finally arrived at when only clear sulphuric acid remains, containing all the arsenic present in the sample. The sulphuric acid is then diluted and evaporated down again to its original bulk, this operation being necessary to guard against the possibility of nitrogen compounds being present during the Marsh-Berzelius test. The liquid was then "Marshed" in the usual manner. A lengthy series of estimations were made, the results being very interesting. Out of 41 control cases, principally hospital and infirmary in-patients of both sexes, who had been taking no arsenic medicinally, the hair of 38 was either free from arsenic or showed no more than 1/150th gr. per lb. Samples of hair were obtained from the same cases after they had taken arsenic medicinally. The male patients who had been taking about 1/10th gr. of arsenic daily at the end of two months showed amounts of arsenic varying from 1/20th to 1/5th gr. per lb. in hair which had been grown during the interval. One case showed 1/50th gr. per lb. Male patients taking smaller amounts, 1/33rd and 1/22nd gr. of arsenic daily for two months, showed quantities of arsenic varying from 1/80th to 1/10th gr. per lb. in the recently grown hair.

With female patients considerable difficulty arose in obtaining samples which represented the hair which had grown during the period of arsenic taking, but the results, though less uniform than in the male cases, were similar in character. The result of testing hair of cases in which arsenic had been taken for less than five weeks were irregular, owing, no doubt, to the fact that the sample examined usually contained a proportion of hair which had grown before the administration of arsenic had began.

The Commissioners point out that the exclusion of small quantities of arsenic from food and drink is of considerable importance, and calls for more attention than it has hitherto received. The effects of very small quantities of arsenic administered over long periods along with food have not been fully studied; although evidence of marked toxicity may be absent, it is possible that the arsenic may have unrecognised effects on nutrition. Professor Delepine stated that continuous daily ingestion of 1/100th gr. of arsenic along with food may be prejudicial to the human subject.

Part 2.

The suggested Relation between the Disease "Beri-Beri" and Arsenical Poisoning.

Certain witnesses examined before the Commissioners had pointed out the similarity existing between the symptoms of the 1900 arsenic epidemic and those of "beri-beri," a disease mainly characterised by peripheral neuritis, which is met with in certain tropical countries and in parts connected with Eastern trade. This disease may be due to the presence in particular articles of diet of a poison which has a toxic action on nerve tissue, and it has been suggested that beri-beri may prove to be due to contamination of food by arsenic. This view was not, however, shared by the Commissioners.

Part 3.

Tests for Arsenic in Food and Substances used in the Preparation or Manufacture of Food.

At the time the first report of the Commission was published a considerable difference of opinion existed as to the relative value of different methods of estimating small quantities of arsenic in beer and other foods. Many instances occurred in which discordant results had been obtained when identical samples were examined by different chemists and by different methods. Since that date the Commission have been in receipt of various reports of work on the subject undertaken by many chemists. The substances examined comprised beer, malt, sugars, and various other foods and organic substances liable to contain arsenic, fuels, and chemical substances used in connection with food preparation.

A number of witnesses were examined by the Commission on this subject, and a condensed account of their investigations and conclusions is to be found in the final report of the Committee appointed by the Manchester Brewers' Association of May 11, 1901, and the report of the Joint Committee of the Societies of Public Analysts and Chemical Industry. This latter report was subsequently discussed at a joint meeting of the two societies. A Departmental Committee was appointed by the Board of Inland Revenue to prescribe tests for arsenic in beer and brewing materials. Their report was presented last April.

It will be well at this stage to consider these reports. The report of the Committee appointed by the Manchester Brewers' Association, dated May 11th, 1901, was of the nature of a preliminary investigation. The report of this Committee has been subjected to a certain amount of criticism, but the circumstances obtaining at that time should be borne in mind. The arsenic scare was at its height, and immediate measures had to be adopted by brewers and others to test materials and to satisfy the public that measures were being taken for their protection. Much divergence of opinion existed then as to the most satisfactory way of testing for small quantities of arsenic. The Marsh-Berzelius test was not elaborated to the extent that we now know it, and in view of the pressing necessity of a more or less rough discriminating test the Committee adopted the Reinsch test. The words of Mr. A. G. Salamon show clearly the way in which the Manchester Committee regarded the test (Q. 1525): "It was not a test which was meant to deal with minute traces, it was a test conceived after consultation with Prof. Delepine, Sir Lauder Brunton, Dr. Stevenson, and Dr. Luff, as to a means of preventing beer being sent out to the public, at a moment of crisis, which contained poisonous quantities of arsenic."

In the final report of this Committee it is pointed out that the first suspicion as to Bostock's sugar being the cause of the widespread poisoning dated from about November 21st, 1900, and its employment in or about Manchester was discontinued nine days later. The members of this Committee were soon confronted with the circumstance that arsenic continued to be found in small quantities in brewings both in Manchester and in other parts of the United Kingdom. This necessitated long and detailed investigation of the different materials used in brewing. It appeared that one-fifth of the samples of beers contained arsenic derived from sources other than Bostock's sugar. Glucose, invert sugar, with the exception of products made by Bostock, raw and purified sugars used in brewing, caramels, and malt adjuncts, were found to be quite free from arsenic. The samples of hops examined were free from arsenic but the possibility of minute quantities being present was foreseen. The Committee also established the fact that yeast absorbs arsenic. Arsenic was found in kilned or sweated barley, in malt, in malt culms, and kiln dust, in malting anthracite and coke. In concluding their report the Committee recommended that brewers should insist on a written guarantee of freedom from arsenic with all purchases of brewing materials of every kind, also that brewers should from time to time test the purity of their beer and brewing materials in respect of arsenic.

With regard to malt the Committee suggested that—

1. The maltster be required to give a guarantee to the brewer that he does not employ gas coke in the preparation of his malt.

2. That the malt culms be regularly tested for the presence of arsenic.

3. If the culms be found to contain noticeable quantities of arsenic, that the kiln dust be at once removed, and that the fuel employed be further examined for arsenic.

4. That wherever possible the best anthracite be employed for malting purposes.

The Committee further suggested a standard test for arsenic in beer. 200 c.c. of the suspected beer is submitted to the Reinsch test and when the presence of arsenic is ascertained the amount is estimated by the Marsh-Berzelius method.

A joint committee was appointed in March 1901 by the Societies of Public Analysts and Chemical Industry. This Committee made an extended investigation of the Marsh-

Berzelius method, and presented a report in June 1902 which was subsequently discussed at a joint meeting of the two societies. In this report the Committee recommend the Marsh Berzelius method and give detailed instructions for purifying the materials employed in the test and for carrying out the test under standard conditions. The Committee stated that organic materials, such as beer, yeast, &c., cannot be tested, when sulphuric acid is used without destruction of the organic matter, whilst as a rule they can be directly tested with hydrochloric acid. Directions are given for determining the amount of arsenic in malt, hops, sugar and other brewing materials with and without the destruction of organic matter. Two processes are available for destroying the organic matter: the acid method which involves treatment by nitric and sulphuric acid, and the basic method where the materials are mixed with pure lime or magnesia, dried, and incinerated. Ling and Newland's process (this Journal, 1901, 1008) is advised for estimating volatile and total arsenic in malting fuels. The Committee were satisfied that arsenic in both states of oxidation can be detected and estimated by the procedure described in their report. The Marsh-Berzelius test as recommended is extremely sensitive; with quantities of 20 grms. or 20 c.c. an indication of one part of arsenious acid in 7,000,000 is possible.

In January 1902 a Departmental Committee was appointed by the Board of Inland Revenue, in pursuance of the recommendation made by the Commissioners in their first report, to prescribe tests for arsenic in beer and brewing materials. The report was presented by Sir Henry Primrose in April 1903. This Committee, which comprised Messrs. Thorpe, Tilden, Dixon, Aldous and Pattinson gave their attention to the methods of detecting and estimating the amounts of arsenic in malt, malt substitutes, wort, hops and hop substitutes, beer, yeast, and yeast foods, chemicals, finings, and fuels. Of the various methods which have been suggested for the detection and estimation of relatively small quantities of arsenic which may be present in beer and the ingredients of beer, the Committee decided that the methods which are based upon the conversion of arsenic into arseniuretted hydrogen, and the subsequent deposition of the arsenic in the elementary form by heating the gas are to be preferred. The hydrogen may be generated either electrolytically or by the action of dilute hydrochloric acid upon zinc. The amount of arsenic deposited by heating the arseniuretted hydrogen is determined by comparison with deposits obtained in a similar manner from wort, beer, malt extracts, &c., containing known quantities of arsenic. The Committee adopted a modification of Bloxam's method (Quart. J. of the Chem. Soc., **13**, 1861, 12 and 338). As the process has already been described in this Journal (1903, 965), it will be unnecessary to again refer to it. Since the electrolytic method is now adopted at the Government laboratory in preference to the Marsh-Berzelius test it becomes *de facto* the official test and it will be well to briefly compare the relative advantages and disadvantages of the two methods.

The advantages of the electrolytic test are that—

1. It obviates the use of zinc.

2. It is simple in execution, is under perfect control, and may be carried out under such conditions that the results obtained by different operators are strictly comparable, inasmuch as with a current-strength of fair regularity the evolution of the gas is practically constant and uniform.

3. The whole of the solution to be tested for arsenic may be added to the apparatus at once, so that during the whole time of testing the arsenic is under the influence of the "nascent" hydrogen.

4. It has been established that such amounts of arsenic as are present in beer or its ingredients are evolved as arseniuretted hydrogen during the 30 minutes occupied by the test. The nature of the material associated with the arsenic is found to exercise no inhibiting effect on the formation and evolution of the arseniuretted hydrogen. Beer and aqueous extracts of malts and worts may be added directly to the electrolytic apparatus without previous destruction of the organic matter as required by the zinc and acid process.

5. The deposits obtained are more uniform in character than those furnished by the zinc and acid method, and admit therefore of more accurate quantitative comparison.

6. The process allows of the simultaneous execution of a number of estimations of arsenic, depending upon the arrangement of the rheostat.

The disadvantages of the methods are:—

1. The initial cost of the apparatus as compared with that employed in the zinc and acid method.

2. That it can only be applied when an electric current of sufficient intensity is available.

The main advantages of the Marsh-Berzelius method are that it is sufficiently delicate, is rapid and easy of execution, and that the apparatus and materials needed are comparatively inexpensive.

The disadvantages attending it are:—

1. That zinc very frequently contains small amounts of arsenic, and hence must be carefully tested before use. It has been established that the arsenic when present is not uniformly distributed throughout the metal, and hence different portions of zinc from the same granulation may contain arsenic in very different amounts. It has been further shown that small quantities of admixed metals, apparently iron in particular, tend to prevent the formation of arseniuretted hydrogen, and so prevent the detection of minute quantities of arsenic.

It is necessary, therefore, to ascertain not only that the zinc is free from arsenic, but that it will give rise to arseniuretted hydrogen when arsenic is usually brought in contact with it.

2. The character of the deposit of arsenic is influenced by the rate at which the hydrogen is evolved, and as this depends upon the "activity" of the zinc, which is not always under complete control, the deposits obtained by different operators, or with different specimens of zinc, are apt to show slight variations.

There can be no doubt that the electrolytic method possesses material advantages over the Marsh-Berzelius test, but it is unfortunate that the official process is only applicable when an electric current of sufficient intensity is available. That the necessity of electric current will bar the official test being used in a large number of laboratories and breweries is a matter of regret, for, in such an important matter as the rejection of a delivery of malt or other ingredients of beer, or prosecutions by a local authority, it is most desirable that the chemists concerned should use the official method. The disadvantages of the electrolytic method have been discussed to some extent among chemists, but I venture to think that many of the points raised against it owe their origin to difficulties attending the manipulation of a new and somewhat complicated piece of apparatus. The Marsh-Berzelius test, carried out under the conditions advised by the Joint Committee, will in all probability continue to be the one in common use for control of purity of products. The electrolytic method will be the final appeal for disputes between buyer and seller of brewing materials.

The Commissioners report at some length upon the Marsh-Berzelius test. After summing up the difficulties of the application of the method, they are of opinion that chemists appear to be in general agreement as to the conditions of the test. The Commissioners are obviously careful not to insist on any one of the many modifications of the method which have been brought before their notice, and they consider that any single detailed routine is not applicable to all cases.

The evidence offered by chemists satisfied the Commissioners that differences in quantities of arsenic as small as 0·002 of a milligram or 1/720 of a grain per lb. can be estimated, whilst it can be detected in amounts below 1/1000 grain per lb., or 1/300 grain per gallon. The important consideration of allowance for differences in personal judgement of the reading of the mirrors is referred to, and the evidence on this point of Messrs. Hehner, Chapman, Allen, McGowan, and Finlow is summed up in the statement, "that a difference in reading, corresponding to 0·002 milligram of arsenic, too much or too little, appears to be regarded as an outside limit. On 10 grms. of material this difference would be ± 1/720 grain per lb., or with 30 c.c. of liquid ± 1/360 grain per gallon.

A considerable amount of data has been brought forward on the preliminary treatment which should be applied to different substances, in order that the total arsenic they contain may be estimated by the Marsh-Berzelius method. In the earlier stage of the enquiry, somewhat contradictory opinions were expressed by different witnesses as to whether the organic matter should be destroyed, but as chemists gained experience in the Marsh-Berzelius method the view became general that destruction was advisable. There are, however, a few exceptions, such as, for example, unground malt. Destruction of organic matter is obviously necessary when the arsenic is in the form of an organic compound, or where it is intimately combined with organic matter such as hair, animal tissues, coal, colouring matters, &c.

The Commissioners advise that the organic matter should be destroyed in wort and beer when the Marsh-Berzelius method is used. Ling's method for the determination of volatile and fixed arsenic in fuel is referred to, and also the method described in the report of the Departmental Committee (substantially the same as that elaborated by Wood Smith, and Jenks, this Journal, 1901, 437), which consists of burning the fuel in a current of oxygen, collecting the arsenic which is volatilised in an absorption apparatus containing dilute sulphuric acid; and subsequently estimating the volatile arsenic obtained in this solution, and also the arsenic left behind in the ash. (This Journal, 1903, 964.)

The use of other methods for the detection and estimation of small quantities of arsenic is not advised, the Commissioners holding, that methods involving the comparison of mirrors have been developed to such a state of efficiency that they are now general. The use of the Reinsch test for the purpose of detecting small quantities of arsenic is condemned; the results may even be misleading, for one of the breweries of Halifax, which supplied arsenical beer in 1902, had their products systematically tested by the Reinsch method, and only negative results were reported.

Looking at the matter of the estimation of small quantities of arsenic broadly, the electrolytic method, when available, possesses the great advantage of removing all the drawbacks connected with impurities and sensitiveness of zinc. This is, undoubtedly, the weak point in the Marsh-Berzelius method, as hydrochloric and sulphuric acids may be obtained free of minute traces of arsenic; but with zinc it is different, and there are few of us who have not experienced trouble in this respect. Another and very important point in favour of the electrolytic method is that beer wort and certain other substances may be added directly to the apparatus without previous destruction of organic matter. This obviously tends to ultimate accuracy of results, for, however careful the chemist may be, the addition of materials to the substance to be tested and subsequent manipulation opens the door to the possibility of contamination, and, moreover, increases the time taken by the test.

PART 4.

Ways in which Foods are liable to become Contaminated by Arsenic.

Much evidence was submitted by witnesses as to the risks of arsenical contamination which arise in the manufacture of foods and substances used in the preparation of food. Mr. H. Hammond Smith instituted enquiries on behalf of the Commission from representative food manufacturers. Many of the samples which were collected were analysed by Dr. McGowan. The results are described in Appendices 24 and 25. Mr. H. Hammond Smith conducted a lengthy and valuable investigation under the following heads:—

The use in the preparation of sundry articles of food and drink of substances liable to contain arsenic, or liable to introduce arsenic into the finished product.

The precautions which have been and are now being taken by manufacturers and vendors of foods or drinks to avoid risk of arsenical contamination.

The approximate degree of contamination of various foods or drinks by arsenic, which might arise on the assumption that all precaution was neglected; and the quantities of arsenic which have been actually found to be present in samples of particular foods or drinks.

Space will not permit of an adequate abstract of [illegible] investigations, but the following summary comprises the principal points dealt with in his report:—

(1) *Glucose* is an important ingredient of numerous articles of food, particularly of table syrups, jams, marmalade, confectionery, and biscuits; also of sundry beverages, particularly brewed ginger beer and certain kinds of wine.

In most of these foods and drinks the proportion of glucose used may be considerable. Arsenical contamination of the glucose on the Bostock scale would involve serious contamination of the finished products. Use in these substances of glucose containing as much arsenic as has in exceptional instances been found in samples on the market in 1901–2, and not coming from Bostock's (*e.g.*, 1/25th to 1/10th grain of arsenic per lb.) would also in most instances involve a material degree of contamination of the finished product by arsenic.

Nearly all the glucoses used are of foreign, usually American, origin.

Food manufacturers using glucose differ very much in their method of taking precautions to secure that it is satisfactory as regards arsenic. At the works visited analytical control of greater or less stringency had been adopted since 1900 by certain firms; others, the majority, were content with guarantees given by the glucose manufacturer, middleman, or agent; others, again, had required no guarantee and had not tested their glucose for arsenic.

(2) In instances where *invert sugar* was used by cider makers, or by manufacturers of brewed "temperance beverages," it was either obtained from brewing sugar manufacturers taking precautions to exclude arsenic from their invert sugar, or it was prepared by the cider maker without the use of sulphuric or hydrochloric acid.

(3) The use of sulphuric acid in the preparation of "*golden syrup*" and *treacle* involves risk of contamination by arsenic if the precautions taken to secure a satisfactory acid are insufficient.

(4) The use of sulphuric acid to convert raw grain in *vinegar making* involves risk of serious contamination of the vinegar by arsenic in the absence of sufficient precautions. Care in this respect was taken by the two firms visited which manufactured vinegar in this way.

(5) Besides the foods above mentioned are a few others, in the preparation of which sulphuric or hydrochloric acid may be used. In the case of certain *meat extracts*, "peptones," the amount of hydrochloric acid employed is relatively minute. Direct addition of sulphuric acid to *vinegar* and *pickles* appears to be seldom practised. If a strongly arsenical acid were employed these substances might become contaminated by arsenic to a marked degree. The information thus far obtained does not suggest that the sophistication of *spirits* by mineral acids, if still practised, is common.

(6) Commercial *phosphoric* acid and commercial *phosphates*, such as are used in sugar refining and in baking powders, are liable to contain arsenic, but the quantity of arsenic which could be introduced in this way into finished products is in most instances small.

(7) *Tartaric and citric acids*, largely used for food purposes, particularly as ingredients of lemonade powders and the like, are liable to contain arsenic. The steps habitually taken by manufacturers of these acids in this country to secure freedom from lead also tend to make serious contamination by arsenic unlikely, and it is the custom of food manufacturers to demand that these acids should be satisfactory in regard to lead.

(8) The use of exceptionally large quantities of *boron preservatives* in articles such as milk, cream, and butter may involve the introduction of material quantities of arsenic into these substances.

(9) *Glycerin* has occasionally been found to contain large amounts of arsenic (*e.g.*, 2 to 4 grains per lb.); quantities of arsenic less than 1/13th grain arsenic per lb., if present, might not be detected by the tests prescribed for

glycerin in the British Pharmacopœia. Glycerin may be used in cakes to the amount of 1 per cent., and also an important ingredient of certain sweets and meat extracts.

Certain food manufacturers visited employed glycerin stated to conform to pharmacopœial tests; they had not, however, caused the glycerin supplied to be analysed for arsenic, and they did not recognise that arsenical glycerin might cause objectionable contamination of their products.

(10) Arsenic may be present in sundry "coal tar" *colouring matters* used in food. In the case of confectionery, it is usual for the confectioner to obtain colours with a guarantee from a responsible analyst that they were harmless for confectionery purposes, such guarantee being given with due regard to the quantity of the colour likely to enter into the finished product. Samples of Bole Armenia and other *mineral pigments* have been found to contain over 0·8 grain of arsenic to the lb.; these pigments are used in sausages, anchovy preparations, and the like, without any steps being taken to secure their wholesomeness.

(11) In one instance *sheep wool grease* sold as "cocoa butter," and employed in sugar refining, contained about 1/16 grain of arsenic per lb., probably derived from arsenical sheep dip.

(12) Samples of brown "*Demerara*" *sugar* coming from the West Indies in certain instances have been found to contain small amounts of arsenic, 1/300th to 1/50th grain per lb.

(13) The British manufacturers of *maltine and malt preparations* visited were in each instance taking precautions to secure that the malt used was satisfactory as regards arsenic. Foods manufactured in America, which consist largely of malt, are coming into extensive use in this country. In the absence of more exact information as to American systems of maltings, and of analyses on a comprehensive scale, it is not possible to decide whether these foods are subject to any material risk of arsenical contamination.

(14) A food preparation consisting mainly of brewers' *yeast*, "Carnos," has been found to contain 1/6th grain of arsenic per lb., notwithstanding the precautions against arsenic adopted in its manufacture.

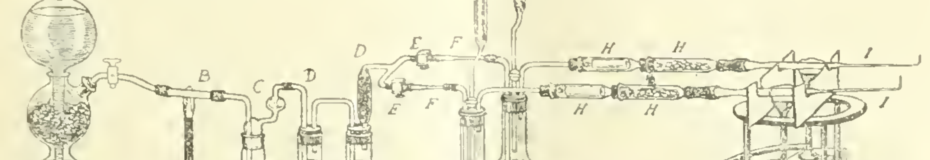
(15) *Chicory* may be dried by exposure of the roots to fumes of coke for several days. None of the few samples examined for arsenic has shown more than 1/100th grain of arsenic per lb. of chicory, but examination of a sufficient number of representative samples would be necessary before a satisfactory estimate of the degree of liability of chicory to contain arsenic can be obtained.

(16) *Hams, bloaters, coffee, lemon peel, &c.*, may be dried by exposure to the fumes of coke, but the degree to which these substances are likely to become contaminated by arsenic in this way is slight.

(17) Considerable daily doses of arsenic may be administered to *fowls* for several weeks or months without causing their flesh or livers to contain more than extremely minute quantities of arsenic.

It will be seen that the food and drink substances referred to in this report vary within wide limits in respect of their liability to contain arsenic. Of foods which are subject to risk of serious contamination the principal are those in which glucose is used, or which, like glucose, are prepared by the use of a relatively large quantity of sulphuric or hydrochloric acid. There can be no question of the necessity that stringent precautions as regards arsenic should be taken by manufacturers of foods of this class, and by persons using them in the preparation of other foods. In the case of certain other foods dealt with, the liability to contamination by arsenic is not so great, but it seems nevertheless important that precautions against arsenic should be taken by those manufacturing them; for example, foods made with glycerin; foods consisting largely of yeast; chicory; or West India sugars. In a third class of foods dealt with in the report, it may be urged that the liability to arsenical contamination, in the absence of all precaution, is so slight that there is no occasion at all for the question of arsenic to be considered by the manufacturer; or again, in the case of particular substances (anchovy sauce, for example), it may be claimed that precaution is unnecessary on account of the small quantities in which they are taken by the individual. But in the majority of cases it would seem a matter of little difficulty for the manufacturer of the substances here in question to secure that none of his ingredients, even if used in small amount, contains any noteworthy proportion of arsenic. A sugar refiner or mineral water maker, for example, might use phosphoric acid or phosphates containing relatively large amounts of arsenic without contaminating his finished product to a degree which could be considered objectionable. But as he can obtain these substances practically free from arsenic with little additional trouble or cost, it would seem more satisfactory that he should do so, and thus secure that his finished product was free from arsenic, in the sense that no arsenic would be detectable, by the Marsh-Berzelius test, in quantities of his product such as are usually taken for arsenic analysis; and if the small proportion of a given ingredient renders its content of arsenic of less moment to the consumer, it also renders insignificant the extra cost of arsenic-free material.

Dr. McGowan and Mr. R. S. Finlow examined most of the foods and materials used for the preparation of food collected by Mr. H. Hammond Smith for arsenical contamination. The results are contained in Appendix 25. The methods employed in the examination are described by Messrs. McGowan and Floris in Appendix 22. For the purification of hydrochloric acid Thomson's method (*British Food Journal*, October, 1902) was adopted, which consists of distilling hydrochloric acid of sp. gr. 1·1 with an excess of potassium dichromate. To work this process satisfactorily the acid in process of distillation must carry with it a continuous stream of chlorine. The bromine method put forward by the joint committee was not always successful in the hands of these chemists. A description is also given of the purification of sulphuric and nitric



A. Kipp apparatus.
B. Jena glass tube heated by Bunsen burner to effect partial purification of hydrogen from arseniuretted hydrogen.
C. Washing apparatus containing strong sulphuric acid.
D D Wash bottles containing silver nitrate; one has a tower packed with glass moistened with silver nitrate.
E and F are arrangements for adjusting the pressure of gas.
G. Generating flasks connected to tubes packed with lead acetate paper and calcium chloride.

acids and other chemicals. The apparatus used for "Marshing" was a modification of that described by Scudder (Evidence, Vol. 1, Q. 4270).

The point which characterises this form of apparatus is that the greater part of the supply of hydrogen other than that required for the formation of arsenuretted hydrogen is derived from a source external to the "Marshing" flask. This is shown in Diagram 1. A disadvantage in the working of the apparatus appears to arise from a deposition of double mirrors, one in front of the other. When the standards are prepared in the same way as the mirrors in the actual determinations, the personal difference in reading the mirrors is practically negligible.

Method of Working the Apparatus.

The portion of the apparatus dealing with the purification of the Kipp hydrogen having been fitted up, and the hydrogen turned on, 3 grms. of zinc and about 30 c.c. of water are introduced into the generating flask. The complete apparatus, with the exception of the mirror tube, is now connected up, and the Kipp hydrogen allowed to flow through it for 10 minutes or so, at the rate of about four bubbles per second. The mirror tube is then attached, and the flow of hydrogen continued for another five minutes, after which the Bunsen burner under the mirror tube is lighted. If after a further period of 10 minutes the tube is still perfectly clean, the hydrogen is slowed down to the rate of about one bubble per second, the diluted acid (10 c.c. of 1 in 4 sulphuric acid, or 10 c.c. of hydrochloric acid of 1·1 sp. gr., as the case may be) run into the generating flask, and another "blank" of 10 minutes performed. Should there still be no sign of any deposit in the mirror tube, the solution to be tested is run into the generating flask, and the experiment continued for at least an hour longer, by which time the whole of the arsenic present will have been deposited in the mirror tube. The rate of flow of the Kipp hydrogen is now slightly quickened for a few minutes, and the mirror tube fused off and read against standards prepared in the same manner. The volume of liquid in the generating flask is always kept as uniform as possible, *i.e.*, at about 50 c.c., and if the flask should show any tendency to become warm it is immersed in cold water.

The materials examined were "Marshed" direct, or, after preliminary destruction of the organic matter by (1) the Fresenius-Babo method, with chlorate of potash and hydrochloric acid; (2) Gautier's method with nitric and sulphuric acids; (3) the Basic method of Ling and Newlands (*loc. cit.*).

The results are tabulated and particulars of each experiment recorded. The following substances were examined:—(1) Preparations of malt or food contained malt. Samples of "Carnos," which is a food prepared from yeast and extracted malt culms, contained quantities of arsenic varying from 1/6th to 1/25th grain per lb. (2) Meat and milk preparations were practically free. (3) Cereal preparations were free. (4) Demerara sugars. In one instance 1/400th grain per lb. was observed. (5) Prepared table salt; free. (6) Table syrups. A sample of Bostock's contained 1 gr. per lb. (7) Preservatives; a preparation known as Friziline contained 1/21th gr. per lb. (8) Baking powders; two samples contained 1/60th and 1/5th gr. per lb. respectively. (9) Powders for beverages containing citric or tartaric acid were free. (10) Gelatins; one sample contained 1/140th gr. per lb. (11) Vegetables; one sample of potato skins contained 1/353th gr. per lb. (12) A sweetening substance described as Porcherine contained 1/260th gr. per lb. (13) Liquorice; the samples examined contained amounts of arsenic varying between 1/130th and 1/780th gr. per lb. (14) Colouring matters; ten samples were examined; all contained arsenic in quantities varying between 1/130th and 9/10th gr. per lb. (15) Smoked and dried food. Of the 22 foods examined, comprising such foods as chicory, coffee, lemon peel, ham, bloaters, and smoked herrings, two were free of arsenic, the remainder contained from a trace to 1/140th gr. per lb. (16) Gooseberries watered with Paris green. The samples of fruit contained 1/20th to 1/60th gr. of arsenic per lb. (17) Fowls to which arsenic had been administered. The flesh and organs contained from 1/600th to 1/200th gr. per lb., the feathers from 1/5th to 2/5ths gr. per lb. (18) Cigarette papers with metalled tips. Seven samples contained from 1/200 to 4 gr. per lb. (19) Parchment paper manufactured with sulphuric acid used for wrapping food in was free. (20) Sulphuric acid. (*a*) Not dearsenicated contained $10\frac{1}{3}$ gr. per lb. (*b*) Dearsenicated, free. (21) A sample of water-softening powder contained 1/40th gr. per lb.

Arsenic was formerly used as an ingredient of the enamel of various cooking utensils, and an investigation carried out by Dr. McGowan in which he employed saucepans lined with a specially made enamel containing arsenic, shows that liquids boiled in such utensils may take up considerable quantities of arsenic. A number of specimens of saucepans and enamelled hollow-ware ordinarily met with did not contain arsenic as an ingredient of the enamel.

Principal Ingredients of Food, or Substances used in Food Preparation, which are liable to contain Arsenic.

Sulphuric Acid.—This is the most important of the substances to be considered, for it is used sometimes in large amounts in the preparation of a variety of foods. Most of the acid used in this country is obtained by roasting pyrites ores. Such ores contain large proportions of arsenic, and unless the acid is submitted to a dearsenication process it will be arsenical. The sulphuric acid (B.O V.) supplied in 1900 by Messrs. Nicholson and Sons to Messrs. Bostock and Co. was contaminated to an unusual extent, as much as 1·45 to 1·9 per cent. of arsenious acid being present. The evidence of many witnesses proved that dearsenicated acid can be easily produced. The difference in price between arsenical and non-arsenical sulphuric acid is so small that it can seldom be of material account to the food manufacturer. Sulphuric acid prepared from brimstone, recovered sulphur, and spent oxide, is not usually submitted to a dearsenication process, as the probability of arsenical contamination is remote. The Commissioners very properly point out that such acids should not be assumed without analysis to be free from arsenic.

Hydrochloric Acid.—Commercial acid frequently contains arsenic derived from the use of arsenical sulphuric acid in its manufacture. Hydrochloric acid is less easy to obtain free of arsenic than sulphuric acid. The liability of hydrochloric acid to be arsenical is small when the acid is obtained by "cylinder" or other processes in which care is taken to use sulphuric acid free of arsenic.

Glucose.—Solid and liquid glucose and invert sugar are liable to obtain arsenic derived from sulphuric or hydrochloric acid used in the conversion process. Bostock's glucose manufactured in 1900 contained as much as 3 grs. of arsenic per lb. Glucose manufacturers were well aware of the necessity of guarding against arsenic before the scare in 1900, and there appears to be no difficulty in producing glucose free from arsenic. It is striking that the material which was the direct cause of the outbreak of arsenical poisoning should, with the single exception of Bostock's preparation, be so generally free from arsenic.

Glycerin.—This substance, which is prepared by distillation of the crude glycerin derived from soapmakers' lyes, may contain considerable amounts of arsenic derived for the most part from hydrochloric acid used in the manufacture of the crude product.

The evidence of Messrs. Moore, Marshall, Campbell, Brown, and Fairley showed that glycerin supplied for pharmaceutical and domestic purposes is sometimes heavily contaminated with arsenic.

Cases were cited where samples of glycerin appeared to be free of arsenic by the Gutzeit test, as directed by the British Pharmacopœia, yet, when examined by the Marsh-Berzelius method, were found to contain appreciable quantities, in one instance as much as 1/13th gr. per lb. The sufficiency of the official test is now under the consideration of the Pharmacopœial Committee of the General Medical Council.

Caramel.—This material is used to colour and flavour a large number of foods, including beer. Considerable quantities of arsenic have been found in caramels, and its presence was probably due to impure alkaline carbonates used in the manufacture. Commercial caramel free from arsenic can be readily obtained.

It is striking to note how much the purity of these and other materials has improved in respect to arsenic since the outbreak of arsenical poisoning in 1900.

A very important section of the report has now to be considered, namely, the question of the contamination of malt by arsenic. This contamination was recognised after the cause of the 1900 epidemic had been ascertained. Beers brewed with an all malt grist were found to contain considerable quantities of arsenic, which was ultimately traced to the malt. This matter has received close attention at the hands of brewers and maltsters, and, from the evidence brought forward, the Commissioners say that it is now commercially practicable to produce malt which either may be considered free from arsenic, or in which the amount of arsenic is less than 1/250th grain per lb., and they further point out that most of the malt prepared during the past two years has been of this character.

The coal or coke used for drying and kilning malt always contains arsenic. When the fuel is burnt in an ordinary malt kiln part of the arsenic is volatilised, and much of the arsenious oxide which is formed becomes condensed in different parts of the kiln and in the malt. Part of the arsenic remains behind in the ash in combination (as arseniate) with basic matter contained in the fuel. Some of this ash, carried up by a strong draught, may become deposited in the malt, and so add to the quantity of arsenic which the latter contains.

The evidence of Mr. Ling in showing how malt may be contaminated with arsenic in a malt kiln and the distribution of such contamination is interesting, and also of importance, in view of the fact that there is little likelihood of any radical alterations being made in existing kilns. In such cases it is obvious that freedom from arsenic can only be attained by exercising strict supervision over the fuel used and the cleanliness of the maltings. Several witnesses showed that sweepings from the inner walls, girders, dispersing plates, and other parts of malt kilns have been found to contain large quantities of arsenic. The liability of malt to become arsenical is greatly increased when such dust is allowed to accumulate on any of these surfaces, either above or below the malt floor. It is most important that the interior of kilns should be thoroughly cleansed, not only at the beginning of the season but at frequent intervals during the season. So marked is the increase of small quantities of arsenic in malt towards the middle and end of the malting year that I have advised the maltings with which I am connected to thoroughly and frequently brush out the kilns, treat them with a lime wash, and leave them at least two days before firing again, so that the dust may settle. It has been amply proved that all malting fuel contains arsenic, and it would appear that as the season progresses the walls of the kiln do not absorb arsenic to the same extent as in the beginning of the season, so that more arsenic passes into the malt, and the successive products from such a kiln show increasing amounts of arsenic. As soon as a kiln is efficiently cleaned, and if the anthracite is of normal quality, the malts show no traces of arsenic.

The Commission discuss the question of drying and curing malt without access of the products of combustion, and point out that sufficient evidence has not been adduced in favour of the general belief that it is essential that the products of combustion should pass through the malt in order that it may possess a flavour which is necessary for beer. Methods of drying and curing malt without the presence of the fumes from the fire require to be tried on a considerable working scale at English maltings before sufficient experience can be gained of their advantages or disadvantages from the point of view of the cost involved, and of the extent to which they meet the requirements of the brewer and the demands of the public taste. With regard, however, to the absolute exclusion of arsenic and consequent freedom in the choice of fuel, the advantage is unquestionable. The Commissioners express the opinion that processes of malting without the products of combustion should in future receive careful consideration from brewers and maltsters who are about to erect new malt kilns.

As the Commissioners were clearly not warranted in suggesting that malt kilns should be structurally altered so that arsenical contamination could be avoided, suggestions were put forward whereby arsenic could be prevented from passing with the other products of combustion to the malt. These methods involved the treatment of fuel before firing or of passing the products of combustion through a suitable filtering medium. In the course of their examination Messrs. Ling and Beavan described in some detail processes for attaining this object. Mr. Ling described Mr. Newlands' (this Journal, 1901, 736) method, which consists in intimately mixing the fuel with milk of lime before putting on the kiln fire. Mr. Beavan (this Journal, 1902, 182, 268) described an arrangement by which lumps of limestone are placed at the outlet of the kiln furnace. He claims that the fumes from the fire in passing over the surfaces of heated lime lose practically all the arsenic they contain. Figures were given by these witnesses in support of their statements.

When the very varied construction of malt kilns is considered it is evident that some kilns have a greater risk of arsenical contamination than others. In old-fashioned kilns, which are still in use in some of our malting centres, the kiln floor is only a few feet above the fire. Arsenical contamination is easy to conceive in such cases. On the other hand, in recently constructed maltings the products of combustion have to pass up a long shaft and traverse baffle plates before they reach the malt, so that the arsenic in the fumes has a greater chance of being deposited. In daily practice it is usual to find that the proportion of traces of arsenic in malts is higher when they are cured in a low kiln.

Much has been said about removing arsenic by screening and brushing malt. All malt is screened before it leaves the maltings and again before it is ground in the brewery. By the process of screening the rootlets or culms are separated and a certain amount of arsenic which may have been deposited is removed. The evidence showed that the rootlets of malt contain more arsenic than the malt, and this is not to be wondered at when the bulky nature of the rootlet is considered. A number of determinations which have been made in my laboratory show that the culms or rootlets roughly contain twice as much arsenic as the malt itself. This point has been recognised by the Commission, for they advise that screening should be thoroughly carried out. The brushing of malt is also of value in removing a considerable proportion of arsenic from malt, especially when the brushing is repeated several times. Messrs. C. Brown and Stopes contend that the arsenic in a relatively high arsenical malt was completely removed after the malt had been brushed three times. Mr. T. Earp on the other hand said that arsenic cannot be altogether removed by brushing. Laboratory experience tends to support Mr. Earp's statement. Brushing will remove comparatively large quantities of arsenic from highly arsenical malts, but malts on the border line of danger, containing such quantities as 1/200th grain per lb. and less, appear to be unaffected or very slightly so. The completeness with which brushing removes the arsenic from malt no doubt depends upon the conditions under which contamination occurred. If malt is dried and cured with an arsenical fuel most of the arsenic is deposited on the outside of the corn, but owing to the porosity of the external covering of the malt, a portion of the arsenic is absorbed internally, and no amount of brushing will remove it.

The Commissioners consider that the brushing machinery which is in use at good maltings and breweries is capable of removing a considerable proportion of the arsenic from arsenical malt. It is however obviously preferable to take steps to prevent the access of arsenic to malt, rather than to rely on any subsequent process for removing arsenic after it is deposited on the grain.

Selection of Fuel.—This matter has been fully gone into by the Commission and the result of the inquiry should be of considerable value to colliery owners and masters.

Up to 1901 oven coke and gas coke were often the principal fuels used in Yorkshire and Midland maltings: this was doubtless partly due to the local abundance of coke and the remoteness of the anthracite collieries. When it was recognised that arsenical malts were generally those which had been dried over gas coke, whereas anthracite dried malts were usually free of arsenic, the use of coke was practically discontinued.

At the commencement of the enquiry few examinations of anthracite with regard to arsenic had been made, and satisfactory methods of estimating small quantities of arsenic in fuel were unknown. In Appendix 30 will be found a series of reports relating to arsenic in anthracite obtained from South Wales. Mr. Strahan of the Geological Survey investigated the appearance and geological correspondence of the seams of anthracite worked at various collieries visited in respect of the removal of the impurities from the coal which they supply to maltsters

From these collieries a large number of samples were carefully collected for the Commission by Mr. S. W. Price, and tested for arsenic by Dr. McGowan, by means of a method devised by himself and Mr. Floris. It is essentially a modification of Ling and Newlands' method (*loc. cit.*). It was found that the whole of the arsenic could not always be estimated when the residue after ignition with or without lime was dissolved in hydrochloric acid and "Marshed" directly. The "non-volatile" arsenic was in several cases in excess of the total arsenic, and this contradictory result was most marked when the residue was rich in iron, the latter thus appearing to be the disturbing factor in the analysis. To overcome this difficulty, these chemists devised the following process.

For the determination of "total arsenic" a weighed quantity of the finely powdered coal, from 1 to 10 grms., is mixed with 3 grms. of arsenic-free lime and ignited in a platinum basin at a bright red heat over a strong Bunsen flame, until the ash shows only the red-brown colour of oxide of iron and there are no obvious black specks left in it; this usually takes about three hours. After cooling, the residue is cautiously slaked with water and treated with about 5 c.c. of dilute arsenic-free nitric acid (1 in 10), dried on the water bath, and re-ignited for a short time to decompose any nitrate that has been formed. The entire mass is now dissolved in excess of arsenic-free hydrochloric acid (the excess amounting to about 10 c.c. of 20 per cent. acid) the solution diluted with water, and gently warmed for some time. It is then filtered, the iron and arsenic in the filtrate reduced with excess of aqueous sulphurous acid, and the excess of the latter evaporated or boiled off very gently. After this sulphuretted hydrogen is passed to saturation through the cold liquid, which has a volume of about 70 c.c., and is contained in a small conical flask of Jena glass of 100 c.c. capacity; the flask is then tightly corked, allowed to stand until the precipitate has settled, and if not still smelling strongly of sulphuretted hydrogen, it is re-saturated from time to time.

The precipitate is then filtered through asbestos in a small Gooch crucible, and washed first with sulphuretted hydrogen water until free from chlorides, and then in succession with alcohol, carbon bisulphide and alcohol again. The entire contents of the "Gooch" are now transferred to a small porcelain basin and extracted three times with about 5 c.c. of dilute aqueous ammonia (1 in 4), the extract being of course, filtered from the insoluble matter each time.

The entire filtrate and washings are then evaporated to dryness on the water-bath, and the residue so obtained treated three times with a very little concentrated arsenic-free nitric acid (about 1 c.c. at the time), the contents of the basin being brought down to dryness after each addition of acid. The last-mentioned residue is finally extracted three times with a few c.c.'s of dilute aqueous ammonium carbonate (1 in 10), the extract being if necessary filtered; the ammonia is then got rid of on the water bath and the arsenic in the liquid reduced with excess of aqueous sulphurous acid, the excess of the latter being evaporated off as before. This final solution is then made up to a given volume, and a suitable portion, usually one-half, is Marshed with 3 grms. of zinc and 2·5 c.c. of sulphuric acid (previously diluted), the total volume of liquid in the "Marshing" flask not exceeding, as a rule, 10 to 50 c.c.

Non-Volatile or "Fixed" Arsenic.

For the estimation of "non-volatile arsenic" an exactly similar procedure is adopted, excepting that the ignition is done without lime.

The sample was prepared for analysis in the following way:—

The entire sample was roughly broken with a hammer, mixed, and halved; one-half of this is again broken, mixed, and halved, and the process is again repeated a third time, Of this last sample one-half or one-quarter is broken up with a hammer between shafts of glazed brown paper on a wooden block, until no pieces are left of larger diameter than about ¼-inch; it is then carefully and successively mixed and halved until only about 50 grms. remain. From this final sample the amount required for the analysis is ground in Wedgwood mortars to an almost impalpable powder. The inside of the bottles in which the final sample is kept should be examined carefully, in order to ensure that there are no loosely adherent flakes of glass.

In August 1901 Mr. Hammond Smith visited four typical maltings, and found that the anthracite used was obtained from different collieries. He refers to the heating power and flavouring properties which appear to influence maltsters in the selection of particular collieries.

All anthracite supplied was understood to be hand-picked at the colliery in order to remove impurities, but impure coal and pyrites were sometimes met with in the fuel delivered. Two maltsters had caused some analyses of anthracite for arsenic to be made, but there had been no question at any of the maltings of purchasing anthracite under guarantee as to arsenic. No weight was attached by the maltsters to copies of analyses which they received from colliery companies showing that anthracite samples had been found free from arsenic.

From Mr. Strahan's report it appears that the great bulk of the anthracite used by English maltsters is derived from a limited portion of the South Wales coalfield contained in an area of 25 miles by 4. To the north it is limited by the outcrop of the coal measure; to the south, where the seams descend to a great depth, their limits have not been ascertained, but there is reason to believe that they gradually lose their anthracite character. Ten collieries were visited, and each supplied anthracite for malting purposes. Five seams were worked for malting, and the greater part of the coal is got from one seam which is generally known in the different collieries as the *Stanllyd*, the *Big*, or the *Nine-feet* vein. This seam is stated to be superior to the others in calorific power and purity. The seams crop up and are worked near the surface and at great depths below it; thus, the term "deep," which is applied to some of them in the trade, has therefore no significance.

Mr. Strahan shows in a series of tables the different seams met with at the several collieries visited, and the names under which they are known, also the distribution of visible yellow or black pyrites in the different seams. Another table describes the seams in detail and shows partings other than those of pyrites. In certain seams no visible iron pyrites occurs, in others it is visible in greater or less abundance. It occurs in lumps of thin impersistent bands and takes one or two forms, namely, that characteristic of yellow pyrites, or that of black material consisting largely of coal, but containing sulphide of iron in a form not distinguishable by the eye.

Seams of anthracite are usually "solid," consisting of coal from top to bottom without any partings of clay or stone. Certain seams have impurities other than pyrites which consist of impure coal and black stone.

The third point which Mr. Strahan investigated was the different methods in use of freeing anthracite from impurities. From a consideration of these it is plain that genuine efforts are made by the collieries to supply anthracite as pure as possible to the maltster.

The same method is in use at all the collieries, with slight differences in detail. The miner is supposed to pick out all visible pyrites, fragments of shale, &c.; but from the conditions under which he works he is unable to do so completely. The coal on reaching the top of the pit is tipped into an iron shoot, down which it passes with a rapidity which can generally be regulated. One or more men are stationed by the side of the shoot whose business it is to pick out pyrites or impure coal. The coal then passes over two or more screens, in the last of which the bars are placed at distances apart varying from two to eight inches at different collieries. The small coal falls through, and large lumps only pass on to the truck for the maltster. In this truck two or more men are stationed whose business it is to arrange the coal and throw out any impurities that have passed the men on the screens.

At all collieries it is stated that a special screen is kept for the malting coal, and that all screening is done in daylight. As a rule no alteration has been made in the system in consequence of the demand for arsenic-free fuel, but in one or two cases the picking is done more carefully than it used to be.

Large lumps of coal in which no pyrites is visible are not broken, it being considered that pyrites, if it existed in them, would always show itself on their surface. Lumps in which pyrites shows itself are broken, and the coal generally put back upon the screen.

All the impurities picked out are thrown on the rubbish heap, except a certain form of bright coal associated with pyrites, which is used locally as a house coal.

Samples of anthracite from the different collieries were collected by Mr. Price and examined by Dr. McGowan. The results are contained in a series of tables of which the following is a brief extract:—

(1) *Anthracite from Seams used for Malting.*—Twenty-two samples of this class were examined, each representing the whole thickness of a seam used for malting exclusive of visible impurities: 19 contained from 0—10 parts per million and 3 from 10—20 parts.

(2) *Anthracite as consigned to Maltsters.*—The 12 samples examined represented a large bulk which was indicated by the colliery proprietors as satisfactory malting anthracite. They contained from 0—10 parts of total arsenic per million. Mr. Ling stated in his evidence that he examined 21 samples, 17 of which contained from 0—10 parts, 3 from 10—20 parts, and 1, from 20—30 parts per million of total arsenic These figures are interesting when compared with the arsenic found in gas and oven coke.

——	—	Gas Coke.	Oven Coke.
0—10 parts per million { 0— 5 parts 0 5—10 ,, 5 }	5	0	5
10—20 ,, ,, ...	3	1	2
20—30 ,, ,, ...	4	4	0
30—40 ,, ,, ...	0	0	0
Over 40 ,, ,, ...	4	0	4
	16	5	11

Dr. McGowan, in 1903, analysed four samples of coke taken from a certain Yorkshire gas-works which formerly supplied maltsters, and other four samples of oven coke, taken from bulk at a Midland ironworks, with the following results:—

——	—	Gas Coke.	Oven Coke.
0—10 parts per million { 0— 5 parts 0 5—10 ,, 2 }	2	0	2
10—20 ,, ,, ...	1	0	1
20—30 ,, ,, ...	1	0	1
30—40 ,, ,, ...	1	1	0
Over 40 ,, ,, ...	3	3	0
	8	4	4

Taking into consideration the number and diverse origins of the various samples of "clean" anthracite examined for the Commission and the care taken to see that they were representative, it may be concluded that the results above summarised give a fair indication of the ordinary limits within which the small amounts of arsenic found in "clean" anthracite from South Wales collieries may vary. Some samples contain much more arsenic than others, but the variations are within much narrower limits than is the case with gas cokes or oven cokes of the kind which are, or have been, used habitually by maltsters It is evident that some oven cokes may contain quite small proportions of arsenic, and it is likely that many gas cokes would show much less arsenic than the Yorkshire samples above referred to. But it may be concluded the clean South Wales anthracites, as a class, are much purer as regards arsenic than either of these kinds of coke.

Impurities of Anthracite with respect to Arsenic:—

(*a*) Definite hard masses or nodules consisting of pyrites contained from 1,300 to 93 parts per million of total arsenic. Hard black nodules locally termed pyrites but showing no yellow pyrites contained comparatively small quantities of arsenic, varying from 2·5 to 10 parts of total arsenic per million.

(*b*) Granular black bands, which consist of black "pyrites" mixed with various amounts of coal, contained from 15·3 to 200 parts of total arsenic per million.

(*c*) Bands of impure coal consisting largely of shale. The samples examined contained from 6·4 to 2·80 parts of total arsenic per million.

(*d*) "Inferior coal" separated by partings from the rest of the thickness of the vein showed in most cases more arsenic than the better coal of the same vein.

The volatile arsenic was also estimated in all the samples examined; in anthracite, and also in coke, no constant ratio between fixed and volatile arsenic appears to exist. The proportion of arsenic volatilised under experimental conditions of combustion is less in cokes than in anthracites. It is pointed out that the evidence is not sufficient to determine the extent to which particular processes of estimating "volatile" arsenic in the laboratory can be relied upon to determine the proportion of arsenic which will become volatilised when the fuel is burnt, under varying conditions, on the fire of the malt kiln.

Dr. Buchanan discusses the bearing of the results on the selection of malting anthracite by colliery owners and by maltsters in the following terms:—

"The results show the extreme importance of careful exclusion, in the mine or on the surface, of all impurities which may be present in the veins worked for malting, and the need for constant supervision and watchfulness on the part of the colliery owner to ensure that his men carry this out properly and thoroughly, so that only 'clean' anthracite is supplied to maltsters. It is essential to remove not only nodules of pyrites, lumps in which pyrites and coal are mingled, and bands of slate or shale attached to or passing through lumps of coal, but also any obvious granular 'black' pyrites. In a seam where such granular black pyrites is present as a definite layer traversing the vein at a particular level, it can be more readily eliminated than where the pyritous portions are distributed irregularly throughout the vein. In one colliery a system exists by which all pieces of anthracite in which the band is represented are rejected.

"It is also essential that maltsters should systematically keep a strict watch on the anthracite supplied to them with the view of detecting and discarding impurities of the kinds above mentioned.

"It is important that 'clean' anthracite, as supplied to maltsters, should from time to time be sampled for the colliery owner, and that the quantity of arsenic contained in it should be estimated and compared with all available data. For this purpose a thorough and accurate method of obtaining a fair sample is essential. This point cannot be too strongly emphasised. The analyses desired are for the information and guidance of the colliery, and not for the purpose of obtaining a favourable report on specially selected samples for exhibition to maltsters.

"Where more than one seam of anthracite is worked at a colliery, advantage may be gained by analyses of the seams separately, together with associated impurities. For example, at a colliery four seams are worked for malting coal, the 'Big,' 'Green,' 'Gras Uchaf,' and 'Pump Quart' veins respectively. The samples from the last two, which are 'solid,' and have practically no impurities to be removed, and also the sample from the Big Vein, in which the impurities consist of large and easily-removed lumps of yellow pyrites, contained in each instance less arsenic than samples of 'clean' anthracite taken from the 'Green' Vein. This Green Vein also was found to have a band of impure top coal which showed 280 parts of arsenic per million. So far as arsenic is concerned, therefore, it would seem better not to work such a vein as the last-named for the supply of malting fuel.

"When colliery owners run short of malting anthracite, they occasionally fulfil their orders by arrangements with owners of other collieries, and this of course is the regular practice of agents and middlemen in similar circumstances. Where this is done it would seem important that the person or firm who has undertaken to supply the maltster should inform him that the source of supply has been changed, and should ascertain that the new supply is satisfactory as regards removal of impurities.

"The exceptional result obtained in the case of anthracite from a colliery outside the anthracite area shows that it is desirable that the maltster, besides taking steps to obtain a supply of anthracite that is 'clean' and apparently free from visible impurities, should also take the precaution of occasionally submitting samples to the analyst. This seems especially important when the supply is obtained from a new colliery, or when the maltster receives anthracite of a different character from that to which he has been accustomed."

In a short note which immediately follows this communication, my colleague, Mr. W. D. Dick, and myself have endeavoured to show that the practice of adding sulphur to the kiln fire may result in the malt becoming contaminated with arsenic. Experimental evidence is adduced proving that when arsenical fuels are burnt in presence of sulphur a considerable amount of the fixed arsenic is rendered volatile, due no doubt to the reducing action of the sulphur on the kiln fire.

The Commissioners report in the following terms on hops:—

"Hops are exposed to the products of combustion of fuel during their drying on the kiln, and it has also been suggested that they may become contaminated through the use of impure sulphur (on the kiln or as an insecticide) and possibly in other ways.

"It is the practice of hop dryers to employ anthracite, and not coke, for burning in the kiln, and if suitable care is exercised in the selection of fuel the risk of hops becoming contaminated is evidently small. The quantities of arsenic which have been reported to us as having been detected in hops have in all cases been minute."

I venture to think that the evidence offered to the Commission on this point was somewhat meagre. Thus Messrs. Niven, Salamon, and A. K. Miller, say that they found small quantities. Mr. Berry said that contamination was not possible in growing hops on a large scale, but admitted the risk if improper fuel were used. Mr. C. O. Sullivan admits the possibility, but points out that owing to the proportion of hops used the risk would be infinitesimal. Dr. Thorpe reported on seven samples; one was free from arsenic. The maximum amount found was 1/100th gr per lb. Mr. Thomson found 1/80th to 1/100th per lb. The expert Committee examined 11 samples of hops and found them free, but recognised that hops might contain arsenic.

My own experience has not been so fortunate, for in many instances I have found that hops sometimes contain relatively large quantities of arsenic. Of 12 samples examined in February 1901, four were free of arsenic, the remainder containing from 1/100th to 3/16th gr. per lb. of arsenious acid. Many samples now contain 1/50th to 1/100th gr. per lb. It is probable that many hops at present in use would be condemned by the Inland Revenue officials.

Finished Foods which are liable to Arsenical Contamination.—Since the 1900 epidemic close attention has been given by brewers to the exclusion of arsenic from glucose, invert sugar, malt, and other materials used in brewing. In spite of such precautions contaminated beer is occasionally met with, for example the Halifax case. Such instances may now, however, be considered unusual. The Commissioners are satisfied that most of the beer made in this country may be regarded as free from arsenic, and that where detected it is usually in minute amount. It has been agreed that it is commercially practicable to produce beer which uniformly shows less than 1/100th gr. of arsenic per gallon, and in which as a rule any arsenic present is in much smaller proportion than this.

Contamination of Cereals or Roots grown on Arsenical Soil.—This probability was investigated by Dr. J. A. Voelcker. Experiments were carried out in which barley and swedes were grown on plots which were manured with superphosphate containing no arsenic, with superphosphates containing various known proportions of arsenic, and left unmanured. The results were practically negative. Very small quantities of arsenic were found in the barley straw and leaves of the swedes, but no arsenic was detected in the grain or bulbs of the swedes. Mr. A. Angell failed to detect arsenic in the ripe grain or in the fruit or seed of any of the plants grown on soil containing arsenical superphosphate.

PART 5.

Precautions which should be taken by Manufacturers to exclude Arsenic from Foods.

The Commissioners state at some length what they consider the duty of the manufacturer of foods or food ingredients when liability to arsenical contamination arises. Thus, manufacturers of sulphuric acid, phosphoric acid, glycerin, glucose, invert sugar, caramel, and malt are advised to take steps to obtain uniformly degrees of purity which are at present commercially attainable, and that they should always be alive to improvements which tend to eliminate even traces of arsenic. Moreover, it is essential that manufacturers of the above substances and also of other ingredients of food which are liable to arsenical contamination should frequently test their products for arsenic, and should keep for their own guidance a systematic record of the results of the testing. It is advised that the estimations should be made by comparison of mirrors, obtained by the zinc and acid method, or electrolitically.

It is regarded as essential that any guarantee as to arsenic supplied by the manufacturer as an ingredient of food should be given with full knowledge of the amount of arsenic which, if present, would be detected by the tests which he employs, and of the significance in terms of approximate quantity of any minute proportions of arsenic which he cannot be certain of excluding by the precautions which he adopts. A manufacturer may give a guarantee as to freedom from arsenic, even if it contains a minute trace of arsenic (for example, 1/500 grain per lb. in glucose or malt), provided that he can state a definite proportion of arsenic which his product does not contain, and that he endeavours to keep out arsenic altogether irrespective of the guaranteed limit.

The Commissioners are of opinion that no substance should be used as an ingredient of food which contains more than 1/100 gr. per lb. of arsenic, or in the case of solution of 1/100 gr. per gal. In many cases, more particularly glucose and malt, much smaller quantities than these are now commercially attainable, and should be insisted on. This is one of the most important paragraphs in the report, for the manufacturer may reasonably conclude that the allowable limit of arsenical contamination in an ingredient of food is 1/100 gr. per lb. or gal. respectively. It was naturally foreseen that 1/100 gr. of arsenic per lb. could not be allowed in the case of glucose or malt, for this amount would mean considerably more than 1/100 gr. of arsenic per gal. in the beer. It is, perhaps, a little unfortunate that the last sentence in the paragraph referred to could not have been strengthened, and the fact emphasised that 1/100 gr. of arsenic in malt is not an allowable quantity.

The Commissioners regard it as important that guarantees as regards arsenic should not be given unless tests are applied systematically and with sufficient frequency. The giving of guarantees should not be allowed to degenerate into a perfunctory routine.

The Commissioners and many of the witnesses are of the strong opinion that the value of guarantees as to freedom of arsenic in ingredients of food and substances used in the preparation of food would be increased if such guarantees were given on a uniform basis with reference to official "standards" which should define for particular substances the amount of arsenic determined by a definite test which should be regarded as inadmissible. The Commissioners state that such standards are needed by manufacturers and the users of food ingredients.

The application of the Sale of Food and Drugs Act to prevention of the contamination of foods by deleterious substances is materially hindered by want of an official authority with the duty of dealing with the various medical, chemical, and technical questions involved. At the present time there is no authority to define impurities or adulterations which should be specifically looked for in the course of examination of particular foods submitted for analysis under these Acts, or to lay down official standards respecting the nature and extent of impurity or adulteration on a given food which, without question, should render its vendor or warrantor liable to proceedings under the Acts. In the case of foods liable to contain arsenic these drawbacks have been amply illustrated. The witnesses have been practically unanimous in urging on the Commission the need for such official standards, and their imposition is considered essential to the successful use of the Sale of Food and Drugs Act to prevent arsenical contamination. The powers of seizure given to the Medical Officer of Health or Inspector of Nuisances in districts where Part II. of the Public Health Amendment Act, 1890, has been adopted, is not capable of satisfactory application where the proof that the article is deleterious is dependent on chemical analysis, particularly as the official would have no power to lay an embargo on the sale of a suspected article pending its chemical examination. The Commission expresses the opinion that the powers which medical officers of health possess under the Public Health Acts to obtain the condemnation of unsound or unwholesome articles of food should be extended, and that they should be able, subject to proper restrictions, to lay an embargo on the sale of the suspected articles or on the use of the suspected ingredients pending their official examination.

It is advised that dealers or middlemen selling to food manufacturers should ascertain from the maker of the food ingredients that the article to be supplied is suitable for food purposes. Attention is also drawn to the too prevalent custom of selling chemical substances to food manufacturers under misleading or ambiguous trade names.

The Commissioners suggest that mineral and coal tar colour makers should prevent colours being supplied for food purposes, for, apart from the possibility of being contaminated with arsenic, they are generally used for undesirable purposes. The use of chloride of tin for producing a bloom on West Indian sugars is also condemned.

Finished Food liable to contain Arsenic.—The manufacturer who uses substances liable to contain arsenic in the preparation of the food which he supplies to the public can guard against arsenical contamination (1) by obtaining adequate assurance from the vendor that the ingredients which he purchases are satisfactory in respect of arsenic, and by taking care that their intended use for food purposes is known to the vendor; (2) by testing the ingredients which he purchases or prepares.

PART 6.

Present Means of Official Control over Purity of Food in relation to Arsenic.

Under this heading the Commissioners summarise the effect of the evidence regarding the means of official control over the purity of food.

(1) *Control over the Manufacture of Food or of Food Ingredients.*—The existing Acts provide little, if any, official control over the proceedings of manufacturers of food or of food ingredients, and control can only be exercised when the manufacture of the food is completed and it is on sale to the public. The powers of the entry of Government officials into factories for specified purposes is discussed. With regard to dutiable articles, various powers of inspection or sampling are conferred upon Revenue officers. The object with which these powers have been granted has been the protection of the Revenue and not that of the public. Under the Customs and Revenue Act of 1888 the Treasury has power to prohibit the use of any substance or liquor of a noxious or detrimental nature in the manufacture or preparation for sale of any article of "excise." In October 1901 this power was used in respect of glucose and invert sugar containing arsenic. Since the issue of the order the Board of Inland Revenue has had numerous samples of various brewing materials examined, and in some instances brewers have been warned when malt or other ingredients were found to be seriously contaminated with arsenic. In the case of substances submitted for sanction as additions to beer, the Inland Revenue have the power of vetoing their use if they are considered undesirable or contaminated with arsenic. It follows, therefore, that so far as beer and dutiable articles are concerned the public can be protected from arsenical contamination.

The Commissioners point out that the evidence received from various official witnesses shows that the Sale of Food and Drugs Act, as at present interpreted and administered, is unsatisfactory for the purpose of protecting the consumer against arsenic or other deleterious substances in food for the following reasons:—

(1) *Prosecution of Retailer.*—In most cases prosecutions must be directed, not against the manufacturer, importer, or middleman, but against the retailer, who in the majority of cases has had nothing to do with the contamination, and is seldom in a position to ascertain that it exists. The retailer may be defended by the manufacturer, but the retailer is liable to be prejudiced in the eyes of his customer, and the evidence brought forward on this point shows that the authorities are often reluctant to institute proceedings in these circumstances against a person whom they do not regard as culpable. The question of warranty and its weak points is discussed.

The Food and Drugs Acts are generally intended to deal with certain well-known forms of fraudulent adulteration, and the officers who collect samples direct their attention to such cases. They have very little expert advice or direction which enables them to know what samples should be obtained as a control against substances injurious to health, or in what number they should be taken. Public analysts receive samples in order to report upon their "genuineness;" it is no part of their official duty to advise as to the nature and number of the samples which should be taken, and, usually, their authorities do not invite their co-operation in the matter.

The absence of official standards is referred to, and as mentioned before the Commissioners consider their imposition essential to the successful use of the Food and Drugs Acts, to prevent arsenical contamination.

PART 7.

Recommendations as to Improvements in Official Control over the Purity of Food.

The Commissioners consider that the control which can be at present exercised is unsatisfactory when applied to the prevention of risk of contamination of foods by arsenic; and, further, that serious defects exist in the machinery available to safeguard the public against the introduction of poisonous, deleterious, or valueless substances in general, into articles of food. In making the recommendations the Commissioners have regard to the broader issues concerned, and not merely to arsenic.

They point out:—

(1) The necessity for more extended administration by the Local Government Board. The work of local authorities should be co-ordinated, and they should have advice as to the way in which the Acts may best be applied to secure the purity of food. The Local Government Board should undertake further duties of supervision and watchfulness in relation to the purity of foods and the administration of the Acts bearing on the subject. The Board should also have the advice of a special officer with suitable scientific

knowledge, who should be in relation with the Government laboratory, and have adequate laboratory assistance.

(2) Necessity for official standards: board of reference.

The Local Government Board should be the authority to prescribe and from time to time vary standards for the purpose of the Sale of Foods and Drugs Acts. Similar recommendations were made by the Committee on Food Products Adulteration and the Committee on Preservatives and Colouring Matters in Foods. Like these committees the Commissioners advise that any action taken by the Local Government Board should be based on the scientific advice tendered by a board of reference. This board should not be administrative, but consultative. The standards for ingredients and substances used in the preparation of food is also dealt with, and there should be no difficulty in arriving at standards which will be of assistance to the manufacturer in preparing substances used in food preparation. The control over arsenical contamination recently exercised in breweries by the Board of Inland Revenue should be continued, and this control should facilitate the general adoption of official standards which may in future be prescribed in respect of arsenic in beer ingredients.

The Commissioners advise the following amendment of the Sale of Food and Drugs Act:—

If, in a prosecution instituted under the Sale of Food and Drugs Acts, it is alleged by defendant A that the article was sold in the condition in which it was supplied to him by B (*e.g.*, the manufacturer, importer, or giver of warranty), or that the contamination is due to an ingredient supplied by C, it should be possible for A to attach B (or C, as the case may be) to the prosecution. The same principle should apply to the person thus associated in the defence if he in his turn alleges that a third party is responsible, by breach of warranty or otherwise, for the adulteration or contamination of the final product.

If the whole facts are thus brought before the court at one hearing, responsibility can be properly brought home to the real offender in a way not at present possible. In making this recommendation the Commissioners had in mind the precedents which are afforded by section 12 of the Truck Act, 1887, and by section 141 of the Factory and Workshop Act, 1901.

A memorandum is appended by Dr. Thorpe to the effect that instead of creating a permanent committee of scientific men, it would be preferable to follow the procedure of the Board of Agriculture, and to entrust the consideration of the propriety of fixing a standard to specially constituted committees on which manufacturers and technical experts in the trade concerned were represented.

Discussion.

Dr. Thorpe said the paper Mr. Baker had brought forward was a very condensed and admirably succinct account of a lengthy and protracted enquiry, and he should have been pleased to have had the opportunity of listening to what gentlemen present might have to say respecting the findings of the Commission, after which he might have been in a position, possibly, to throw some light upon the points which might be raised, or to give further information.

The Chairman said they would be glad to hear Dr Thorpe again later on if necessary.

Dr. Thorpe said the first point that occurred to him was the position which the electrolytic method had been placed in by the Government Laboratory as being what Mr. Baker had called the *de facto* official method. It was not the intention of the Departmental Committee appointed by the Board of Inland Revenue to put the electrolytic method in any superior position to the zinc and acid method, but it was the fact that it had become the method in vogue at the Government Laboratory. But that in no true sense constituted it the official method. He should think it convenient that, should any judicial proceedings arise in connection with the determination of the amount of arsenic in a material, the amount should be assessed by the electrolytic method. There were a number of reasons which had led them at the Government Laboratory to prefer the electrolytic to the zinc and acid method. He need hardly remind those who had had to make determinations of the amount of arsenic in articles of food or other articles that the difficulties which attended the use of zinc were very considerable, when minimal quantities of arsenic had to determined, as was the case in the great majority of cases. The zinc and acid method laboured under the theoretical disadvantage that if the zinc was in the ideal condition—an absolutely pure zinc—it was useless for the purpose, because it would not generate hydrogen, and therefore would not make arseniuretted hydrogen. There must be a certain quantity of associated metal with the zinc before it would do its work. They were thus placed in a dilemma. If the zinc were absolutely pure, it would be inoperative; but if, on the other hand, it contained certain associated metals it would in the case of some of them also be inoperative. For it was found that if zinc contained any considerable quantity of iron, although it generated hydrogen with remarkable facility, yet, when arsenic was added to that zinc very little was obtained in the form of arseniuretted hydrogen. For some reason, which was not wholly explained, the presence of the associated iron tended to retain the arsenic and prevent its evolution as arseniuretted hydrogen. Therefore, some metal must be present, but care should be taken what that particular metal was which set up the galvanic action on which the evolution of the hydrogen depended. He need hardly say that it was not always practically possible to secure that happy condition of things, namely, a sample of zinc which might be operative, and which should be at the same time sensitive and sufficiently free from arsenic to be used. It was that fact which caused the difficulty, and although they made every effort to get all the samples they could, they were constantly met with the eccentricities arising from the zinc used, and that being so they were obliged to rely on a method which did away with the zinc altogether. In the Government Laboratory they were in the fortunate position, as were many others in large towns, of having a ready supply of current available, and it was very easy to reduce the intensity to manageable proportions suitable for the generation of hydrogen, and therefore to the formation of arseniuretted hydrogen. It was really by *force majeure* that they were driven to the adoption of the electrolytic method, and being so driven, they gradually worked out the principles of that method in the form in which the Departmental Committee eventually presented the matter to the Commissioners. At the same time they fully recognised, as Mr. Baker had pointed out, that there must be innumerable cases in which it was not possible for operators to avail themselves readily of the electric current (and the adoption of secondary batteries was a very troublesome procedure), and for that reason they did their best to make the zinc and acid method, as far as they could, a practical method. He might say, in this connection, that from careful experiments by some of his assistants, he was convinced that when they did get that comparatively rare thing, the proper kind of zinc, the results of the tests, the character and intensity of the mirrors obtained by the zinc and acid method, substantially agreed with the results obtained by the electrolytic method. At the same time, on account of the difficulties which attached to the zinc method, he thought it would very considerably clog judicial proceedings if one had to go into Court with a method which was liable to so many doubts and open to so many points of attack, and therefore he thought on the whole it was preferable to confine themselves to a method, when there was an issue of a judicial character, in which those difficulties were obviated. Certainly for the general purpose of working, for the brewer or the maltster he was sure that the public was efficiently protected by the intelligent use of the zinc and acid method. As Mr. Baker had said, it was the fact that brewing sugars at the present day were practically free from arsenic. He did not wish to claim any special credit for the action of the Inland Revenue, but there was no doubt that the efforts of the authorities to carry out the intention of the Commissioners had very largely resulted—of course, with the intelligent co-operation of the manufacturers themselves—in getting to this very happy consummation. He might remind them that all the makers of brewing sugars in this country were now under Excise supervision. There was a permanent Revenue

Officer attached to them, and by direction of the Commissioners of Inland Revenue it was one of the duties of that officer from time to time to take samples of their products, every month he believed, and to forward those samples to the Government Laboratory for the purpose of being tested as to their freedom from arsenic. Thus they were in a position to warn the makers if there was any contravention of the intention of the Commissioners as to purity in this respect. Having now made very many hundreds of estimations of arsenic in these materials, he could assure them that probably there was no common articles of food so free from arsenic as these particular materials. He regretted to say, however, that that was not quite the case with regard to malt. Immediately after the arsenic scare a very considerable quantity of malt was withdrawn from the market, as it was found to be arsenicated, and it was practically an unsaleable article, and for some time after the Commission commenced its enquiry malts were of a very high degree of purity. Whether the idea of arsenic and the constant talk about it bred a sort of familiarity which led to contempt he did not know, but he was sorry to say that it was the fact that within a comparatively recent time the general character of the malts which had come into consumption was not by any means so high as regarding freedom from arsenic, as it was immediately subsequent to the so-called arsenic scare. At the same time he did not wish to be an alarmist in this matter. The amounts he found were not very large—nothing approximating to what the condition of things was before, and certainly not so large as they found in the samples of malt to which reference had been made. Still he now did occasionally meet with samples which were distinctly beyond the limit of 1/100th grain per 1 lb. as prescribed by the Commissioners. Mr. Baker had said he thought the Commission, perhaps, was not fully informed as to the amount of arsenic which might occur in hops, and he could corroborate him to this extent, that within the last two or three days he had had samples of hops through his hands which certainly contravened the limit of 1/100th grain of arsenic per 1lb. Even now there were certain materials occasionally used by brewers—things which were ancillary, he might say, to the operations of the brewer, not exactly part and parcel of his every day work—where apparently sufficient care was not taken to exclude, as it easily might be excluded, even small quantities of arsenic. He had a particular article in his mind which was used to a limited extent by brewers which contained as much as two grains of arsenic to the 1lb. That showed an amount of culpable carelessness on the part of somebody which ought not to be tolerated.

Mr. A. Gordon Salamon desired to add his tribute to the praise already accorded to Mr. Baker for his *résumé* of what he thought they would all describe as a masterly document. He might be permitted as one who was concerned at the time of this outbreak in attempting rapidly to quell it, to say a few words respecting the use of the test which the Manchester Committee felt was the right one to adopt in the midst of that terrible calamity. He asked permission because that test had certainly at the time of the outbreak come in for an undue share of criticism. He was glad to say the Royal Commission in their Report had fully justified the use of the test under the conditions mentioned, and he was also glad to think that Mr. Baker had, that evening, endorsed the conclusions of the Commission. The position of the Manchester Committee was this: The Marsh-Berzelius test had not been then elaborated as it was to-day, and they found themselves in the midst of a calamitous outbreak of poisoning, and they had to stop its spread if possible. They were called upon to make thousands of rapid tests on barrels of beer very often isolated as single barrels in small public-houses. These beers had to be tested not for traces of arsenic, but for the amounts which the medical men who formed part of the Committee deemed to be poisonous quantities. Traces had obviously to be relegated to the Marsh-Berzelius test, and of that they were well aware when making the investigation. Looking back, and recognising as he did and had done ever since, the superiority of the Marsh-Berzelius method as a test when properly equipped and carried out, he still thought that if any one of those who had criticised that process were to go to Manchester under similar circumstances they would revert to the Reinsch test recommended under the conditions then existing. The result of the whole investigation by the Commission had come to this, that the two chief causes of food contamination by arsenic consisted in sulphuric acid and in fuel. He could have wished, although he knew he should not have the sympathy of sulphuric acid manufacturers, that having regard to what he had seen and to his experience quite recently—having regard to accidents which might occur through mis-direction or by non-direction—that the Royal Commission had seen its way to insist that all sulphuric acid manufactured from pyrites should be de-arsenicated. It was not a very great additional expense, and it would certainly minimise the risk of accidental contamination against which no legislation could provide. One could say to-day that the precautions which had been taken by the Inland Revenue had certainly given them sugars, which he could with confidence state might be regarded as free from arsenical contamination. He did not think at the present there was any danger in that respect other than danger due to accident or design.

With respect to fuel, the conditions were different. When they adopted the Reinsch test at Manchester they had no idea that malt was apt to be contaminated with such notable traces of arsenic as were subsequently discovered. Therefore they devised conditions for the use of the Reinsch test, which would deal with the quantity which would in effect prevent poisonous beer going to the public. They soon found, however, that the conditions prescribed were too rigid to pass beers as arsenic free, and they subsequently altered that test and made it into one which would pass a mere trace, but which at the same time would reveal the presence of any injurious quantity of arsenic. In the case of the Halifax malt to which allusion had been made in which the Reinsch test was applied, it would be found that the first prescribed method was adopted and not the second. They had discovered that these traces of arsenic came from malt and that their presence should be prevented. No doubt the bulk of the arsenical contamination of malt came, in the Yorkshire and Lancashire district certainly, from the use of gas coke, and as Dr. Thorpe had pointed out, since gas coke was wholly discontinued the malt became of exceptional purity. The cause of the contamination of some of the malt of to-day he thought was not far too seek. Maltsters had been loyally working to produce a malt free from arsenic, and the brewers on their side had spared no pains in insisting that they should have such deliveries. That had meant that maltsters had been advised to give up using coke, and in fact every fuel but anthracite. Thus there was an increased demand for anthracite used for malting purposes. His experience was that anthracite fuel as now employed showed a distinct increase in the traces of arsenic it contained. That was probably due to a larger consumption, and to the difficulty of sorting the quality, in the manner Dr. Thorpe had pointed out as being a necessity. He did not say that the exercise of greater care on the part of the suppliers of anthracite would not prevent this, but there was no doubt a tendency for maltsters to be lulled into security when they were using anthracite, and to think that they were more free from any possibility of trouble. Such was not the case, for he had come across numerous samples of anthracite containing very appreciable amounts of arsenic by way of traces. He had come across some which showed as much as 1/20th grn. to the 1 lb., and sometimes some kinds of anthracite in which a considerable proportion of it was in the volatile and not in the fixed condition. Again he had met with specimens from deliveries in which one could see cretaceous lines running through it, and if one split them and pulled off the scales, they were found to be highly arsenical. It was extremely necessary, therefore, that the utmost care should be taken in the selection of anthracite, and that the maltsters should devise some form of test, or some form of treatment which would prevent the possibility of these traces of arsenic from anthracite getting into the malt.

Mr. A. R. Ling said he also must congratulate Mr. Baker on the very clear and lucid way in which he had presented this very important report. It was very satisfactory to him to find that the Commission through Dr. McGowan's work substantially corroborated what he found in the case of malting fuel. He believed his own analyses were low, as he had not removed the iron as Dr. McGowan had done in the solution in which the arsenic estimation was performed. They had to thank Dr. McGowan for the very exhaustive data which he furnished to the Commission, which from the chemical point of view constituted, perhaps, one of the best features in the report. He thought that Mr. Baker's suggestion that sulphur exercised a reducing effect on arsenic and caused it to be volatile was no doubt correct, and he could corroborate the fact that hops were far more frequently found contaminated with arsenic than had been generally supposed. He himself had quite recently found commonly such amounts as 1/100th grain per 1 lb., and that day he had examined a sample of hop which contained 1/40th grain. Of course, he knew hops were very much more frequently sulphured on the kiln than malt, and probably that was the reason of their contamination.

Mr. Grant Hooper said that after the remarks already made he need say nothing with reference to the analytical results which had been brought out by the Commission. But there was one point which had not been touched upon so far in the discussion, and that had reference to the condition of the malt actually in use at the present moment. He must say he was much struck by the fact that in the evidence given before the Commission the malting witnesses, who came specially to deal with the question of the preparation of the malt, were one and all agreed upon the fact that satisfactory malt could not be prepared without the direct action of the kiln fumes upon the grain. Again and again the Commission were told that whilst it was quite possible to dry malt, it was impossible to cure malt without the direct application of these fumes from the fire. Believing there were many practical men present he ventured to put it to them, whether that opinion was an altogether sound one, whether there was not something of a tradition which might be usefully questioned when they were face to face with the fact which Dr. Thorpe had mentioned, that malt was still found containing arsenic in quantities which occasionally approached a dangerous limit. Sugars had been brought to a degree of purity which rendered them entirely satisfactory from this point of view. Was it not a question for the practical men in the industry to consider whether the production of malt could not be made equally safe. Some years ago an endeavour was made to interest the brewing trade in the preparation for brewing purposes of unmalted grain which should have something of that empyreumatic flavour characteristic of malt, and a patent was taken out for a plant more especially designed for the treatment of barley. This torrified barley was produced by passing the grain through something which approached the character of a coffee-roasting machine, with this difference, that the cylinder instead of being open from end to end was so divided that the grain passing in at one end travelled continuously through and round the cylinder, and when it reached the other end it had been exposed to a high temperature sufficiently long to completely dry the grain and give it a certain toasted character, whilst at the same time the grain was so distended that it exhibited something of the light porous character of malt. He did not know whether this patent was still in existence, but he would ask whether, in connection with that invention or some similar application of the idea, there was not a possibility of producing a satisfactory malt which yet should not have been directly exposed to the fumes of a kiln fire.

Mr. R. J. Friswell said the few words he had to say were practically historical. There was an "arsenic scare" in the year 1869, at which time he was a student at the Royal College of Chemistry. The Royal Commission on the Pollution of Rivers had discovered arsenic in sewage, and Dr. Frankland set Mr. Adrian Brown and himself to work to discover the source of this arsenic. This resulted in the preparation of a number of standard mirrors, and a few days ago he discovered an old note-book containing 46 determinations of arsenic made by himself, and also a number of researches on the sensitiveness of the tests. From this note-book he was able to recover the standard mirrors which they then used, and he found that the lowest standard was $\frac{1}{100}$th mgm., and they went up 2, 4, 6, 8, 10, 15, 20, and 30 hundredths. They had to draw out the tubes in which these mirrors were made from large pieces of combustion tubing. They were sealed up in hydrogen, because they found that they were volatile and disappeared. The result of the matter was to discover arsenic in a great number of substances—in nearly all soda ashes, caustic soda, in some soaps, and generally they traced the arsenic back through sulphuric acid to the pyrites used in producing it. Then another series of experiments was conducted with London soot and London air. He had no record of those, but he believed a certain amount of arsenic was detected in 25 cubic feet of air drawn from the space over the lecture theatre of the old College of Chemistry in Oxford Street. He had one record of the soot taken off the roof, but the note-book stated there was no arsenic in that. The result of the whole series of investigations was to show that the arsenic found in sewage products was traceable back to pyrites, partly through alkalis, soap, and products in which sulphuric acid was used at some stage of the manufacture, and partly through the coal brasses, as he believed that soot was found to be arsenical, though he did not examine any, and the only sample of roof-sweepings examined contained none. He might call Dr. Thorpe's attention to the fact that a large quantity of sweetstuff was made of maize which was burst by roasting over small coke fires. It was afterwards coated with sugar, and he would suggest that it should be examined for arsenic.

Mr. Thorne said he could endorse what Mr. Salamon said with regard to anthracite. He had had occasion recently to test different samples of malt made in the same kilns under similar conditions, except the coal used, and he found that although only different kinds of anthracite coal had been used, the malts varied very considerably in the arsenic contained in them. It never reached a serious amount, the maximum being 1/400th grn., but varied from about 1/1,000th up to about 1/400th grn. per lb. He would ask Dr. Thorpe whether he would correct one expression he had used, which he thought was taken in a little different meaning to what he intended. When he spoke of confining the standard to 1/100th grn. of arsenic per 1 lb. in malt, the speaker had noticed that that was a point which had been misunderstood in the report of the Commission, and had been misunderstood or overlooked in Professor Thorpe's evidence. A great many people had supposed that it authorised the assumption of safety if the arsenic in malt did not exceed 1/100th grn. per 1 lb. Of course, as Dr. Thorpe pointed out in his own evidence, if they had a malt containing that quantity, the beer produced from that malt might contain anything from, say, 1/80th grn. up even to 1/50th, or in strong beers to 1/30th, and would then be condemned by the Royal Commission limit. He quite agreed with what Dr. Thorpe said as to the relative positions of the electrolytic and Marsh-Berzelius methods. All who had used the Marsh-Berzelius method knew of the difficulties as to purity of materials, and those who had facilities for adopting the electrolytic method would certainly overcome those difficulties. But his experience in a very large number of determinations was, that if care were taken, the Marsh-Berzelius method was still a very reliable one, and by a slight modification of the method of purification of zinc by sodium, which Mr. Hehner first told them of, one was able to get a zinc which was very reliable indeed. If the purification were carried out at a low temperature and with precaution, to prevent too rapid oxidation, one could obtain a zinc which was sensitive, fairly easily attacked by acid, not giving a rush of gas but a regular and fair current, and yet free from arsenic.

Mr. Bryan Corcoran, with the reference to the question of arsenic in malt, said there were different sorts of malt kilns, and it is only necessary to know the kiln which actually made the malt to enable one to judge the quality of the malt itself. Some malt kilns do not properly dry with any amount of heat, while others dry at a very low temperature, and these points were very necessary to be known, as they regulate the deposition of the volatile substances.

With regard to the fumes of combustion not coming in contact with the goods, this could be done, but it was not so easy or so economical, and malt generally was not so satisfactory as when the fumes passed through it. He could show Mr. Hooper a torrefying machine in which all the starch cells were ruptured, so that barley weighing 50 lb. per bushel would come out weighing only 25 lb.; in other words, one bushel of barley is equivalent to two bushels of torrefied material.

Mr. **Berry** said that many imported German materials used in brewing were sometimes found to contain arsenic.

Dr. **Thorpe** said if he accurately appreciated the observation of Dr. Thorne it was that a limit of 1/100th grain per ton of malt amounted to much more than 1/100th grain per gallon of beer. That might or might not be the case. That assumption was based on the supposition that all the arsenic present in the malt got in the wort, and eventually into the beer, but all experience went to show that that did not necessarily follow. Practical experience had shown that a limit of 1/100th grain per 1 lb. of malt did tend to the production of beer with less than 1/100th grain per gallon. It was a fact that the greater portion of the arsenicated material from the malt was frequently in such a condition that it never went into solution at all. It was not all there as sublimated arsenious oxide, but a considerable fraction was there simply mechanically put on the malt by the fine particles of insoluble arseniates which were deposited on the grain.

Dr. **Buchanan** writes: "I hope the administrative side of the report will not be lost sight of by chemists, though perhaps questions that more particularly affect public analysts will hardly come under discussion much at your meeting. I feel that one of the chief lessons of the inquiry is that both manufacturers and chemists, and the chemists of public authorities, should be in much better and closer relations with processes of food manufacture than they are at present. They seem to me to be much too much treated as mere analysts, and to be called in at too late a stage. But I suppose this is an old complaint."

A letter was received from Mr. A. C. **Chapman** in which he says that so far as brewers and maltsters are concerned the limits suggested in the Report are fair, and will not press at all heavily on any man who exercises reasonable care and supervision over his materials and manufacturing operations. Owing to its extraordinary ramifications it is quite possible that cases may arise (although they must necessarily be few) which have not been brought before the notice of the Commissioners, and which are consequently not specifically dealt with in their Report. The recommendations contained in the final Report might therefore very seriously affect one or two manufacturers of materials of which the Commission could have had no cognizance. These cases, however, would doubtless receive due consideration from the Authorities as they arose. Not the least important recommendations made in the Report are those dealing with the existing Sale of Food and Drugs Acts, and all who are concerned in the administration of these Acts can only hope that before long full effect will be given to those recommendations.

Mr. G. F. **English** wrote: "In his remarks to the meeting, Mr. Gordon Salamon said 'he could have wished, with regard to the sulphuric acid, that the Royal Commission had seen its way to insist that all sulphuric acid manufactured from pyrites should be de-arsenicated.' This is a very serious suggestion to come from such an authority as Mr. Salamon.

"The amount of sulphuric acid used in the manufacture of foodstuffs is only a very small percentage of that produced for other important industries. Large quantities of acid made from well-known ores such as the Rio Tinto, Tharsis and others, containing about 0·1 per cent. of arsenic are used in the soda, &c., cotton-bleaching and dyeing, manure, explosive, celluloid and other industries without detriment. As to the cost of de-arsenication, which Mr. Salamon considers so small as to be almost negligeable, I may say, from practical experience, that it adds materially to the cost of producing sulphuric acid.

"To insist that all sulphuric acid made from pyrites should be subjected to the process of de-arsenication to ensure that the manufacture of foodstuffs should be guarded against the introduction of arsenic into their products would indeed be a serious, and at the same time, an unnecessary piece of legislation.

"It would add considerably to the cost of production of many articles manufactured in the industries cited and add further restrictions to many trades which are now struggling in the face of severe competition from abroad.

"Mr. Salamon's suggestion is no doubt made with the best intention, namely, that the public be safeguarded against any recurrence of the arsenical poisoning which has been traced to the use of highly arsenical sulphuric acid in the manufacture of glucose, &c., but I do not think that he has taken into consideration how unfair it would be to other manufacturers, to insist upon such measures, which he evidently deplores have not been taken, for the benefit of one class of manufacturers.

"The public can be ensured against arsenical poisoning, without resorting to such extreme measures, by compelling the manufacturer of foodstuffs to examine carefully every article which he uses in the manufacture of his products, and to insist upon the examination of such products before leaving his works."

The **Chairman** said they had had a most interesting discussion. No doubt a great number of articles of food were liable to contamination from arsenic, and it was fortunate that the death rate kept falling, instead of rising under these conditions. He was glad to find that articles of food were so carefully watched, but there was one question he should like to ask, and that was with regard to the very large quantities of glucose which came into this country for the manufacture of beer and other articles of food. He was in the law courts some time ago and heard two witnesses, large confectioners, swear that they did not test the glucose as they used it in the manufacture of the articles they made. It that was the general state of affairs, and they got materials like that from abroad, there seemed to be a great opening for analytical chemists.

Mr. A. G. **Salamon** said he had made many tests of this foreign glucose, and though he would rather see it made in England, he was bound to say that, as a rule, it was extremely free from arsenic.

The **Chairman** said he did not mean to say that imported articles were impure, but he did not think Mr. Salamon had quite given the information he wished for, which perhaps, someone else could supply, namely, whether there was any control of such materials that came to this country. They knew English manufacturers were conscientious, they believed the Germans were also, and they thought the American manufacturers were highly conscientious, but at the same time he should like to have some little analytical control over the large quantities of glucose that came to this country.

An important point had been raised as to the fuel; it seemed they were in rather a bad way with regard to that. It was naturally a disadvantage if they could not use coke, and if anthracite were unreliable, where was pure British beer to come from. He believed there were methods of purifying fuel, and possibly some fuels, such as peat, might be utilised, but clearly some kind of fuel by which they could cure or dry malt without the danger of contamination was evidently a great want. They were importing such large numbers of cheap articles that it would be almost worth while importing fuel if they could find one free from arsenic.

Mr. **Baker**, in reply, said there was one point which he should like to refer to, as it was probably the most important raised during the discussion and that was the statement of Dr. Thorpe about malt containing 1/100th gr. of arsenic per lb. The wording of the report was, "We think that no substances should be used as an ingredient of food that contains a larger proportion of arsenic than 1/100th gr. per lb." And then later on it said, "in many cases, particularly glucose and malt, more stringent limits are now attainable commercially, and should be insisted on."

Then turning to the question of malt, the Commissioners reported: "All our evidence goes to show that it is now commercially practicable to produce malt which either may be considered free from arsenic or in which the amount is certainly less than 1/250th of a gr., most malts prepared during the past two years being of this nature." He thought it was clearly in the minds of the Commissioners that malt should not be allowed to contain

1/100th gr. of arsenic per lb., but from what Dr. Thorpe had just now said he gathered that 1/100th was his limit, and if a malt contained 1/100th the Inland Revenue would presumably allow it to be used. Now, if malt were allowed to contain that quantity, which was really much larger than was necessary nowadays, he thought that in the course of a short time it would contaminate the beer to an extent exceeding 1/100th grain of arsenic per gallon. Assuming the grist, as it passed the mill, contained 1/100th gr. of arsenic per lb., presumably in the first batch of beer prepared it would not contain 1/100th gr. per gallon, because the yeast would absorb a large quantity of it. But in the succeeding gyle, where a similar malt was used containing 1/100th gr., if it were pitched with the arsenical yeast, then the beer would contain 1/100th gr. or more, for the reason that the pitching yeast was already saturated. That was rather the point he thought the Commissioners had in view when they put in that paragraph in the case of malt and glucose more stringent limits should be insisted upon."

Dr. Thorpe said he might add another word or two in order to remove any misconception. In the first place with regard to imported glucose. He did not pretend that imported glucose had the same stringent surveillance that the home made article had, but nevertheless all imports were sampled, and they came either directly or indirectly under the purview of the Government Laboratory either at the Customs or eventually at the Excise branch of the Revenue Laboratories, and so a very considerable amount of surveillance was exercised even on imported glucose.

With respect to the other point to which Mr. Baker had referred, it was their practice in the laboratory whenever they got malt trespassing closely on the limit to require the officers to send samples of the wort produced from such malt. They had pointed out what was the limit suggested; they had no legal power in these matters, but they pointed out to brewers that the malt was perilously near the limit suggested. But as they had no knowledge of the real proportion which would go in practice into solution by continuous use they required their officers to take samples of the wort produced from any sample of malt on the confines of insecurity as defined by the Royal Commission.

THE POSSIBILITY OF MALT BECOMING CONTAMINATED WITH ARSENIC WHEN SULPHUR IS EMPLOYED DURING KILNING.

BY JULIAN L. BAKER AND W. D. DICK.

For some years past many brewers have demanded that the malts used in the preparation of certain beers, such as pale ales, should be very bright and light in colour.

By throwing sulphur into the kiln fire at certain stages of curing, the maltsters have obtained this effect, and the practice is more or less common in this country. Apart from giving the malt an appearance not commensurate with its value, sulphuring is apt to be dangerous to the maltster, for, if improperly carried out, the malt instead of being bleached is darkened, owing to the production of small quantities of sulphuric acid which caramelise portions of the corns.

Since the epidemic of arsenical poisoning chemists have warned maltsters that by using the cheaper kind of sulphur the malts might become contaminated with arsenic. Since 1901 maltsters have been careful to use Sicilian sulphur, which is practically free of arsenic.

For some time past we have noticed that sulphured malts contain relatively large traces of arsenic, whereas previous and subsequent curings in the same kiln of the same type of malt, and with the same fuel, but unsulphured, contained no arsenic.

The possibility occurred to us that the sulphur when thrown on the fire would exert a temporary reducing action whereby the arsenates in the burning anthracite might become reduced to arsenites and so rendered volatile.

To determine this point a number of experiments were carried out in which arsenical anthracites and cokes were burnt alone and in presence of sulphur. The method of experiment was as follows: 5 grms. of the arsenical fuel was burnt in a porcelain capsule, and when the combustion was complete the ash was treated with dilute arsenic-free hydrochloric acid made up to a given volume, and an aliquot portion submitted to the Marsh-Berzelius test. An equal weight of the same fuel was burnt under similar conditions with this difference, that 0·5 grm. of sulphur free from arsenic was added in small portions before the fuel was completely burnt. The arsenic was then determined in the ash. The following results were obtained:—

——	Without Sulphur.	With Sulphur.	Arsenic volatilised by addition of Sulphur.
	Parts per Million.	Parts per Million.	Parts per Million.
1. Coke	47·6	28·5	19·1
2. Anthracite	35·7	10·3	25·4
3. Anthracite	71·4	35·7	35·7

Other experiments were carried out with malting anthracites to which known quantities of sodium arsenate had been added. The difference in the amounts of arsenic remaining in the ash of the fuel when burnt alone and in presence of sulphur was very marked, and confirms the results obtained by burning naturally contaminated fuels in presence of sulphur.

The experimental results clearly indicate that sulphur effects the partial volatilisation of fixed arsenic in anthracite and cokes, and the assumption that the sulphur acts as a reducing agent when thrown on to the fire appears to us to be reasonable. If maltsters desire to sulphur malt great care should be exercised in selecting an anthracite which contains a minimum amount of arsenic.

An ordinary malting anthracite containing an amount of fixed arsenic which would be unnoticeable in the malt cured by it may show an appreciable quantity of arsenic, if, during some stage of the combustion, sulphur is added.

The practice of bleaching hops in the oast houses by burning sulphur before and during the drying may possibly account for the heavy traces of arsenic (frequently 1/5th to 1/100th grn. of arsenious acid per lb.) which are sometimes found in hops. Probably hop growers are not so alive to the importance of the proper selection of fuel as are maltsters.

New York Section.

Meeting held at Chemists' Club, on Jan. 22nd, 1904.

DR. VIRGIL COBLENTZ IN THE CHAIR.

THE MAKING AND SETTLING OF BLEACHING POWDER SOLUTIONS.

BY MARTIN L. GRIFFIN.

Messrs. Carey and Muspratt have treated this subject in the June 15 number of this Journal (1903, 674—676). I desire here to make some additional observations and to supplement their work from the consumer's point of view.

The Duncan Company, manufacturers of pulp and paper, with which I have been connected for nearly 20 years, has been using from 100 to 250 tons of bleaching powder per month during this time, and we have at intervals modified our plant and process of making up solutions until we feel satisfied that we are getting out of it all there is in it. During this time the makers of bleaching powder have greatly improved the quality of their product, and I think they should continue to do so. The sludge resulting from solutions of bleaching powder is a very objectionable waste, and will have to be dealt with very differently in the future from what has been done in the past. The manufacturers of bleach can contribute very much to the solution of this problem if they will give us a powder containing 38 to 39 per cent. of chlorine, which is a very easy thing to do. When we receive bleach of this strength, our sludge will be of very little consequence, and there will be much less difficulty in settling out what there is.

There is frequently a difference in the deportment of bleaching powder made in different countries as regards settling, but at the present time there is little variation in the product of the same manufacturer of high grade goods.

Without doubt the quality of the water supply has an important influence, but the problem is simply one of relative specific gravity of the insoluble matter and the solution. I have observed that natural waters containing even a small amount of available carbon dioxide will settle much more readily than those without. The reason for this is apparent.

The temperature of the water does exert a decided influence on the rate of settling, because the warmer the water is the less dense, and consequently the less buoyant it is. While heating may be employed to hasten the settling I do not think it advisable to resort to it largely, and in large works the cost for steam would amount to a considerable item in cold weather. The only steam we use is that to work a siphon moving the final washings of the sludge, to be described later. We have no trouble if we keep our water up to a temperature of 55° to 60° F.

With regard to the effects of prolonged agitation on the rate of settling, I agree with Carey and Muspratt that simple wetting out and mixing, which may be accomplished in ten to fifteen minutes with a good apparatus, is all that is necessary, and further agitation would be objectionable.

One of the most important problems to decide in making bleaching solutions and not definitely discussed by Carey and Muspratt, is what the strength should be. I have found after many trials that a solution between 4·5° and 5° B. (about 6° to 7° Tw.) is by far the most convenient to make up, and from this, together with the liquor from the first washing of the sludge, a finished solution of 3° (4·2° Tw.) gives the best results in practice. It is a good strength for all kinds of work, and much greater uniformity and accuracy can be had by it than by employing stronger solutions. Whether the amount of bleach consumed be large or small I would recommend this strength. This would require a capacity in making of about 1 cb. ft. for each 3·75 lb. of high test powder.

Let me now describe a plant for small requirements, then for larger. Two round or square concrete tanks of the same size, somewhat deeper than their width, are each provided with agitators and adjustable siphons for drawing off the clear liquor into one common pipe leading to a storage tank at least equal in capacity to the two mixers, larger would be preferable. These mixers should be set level with the floor for convenience in furnishing the powder, and dumping it at once into the mixer without screening, which is good but not practicable. The storage tank should be situated on a lower level so that the liquor would flow into it by gravity. Square mixers are preferable because much better agitation can be had in them than in round tanks. The operation of this system is as follows: One mixer of freshly-made solution of about 4·5° B. is made up to settle, the other we will say has the sludge from a former make of same strength; this is filled up with fresh water only, or a weak liquor as will be described later, and agitated just enough to stir it up uniformally. The strength of this will be about 1½°, depending, of course, much on the volume of the strong sludge. The two mixers when settled sufficiently are drawn off in about equal volumes in equal times, giving a finished liquor of 3° B. With proper care in drawing down, regulating the flow of second liquor, an exact and uniform strength may be had for work at all times. This is very desirable for good work. The sludge from the second liquor is again covered with fresh water, filling the mixer, and stirred up as before, making what we may call a third liquor. This is settled and drawn off by a small pump and discharged into the other mixer containing strong sludge in order to wash it. It is then agitated just enough to mix for the second liquor. The sludge from the third liquor is now washed out, and is practically free from bleach. This mixer is then ready for a fresh charge of powder, and when settled is to be drawn down with the second liquor in the manner described; this is the best practice possible with two-mixer tanks. It will be seen that much time is lost in making up the third liquor, and that this is used in washing up the strong sludge, for which it would be better to use fresh water, and the third liquor for making up the next strong liquor. In order to do this conveniently four mixers would be required.

At one time we used three mixers, making our strong solution test 6° B. or a little more, the second 2°, and the third 1° or less. These three were drawn down together in about equal volumes making the finished liquor 3° B. They were operated in cyclic order, using fresh water for each making. With water uniformly 70° to 75° F. this is a very satisfactory way, and there is no loss of time and no pumping of liquors necessary.

We are now using about 10 tons of bleaching powder daily, and our plant consists of four large concrete settling tanks of a capacity of about 1,100 cubic feet each, provided with adjustable syphons leading into a common conduit. These siphons have their outlet point very near the bottom of the tank, and consist of pieces of three-inch cast-iron pipe fixed in a movable joint or elbow at the outlet from the tank and reaching to the top. These are let down into the liquor and held in place by a chain. By this arrangement, the fixing of any particular point for the "run off" and sludge is of little consequence, only to have it low enough to get off all the clear liquor. Another advantage is that clear liquor can be drawn off as fast as it settles, if desired.

The balance of the plant includes a mixer of about a quarter of the capacity of a settler, without any agitator, but provided with a 4-in. centrifugal pump and suitable piping for circulating the contents from bottom to top, discharging in such a way as to give the mass a rotary motion in the mixer. The pump is also so piped that the contents of any settler may be moved into any other, receiving it into the mixer or not. There are also two large settling tanks for the final washings, and the storage system for finished liquor. The pump mentioned is the only power used.

The plant is worked on the two-liquor plan above described. A full settling tank of strong solution is made by the discharge of the prepared contents of three or four mixers of same strength, requiring about one hour. The tank is then ready to settle, and with water as cold as 55° F. will settle in five to six hours, leaving about 3 cubic feet of sludge for each 100 lb. of powder. It must be borne in mind that at the end of this settling period all the solution may have been siphoned off.

It is customary to draw off all that can be drawn in the time available. The strong sludge is washed successively with two waters, making what is called second and third liquors. The second liquor is made by running off the settled strong sludge into the mixer by gravity, and it is to remain there without agitation until the tank has been about three quarters filled with third liquor, when the valve on the mixer is opened and the pump throws it on top of the settler containing the weak liquor. In this way the strength of the sludge becomes diffused through the water and washed, being denser and heavier. The result is a weak liquor of uniform strength with no agitation except what it gets in passing through the pump and connecting piping.

The third liquor is made by repeating the above operation on the sludge of the second liquor, using water only. When this has settled and the liquor has been pumped off for the making of a second liquor, the sludge is washed out into one of the two final settling basins or tanks. These tanks will hold the sludge from several settlers and ample time is given for a thorough settling. This very weak liquor is thrown up into the mixer by a bronze steam siphon or injector and used for the making, in part, of the strong bleach, and is a very satisfactory arrangement. The sludge is then finally discharged. By the above practice almost nothing is lost, and we could not afford to lose even as much as 2 per cent. of the powder, as this loss would amount to some 1,500 dols. yearly.

With the exception of the second liquor, which is a little handicapped for time in settling, the sludge in each settling tank will usually be less than 3 cb. ft. for each 100 lb. of powder of a strength of 35 to 36 per cent. chlorine, and, as noted above, with 38 to 39 per cent. chlorine it would be inconsiderable with high-grade lime, which abounds in many parts of this country. We would be glad to pay the relatively higher price for such high test goods.

From this review, the important points to note are, care in determining the most available making strength and with this a fixed temperature.

If the temperature varies, the equivalent strength must be determined. Of course it is understood that the hydrometer test is not an accurate guide as to the amount of available chlorine, but simply indicates the gravity of the liquid, but it is usually a safe guide for mill practice when the supply of bleaching powder is uniformly regular. If, however, a mill were in the habit of receiving fresh shipments and then for some reason a shipment which had been lying in store or out of doors for some weeks or even months, the hydrometer test ought to be supplemented by a determination of the actual chlorine in solution, and the strength or rate of consumption gauged accordingly. I have found that a difference of 5° F. will make a difference of about 0·1° B. in a 3° solution between 60° and 100°. So that the temperature plays a very important part during the changing seasons of the year when the temperature of the water varies. Uniformity in strength is very desirable in doing uniformly good work whether the bleaching operations are carried on by successively charging kiers or engines in a continuous process, as is now commonly done in bleaching chemical wood pulp. By this latter process the strength and rate of flow have to be very carefully gauged. Lastly, the plant should be of ample capacity for easy work, in which the powder can be properly treated, and the sludge well washed.

ARTIFICIAL SILK.

BY J. MERRITT MATTHEWS.

In this age of industrial and chemical syntheses, it would be natural to expect that such a valuable and useful substance as the fibre spun by the silk worm would be subject to many attempts of artificial imitation, if not of actual synthetic preparation. In fact, the entomologist Reaumur, as early as the year 1734, in a memoir on the history of insects, seemed to look forward to the possible preparation of silk by artificial means. It was not until 1885, however, that the first commercial process for the preparation of artificial silk was taken out in patent form by the Count Hilaire de Chardonnet.

At this point I wish to define clearly the substance which is commonly understood by the general name of artificial silk. We have grown so accustomed at the present time to the preparation of naturally occurring substances by means of purely chemical methods, that when we use the term artificial silk, many may reasonably suppose that the substance so designated is the same in composition and nature as the fibre derived from the silk worm, but made by chemical or other artificial means. Unfortunately this is not the case, however, and the term "artificial silk" proves to be a rather misleading one in this sense. What the name really does stand for is a fibre, resembling in its lustre and general appearance the true silk of nature; but the identity goes no further than this, for, in its chemical composition and other properties, the artificial silk of trade is entirely distinct from that produced by the silk worm. It would be better to call the artificial product "imitation silk," or give it some other name more distinctive of its origin and true nature, such as the term "lustra-cellulose," proposed by Cross and Bevan. This latter term is especially adapted to the product in question, for the different varieties of artificial silk which have acquired any degree of technical importance are all made from cellulose derivatives, and their chief quality is their high degree of lustre.

The idea of preparing lustrous filaments of cellulose to be used as substitutes for silk seems to have grown out of the manufacture of carbon filaments for use in incandescent electric lamps. Chardonnet discovered that a solution of pyroxylin (known as collodion) could be drawn out very satisfactorily into delicate threads, and then coagulated or hardened to a comparatively strong and coherent fibre possessed of a very high lustre. The original patent of Chardonnet was taken out in 1885, but some years elapsed before this new material could be prepared in a manner sufficiently successful to allow of it appearing in commerce. Although in its conception, the idea of preparing these lustrous threads of pyroxylin appears to be of a simple character, yet the conditions of the treatment and preparation are in reality quite complex and difficult.

The pyroxylin employed for the production of Chardonnet's silk may be prepared for either wood-pulp, cotton, ramie, or other source of purified cellulose. As there are several nitrated compounds of cellulose soluble in the alcohol-ether mixture (which is employed as the pyroxylin solvent), and as it is difficult to obtain satisfactory separations of the individual compounds, it is probable that the pyroxylin contains penta-, tetra-, tri-, and di-nitro-cellulose, the tetra- and tri-nitro-compounds probably occurring in larger amounts. The preparation of a pyroxylin suitable for use in the making of Chardonnet silk, as prescribed by Wyss-Naef, calls for a nitrating mixture of 15 parts of fuming nitric acid (of 1·52 sp. gr.), with 85 parts of sulphuric acid. For 4 kilos. of cellulose, about 35 litres of this acid mixture are required, and the time of action is from four to six hours. Samples are examined from time to time with the micro-polariscope in order to ascertain the degree of nitration, and when all the fibres appear of a uniform bright blue under the polariscope the action of the acid mixture is discontinued. The excess of acid is removed from the fibre by means of a hydraulic press, after which the nitro-cellulose is washed for several hours with water, and then pressed again, until the mass contains only about 30 per cent. of water. At first, the pyroxylin so prepared was dried before being dissolved in the alcohol-ether solvent, but it was subsequently discovered that a better solution could be obtained by using the pyroxylin containing the amount of water above noted. This form of pyroxylin has been called by Chardonnet "pyroxylin hydrate," but it is doubtful if the substance is a true hydrate. However, it appears to be about 25 per cent. more soluble than the dry pyroxylin. The solvent employed for the pyroxylin consists of a mixture of 40 parts of 95 per cent. alcohol with 60 parts of ether, and 100 parts of this liquid will dissolve about 28 to 30 parts of pyroxylin. The collodion so produced is filtered several times under pressure, in order to free it from all non-nitrated and undissolved fibres, and to obtain a perfectly clear and homogeneous solution. This condition is a very essential one for the successful production of the silk, as any irregularity in the solution would cause a break in the continuity of the spun filament, or a stoppage of the machine. The pyroxylin requires from 15 to 20 hours for complete solution, and that prepared from cotton requires a longer time to dissolve than that from wood-pulp. In order to properly filter the solution a pressure of 30 to 60 atmospheres is necessary.

The next operation in the manufacture of the silk is purely a mechanical one, and yet one which has required the use of considerable ingenuity and skill. The object is to force the collodion solution through very fine capillary glass tubes, so that it may be drawn thence as a fine continuous filament. The collodion solution is quite viscous, and requires a pressure of from 40 to 50 atmospheres to force it through capillaries of 0·08 mm. in diameter. The flow of solution and pressure must be so adjusted and capable of regulation as to provide a uniform filament, and this involved many mechanical difficulties, which were only overcome after long experimenting and numerous failures. I will not, however, enter into a consideration of the various mechanical devices, ingenious though they are, which have been perfected for the proper spinning and handling of this artificial fibre.

The thread as it emerges from the capillary tube is rapidly coagulated in the air by the evaporation of the solvent. By suitable arrangement of a hood over the machine and condensing chambers in connection therewith, a large portion of the mixed volatile vapours of the alcohol and ether employed as the solvent are condensed and collected, thus effecting a considerable saving in the amount of solvent required, and also minimising the danger of explosions occurring. Several of the individual filaments are brought together into a single thread and wound on to spools in the manner of ordinary silk. In this operation a certain amount of adhesion takes place between the separate filaments, which considerably enhances the ultimate strength of the finished thread. The thread in this form now consists of pyroxylin or nitrated cellulose, and is highly inflamable and otherwise unsuitable for use in textile fibres. The next operation through which it passes is one for the purpose of denitrating the cellulose, in order that the fibre may ultimately consist of what might be termed "regenerated" cellulose, the exact chemical nature of which it is not possible to definitely state, though it is evidently some form of cellulose. The denitration is accomplished by passing the pyroxylin threads through a bath of ammonium sulphide, though other alkali sulphides, and some other compounds also, will effect the result. The silk in this condition has a rather yellow colour, which, however, may be bleached out in the usual manner with a solution of chloride of lime. The fibre, as finally obtained, possesses a very high lustre, though it is somewhat metallic in appearance; it has considerable tensile strength, though in this respect, as also in elasticity, it is considerably below true silk. The fibre is also rather harsh and brittle, and does not possess the softness and resiliency of natural silk.

The Chardonnet process that I have outlined is the principal commercial method for the production of artificial silk at the present time, and very considerable quantities are being manufactured, principally at the town of Besançon, in France. There are other methods, however, for the production of this fibre, or at least of analogous fibres, which I will briefly review.

Vivier's silk was also produced from pyroxylin, the product used being said to consist of trinitro-cellulose; this was dissolved in glacial acetic acid, and mixed with solutions of guttapercha and fish-glue. This mass was forced through capillary tubes in the usual manner, and then coagulated by a passage through a variety of solutions such as caustic soda, sodium bisulphite, albumen, mercuric chloride, and aluminium sulphate. The process proved to be complicated and costly, and, though some of the silk so prepared appeared in the market under the name of "soie de France," I believe that the process has now been abandoned.

Lehner's silk is produced by much the same means as that of Chardonnet, and the fibre is very similar to that of the latter. Lehner at first attempted to obtain a fibre from a mixture of pyroxylin solution with various vegetable gums and oils, with solutions of cotton in copper-ammonium sulphate, and even with solutions of waste silk itself. None of these, however, proved a success, and he reverted to the more simple solution of pyroxylin in combination with a drying oil. He also discovered that the fluidity of the collodion could be materially enhanced by the addition of sulphuric acid, and consequently he was able to work his solution under much less pressure than Chardonnet.

Other processes have been suggested for the manufacture of artificial silk which do not employ solutions of pyroxylin. Pauly has suggested the use of a solution of cellulose (wood-pulp or cotton) in copper-ammonium sulphate, while others have considered the solutions of cellulose in concentrated solutions of zinc chloride. None of these methods have attained to any commercial importance. We next come to the use of "viscose" solutions for the spinning of artificial silk. The nature of viscose is probably well known to most chemists at the present time; it is obtained by dissolving wood-pulp (or other form of cellulose) in caustic soda and carbon disulphide, whereby a very viscous solution of presumably cellulose thiocarbonate is obtained. This is forced through capillary tubes, and coagulated in a bath of ammonium chloride or other suitable salt, which causes the precipitation or regeneration of the cellulose. This process, originating with Stearn of England, has received considerable development, and the fibre has been manufactured to some extent in England and the continent, and its manufacture has even received some encouragement in this country by the establishment of a small factory at Lansdown, near Philadelphia. Its commercial development, however, may be said to be still in the experimental stage. This factory is now turning out about 300 pounds of artificial silk per day.

During the year ending 30th June 1902, there was imported into the United States about 170,000 dols. worth of artificial silk fibre. This does not include the large amount of manufactured articles composed either partially or totally of this fibre. The uses to which artificial silk may be put in the textile industry are varied. It is being used extensively for the manufacture of fancy braids and trimmings, and a wide variety of miscellaneous and small articles which come under the general name of "passementerie." It is also used with true silk or cotton in the weaving of material for cravats, scarves, and for various effects in ladies' dress silks. It cannot be used as warp threads on account of its lack of strength and elasticity, but for filling threads it may be used without special precaution. Owing to its high lustre, which is rather metallic in appearance, it is especially suitable for certain effects in ornamental upholstery material, for hangings and draperies. It has not adapted itself, however, to the manufacture of pile fabrics, as it is too brittle and harsh. Artificial silk readily lends itself to dyeing, and no difficulty is encountered in dyeing it in all manner of colours. The chief drawback to artificial silk is the fact that it weakens to a considerable extent on becoming wet with water.

Nottingham Section.

Meeting held at Derby, on Wednesday, January 27th, 1904.

MR. J. T. WOOD IN THE CHAIR.

THE ELECTROLYTIC ESTIMATION OF ARSENIC.

BY S. R. TROTMAN.

The publication of the report of the Commission on Arsenic in Brewing Materials has attracted considerable attention partly because certain methods of testing are recommended by the specially appointed Excise Departmental Committee. The most important of these is that known as the electrolytic method of testing, which has also been described by Prof. Thorpe in considerable detail before the Chemical Society. The method is an adaption of the use of a double cell which appears to have been originally suggested by Bloxam, though, as Prof. Thorpe says, the method "had several disadvantages which prevented it from being generally adopted by chemists."

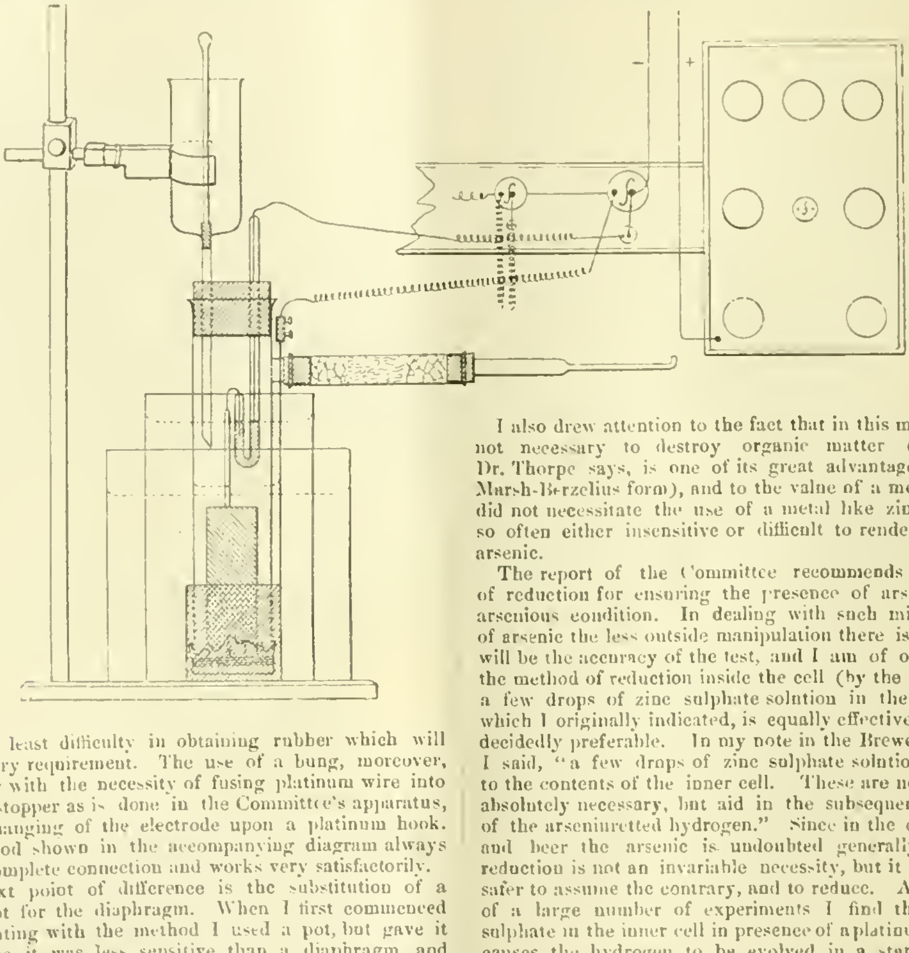
The description of a method by which the principle could be employed in a satisfactory manner for the detection of minute quantities of arsenic was originally published by me in the Brewers' Journal in July 1902, and the main features of the test communicated to the Commission some three months earlier. In a slightly modified form the apparatus has been constantly used in my laboratory ever since. The apparatus recommended by the Excise Committee is similar in principal with that previously described by me, and differs only in certain details, namely, the substitution of glass for rubber joints and a porous pot for a parchment-paper diaphragm. After a very careful trial of this apparatus I am convinced that it has no advantages over mine, and that, on the other hand, it is more difficult to manipulate, more costly, and distinctly less sensitive.

The accompanying diagram shows the form of apparatus I use. The double cell is made of glass with a parchment-paper diaphragm, the upper end of the cell being fitted with a rubber bung, through which pass the tap, funnel, and electrode. The substitution of glass for this rubber bung is no advantage, and makes the apparatus more costly and difficult to replace if broken. If care be taken in the selection of the rubber there is not the least danger of introducing arsenic. This point was apparently recognised by the Joint Committee of this Society and the Society of Public Analysts in their report of Jan. 1902. I have never found the least difficulty in obtaining rubber which will satisfy every requirement. The use of a bung, moreover, does away with the necessity of fusing platinum wire into the glass stopper as is done in the Committee's apparatus, and the hanging of the electrode upon a platinum hook. The method shown in the accompanying diagram always ensures complete connection and works very satisfactorily.

The next point of difference is the substitution of a porous pot for the diaphragm. When I first commenced experimenting with the method I used a pot, but gave it up because it was less sensitive than a diaphragm, and more difficult to clean. It is much easier to clean a glass apparatus and renew a paper diaphragm than a porous cell.

With a perfectly clean pot I have repeatedly found it impossible to detect 0·000001 grm. of arsenious oxide. It appears that the pot has a certain coefficient of absorption, and it is not until this absorptive capacity is satisfied that it becomes sensitive. As the result of a large number of experiments I find that the smallest quantity of arsenious oxide that I can detect with certainty by the apparatus of the Committee is 0·000002 grm., and that, further, with a freshly mufiled pot even this quantity does not give its full mirror.

With my apparatus I can always detect 0·0000002 grm. of arsenious oxide with certainty, so that, apparently, the substitution of the pot causes a great diminution in the delicacy of the test. This power of absorption which the pot possesses also shows itself in another way. When a large quantity of arsenic has been introduced into the inner cell, it is extremely difficult to get it all out, and unless the pot be ignited in the muffle, subsequent tests are inaccurate. This difficulty never arises in my apparatus. I note that other chemists have drawn attention to these points, and that the absorptive power of the pot has been specially noticed by Mr. A. C. Chapman in a recent paper. If the cell be placed in an outer vessel of water, as shown in the diagram, there is not the slightest risk by rupture of the diaphragm. The parchment paper is cut into suitable squares, which are kept soaking in water till required. They are thus rendered quite pliable. I have made several thousand tests with perfectly satisfactory results. The arrangement for utilising the main current by means of lamp resistances was described by me in the paper mentioned, and I have carried out several tests side by side.



I also drew attention to the fact that in this method it is not necessary to destroy organic matter (which, as Dr. Thorpe says, is one of its great advantages over the Marsh-Berzelius form), and to the value of a method which did not necessitate the use of a metal like zinc, which is so often either insensitive or difficult to render free from arsenic.

The report of the Committee recommends a method of reduction for ensuring the presence of arsenic in the arsenious condition. In dealing with such minute traces of arsenic the less outside manipulation there is the greater will be the accuracy of the test, and I am of opinion that the method of reduction inside the cell (by the presence of a few drops of zinc sulphate solution in the inner cell), which I originally indicated, is equally effective, and hence decidedly preferable. In my note in the Brewer's Journal, I said, "a few drops of zinc sulphate solution are added to the contents of the inner cell. These are not, however, absolutely necessary, but aid in the subsequent evolution of the arseniuretted hydrogen." Since in the case of malt and beer the arsenic is undoubted generally arsenious, reduction is not an invariable necessity, but it is of course safer to assume the contrary, and to reduce. As the result of a large number of experiments I find that the zinc sulphate in the inner cell in presence of a platinum electrode causes the hydrogen to be evolved in a state of supertension possessed of increased chemical activity. I have proved that a solution containing only arsenate will, when treated in this way, give mirrors of exactly equal intensity to those obtained from an equivalent quantity of arsenious oxide. I find that, even if the metabisulphite be used for the reduction, the production of the mirror is much assisted by the use of zinc sulphate.

A further point in favour of my form of apparatus is its cheapness and the ease with which the parts may be replaced. The Committee's apparatus is costly, and once broken is useless. The chief criticisms that have been passed on the electrolytic apparatus, described by the Excise Committee, have been directed to its alleged insensitiveness, but they certainly do not apply to the apparatus here described. A method that will detect 0·0000002 grm. of arsenious oxide with certainty satisfies, I think, the most stringent requirements.

A copy of this paper was sent by the author to Prof. Thorpe, who in his reply says:—

"You say, and rightly so, that the method described by me is a modification of the Bloxam method. Would it not be desirable to say in explicit terms that yours, too, is a modification of that method, and that it bears even a closer resemblance to it in its details than mine does? In your paper in the Brewer's Journal you omitted all reference to Bloxam's prior method.

"As I have already informed you, I am not in a position to say anything about your modification of Bloxam's process, as I have not put your apparatus together. It has certain features in its construction which would make it open to attack in judicial proceedings, and I should deprecate its adoption, therefore, in connection with any work which may be the subject of guarantees or warranties.

"Your statement that the use of the Pukal cell interferes with the sensitiveness of the electrolytic test is entirely groundless, as I am in a position to demonstrate. I am not able to perceive any difference as regards the apparent amount of arsenic deposited by the ordinary Marsh-Berzelius method and the electrolytic method, as we practise it here; the main difference appears to be that the electrolytic mirrors tend to be more uniform in character and more evenly deposited than the zinc and acid mirrors.

"As regards the rheostat, this is a common article of electrical furniture, and has long been employed here as in other laboratories, where a main current has to be reduced for electrolytic operations.

"You say, 'that there is no doubt that the presence of zinc in the inner cell causes the hydrogen to be evolved in a condition of increased chemical activity.' I, in common with others, would be glad to be furnished with the evidence upon which this hypothesis of a peculiarly active hydrogen is based."

In reply, Mr. Trotman remarked that the reason why no reference was made to Bloxam in his original paper was that at the time he was not aware of the latter's publication in 1861. The paper was published many years before he was born and, as Prof. Thorpe himself said, the method was never generally used, and hence it was not surprising that he should not have known of the paper. In the present paper he thought it was sufficiently clearly indicated that his method was a modification of that proposed by Bloxam. In any case, however, the point at issue was not which apparatus was more like Bloxam's, but which was the more sensitive. All he claimed was, firstly, priority of publication of a workable modification of Bloxam's idea; and, secondly, that his apparatus was simpler and more delicate than the other. The only objection to the apparatus that could be urged in cases connected with guarantees or judicial proceedings was its excessive delicacy. Dr. Thorpe did not state the nature of the objection which he would raise, but one might assume that he referred to the use of a rubber bung; but carefully selected bungs were no more likely to contain arsenic than glass. Even glass sometimes contained very distinct traces of arsenic and vitiated tests.

Dr. Thorpe stated that his apparatus gave results comparable with the ordinary Marsh-Berzelius method. He had never denied this, but that was an additional proof that his apparatus was even more delicate, for one could never detect with any certainty so small a quantity as 0·0000002 grm. of arsenious oxide by the Marsh-Berzelius method.

In reply to Prof. Thorpe's question about the facts upon which the hypothesis of the action of zinc in the inner cell was founded it appeared to the writer that the facts were fairly plain. In the first place Prof. Thorpe had stated that the electrolytic method would not detect arsenates, with which statement the speaker agreed; but if arsenates were reduced to arsenites before introduction to the inner cell they were readily detected. When the author introduced an arsenate into his apparatus in the absence of zinc sulphate no mirror was obtained, but in the presence of the zinc sulphate the correct mirror was always produced. Therefore the arsenate must have been reduced inside the cell. The facts appeared to him capable of only one explanation. He might state, however, that experiments had been for a long time in progress, by one of his assistants and Dr. Sand, who first suggested the use of zinc sulphate, which would probably throw more light upon the question. Lastly, with reference to the rheostat, he had not claimed to have invented tapping the main current, but he claimed to be the first to realise its possibilities in the production of arseniuretted hydrogen and therefore fully described his method of using it by means of a lamp rheostat.

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I.—PLANT, APPARATUS, AND MACHINERY.

Steam Boilers; Internal Rusting of ——. J. Reischle. Zeits. Bayer Revisionsver f. Kraft, Heiz- u. Licht-Anlagen, 1903. [23]; through Woch. f. Brau., 1904, 21, 82—83.

The author believes that the internal corrosion of steam boilers by rusting, generally attributed to the action of purely chemical agents, is more often due to feeble electric currents set up by the differences in potential between the iron and any other more negative metals which may be present (*e.g.* copper). Even if no metal other than iron be present, there are distinct differences of potential between the various forms of iron used in the construction of the boilers, and even between different portions of the same plate, in virtue of the different proportions of carbon contained in the metal. As an instance of this, it is remarked that wrought-iron rivets in cast-iron plates are frequently corroded. The strains produced in iron by drawing or pressure, also cause differences in chemical activity, and for this reason plates with punched rivet holes are less permanent at those spots, than plates with drilled holes. Further, electrical currents may be set up by thermo-electric phenomena caused by differences in temperature in various parts of the boiler. Once corrosion has been started it will be continued owing to the difference of potential between the iron and its oxide. Plates of zinc suspended in the boiler will themselves become rapidly corroded, thus saving the iron because of their more positive nature.—J. F. B.

English Patents.

Covers or Stoppers of Vessels in which it is desired to Maintain a Vacuum; Impts. in ——. J. Maiden, Manchester. Eng. Pat. 3287, Feb. 11, 1903.

The combination is claimed of an outer edge of a cover or stopper making an airtight joint with a suitable bearing surface formed on or in the neck or mouth of the vessel thus covered or stoppered. The cover or stopper of a vessel having a flared or conical mouth, may have an exhausting aperture adapted to be closed tightly by a wooden or other peg, after the vessel has been exhausted. Or, the cover or stopper may be formed with a recess having at the bottom an exhausting aperture covered by a valve, the recess being filled with melted wax, paraffin, fat, &c., after the vessel has been exhausted.
—R. A.

Drying, Grinding, and Screening; Apparatus for ——. L. Rissmuller, Brooklyn, N.Y. Eng. Pat. 22,164, Oct. 14, 1903. Under Internat. Conv., Jan. 31, 1903.

The apparatus is especially applicable for treating materials of a fibrous nature, such as meat, and consists of a rotary drum provided internally with a crushing roller and a screening device operated by the rotation of the drum. The crushing roller is journalled in a U-shaped support mounted to rotate independently on the axis of the drum, the roller being capable of sliding towards and away from the axis of the drum, and tending to return by gravity to a position below the axis. The screening device, with a screen adjacent, is located at the discharge end of the drum, the screen co-operating with a roughened face on the crushing roller. Means are also provided for passing a heating medium through the drum.—R. A.

Filters; Impts. in ——. O. Loffler and W. Weidle, Vienna. Eng. Pat. 21,149, Nov. 6, 1903.

The filtering chamber is formed by two plates of filtering material and a washer, against which the plates are pressed by suitable means, between them, a suction pipe being connected to a tube passing through the washer. The walls of the casing are perforated opposite the filtering plates, to admit the liquid, and are shaped so that spaces are formed between them and the plates. A modified form, for pocket use, is provided with a screw-threaded cover.—R. A.

United States Patents.

Distilling Apparatus. J. M. Moore, Wena, Ala. U.S. Pat. 749,316, Jan. 12, 1904.

This apparatus comprises a horizontal cylindrical receiver, having within it a single central flue stretching beyond it, and so of relatively longer diameter; a detachable dome mounted on top of the receiver, near one end, and communicating with the interior of the receiver; and a condenser, provided with inlet and outlet valves, mounted near the other end of the receiver. A condensing-pipe leads from the top of the dome to the bottom of the condenser, and a conducting-pipe leads from the top of the condenser to a worm. A discharge-valve is provided in the bottom of the receiver.—R. A.

Distilling Apparatus. A. C. G. Dupuis, New Orleans, and W. S. Fell, Waveland, Miss., Assignors to F. P. Morrill, and G. E. Pitcher, New Orleans, La. U.S. Pat. 749,368, Jan. 12, 1904.

The liquid-containing receptacle is formed with walls corrugated internally, and is surmounted by a conical vapour chamber, having an outlet at its apex for the lighter vapours. A foraminous chemical-containing plate is mounted between the receptacle and the chamber, and converging plates extending upwards are arranged in the chamber above the partition, outlet conduits for the heavier vapours being formed between these plates and the walls of the chamber.—R. A.

Centrifugal Machine. J. J. Berrigan, Orange, N.J., Assignor to F. J. Arend, New York, and J. Bernstrom, Stockholm, Sweden. U.S. Pat. 750,079, Jan. 19, 1904.

This machine is adapted for separating combined liquid and solid materials, and consists of a rotary receptacle having within it two eccentrically-disposed separating vessels, which are arranged concentrically one within the other, whereby the combined materials are subjected to two successive separations in the vessels. A conduit for the separated solid material and an outlet are provided. (See also Eng. Pat. 12,181 of 1901, and U.S. Pats. 689,570–2 and 696,130; this J., 1901, 1095, and 1902, 244 and 597.)
—R. A.

Centrifugal Machine. J. J. Berrigan, East Orange, N.J. U.S. Pat. 750,080, Jan. 19, 1904.

This machine is adapted for the separation of solids and liquids, and consists of a rotary receptacle provided internally with a cylindrical chamber, having a perforated wall. The inner surface of this wall is provided with bars arranged parallel to the axis of rotation, to prevent the circulation of the liquid around its inner periphery. The solid material is deposited in the sections of the inner periphery of the perforated chamber, surplus solid material being conveyed away through a conduit. The rotary receptacle is provided with a liquid-outlet outside of the perforated chamber. (See also preceding abstract.)
—R. A.

French Patent.

Centrifugal Purifier-Separator. C. E. Lossignol. Fr. Pat. 335,268, Aug. 22, 1903.

The patent relates to a machine for separating solid materials from gases or liquids which contain them, by centrifugal force. It consists of a turbine formed of three truncated conical parts, one within another, the lengths of which are in certain ratios, mounted on a vertical or horizontal axis, and rotating in a vat containing water, which, by the motion of rotation, is formed into a parabolic wave, which forms the bottom of two compartments in the turbine, one of ingress, and the other of egress. In these two communicating vessels, the separation is effected by centrifugal force, the solid particles being thrown to the outer edge of the turbine into the water, from which they can be collected, and the fluids flowing away, under the equilibrium of the pressures existing in the communicating vessels, from the openings of ingress and egress of the turbine.—W. C. H.

II.—FUEL, GAS, AND LIGHT.

Unburnt Products in Chimney Gases; Determination of ——, *by a Modified Orsat Apparatus.* W. H. Sodeau. XXIII., page 206.

English Patents.

Coke; Manufacture of——. A. Custodis, Düsseldorf. Eng. Pat. 501, Jan. 8, 1903.

ee Addition, of Jan. 7, 1903, to Fr. Pat. 305,879 of 1900; his J., 1903, 944.—T. F. B.

Turf [*Peat*] *Bricks; Manufacture of*——. G. Peters, Langenberg, Germany. Eng. Pat. 4978, March 3, 1903.

The turf is reduced to fibres or small pieces and piled up n heaps about 30 feet high. The heaps become heated, robably in consequence of oxidation, and the proportion f water is reduced sufficiently to allow the turf to be ompressed into bricks.—H. B.

Smokeless Fuel; Manufacture of ——. A. Hage. Eng. Pat. 27,355, Dec. 14, 1903.

 smokeless fuel is prepared by suitably mixing a ground mokeless coal, such as long flame coal or coke, with a round smoky coal, such as non-flaming coal or brown coal, nd forming the mixture into briquettes, with or without the ddition of tar as a binding material.—L. F. G.

roducer Gas; Process and Apparatus for Generating ——. F. Jahns, Saarbrücken, Germany. Eng. Pat. 1994, Jan. 27, 1903.

n order to obtain, from bituminous coal, producer gases ontaining no tar, or very little, a number of producers are rouped together. Each producer is charged and allowed burn out without recharging; then it is cleaned out, gain charged, and again connected into the series. The roducers are kindled in succession, with due intervals etween, so that there is always one in which tarry gases re no longer being produced; and the gases from all the ther producers are finally led through the latter, in order hat any tarry matters they contain may be fixed. When e fuel in this producer is exhausted, it is cut out to be eaned and recharged, the next in succession becoming the xing producer, and so on continuously in rotation. The ases may be drawn through all the producers, arranged in eries, or may be drawn from each producer directly rough the fixing producer.—H. B.

oal Gas or other Gas; Apparatus for the [*Benzol*] *Enrichment of* ——. H. Pooley and A. Poulson, Stafford. Eng. Pat. 20,330, Sept. 22, 1903.

 vertical steam chest, provided externally with projecting rizontal ribs, is enclosed in an outer casing having ternal ribs which interlace with those on the steam chest. benzol supply-pipe passes vertically up through the eam chest and discharges any unvolatilised benzol, which ay escape from it, into a tray on the top of the steam-est, whence it trickles down over the baffling ribs. A pe supplying the gas to be carburetted likewise passes up rough the steam-chest and opens above the tray; the s thus receives a preliminary heating and then passes wn the space between the interlacing ribs, mingling with e benzol vapours and passing out by a pipe at the base the apparatus. The enriched gas is subsequently mixed th uncarburetted gas.—H. B.

as; Process and Apparatus for Producing Combustible ——. L. Herzog, Arbon, Switzerland. Eng. Pat. 22,547, Oct. 19, 1903.

he apparatus, which is adapted for use with a suction-tor or exhauster, comprises a central generator-furnace, rmounted by a tubular evaporator which surrounds the eding hopper; a water supply-pipe opening into the aporator; a thermostatic device placed in the path of the ses which heat the evaporator, this device regulating the pply of water according to the temperature; three con-ntric cylinders surrounding the generator, forming two nular spaces, the inner one serving to lead off the nerator gases, and the outer one for giving a preliminary heating to the air supply which is drawn up through it; an air fan for use in kindling the fire when the generator is first started; a closed ash-pit, suitable valves, &c. When the plant is operating, air is drawn in at each suction, through openings in the outer cylinder; the heated air is led through the evaporator and passes down, mixed with steam, to enter at the grate of the furnace; and the gases generated are led off through the annular space surrounding the furnace. The heat of the latter is thus conserved, permitting a large proportion of steam, to be used.—H. B.

Gas; Generator for a Simultaneous Production of Heating and Lighting ——. E. Meininghaus, Barmen, Germany. Eng. Pat. 10,597, Nov. 23, 1903.

A vertical retort, having an inclined discharge end, is arranged inside a vertical generator furnace. The retort is fed intermittently with coal, the coal gas being led off at the top, and the coke withdrawn at the lower end; while the generator is fed with coke, and the generator gas is led off at the top. Charging, discharging, and gas-purifying devices are provided.—H. B.

Gas; Improved System of Purifying and Distributing ——. E. Meininghaus, Barmen, Germany. Eng. Pat. 10,770, Nov. 23, 1903.

Coal gas and the like, instead of being distributed by pipes in the usual way, are to be compressed and distributed in the liquid state in cylinders. Before compression, carbon dioxide is removed from the gas by means of caustic potash or other suitable material.—H. B.

Burners for Testing Gas. W. T. Sugg. Eng. Pat. 4052, Feb. 20, 1903. XXIII., page 205.

United States Patent.

Gas; Process of Manufacturing ——. P. Naef, New York. U.S. Pat. 749,945, Jan. 19, 1904.

See Eng. Pats. 20,658 and 20,659 of 1899; this J., 1900, 10,904 and 10,905.—H. B.

Furnace [*Carbide*]; *Electric* ——. Stevens and Timmerman. U.S. Pat. 749,461, 1904; also *ibid.* U.S. Pat. 749,462. XI. A., *page* 192.

Furnace [*Carbide*]; *Electric Resistance* ——. A. H. Cowles. U.S. Pat. 750,093; also *ibid.* 750,094; 750,095; 750,096: 750,170; and 750,171. XI. A., *page* 192—193.

French Patent.

Gas-Generator for the use of Small Coal or Coal-Dust. Vereinigte Anthracit Werke, G. m. b. H. Fr. Pat. 335,291, Sept. 11, 1903.

In order to diminish the pressure of the fuel on the grate, a horizontal supporting surface is arranged in the upper part of the generator immediately above the grate; the latter consists of a number of rings arranged one above another, of decreasing diameters, thus forming an inverted cone. The fuel falls from the supporting surface into the conical grate, and the gas produced is led away through a central vertical pipe, which is surrounded by a similar pipe of larger diameter, and in the hollow space between these the steam necessary for the generation of the gas is produced and led from the upper part of the hollow space by a pipe and introduced beneath the grate. In another form of the apparatus the fuel is supplied to a funnel-shaped vessel, with its narrow end pointing downwards, arranged inside the generator, the inclined side of which vessel acts as a supporting surface; the fuel falls from this on to an erect conical grate. In another form the lower portion of the generator is narrowed below the fuel-supply chamber—the distance between the bottom of which and the narrow portion of the generator can be regulated according to the size of the fuel. The fuel, as it falls from the supply chamber, forms a conical mass from the free surface of which—between the bottom of the supply chamber and the wall of the generator—a regular supply of gas is produced. The lower part of the generator is used chiefly as a steam chamber and acts as an ash-pan after the insertion of a grate into the narrowed portion of the generator chamber. —W. C. H.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM AND MINERAL WAXES.

English Patents.

Pitch ; Process for the Manufacture of ——. C. G. von Wirkner, Schalke, Westphalia. Eng. Pat. 13,185, June 12, 1903.

See Fr. Pat. 333,011 of 1903 ; this J., 1903, 1259.—T. F. B.

Naphthalene ; Method for Purifying ——. H. J. Haddan, London. From I. Paradell-Mateu, Barcelona. Eng. Pat. 25,989, Nov. 27, 1903.

Naphthalene vapour is subjected to a process of fractional condensation by driving it along a chamber or tube by means of a current of air or other inert gas.—T. F. B.

Yeast ; Manufacture of Certain Products from Waste Brewery or Distillery ——. P. Schidrowitz and F. F. Kaye. Eng. Pat. 6601, March 21, 1903. XVII., page 200.

IV.—COLOURING MATTERS AND DYESTUFFS.

Indigo ; Manufacture of —— [*from Indigo Plant*]. C. Rawson. J. Soc. Dyers and Colourists, 1904, **20**, 35.

Contrary to Bréaudat's experience (this J., 1904, 15), the author has never found any loss of indigotin, real or apparent, to take place during the drying of natural indigo. On the contrary, it is stated that indigo slowly dried in the usual way invariably contains a slightly higher percentage of indigotin than indigo dried rapidly. This is explained by the fact that some of the impurities present are decomposed into ammonia, carbon dioxide, &c., by the fungus always present. The following example is given. Two cakes of indigo were taken from the centre of a press ; one, dried in an air oven, gave 39·5 per cent. of dry substance, containing 58·8 per cent. of indigotin, corresponding to 23·22 per cent. on the moist cake. The second sample was dried in the drying-house in the usual way for nearly two months, and, after a final drying in the air-oven, yielded 38·3 per cent. of dry matter, containing 60·4 per cent. of indigotin, or 23·13 per cent. on the moist cake.—T. F. B.

Anthraquinone ; β-Substitution Products of ——. P. Kaufler. Ber., 1904, **37**, 59—66.

The author diazotised β-aminoanthraquinone by means of amyl nitrite, and obtained β-iodo-, β-chloro-, and β-nitro-anthraquinone from the diazonium salts by elimination of nitrogen, and β-bromo-anthraquinone by decomposition of the diazonium perbromide. The products are fairly stable, yellow, crystalline compounds. β-Iodoanthraquinone forms no addition-product with chlorine. β-Anthraquinonediazonium salts are not explosive. Even the nitrate is not affected by percussion, and only decomposes locally on contact with a hot glass rod.—E. F.

Anthraquinone-α-sulphonic Acids. R. E. Schmidt. Ber., 1904, **37**, 66—72.

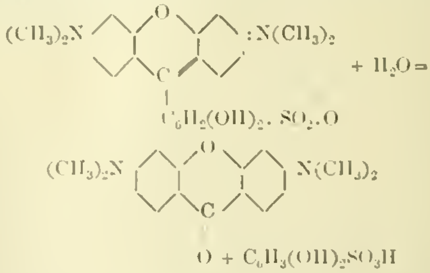
The author claims priority with regard to the formation of anthraquinone-α-sulphonic acids in presence of mercury or its salts. The mercury, or mercury salt, must be very finely divided, but only very small amounts are necessary. Exact recipes for the preparation and isolation of anthraquinone-α-sulphonic acids and of the 1.5- and 1.8-disulphonic acids are given. They all form rather insoluble and characteristic potassium salts. Instead of obtaining them by sulphonating anthraquinone in presence of mercury, these acids may also be obtained from the corresponding α-nitro-anthraquinones by boiling with 10 per cent. sodium sulphite solution. They are readily converted into the corresponding hydroxy-compounds by heating under pressure with milk of lime. With ammonia or alkylamines in aqueous solution, they form amino- or alkylamino-anthraquinones. With methyl alcoholic potassium hydroxide solution they yield methoxy-anthraquinones, and with phenolic potassium phenolate solutions they yield phenyl ethers of hydroxyanthraquinones. Anthraquinone-α-sulphonic acid is reduced by zinc dust and ammonia to anthracene-α-sulphonic acid, which yields α-anthrol on fusion with caustic alkalis. With 80 per cent. fuming sulphuric acid, anthraquinone-α-sulphonic acid may be oxidised to 1.2.4-trihydroxyanthraquinone-5 (or 8) sulphonic acid. On nitration it yields 1.5- and 1.8-nitro-anthraquinone sulphonic acids, which are reduced by sodium sulphide solution to the corresponding aminosulphonic acids. These latter can be diazotised and coupled with phenols or amines, and form aminohydroxyanthraquinones with milk of lime and 1.5- and 1.8-monomethyldiamino-anthraquinones with methylamine. Various other derivatives of anthraquinone-α-sulphonic acids are also described. They are all characterised by exceptional tendency to crystallisation.—E. F.

Dimethylaniline ; Addition Products of ——. C. L. Jackson and L. Clarke. Ber., 1904, **37**, 176—180.

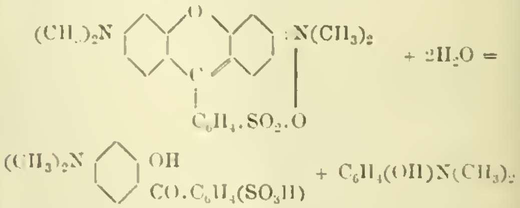
Substituted quinones combine with one molecule of dimethylaniline to form dark-blue unstable compounds, crystallising in prisms, of definite melting-point. They gradually decompose at the ordinary temperature into their constituents. The compounds with chloranil and with trichloroquinone are described. Substituted nitrobenzenes form similar compounds with dimethylaniline, which differ, however, by being brown, yellow, or red. Some of these have already been described by Hepp. The authors describe compounds with 1.3.5-trichlorotrinitrobenzene, 1.3.5-tribromotrinitrobenzene and with several highly substituted dinitrobenzenes.—E. F.

Dihydroxytetramethylrosaminesulphonic Acid ; Decomposition of ——. C. Liebermann and A. Glawe. Ber., 1904, **37**, [1], 203—210.

When dihydroxytetramethylrosaminesulphonic acid is boiled with dilute caustic alkali, it is decomposed, forming tetramethyldiaminoxanthone and catecholsulphonic acid, according to the equation—



When tetramethylrosaminesulphonic acid is treated in a similar manner, the molecule is broken up with greater difficulty and then separates in quite a different direction, according to the equation—



forming dimethylaminohydroxybenzophenonemonosulphonic acid. The authors remark that triphenylmethane dyestuffs in general are capable of decomposition with formation of benzophenone derivatives, but that the line of cleavage of the molecule varies with the nature of the dyestuff, as indicated by the above-mentioned cases. The corresponding leuco-compounds decompose in this manner either with very great difficulty or not at all.—E. F.

Colour-Acids; Action of ——, on Cellulose, Alcohol, and Acetone; and Nile Blue Base as a Reagent for Carbon Dioxide in Air. M. Heidenhain. Pflüger's Arch., **100**, 217—241. Chem. Centr., 1904, **1**, 116.

Michaelis (compare this J., 1903, 1083) has brought forward instances of histological colorations which he considers support Witt's solid solution theory of dyeing. The author, however, maintains his view that the property of albuminoids of taking up and fixing dyestuffs is of a chemical nature. The fact that whilst basic aniline dyestuffs are more readily soluble in alcohol than in water, yet dyeing with such dyestuffs is effected more easily in alcoholic than in aqueous solution, is incompatible with Witt's theory. White insoluble powders, *e.g.*, antimony oxide, zinc oxide, aluminium hydroxide, &c., when treated with dye liquors, condense the dyestuffs on their surface, and acquire various colours depending upon the nature of the dyestuff; for example, antimony oxide when shaken with the yellowish solution of *Hæmatoxylinum puriss* is coloured blue. In these cases, and also in the cases of histological colorations, absorption processes first come into play, but only as a preliminary to chemical action. According to Michaelis the fact that indifferent bodies, as cellulose, alcohol, and acetone, give the same colour reactions with colour-acids and bases as albuminoids, negatives the idea of salt formation, and confirms the view that the alteration of colour is due to the substitution of one solvent for another. The author, however, maintains that in all these cases salt formation takes place. He states that the blue coloration produced by spotting filter paper with the yellowish red solution of Nile Blue base is caused by the carbon dioxide present in the air, as is shown by the fact that the solution of the base when allowed to stand in a test-tube becomes coloured blue on the surface. The blue coloration produced when Nile Blue base is dissolved in alcohol is caused by an acid which is present in small quantity in alcohol. If the alcohol be first treated with calcium hydroxide, it dissolves the colour base to a yellowish-red solution. Like Eosin acid, the colour-acids Benzopurpurin 6B and Congo acid stain cellulose the colour of the colour salts. Here, also, however, chemical combination takes place between the colour-acid and the cellulose, for whilst the alkali salts of the colour-acids are turned blue by both hydrochloric and glacial acetic acids, the red stain produced on cellulose is turned blue by hydrochloric, but not by glacial acetic acid. The solutions of the colour acids named in glycerol, phenol, and cresol, as in methyl and ethyl alcohols, have the colour of the colour salts. The author points out that all these solvents contain hydroxyl groups, and in support of his view that the change of colour is due to chemical action, he cites the facts that Benzopurpurin acid and Congo acid dissolve in pure water with a blue colour; are insoluble in absolute alcohol; and dissolve in aqueous alcohol with the red colour of the colour salts. This change of colour in aqueous alcohol is explained as being due to the dyestuff undergoing electrolytic dissociation when dissolved by the water, and thus being rendered susceptible to chemical reaction. (See also this J., 1902, 966, 1072.)—A. S.

English Patents.

Azo Dyestuff; Manufacture and Production of a New ——. H. E. Newton, London. From the Farbenfabr. vorm. F. Bayer and Co., Elberfeld. Eng. Pat. 5269, March 6, 1903.

See Fr. Pat. 329,866 of 1903; this J., 1903, 1042.—T. F. B.

Azo Colouring Matter; Manufacture of ——. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen-on-the-Rhine, Germany. Eng. Pat. 5689, March 11, 1903.

A monoalkyl-*p*-phenylenediamine or homologue thereof is treated with two molecular proportions of nitrous acid. The *p*-diazomonoalkyl-alphylnitrosamines so formed combine readily with 1.8-dihydroxy-3.6-disulphonic acid to form dyestuffs containing a nitroso group, which dye in violet red shades from a bath containing acetic acid. In presence of a mineral acid they dye in blue shades, the nitroso group being split off. By heating aqueous solutions of these new dyestuffs with saponifying agents, such as dilute hydrochloric acid or caustic alkali, the nitroso group is split off, and dyestuffs result which dye wool in blue shades.—E. F.

Indoxyl and Indoxylic Acid; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabr., Ludwigshafen-on-Rhine. Eng. Pat. 6119, March 19, 1903.

See U.S. Pat. 731,385 of 1903; this J., 1903, 861.—T. F. B.

Sulphurised Colouring Matters [Sulphide Dyestuffs]; Manufacture of ——. G. B. Ellis from Soc. Chim. des Usines du Rhone, Lyons, France. Eng. Pat. 6078, March 16, 1903.

Azo compounds of *p*-phenylenediamine and phenols or naphthols or their substitution products are heated with alkali polysulphides or with sulphur and alkali sulphides at a low temperature, so that the azo group apparently remains intact. From *p*-aminophenyleneazonaphthol there is obtained in this way a green dyestuff, the melt being heated to 120°—130° C. In a similar manner a greenish-black dyestuff is obtained from *p*-aminophenyleneazophenol at 140°—160° C. Under similar conditions β-naphtholazophenyleneazo-β-naphthol yields a yellow, β-naphtholazophenyleneazophenol an olive green, and phenolazophenyleneazophenol a bluish black dyestuff. The products dye cotton directly in presence of an alkali hydroxide or carbonate without the addition of an alkali sulphide and can be used for printing from ordinary copper rollers.—E. F.

United States Patents.

Purpurin α-Sulphonic Acid. K. Thun, Elberfeld, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 746,405, Dec. 8, 1903.

See Fr. Pat. 334,658 of 1903; this J., 1904, 113.—T. F. B.

[Sulphide] Dyestuff; Green ——. A. Lüttringhaus, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. U.S. Pat. 750,113, Jan. 19, 1904.

Methylene violet is "treated with sodium tetrasulphide, carbon bisulphide, and alcohol." The dyestuff produced is soluble in sodium sulphide solution, the solution obtained dyeing unmordanted cotton green, which changes to blue on treatment with potassium bichromate and sulphuric acid. Compare Fr. Pat. 322,784 of 1902; this J., 1903, 360.
—T. F. B.

French Patents.

Sulphurised Dyestuffs [Sulphide Dyestuffs]; Preparation of Violet-Red ——. Raison Commerciale Kalle et Cie. Fr. Pat. 335,383, Sept. 16, 1903.

A polyhydroxylated rosinduline is obtained by melting substances capable of forming 1.4-naphthylenediamine, such as the azo-dyestuffs formed from α-naphthylamine, with *p*-aminophenol and hydrochloric acid. Or naphthylenediamine may itself be melted with aminophenol and hydrochloric acid in presence of a suitable oxidising agent, preferably in the form of an aromatic nitro-compound. Or α-nitronaphthylamine may be melted with *p*-aminophenol in presence of hydrochloric acid. The hydroxylated indulines obtained by any of these methods are melted with sulphur and sodium sulphide. The products dye unmordanted cotton in reddish-violet shades fast to washing and to light.—E. F.

Red Dyestuff [Azo Dyestuff]; Manufacture of New Compounds of the Benzene Series, and their Transformation into a ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 328,130, Nov. 3, 1902.

o-Chlorobenzylsulphonic acid is nitrated, forming *p*-nitrochloro-o-benzylsulphonic acid. This is converted into "*p*-nitranilinehomosulphonic" acid by heating with ammonia. This latter body yields a red dyestuff, very suitable for the manufacture of lakes, on diazotisation and combination with β-naphthol.—E. F.

Rhodamines [*Pyrone Dyestuffs*] *of a Yellow Shade derived from Tetra-Alkylated Rhodamines; Preparation of* ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 328,139, Nov. 12, 1902.

The tetra-ethyl rhodamine derived from phthalic acid is treated with caustic alkali in dilute aqueous alcoholic solution. The product dyes in more yellow shades than the original dyestuff and its tinctorial power is greater. —E. F.

Sulphide Dyestuff; Preparation of a Bluish-Black ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 328,158, Nov. 28, 1902.

See Eng. Pat. 25,851 of 1902; this J., 1903, 1191.—T. F. B.

Indoxyl and its Derivatives; Production of ——. Badische Anilin und Soda Fabrik. First and Second Additions, each dated Dec. 8, 1902, to Fr. Pat. 328,148, Nov. 21, 1902.

See Eng. Pat. 26,372 of 1902; this J., 1903, 1289.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Printing of Cotton, by the Discharge or Reserve Methods, with Blue Sulphide Dyestuffs. A. Sansone. Rev. Gén. des Mat. Col., 1904, **8**, 37—39.

It is probable that in the printing of cotton, indigo will be partly replaced by the blue sulphide dyestuffs. The latter can be applied in discharge or reserve printing by the same methods as those employed for indigo, except that the chromic acid discharge is not suitable to them. For reserve printing, the material is printed, either with sulphate of lead or with a mixture of zinc white and zinc sulphate, thickened with gum. The following is a typical white reserve:—250 grms. of zinc white paste 1 : 1, or the same quantity of kaolin paste; 300 grms. of sulphate of zinc; the whole thickened with 450 grms. of gum water, 1 : 1. After printing, dry at a moderate heat and dye as rapidly as possible so as to avoid the penetration of the reserve by the dye solution. It is best to dye in a padding machine, which must have no copper used in its construction. The padding should take from one to two minutes and be done cold for light shades and not above 80° C. for full colours. The padding solution is made up of the sulphide dyestuff dissolved with the necessary amounts of sodium sulphide and soda ash, and thickened with a suitable thickening such as gum tragacanth. After padding, the cloth is exposed to the air in order to develop the colour: it is then washed, passed through a weak acid bath, again washed and finally soaped and dried. The chlorate discharge gives the best results with sulphide colours. The cotton is dyed in the usual manner and then printed with a discharge such as the following:—70 grms. of kaolin made into a paste with 70 grms. of water; a solution of 175 grms. of chlorate of soda in 240 grms. of British gum thickening added; the mixture warmed to 60° C.; 125 grms. of tartaric acid, finely powdered, added; and, after cooling, 70 grms. of solution of ammonium ferrocyanide 25° B. Print dry at a moderate temperature and steam one to three minutes in a Mather-Platt at 98°—100° C., using dry steam. The discharge method gives a better white than the reserve method, but the latter is good enough for most purposes. —A. B. S.

English Patents.

Bleaching Flax, Hemp, Cotton, Jute, Ramie, Straw, and the like; Process of ——. L. C. P. Jardin, Cambrai, France. Eng. Pat. 9724, April 29, 1903.

See Fr. Pat. 331,574 of 1903; this J., 1903, 1127.—T. F. B.

Bleaching Apparatus; Continuous ——. M. Muntadasy, Rovira, Barcelona. Eng. Pat. 11,200, June 25, 1903. Under Internat. Conv., Nov. 10, 1902.

See Fr. Pat. 327,931 of 1902; this J., 1903, 948.—T. F. B.

Polychrome Printing on Calico and other Materials. E. Rolffs, Siegfeld, Germany. Eng. Pat. 1583, Jan. 22, 1903.

The patterns to be printed are transferred by photographic means to the surface of the printing cylinders, and there etched in. To produce a coloured print, the object to be printed is photographed through light filters of various colours, and the resulting negatives are transferred to different rollers, and the material is printed by each of these rollers with the colour corresponding to the light filter used in its preparation. Soluble colours are employed. For the preparation of rollers, see Eng. Pat. 16,944, 1899. —A. B. S.

Printing Vegetable Fabrics. H. Schmid, Mülhausen, Germany. Eng. Pat. 3778, Feb. 17, 1903.

See Fr. Pat. 329,747 of 1903; this J., 1903, 1044.—T. F. B.

Steaming Cloth and other Fabrics; Apparatus for ——. F. I. Burgher, Stapleton, U.S.A. Eng. Pat. 25,369, Nov. 20, 1903.

The peripheral face of the steaming cylinder has a longitudinal shoulder or offset, so that the covering, of suitable fabric material, forms a similar offset, which leaves room for one edge of the cloth to be treated to abut against, thus preventing the formation of a crease in the cloth. The steaming cylinder contains inside a longitudinally corrugated tubular stiffener, one end of which is non-corrugated to form an annular water draining chamber. The cylinder and stiffener have registering perforations for the passage of steam which comes from a perforated chamber within the cylinder and passes out, finally, through the material to be treated.—E. F.

Metallisation of Textile Fibres and Products therefrom, and also of Leather, Paper, and the like. A. Forster, Plauen i. V., Germany. Eng. Pat. 24,289, Nov. 9, 1903.

Solutions of nitrocellulose are thickened by the addition of water. The fibre or fabric is saturated with the thick liquid so obtained, and the metallic powder is either held in suspension in this solution, or is afterwards strewn over or applied to the materials. The metallised material may then receive an external coating by the application of a thinly-liquid solution of nitrocellulose to which water has not been added. It is then preferably passed through "satining" machines ["Satinirmaschinen"] whilst being warmed. —E. F.

Waterproof Cloths and Fabrics; Manufacture of certain kinds of ——, *and Machinery for use therein.* W. M. Mackintosh, Liverpool, and A. Smith, Manchester. Eng. Pat. 218, Jan. 5, 1903.

The composition used is made from a vegetable oil, an alkali or metallic carbonate or oxide, and resin or other analogous substance or starch or starch preparation. The fabric is first passed through heated drying rollers, and then through a vat containing the fluid composition, passing over rollers which are immersed in the same. It is then passed over scraping knives, which remove the excess of composition from both surfaces, and finally is pressed between heated nipping rollers which thoroughly force the composition into the fabric.—E. F.

French Patents.

Mordanting of Cotton; Process for ——. F. L. Grenot. Fr. Pat. 334,945, Aug. 31, 1903.

The cotton is padded in a solution of barium aluminate, then dried slowly in the air, the carbon dioxide of which converts the barium into carbonate and the aluminium into its hydrate. The cotton is then washed either in water or in a chalk bath, which, in the latter case, fixes lime on the fibre. It is then dyed as usual. The mordant can also be applied by alternate paddings in Turkey red oil and barium aluminate. The alumina can also be fixed by steaming at low pressure in presence of carbon dioxide or ammonium carbonate.—A. B. S.

[Dyeing, Bleaching, Mercerising, &c.] Treatment of Textiles; Apparatus for ——. T. de Naeyer. Fr. Pat. 334,828, Aug. 25, 1903.

The material to be treated is placed in a vertical vessel between perforated plates. This vessel is preferably larger at the top than at the bottom, in order that the liquid which has been weakened in strength by passing through the upper layers of material, should have a smaller amount of material to act on. The liquid is showered over the top in the usual way by means of a circulating pump; it passes out of an opening at the bottom of the apparatus into a jacketed heating vessel, where it is heated to the desired temperature, and then circulated by the pump. This avoids dilution of the liquid employed, by condensed steam.
—A. B. S.

Printing or Decoration of Fabrics, Paper, &c.; Process for ——. C. L. Burdick and H. Pervilhac. Fr. Pat. 334,667, Aug. 17, 1903.

In printing designs such as annular rings by means of stencil plates, use has to be made of wires, &c., to support the central portion of the stencil. To avoid this the material is first printed with a resist so as to cover the central parts which it is not desired to print; after this the colour paste is printed through a larger stencil so as to cover the resist and also form the required pattern around it. The colour is fixed as required and then the resist is removed, and leaves the centres uncoloured. A good resist consists of a mixture of resin, paraffin, beeswax, and turpentine. It can be removed by means of benzene.—A. B. S.

Multicolour Effects on Silk or Mixtures of Silk and Cotton; Process for Obtaining ——, by Printing a Single Mixture of Colours. J. Mennweg and D. Mennweg. Fr. Pat. 334,874, Aug. 27, 1903.

The mixed fabric is treated with tannic acid in the usual way, and then printed with a mixture of mordant, and basic and substantive dyestuffs, to which is added chromium acetate or a salt of similar properties. After printing, the fabric is steamed and washed. The chrome compound prevents the substantive dyestuff from dyeing the tanned silk, whilst the cotton takes all the dyestuffs and so gives a mixed effect. To obtain two-colour effects on silk alone, the warp or the weft is mordanted with tannin before weaving. A mixture of acid and basic dyestuffs can be then printed on, in which case the mordanted silk is only dyed by the basic dyestuff, whilst the unmordanted is dyed by both. Three-colour effects on cotton and silk mixtures can be obtained by mordanting part of the materials before weaving.—A. B. S.

Painting on Tissues; Process for ——. A. Boyeux and F. Prud'hon. Fr. Pat. 334,886, Aug. 27, 1903.

The colour is made into a paste and supplied to a printing roller by a metallic furnisher. The printing roller is in contact with another roller, and the fabric to be printed passes between them. The printing roller can either be simply engraved in fine lines for printing a plain colour, or it can be engraved in any desired pattern. The fabric can be printed on both sides if desired.—A. B. S.

Finishing of Textiles; Continuous Process for ——, with Intermediate Drying. Soc. F. Bertrand and Co. Fr. Pat. 334,890, Aug. 14, 1903.

The machine for treating the cloth with the finishing material consists of three or more rollers placed one above another; the lower one dips into the finishing liquid, and pressure can be applied as usual. The cloth passes first between the two upper rollers, and is thus impregnated with the liquid; it is then passed over a drying arrangement. If the treatment with the finishing liquid has to be repeated, the cloth is passed back between one of the lower pairs of rollers and again dried. This process is repeated as often as necessary.—A. B. S.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

English Patent.

Colouring and Hardening Natural Stone; Process for ——, also applicable to Organic Materials such as Ivory. H. H. Lake. From Chem.-Tech. Fabr. Dr. A. R. W. Brand and Co. Eng. Pat. 5594, March 10, 1903. IX., page 188.

VII.—ACIDS, ALKALIS, AND SALTS.

Peroxylaminesulphonic Acid. E. Divers. J. Chem. Soc. (Trans.), 1904, 108—110. (See also this J., 1904, 60.)

The formation of peroxylaminesulphonic acid, with evolution of nitric oxide, when sulphur dioxide is passed into the Gay-Lussac tower, *i.e.*, into sulphuric acid containing nitroso-sulphuric acid, is explained by the fact that nitroso-sulphuric acid consists of the mixed anhydrides of sulphuric and nitrous acids ($N_2O_3 + 2SO_3$), and is decomposed in accordance with the equation $2N_2O_3 + 4SO_2 + 2H_2O = 2NO + [ON(SO_3H)_2]_2$, just as nitrous anhydride is decomposed into nitric oxide and peroxide, the latter, in the case under notice, being sulphonated. The purple peroxylaminesulphonic acid is also formed, along with nitroso-sulphuric acid, from nitric oxide and sulphuric acid in presence of cupric or ferric sulphate as catalytic agent; the sulphuric acid acts in its "pyro" form in presence of the nitric oxide, and the reaction is as follows: $6NO + 4O(SO_3H)_2 = 4NO.O.SO_3H + [ON(SO_3H)_2]_2$.—T. F. B.

Salts; Preparation of ——, by Double Decomposition. W. Meyerhoffer. Ber., 1904, **37**, 261—263.

The explanation given by Witt and Ludwig (this J., 1904, 61) of the separation of barium nitrite, in their method of preparation, is hardly justified, the author thinks. The following principles, due partly to van't Hoff and partly to the author, afford a truer explanation:—1. Of two reciprocal salt-pairs, as $KCl + NaNO_3$ and $KNO_3 + NaCl$, one is always (in the solid state) stable at a given temperature; in this case, at the ordinary temperature, $KNO_3 + NaCl$. Hence the other pair will slowly change into the stable pair, and the change will be greatly accelerated by addition of a little water. 2. Under certain circumstances a "labile" pair may dissolve, and only one salt deposit; *e.g.*, $NaNO_3 + NH_4Cl$, from which NaCl will deposit, within a certain range of temperature only, "the exchange interval." 3. In the case in question, $Ba(NO_2)_2 + 2NaCl$ is the stable pair. When the pair $2NaNO_2 + BaCl_2$ begins to dissolve and to form the stable pair $Ba(NO_2)_2 + 2NaCl$, $BaCl_2$ also separates out. This involves $NaNO_2$ remaining in solution. By doubling the quantity of sodium nitrite the separation of $BaCl_2$ is prevented, and $Ba(NO_2)_2 + 2NaCl + 2NaNO_2$ remain in solution. This is at 100° C.—J. T. D.

Sodium Ferric Sulphates; Preparation of Two ——. A. Skrabal. Zeits. anorg. Chem., 1903, **38**, 319—321.

If a solution of 50 grms. of ferric sulphate, to which 10 c.c. of dilute sulphuric acid (1:6) have been added, is warmed with 300 grms. of Glauber's salt on the water-bath, the solution becomes lighter in colour, and a yellowish-white salt is precipitated. After cooling, a large quantity of water is added to dissolve the separated Glauber's salt, the mother-liquor filtered off, and the salt washed with a little cold water, alcohol, and ether, and dried between filter-paper. Analysis shows its composition to be—

$$2Na_2O.Fe_2O_3.4SO_3.7H_2O.$$

Another double salt is obtained by melting 100 grms. of Glauber's salt, adding 10 grms. of ferric sulphate and 15 c.c. of concentrated sulphuric acid, and continuing the heating till the solution becomes nearly colourless, when a white salt is precipitated. After cooling, the precipitate is filtered off, washed with alcohol acidified with sulphuric acid, alcohol, and ether, and dried between filter-paper. Its composition is $3Na_2O.Fe_2O_3.6SO_3.6H_2O$. Both salts are white, and decomposed by water.—L. F. G.

Carbon; Action of —— on Lime at the Melting-Point of Platinum. H. Moissan. Comptes rend., 1904, **138**, 243—245.

Carbon and lime, in the proportions for CaC_2, were heated in a graphite boat in a tube of quartz by means of a small oxy-coal-gas furnace. At a temperature at which platinum was melted, and at which the quartz tube softened but did not run down or rupture, there was not the slightest reaction. Neither lime itself, nor calcium carbide, shows signs of even incipient melting at the melting-point of platinum, and apparently lime and carbon only react above the melting-point of the lime. At the temperature of these experiments, silica was found to have a sensible vapour-pressure, for needles of a calcium silicate were seen to form slowly on the surface of the lime.—J. T. D.

Ozone; Action of —— on Hydrogen. G. Pickel. Zeits. anorg. Chem., 1903, **38**, 307—310.

Sulphuric acid of sp. gr. 1·18 was electrolysed in a cell, 20 cm. high and 7 cm. in diameter, using lead electrodes, the current strength being about 0·9 ampère and the potential difference 3—7 volts. The anodes were small, and made of lead wire, 1 mm. in diameter and 3 mm. in length. They soon become covered with lead peroxide, and ozonised about 3 per cent. of the oxygen. The ozonised electrolytic gas thus produced, was dried by sulphuric acid and passed through a glass spiral heated in a paraffin or air bath, and the water formed absorbed in a weighed tube containing sulphuric acid. The experiments lasted several hours, and when the spiral was heated to 174° C. 4·45 mgrms. of water were found to be formed per hour, at 128° C. 3·8 mgrms., at 100° C. 3·7 mgrms., at 75°—90° C. 2·6 mgrms., and at 20° C. 0·4 mgrms. This is about two-thirds of the amount that would be produced if all the ozone present combined with hydrogen to form water.—L. F. G.

Periodic Acid and Periodates: Electrolytic Production of ——. E. Muller. XI. A., page 191.

Chloric Acid and Chlorates; Electrolysis of ——. A. Brochet. XI. A., page 191.

Potassium Chlorate; Electrolytic Reduction of ——. G. H. Burrows. XI. A., page 191.

Chlorates, Bromates, and Iodates; Volumetric Determination of ——. L. Débourdeaux. XXIII., page 206.

Cobalt and Nickel Salts: Distinctive Reaction for ——. G. Guérin. XXIII., page 205.

Uranium in Uranyl Compounds; Iodometric Method of Determining ——. B. Glasmann. XXIII., page 206.

English Patents.

Sulphate of Copper; Manufacture of ——. G. Gin, Paris. Eng. Pat. 4625, Feb. 27, 1903.

See Fr. Pat 328,800 of 1903; this J., 1903, 996.—T. F. B.

Alumina and other Products; Process of Treating Ores of Aluminium to Obtain ——. A. J. Boult, London. From Soc. Romana Solfati, Rome. Eng. Pat. 6180, March 17, 1903.

See Fr. Pat. 330,280 of 1903; this J., 1903, 1086.—T. F. B.

Alumina and By-Products; Manufacture of ——. L. Kergh and B. Broughton, Hamilton, Canada. Eng. Pat. 23,919, Nov. 4, 1903.

See U.S. Pat. 744,765 of 1903; this J., 1903, 1347.—T. F. B.

Yeast; Manufacture of Certain Products from Waste Brewery or Distillery ——. P. Schwidrowitz and F. Kaye. Eng. Pat. 6604, March 21, 1903. XVII., page 200

United States Patent.

Sulphur; Apparatus for Burning ——. J. A. Marsden. Assignor to A. R. Paul, both of Lyon Falls, N.Y., and A. Tromblee, Carthage, N.Y. U.S. Pat. 749,311, Jan. 12, 1904.

A vertical rotary cylindrical retort, having reduced axial openings at the top and bottom, is divided as to a portion of its interior by longitudinal and transverse partitions, forming a chamber adapted to hold a molten or fluid mass. The lower, discharge end of the retort opens into an oxidising chamber, within which is arranged a melting tank, utilising the heat of the former; this tank is connected by a pipe to the retort, into which it discharges. Means for producing combustion and circulation of gases, within and through the retort, are provided.—E. S.

French Patents.

Cuprammonium; Manufacture of ——, in Closed Vessels and with "Hyperhermetic" Conditions. A. H. Bellot Des Minières. Fr. Pat. 335,207, Aug. 17, 1903.

A series of jars, each having a charge of copper fragments within a perforated cylinder resting on the bottom, and closed air-tight by a removable cover, is supplied with compressed air and with ammonia in a stated order, the transfer of liquid, when required from jar to jar, or to or from the feeding carboys, being effected by using the compressed air, suitably arranged tubes for charging and discharging being provided. The end jar of the series discharges any small portion of ammonia that may remain unabsorbed, into a vessel containing water.—E. S.

Sulphur; Retort for Continuous Work in the Sublimation and Refining of ——. A. A. Consoli, Italy. First Addition, dated Aug. 21, 1903, to Fr. Pat. 316,226 of Nov. 25, 1901. See Eng. Pat. 8757, 1902; this J., 1902, 970.

A battery of several retorts is arranged in a furnace, each of which communicates with a condenser for the sulphur vapour produced, and with a trough on the same level from which it receives a continuous or regulated supply of melted sulphur, through a tube curved downwards in the trough, so as to be always covered by liquid, access of air to the retorts being thus prevented. The trough is fed from a higher trough, which is itself charged by a horizontal pipe from a reservoir in which the raw sulphur is melted, the flow taking place from above the bottom, so that the impurities deposited by gravity are not disturbed. Special regulating valves are shown.—E. S.

Nitrous Anhydride and Salts of Nitrous Acid; Production of ——. Soc. Anon. des Prod., F. Bayer and Co. Fr. Pat. 335,229, Aug. 27, 1903.

A mixture of ammonia with air or oxygen is passed over ferric oxide (or other oxide of a heavy metal, such as copper oxide) heated to about 700° C. The nitrogen trioxide produced is caused to react upon a caustic alkali, or metallic oxide, hydroxide or carbonate, and water, to form the corresponding nitrite.—E. S.

Gaseous Reactions; Process for Facilitating Electrochemical ——. W. Ostwald. Fr. Pat. 328,157, Nov. 27, 1902. XI. A., page 193.

Oxides of Nitrogen; Electric Production of ——. Siemens and Halske. Fr. Pat. 335,453, Sept. 21, 1903. XI. A., page 193.

Gaseous Mixtures; Production of Intense Chemical Reactions in ——. S. Eyde and K. Birkeland. Fr. Pat. 335,692, Sept. 18, 1903. XI. A., page 193.

VIII.—GLASS, POTTERY, ENAMELS.

French Patent.

Ceramic Articles; Manufacture of Enamelled and Glazed ——. A. Bigot. First Addition, of Sept. 7, 1903, to Fr. Pat. 323,657 of Aug. 11, 1902. See this J., 1903, 496.

The enamel or vitrifiable colouring matter is applied to the article during the moulding in the form of thin plates or leaves formed by mixing the ground colour with a binding agent such as collodion, gelatin, casein, or flour, with which a fibrous material such as paper-pulp has been incorporated, these leaves being placed inside the mould during pressing. —A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

Lime-Sand Bricks; Influence of Pressure in the Manufacture of ——. S. V. Peppel. Thonind.-Zeit., 1904, **28**, 3—4.

The test blocks were made of 60 parts of coarse sand, 30 parts of fine sand, and 5 per cent. of white lime or dolomitic lime, the whole being subjected in the moulds to pressures ranging from 350 to 1,400 kilos. per sq. cm., and hardened under high pressure steam for 10 hours. The maximum crushing-strength (about 210 kilos. per sq. cm.) in the white lime series was shown by the blocks formed under 1,150 kilos. pressure, the curve receding beyond this point. In the dolomite lime series, the maximum (about 315 kilos. per sq. cm.) was attained under the same conditions, but here the strength was greater throughout. To ascertain whether this pressure is the optimum for bricks of other proportional composition, the tests were repeated with blocks made from 66 parts of coarse sand, 33 parts of fine sand, and 10 per cent. of white or dolomitic lime respectively. Broadly speaking, the results were parallel, the maxima being furnished by the blocks pressed to 1,150 kilos., though the curves proved irregular, the white lime series showing the same strength at 700 kilos. pressure as at 1,150 kilos., with a sharp decline in the case of the blocks pressed at 875 kilos. The author also found that the use of hardened steel mould plates facilitated the ejection of the finished blocks.—C. S.

Lime-Sand Brick; Influence of Steam Hardening on the Strength of ——. S. V. Peppel. Thonind.-Zeit., 1904, **28**, 23—25.

The tests performed by the author were made on blocks composed of 66 parts of coarse sand and 33 parts of fine sand, *plus* 10 per cent. of white lime or dolomitic lime, with or without 10 per cent. of kaolin, the whole moulded under a pressure of 1,050 kilos. per sq. cm. In the white lime series, without kaolin, the maximum crushing-strength —398 kilos. per sq. cm.—was attained by hardening under a steam-pressure of 8 atmos. for 8 hours, and the same applied to the dolomite series, with (410 kilos.) and without (422 kilos.) kaolin; but in the case of the lime-kaolin series, hardening for 10 hours at the above pressure gave the highest results (431 kilos.).

The hypothesis that equality in the factor of atmosphere-hours gives equality of crushing-strength was also investigated, but is considered not to hold good, except in the case of the white lime mixture.

When felspar is employed as an ingredient, the crushing-strength suffers considerably by prolonging the exposure to high pressure steam, the assumption being that potash and soda are thereby liberated and cause efflorescent incrustations.—C. S.

Cement; Composition of Roman ——. — Gresly. La Céramique, 1904, **6**, 114—115.

The analysis of a number of the best Roman cements of French origin gave the following mean proportions of essential constituents:—Silica, 23 per cent.; alumina and ferric oxide, 13 per cent.; lime and magnesia, 59 per cent.; sulphur trioxide, 3 per cent.; or a ratio of acids to lime and magnesia, 39 : 59. A corresponding synthetical cement may be prepared from 259 parts (30·2 per cent.) of kaolin and 600 parts (69·8 per cent.) of calcium carbonate, made up into briquettes, and burned at 1190°—1250° C. If materials free from iron be used, a perfectly white product will be obtained, and this, when ground to powder, exhibits excellent hydraulic properties, though in the state of lumps it seems to react but very slightly with water. The technical difficulties in the way of firing mixtures rich in lime are overcome by adding a small quantity ($\frac{1}{5}$—$\frac{1}{4}$ mol.) of calcium sulphate to the ingredients. This method furnishes highly energetic cements, and allows of greater variation in compounding the mixture.—C. S.

Blast-Furnace Slag and Portland Cement. M. Gary. Mitt. königl. techn. Versuchsanst., 1903, **21**, 159—169.

The strength of mixtures of blast-furnace slag with a binding agent decreases rapidly if the mixture is preserved for some time. This effect of keeping is more noticeable with regard to the crushing-strength than to the tensile strength. During the first week of storing, the tensile strength increases, but the crushing-strength begins to diminish immediately after preparation of the mixture. The effect is greater in the case of mixtures containing Portland cement than in those containing lime. The volume-weight of test-pieces prepared with mixtures containing blast-furnace slag also decreases considerably when the mixture has been kept for some time.—A. S.

Portland Cement in Concrete. C. Pars. Centralbl. d. Bauverw., 1903, 608; Thonind.-Zeit., 1904, **28**, 25.

It is claimed that the results of the Vicat test cannot be correlated directly to practical conditions. For instance, a Portland cement which, under this test, commenced to set in 32 minutes and 25 seconds, gave a concrete with the tensile strength of 21·4 kilos. (per sq. cm.) after 28 days, when the block was made immediately after mixing, but when the cement mortar was kept 10 minutes before making the block, the strength fell to 20·1 kilos., and when the delay was increased to 20 minutes, it was found impossible to prepare the block at all, the mortar having become unusable. Concrete that is to be deposited direct under water should be dumped in large masses with as little fall as possible, in order to give the core of the mass a good opportunity of setting, and prevent separation of the mixture, but no attempt should be made to use coarsely ground cement as a remedy for this latter evil. The loss on calcination test is recommended as affording an indication of proper burning, and the lime content should also be determined when the tensile strength is high, since an excess of this constituent causes gradual diminution of the cohesive power.—C. S.

Concrete; Crushing-Strength of ——, *and Influence of the Size of the Blocks (Cubes) upon the Setting and Strength of Cement-Mortar and Concrete.* H. Burchartz. Mitt. königl. techn. Versuchsanst., 1903, **21**, 111—159.

The author gives, in a long paper accompanied by numerous tables and curve-diagrams, an account of a series of experiments on the crushing-strength of mortar and concrete mixtures. The results show that the prevailing view that concrete mixtures attain a greater strength than the mortar used in their preparation is not always correct; on the contrary, concrete mixtures, especially when formed into cubes, may, under certain conditions, be considerably inferior in strength to the mortar present in the mixtures. In general it may be stated that within the time usually allowed in the examination of mortar and concrete mixtures, the strength decreases with increase of the size of the cubes formed of the mixtures, and this variation in strength persists, at all events, up to a period of 180 days. In view of these results, it is pointed out that the size of cubes prepared for strength tests, should as far as possible approximate to that of the concrete blocks used in practice. —A. S.

Cement Kiln: Thermal Efficiency of a Rotary ——. J. W. Richards. J. Amer. Chem. Soc., 1904, **26**, 80—88.

Experiments made on a rotary cement kiln 60 ft. long and 6 ft. external diameter, fired by pulverulent bituminous slack coal, gave the following results :—

Theoretical heating power of fuel	790,000 cal.
Heat of formation of cement	142,819 „
Total.............	932,819 „

	Calories.	Per Cent. of Total.
Heat in hot clinker	100,050	10·7
Heat in chimney gases	676,000	72·1
Heat in flue dust	2,112	0·2
Loss by imperfect combustion*...............	12,248	1·3
Evaporation of moisture in charge...........	1,446	0·2
Expulsion of carbon dioxide from carbonates	21,628	2·3
Loss by radiation and conduction (by difference)................................	119,335	12·8

* Estimated from the amount of carbon monoxide escaping.

The temperature at the lower end of the kiln was 1,200° C., and in the waste gases in the chimney 820° C. This latter represents the greatest heat loss, and could be remedied by using a longer kiln and also by admitting less air. The temperature of the gases in the kiln, calculated from their composition, is 1,000° C., that of the clinker being 1,200° C., the excess in the clinker being accounted for by the heat of combination of the ingredients. The temperature of the kiln gases is found thus : The available heat of combustion of the fuel is 790,000 cals., and this is taken up by the products of combustion and the excess of air, *viz.* :—

	Cb. m.	
Nitrogen............................	1,737	2,004
Oxygen	263	
Carbon monoxide	4	
Carbon dioxide......................	136	
Water vapour........................	128	

The maximum temperature of the gases in the kiln is the temperature to which 790,000 cals. will heat these volumes of gas. Using the specific heats of these gases as elsewhere in the paper, this temperature is calculated as 1,000° C. The kiln under notice turned out, on an average, 3,635 lb. of clinkered cement per hour from 5,980 lb. of mixture introduced, 200 lb. of fine dust being also produced. 110 lb. of coal were used to produce one barrel (380 lb.) of cement.—T. F. B.

English Patents.

Non-Conducting Coverings, Blocks, and Slabs suitable for Covering Steam Pipes, Boilers, and the like, and for other Purposes. H. C. Mitchell, London. Eng. Pats. 21,386 and 21,387, Oct. 1, 1902.

A solution of sodium silicate, or other silicious binding agent, is mixed with mica or asbestos, or with both, the mixture being then moulded, dried, and burnt at a temperature of about 1,000° C., so as to cause the asbestos and sodium silicate to fuse and unite. The slabs or blocks may be made hollow and filled with mica or with organic substances, which last become charred during the subsequent heating.—A. G. L.

Artificial Stone. C. Reinke, Bredelar, Germany. Eng. Pat, 26,478, Dec. 3, 1903.

Four parts of Permian limestone are mixed with 1 part of cement and a small quantity of magnesium oxide; the whole is moistened with water and moulded as usual.
—A. G. L.

Waterproofing Bricks, Stone, and like Porous Materials. N. Farnham, New York. Eng. Pat. 27,928, Dec. 19, 1903.

See U.S. Pat. 748,595 of 1904; this J., 1904, 116.—T. F. B.

Colouring and Hardening Natural Stone; Process for ——, also applicable to Organic Materials, such as Ivory. H. H. Lake, London. From Chem. Techn. Fabr., Dr. A. R. W. Braud and Co., Charlottenburg, Germany. Eng. Pat. 5594, March 10, 1903.

The stone or other article to be coloured is freed from hygroscopic moisture at a gentle heat *in vacuo*; it is then placed in a vacuum chamber filled with the colouring liquid, and the vacuum is applied until the enclosed air is removed as much as possible from the stone or other material. After this, the liquid is allowed to act either under atmospheric or increased pressure. When completely impregnated, the material is suitably dried. For colouring purposes, coal-tar dyestuffs may be employed, dissolved in water or alcohol. Liquids, such as ammoniacal oxide of copper, which give a precipitate on heating, may also be used, or two liquids which react to form a coloured precipitate may be used successively; for example, lead acetate and potassium chromate. In the latter case, in order to avoid the immediate combination of the two interacting substances on contact, which would block up the pores of the substance and so retard penetration, solvents are chosen which dissolve only one of the ingredients. In the case given, the stone can be impregnated with potassium chromate dissolved in water, and then the water removed by means of the vacuum. The stone is then impregnated with an alcoholic solution of lead acetate and the alcohol removed. At this point there is no combination between the two bodies, but if water is forced in, it dissolves both of them, and they immediately interact to form chrome yellow throughout the whole mass of the stone. For hardening purposes a solution of soluble glass, potassium borate, or some similar body is employed.—A. B. S.

French Patents.

Wood Uninflammable; Process for Rendering ——. J. Wetter. Fr. Pat. 335,427, Sept. 21, 1903. Under Internat. Conv., Sept. 22, 1902.

See Eng. Pat. 20,592 of 1902; this J., 1903, 998.—T. F. B.

Kiln for Burning Cement, Lime, &c. N. Perpignani and E. Candlot. Fr. Pat. 335,377, Sept. 18, 1903.

The kiln is characterised by a chimney, the bottom of which is placed in the material to be burnt to a depth determining the zone of combustion. In the lower part of the kiln is placed a circular grating of vertical bars, through which air enters and becomes heated in its passage upwards through the burnt material. This grating is surrounded by masonry in which openings are made to allow the material to be raked.—A. G. L.

X.—METALLURGY.

Steel-Production; Continuous ——, in Fixed Siemens-Martin Furnaces. S. Surzycki. Stahl u. Eisen, 1904. **24**, 163—164.

Since September 1902, the author has worked a continuous process in fixed open-hearth furnaces at the works at Czenstochau, in Russian Poland, by the device of a double tap-hole, one of the twin holes being at a higher level than the other. The arrangement is sufficiently explained by the figures, of which the first represents a front elevation, the second a vertical section, and the third a plan. In a furnace holding in all, with a sufficiently deep hearth, 45—50 tons of melted metal, the higher tap-hole is so adjusted as to allow of tapping 25—30 tons, and the lower so as to empty the charge. In starting, cold scrap is put in, and when this is melted, the molten iron is poured in either direct from the blast-furnace or from a ladle. When agitation has ceased in the bath, the latter also remaining quite fluid, the necessary quantity of ore is added, and then more iron, till the capacity of the furnace is reached. The charge is dephosphorised by lime, and then tapped through the higher hole; during the flow, the requisite amounts of charcoal and of finely-divided ferromanganese are thrown into the ladle, and cause a violent reaction.

which, however, rapidly subsides, and the contents of the ladle are soon ready to be poured. It is stated that the blocks roll well, and give a steel of excellent quality in every respect. The tap-hole is plugged with well-burnt dolomite, the lining repaired where necessary, ore is added to the bath, and the charge of fluid iron added, during which a reaction evolving considerable heat raises the temperature of the furnace though the gas is shut off, and the process is correspondingly accelerated. In this manner the furnace works continuously for a week or two at a stretch; when the process must be interrupted, the furnace can be emptied through the lower tap-hole. The results, during a year, have been very satisfactory. A furnace which in the ordinary way gave per 24 hours, using 80 per cent. of pig, and 20 per cent. of scrap, 65—70 tons of steel, yielded during this continuous working, using 20—25 per cent. of ore and rolling-mill scale, 75—90 tons of steel. It is advantageous, in this continuous process, to have a capacious furnace, so that the quantity remaining continuously in the furnace is considerable in comparison to the amount discharged at each tapping. The process is based on the Talbot process; but an ordinary furnace can be adapted for it at a fraction of the cost of erecting a tilting furnace of the Talbot type.—J. T. D.

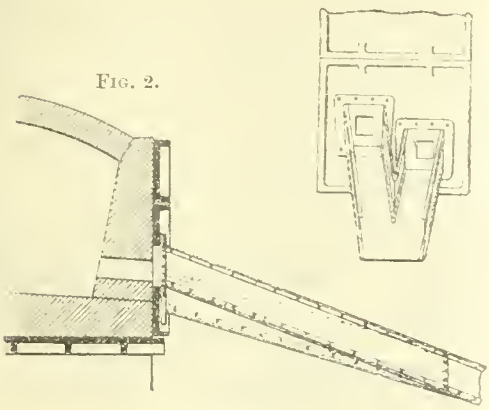


Fig. 1.

Fig. 2.

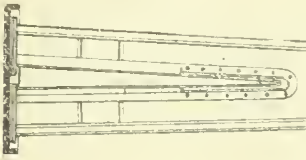


Fig. 3.

Iron and Steel Alloys. R. A. Hadfield. Iron and Steel Metall., 1904, 7, 3—21.

The author describes the properties of alloys of iron with manganese (this J., 1888, 211—212; 1895, 641), silicon (this J., 1889, 788—797), aluminium (this J., 1890, 1131—1133), chromium (this J., 1892, 910), nickel (this J., 1900, 150), tungsten (this J., 1903, 1050), cobalt, copper, titanium, molybdenum, and vanadium.

Alloys of Iron and Cobalt.—The effect of cobalt as an addition to iron is very similar to that of nickel.

Alloys of Iron and Copper.—The elastic limit of iron is raised considerably by the addition of a certain amount of copper, but considerable "red-shortness" is also caused.

Alloys of Iron and Titanium.—Titanium appears to act somewhat like aluminium in absorbing gases; small quantities cause an increase in the elastic limit, but amounts exceeding 0·3 per cent. have an injurious effect on the physical properties of the metal.

Alloys of Iron and Molybdenum.—Molybdenum acts in a somewhat similar manner to tungsten, "though a much lower percentage than of tungsten is necessary to produce the same effect."

Alloys of Iron and Vanadium.—The action of vanadium appears to be somewhat similar to that of chromium, though a smaller amount is required to produce a given effect. It has been claimed that vanadium greatly increases the elastic limit, but the author points out that a steel containing nickel and chromium can be produced having a higher elastic limit and tenacity and also comparatively higher elongation than iron-vanadium alloys have. (See also this J., 1900, 911; 1902, 411.)—A. S.

[*Coke-*] *Oven Gas and Tar as Fuels for the Open-Hearth Furnace.* D. Baker. Iron and Steel Metall., 1904, 7, 21—26.

An attempt to use coke-oven gas (from Otto-Hoffmann retort ovens) as sole fuel for open-hearth furnaces resulted in failure, but by using, in addition, a certain amount of coke-oven tar, delivered to the burner in the furnace through a steam-heated main, there was no difficulty in maintaining the desired temperature in the furnace. The tar also gave satisfactory results when used alone as fuel. For the production of 1 ton of steel, 17,127 cb. ft. of coke-oven gas (550 B.T.U. per cb. ft.) and 584·2 lb. of tar (15,781 B.T.U. per lb., "solid") were required, whilst, when producer-gas was employed, 1,076 lb. of coal (12,500 B.T.U. per lb.) were needed. In the furnace, 1 lb. of tar is equal to 12·52 cb. ft. of coke-oven gas, and 1,952 lb. are equal to 1,076 lb. of coal. The sulphur introduced into the process by the fuel (1,076 lb. of coal) amounted to "22·596 lb." when producer-gas was used, and 13·693 lb. when the fuel consisted of coke-oven gas and tar (17,127 cb. ft. gas and 584 lb. tar). If tar alone had been used, only 4·88 lb. of sulphur would have been introduced.—A. S.

Cyanide Process; Notes on the Limitations of the ——. H. T. Durant. J. Chem. and Min. Soc. of S. Africa, 1903, 4, 233—235.

Ores amenable to cyanide treatment are classed as: (1) those in which the gold is carried mainly in the mineralised portion of the ore, as in iron-, copper-, and arsenical pyrites, &c., and (2) those in which the gold is carried free in quartz or other gangue. In the case of the second class of ores, the value of gold extracted depends on the fineness of the crushing, whether the amalgamation or the cyaniding process is used; but ores vary in respect of the coarseness or otherwise of the gold in them, and the procedure needs to be adjusted to each case. An instance is given in which fine crushing of the whole ore followed by amalgamation yielded exactly the same results, as regards recovery of gold, as coarser crushing with amalgamation followed by cyanide treatment for the sands.—E. S.

Smelting and Cupellation; Notes on ——. F. L. Piddington. J. Chem. and Min. Soc. of S. Africa, 1903, 4, 232—233.

The notes relate to the methods generally used in treating small parcels of rich material, such as cyanide precipitates, sweepings, and drosses. A simple smelting is effected with litharge and a reducing agent in a reverberatory furnace. If a removable hearth is used, it may be in the form of a large cupel. When the smelting is finished, the slag is skimmed, the blast turned on, and the bullion concentrated up to about 50 per cent. of precious metals, when it is transferred to a smaller refining cupel. For the avoidance of absorption, it is recommended to enclose the bottom and sides of the hearth in a water-jacketed pan. A cupel may be cooled by an embedded water pipe or by an enclosing jacket. The test frame is mounted on jack-screws, and a water-cooled breast of a casting of iron, gunmetal, or preferably of copper, is used. For the test filling, any one of the four following mixtures may be used:—

	Parts by Volume.			
Limestone	7	4	8	4
Cement	2	1	1	1
Fireclay	1	1	1	1
Magnesite	..	4	..	2

When much zinc is present in the ore, roasted pyrites concentrates are stated to be a good flux, any valuable metals present in them being thus recovered. In the cupellation of zincy bullion, a purple fume, containing both gold and silver, condenses on the outside of the cupel, particularly on the door. "The amount lost in this way depends very largely on the care taken to keep the bath well covered with litharge."—E. S.

Metals; Decay of ——. J. T. Milton and W. J. Larke. Proc. Inst. Civil Eng., 1903, **154**.

THE examples of deterioration considered were (1) the pitting of tubes of marine surface-condensors; (2) the decay of brass or yellow metal bolts in composite vessels; (3) the decay of brazing metal in copper steam pipes; (4) the deterioration (other than oxidation) of cast-iron parts in frequent or constant contact with sea-water; (5) the decay of propellers made of certain bronzes when fitted to copper-bottomed vessels. The action seems to be erratic and often extensive before ordinary examination will reveal it. Chemical analysis shows that a change of composition has taken place, but does not explain why, but microscopic examination shows that the chemical constituents have been unequally affected, owing in many cases to the setting up of local galvanic currents. Certain illustrative experiments and observations, and particulars of methods employed, are detailed in two appendices. The authors summarise their conclusions as follows:—(1) "Decay" is more frequent in the metals which have the more complex structure; (2) is due to a slower or less energetic action than "corrosion," and, moreover, requires an action which removes part only of the constituents; (3) both "decay" and "corrosion" may result from chemical action alone, or from chemical and electrolytic action combined; (4) "pitting," or intense local corrosion, is probably often due to local segregation of impurities in the metal; but it may also in some places be due to favourable conditions furnished by local irregularities of surface or structure producing local irregularities in the distribution of galvanic currents; (5) in brass exposed to sea-water, the presence of tin is distinctly preservative, while lead and iron are both injurious, rendering the alloy more readily corrodible; (6) the internal surfaces of condenser tubes should be as smooth and uniform as possible; (7) the experiments with an applied electric current show that electrolytic action alone, even where exceedingly minute currents are employed, may result in severe corrosion or decay.—J. H. C.

Gold in Cyanide Solution; Colorimetric Method for the Determination of ——. A. Prister. XXIII., page 207.

Nickel Carbonyl; Chemical Reactions of ——. *Part I. Reactions with the Halogens and other Inorganic Substances.* J. Dewar and H. O. Jones. Proc. Chem. Soc., 1904, **19**, 5.

THE previous study of the physical properties of nickel carbonyl (this J., 1903, 626) showed that it was a comparatively stable substance when heated under pressure. Nickel carbonyl is completely decomposed by solutions of chlorine, bromine, iodine, cyanogen, and sulphur in organic solvents, carbon monoxide and a nickel compound being produced; in no case was any combination of the carbon monoxide with the halogen or other reagent observed, even when a considerable excess of the latter was present. Liquid chlorine and bromine decompose solid nickel carbonyl, but solid iodine appears to have no action on liquid nickel carbonyl. Iodine mono- and trichlorides and cyanogen iodide in carbon tetrachloride solution react with nickel carbonyl in two distinct stages, the free iodine liberated at first subsequently decomposing a further quantity of nickel carbonyl. Hydrogen iodide readily interacts with nickel carbonyl, whereas the corresponding bromide and chloride do not affect it. Hydrogen sulphide reacts very slowly with nickel carbonyl, producing nickel monosulphide, hydrogen, and carbon monoxide. Sulphuric acid also decomposes the compound slowly, giving rise to nickel sulphate, hydrogen, and carbon monoxide.

ENGLISH PATENTS.

Manganese Steel; Toughening ——. R. A. Hadfield, Sheffield. Eng. Pat. 4981, March 3, 1903.

THE manganese steel, after being heated to from 940° to 1125° C., is allowed to cool down to about 800° C., and is then again heated to the proper toughening point, after which it is quenched in cold water. The supplementary cooling and reheating operations may in some cases be repeated before the final quenching. Reference is made to Eng. Pats. 11,833 of 1896 and 5604 of 1902; this J., 1897, 544, and 1903, 870, respectively.—E. S.

Case-hardening Iron and Steel; Processes for ——. G. C. Marks, London. From C. Lamargese, Rome. Eng. Pat. 5597, March 10, 1903.

SEE Fr. Pat. 333,076 of 1903; this J., 1903, 1297.—T. F. B.

Reducing Iron Ore to Iron Sponge, and Furnaces therefor. G. Gröndal, Djursholm, Sweden. Eng. Pat. 6283, March 18, 1903.

SEE Fr. Pat. 330,763 of 1903; this J., 1903, 1091.—T. F. B.

Gold from Sea Water; Process and Apparatus for the Extraction of ——. W. L. Peet, Portsmouth. Eng. Pat. 3470, Feb. 13, 1903.

SEA water is raised to an elevated tank, whence it passes by gravity through a pipe reaching to the bottom of a vertical vessel, wider at the top than at the bottom, containing mercury. A series of such mercury-charged tanks is used, and in each there are "one or more perforated plates for the purpose of dividing the bulk of the sea water into a number of small divisions or currents." A chamois leather or other strainer may be placed at the top of each tank to prevent loss of mercury during the process.—E. S.

Copper; Process for the Extraction of ——, *from its Sulphuretted Ores.* G. Gin, Paris. Eng. Pat. 2036, Jan. 28, 1903.

SEE Fr. Pat. 328,801 of 1903; this J., 1903, 1002.—T. F. B.

UNITED STATES PATENTS.

Ores; Process of Lixiviating ——. P. Naef, New York, N.Y. U.S. Pat. 749,700, Jan. 12, 1904.

THE powdered ore is passed in thinly-divided layers downwards in a zigzag path through an ascending stream of leaching solution, whilst a current of air or gas is passed repeatedly through the ore layers in "numerously divided" jets, the ore particles being thus agitated in the solution, and the same volume of gas acting successively as an agitating medium. Compare U.S. Pat. 700,972 of 1902; this J., 1902, 916.—E. S.

Metallurgical Furnace. W. S. Dempsey, New York, N.Y. U.S. Pat. 750,022, Jan. 19, 1904.

IN a horizontal furnace, the combustion chamber opens into the working chamber, and in the former, blasts are arranged above the grate to drive the gases generated towards the working chamber, whilst other blasts below the grate are directed angularly in an opposite direction. Within the working chamber cross blasts are directed from opposite sides, and backward from near the end towards the combustion chamber. Air-supply heating coils are interposed between the sources of supply and the various blast pipes, &c.—E. S.

Zinc Blende; Process of Separating —— *from Ores.* W. Jamieson and F. J. Odling, Melbourne, Australia. U.S. Pat. 750,034, Jan. 19, 1904.

ORES containing zinc blende are powdered, moistened with water, and treated with chlorine so as to act superficially on the particles of blende. The ore is then vanned with the aid of appropriate apparatus, until the attacked blende particles adhere together in groups, and admit of separation from the rest of the ore and gangue by suitable mechanical means.—E. S.

French Patents.

Steel for Springs of all Kinds. Soc. Anon. Fried. Krupp, Akt.-Ges. Fr. Pat. 335,405, Sept. 17, 1903.

See Eng. Pat. 3822 of 1903; this J., 1903, 1246.—T. F. B.

Steel or Iron; Manufacture of ——. B. Talbot. Fr. Pat. 335,698, Sept. 29, 1903. Under Internat. Conv., Nov. 5, 1902.

See U.S. Pat. 747,662 of 1903; this J., 1904, 66.—T. F. B.

Zinc [Soft]; Manufacture of ——. L. Gührs, Veuve. Second Addition, dated Aug. 31, 1903, to Fr. Pat. 332,657, of May 30, 1903. (See this J., 1903, 1247.)

The alloy intended to be added to zinc for the improvement of the latter, is obtained by melting together zinc with aluminium; or the zinc is added to the melted aluminium, and (in either case) the viscosity of the molten mass is destroyed by the addition of tin. The zinc melted with this alloy is stated to give better adherence in coating iron plates with zinc, besides possessing other advantages. —E. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Ozone; Production of ——, by the Silent Electric Discharge in the Siemens Ozoniser. A. W. Gray. Sitzungsber. Kgl. pr. Akad. Wiss., Berlin, 1903, 1016—1020. Chem. Centr., 1904, **1**, 9.

In the Siemens apparatus the yield of ozone per coulomb appears to attain an almost constant value, which is independent of the difference of potential between the electrodes of the generator, and probably also of the quantity of electricity passed; in the apparatus used by the author, this constant value was 0·27 grm. Apparently, therefore, for a given consumption of energy the best yield of ozone will be obtained when the difference of potential between the electrodes is only just sufficient to cause the luminous discharge in the gas passed through the apparatus.—A. S.

Ozonising of Oxygen by the Silent Electric Discharge. E. Warburg. Sitzungsber. Kgl. pr. Akad. Wiss., Berlin, 1903, 1011—1015. Chem. Centr., 1904, **1**, 9.

The author's experiments were made with a view to determine the physical conditions which influence the amount of ozone produced by the electric discharge from a point electrode. Commercial 93 per cent. oxygen was led by an electrode maintained at a constant potential, which varied in different experiments from 4,000 to 12,000 volts. When the potential of the electrode was negative, the amount of ozone produced per coulomb was influenced only by the strength of the current, in that with increase of the latter the yield of ozone per coulomb slowly decreased. The actual figures were 0·0431 grm. at 29×10^{-6} ampère and 0·0370 grm. at 94×10^{-6} ampère. When the potential of the electrode was positive, the yield of ozone per coulomb increased rapidly with the strength of the current, and was smaller with weak currents, but greater with strong currents, than when the potential was negative (at 29×10^{-6} ampère, 0·02 grm., and at 94×10^{-6} ampère, 0·06 grm.). By the discharge between dielectric surfaces the yield of ozone per coulomb was from four to five and a half times greater than by the discharge from point electrodes.—A. S.

Chloric Acid and Chlorates; Electrolysis of ——. A. Brochet. Comptes rend., 1904, **138**, 200—203.

The author confirms the conclusions of Bancroft and of Burrows, that when barium, sodium, or cupric chlorate is electrolysed with a copper anode, more copper is dissolved than corresponds with the current which passes. This is because the copper dissolves partly in the cuprous condition. No cuprous compounds are found in solution, because they are converted into cupric compounds by the chlorate, which is partly reduced to chloride. The quantity of cuprous ions dissolved, depends on the physical conditions and on the nature of the electrolyte, so that the amount of copper dissolved from the anode may be anything from one to two times that deposited in a voltameter in the circuit. The conversion of the cuprous compounds involves the formation of cupric chloride and hydroxide. The latter is dissolved in an acid solution; but in a solution of cupric chlorate it forms basic salts. With sodium or barium chlorate, these basic salts are decomposed by the hydroxide formed at the cathode, and the precipitate contains cupric chloride and chlorate, which consume some of the cathodic hydrogen; there is consequently but little copper in the cathodic deposit, while, when the electrolyte, sodium sulphate, for example, gives no reducible compounds, the cathode deposit consists almost entirely of copper.—J. T. D.

Potassium Chlorate; Electrolytic Reduction of ——. G. H. Burrows. J. of Phys. Chem., **7**, 537—538. Chem. Centr., 1904, **1**, 74.

In a previous communication (this J., 1903, 33) the author overlooked the fact that the oxides of nitrogen present in nitric acid reduce potassium chlorate to chloride. By taking this fact into account the maximum apparent current-yield falls from 200 to 160 per cent. Brochet (this J., 1903, 215) has stated that no true electrolytic reduction of potassium chlorate occurs, and that the high yield is due to a purely chemical reaction between potassium chlorate and metallic copper. This reaction could cause an apparent yield of 600 per cent., but is balanced to a certain extent by a re-formation of potassium chlorate by the action of caustic potash, formed at the cathode, on copper chlorate. If Brochet's view were correct, an apparent yield of 600 per cent. should result if the caustic potash formed at the cathode were separated from the anode products; this, however, is not the case. Experiments with platinum anodes showed that a direct electrolytic reduction of potassium chlorate can be effected, and the probable explanation of the high yield lies in the fact, proved by Gladstone and Tribe, that the potassium chlorate is reduced by hydrogen occluded by the copper.—A. S.

Periodic Acid and Periodates; Electrolytic Production of ——. E. Müller. Zeits. f. Elektrochem., 1904, **10**, 49—68.

Iodates can be almost quantitatively oxidised to periodates by the following method:—Normal caustic potash solution, to which a little potassium chromate has been added, is saturated with potassium iodate and electrolysed with smooth platinum electrodes at an anodic current-density of 0·05 ampère per sq. cm. The current-efficiency increases in the course of electrolysis, the more so the higher the density; high temperatures depress it somewhat. In neutral or acid solutions hardly any periodic acid is formed, but it is remarkable that an addition of sulphate enables the oxidation to take place in neutral solutions. In acid solutions the use of lead peroxide anodes brings the current-efficiency to near 100 per cent.; this appears to be due to the fact that lead peroxide has the purely chemical property of oxidising iodic to periodic acid.—W. A. C.

Lead Dioxide; Electro-deposition of ——, in Quantitative Analysis. A. Hollard. XXIII., page 207.

English Patents.

Batteries; Storage ——. W. Fennell and W. P. Perry, both of Leytonstone. Eng. Pat. 6145, March 17, 1903.

The active material, in the form of a paste, is mixed with a hard, rough, porous substance, such as powdered or granulated pumice, earthenware, porcelain, or the like, or the latter substances may be used in the form of tubes, spheres, rods, honeycomb, or network. The plates may thus be packed closely together, and in block-like form, and holes or passages are made in the blocks in the direction of the path of the current, so as to reduce the internal resistance, the holes being lined with porous or perforated material so as to hold a surplus of electrolyte. A second form is described in which a network honeycombed support is used, on which is spread a film of active material. Granules of conducting substance, such as metallic balls or the like, are rolled in active material, and then filled into the containing vessel, grid, or support, while the layer of active material is still soft, thus ensuring good contact. The honeycomb support may be made in one piece by mixing the clay with pellets or rods of wax, charcoal, and the like, and then burning away these substances so as to leave interstices, into which, after damping, active material may be blown so as to form a layer. The thickness of the latter may be increased by plating with metal, or by depositing litharge from a warm alkaline solution. In both forms a conductor is embedded in the mass, and coated with a dense layer of active material, which serves to protect the conductor and also to make good contact with the bulk of active material.—B. N.

Batteries; Secondary ——. G. Rosset, Paris. Eng. Pat. 23,482, Oct. 29, 1903. Under Internat. Conv., Nov. 24, 1902.

The active material consists of a paste made from oxide of lead and dilute sulphuric acid, the latter containing acetic acid, or an acetate, or compounds capable of producing acetic acid, such as ordinary alcohol. Finely-divided lead, obtained by the electrolysis of lead acetate, using lead electrodes, may be employed instead of lead oxide. The precipitated lead is scraped off the electrodes, and washed with water in such a manner as to leave a little acetate in the pores of the metal. After drying, the metal is oxidised, pulverised, sifted, mixed with dilute sulphuric acid, and filled into grids or supports made from a lead-antimony alloy, the support being coated electrically with metallic antimony. The plates may be formed in a 2 to 3 per cent. solution of an alkali sulphate, bisulphate, persulphate, or pyrosulphate, rendered ammoniacal, and with 1 to 2 per cent. of acetic acid or of an alkali acetate added.—B. N.

Reducing Elements which are Reduced and Volatilised at nearly the same Temperature; Method of ——. F. J. Tone, Niagara Falls. Eng. Pat. 23,964, Nov. 4, 1903.

See U.S. Pat. 745,122 of 1903; this J., 1903, 1356.—T. F. B.

United States Patents.

Carbon Articles; Method of Making ——. E. G. Acheson, Niagara Falls. U.S. Pat. 749,118, Jan. 12, 1904.

The carbon articles are embedded in material, the specific resistance of the entire volume of which is greater than that of an equal volume of the completed carbon articles, the latter being arranged in separate piles with their longest dimensions in the same general direction, and so that the current of electricity traverses the mass in a direction approximately at right angles to the longest dimensions of the articles. The heat, produced within the mass of the resistance material, "polymerises the carbon articles without graphitising them." The piles may be separated by a mass of granular coke, the latter being thus purified.—B. N.

Furnace; Electric ——. Le Roy W. Stevens and B. Timmerman, Chicago, Assignors to Advance Furnace Co., New York. U.S. Pat. 749,460, Jan. 12, 1904.

The material for making carbide or like substances was fed from a hopper into a vertical main flue, in which was maintained a flame zone, so that the falling material received a preliminary heating. Near the bottom of the main flue was fixed a baffle plate, which directed the falling material to one side of the flue, and immediately under the plate was a side flue for withdrawing the resulting gases, and for maintaining a down-draught in the main flue. The heated material was fed into an electric furnace provided with one vertical and one horizontal electrode, the latter forming the floor of the chamber, a suitable arrangement being provided for withdrawing the carbide; the furnace may be removable, and may be made with an open top provided with a cover carrying the vertical electrode. The upper portion of the furnace is connected by a gas flue to the upper part of the main flue, the down-draught in the latter drawing off the gases formed in the furnace, and these gases are ignited by suitable means, one or more burners being provided for directing the flame into the main flue.—B. N.

Furnace [*Carbide, &c.*]; *Electric* ——. Le Roy W. Stevens and B. Timmerman, Chicago, Assignors to Advance Furnace Co., New York. U.S. Pat. 749,461, Jan. 12, 1904.

The apparatus is the same as that described in the preceding patent. The material is first fed into the main flue, so as to form by its accumulation, a baffle in the lower portion, and is afterwards supplied in a relatively small stream. From the lower portion of the main flue it is fed into the furnace by means of a pusher, at a speed and in quantities equal to the discharge of carbide, the pusher being arranged so as to form a valve in the main flue. —B. N.

Furnace: Electric ——. Le Roy W. Stevens and B. Timmerman, Chicago, Assignors to Advance Furnace Co., New York. U.S. Pat. 749,462, Jan. 12, 1904.

The apparatus is similar to the one described in the two preceding patents. The main flue is provided with a safety-valve, and is made to discharge into one or more electric furnaces, the rate of supply of the material to the main flue being equal to the combined discharges into the furnaces. The gases produced in the formation of carbide are conducted from one or all of the furnaces to the main flue. The material is stored at the bottom of the main flue in an enlarged portion, surrounded by a casing through which the gases are exhausted, so as to maintain the material in its heated condition preliminary to its discharge into one or other of the furnaces, the exhaust flue being fixed above the casing surrounding the heated material.—B. N.

Furnace [*Carbide*]; *Electric-Resistance* ——. A. H. Cowles, Cleveland, Ohio. U.S. Pat. 750,093, Jan. 19, 1904.

A resistance-conductor, of varying cross-section and made of loose, broken, or granular material, is in proximity to the charge of carbide-forming materials, so as to heat the charge, and means are provided for passing through the conductor an electric current, the density of which increases, inversely as the cross-section of the conductor. The heat generated by the resistance of the conductor gradually increases to a point at which the materials react to form and melt the carbide, and the latter is withdrawn by gravity in a molten condition at a point adjacent to the region of maximum current density.—B. N.

Smelting Materials [*Carbide Production, &c.*] *and Producing Carbide: Process of* ——. A. H. Cowles, Cleveland, Ohio. U.S. Pat. 750,094, Jan. 19, 1904.

The charge of lime and carbon is heated, preliminary to the formation of carbide, by passing hot gases through it, whereby its electrical conductivity is increased, the gases formed in the production of the carbide (see previous abstract, U.S. Pat. 750,093) being burnt for the purpose of preheating the charge.—B. N.

Heating Materials; Process of Electrically ——. A. H. Cowles, Cleveland, Ohio. U.S. Pat. 750,095, Jan. 19, 1904.

The process of heating materials as described in U.S. Pats. 750,093 and 750,094 (see preceding abstracts) is claimed, and, in addition, the process of reducing a compound by placing a mixture of a compound and a reducing agent in proximity to a resistance-conductor, which is heated in a non-uniform manner, an electric current of sufficient volume being passed to effect reduction. Fresh materials are supplied as required.—B. N.

Chemical Changes [*Carbide Production*]; *Process of Effecting* ——. A. H. Cowles, Cleveland, Ohio. U.S. Pat. 750,096, Jan. 19, 1904.

This invention consists of a process for producing carbide, the terminals of a source of electric current being placed in contact with different parts of a body of carbide-forming materials, such as a calcium compound and carbon. An electric current is passed between the terminals, so as to cause the lines of current-flow to converge from one terminal or set of terminals to the other, and thereby increase the energy and current density along the path of the current (see preceding abstracts, U.S. Pats. 750,093–5). The body of carbide-forming materials may be used as the resistance-conductor in the electric circuit, and the charge is moved along the path of current-flow.—B. N.

Heating [Calcium Carbide]; Method of Electric ——. A. H. Cowles, Cleveland, Ohio. U.S. Pat. 750,170, Jan. 19, 1904.

This invention consists of a process for making calcium carbide, the method being similar in principle to those described in preceding abstracts (U.S. Pats. 750,093–6). The electric current is passed through a pool of conductive material, such as calcium carbide, in which is maintained a region of maximum energy and current density. A suitable charge, as, for instance, a calcium compound mixed with carbon, is fed into contact with the pool, and the product, calcium carbide, is withdrawn from the region of maximum energy and current density.—B. N.

Furnace [Carbide, &c.]; Electric ——. A. H. Cowles, Cleveland, Ohio. U.S. Pat. 750,171, Jan. 19, 1904.

This invention consists of a modification of the furnace described in U.S Pat. 750,093 (see above). The furnace is provided with a hearth, which may be an inclined one, an annular one, an annular one with converging sides, or with downwardly-converging sides, and the hearth is arranged to support a body of conductive material, such as carbide or carbide-forming materials, an electric current being passed through the latter by means of a number of electrodes. A tap-hole extends through the hearth at or near the lower end of the furnace, and adjacent to the region of maximum current density, for withdrawing the product by gravity.—B. N.

Furnace; Electric ——. R. C. Contardo, Sèvres, France. U.S. Pat. 750,753, Jan. 26, 1904.

The hearth of the furnace is depressed on all sides towards the centre, above which are arranged the electrodes. Above the hearth is an arch, formed of two inclined plates placed in a symmetrical manner, and sloping downwards from the point of junction above the centre to the outer edges of the inclined hearth. The side walls are parallel to these plates, and thus form, with the latter, two inclined feed flues, which unite above to form a vertical charging shaft. The latter has a suitable arrangement for opening and closing, and is also provided with an outlet near to the top, through which the escaping gas may be aspirated.—B. N.

French Patents.

Insulated Electric Conductors; Impts. in ——, and in their Mode of Manufacture. J. A. Heany, United States. Fr. Pat. 335,612, Sept. 29, 1903.

The metallic wire passes through a bath of adhesive material, such as glue, and, whilst turning on its axis, it then passes over a belt carrying asbestos, and is thus covered with a layer of that substance. The covered wire passes through compression rollers, and finally through a mixture of 4 parts of glue and 1 part of the following :—6 parts of clay, such as kaolin, 4 parts of calcium sulphate, 2 parts of alumina, $1\frac{1}{2}$ parts of aluminium sulphate, and $\frac{1}{16}$ part of boric acid. The excess of this material is removed by compression rollers. It is claimed that the covering, when dry, resists fire, and is impermeable to water.—B. N.

Gaseous Reactions; Process for Facilitating Electro-Chemical ——. W. Ostwald. Fr. Pat. 328,157, Nov. 27, 1902.

Better yields are obtained when mixtures of nitrogen and hydrogen, or nitrogen and oxygen, are sparked for the production of ammonia or nitrogen peroxide, or when the electric discharge is passed through oxygen for the production of ozone, if more than 1·5 per cent., preferably 10 per cent.. of argon, or one of the gases of the argon type (argon, helium, neon, metargon, krypton, and xenon), is previously mixed with the gases.—B. N.

Gaseous Mixtures; Process for the Production of Intense Chemical Reactions in ——. S. Eyde and K. Birkeland. Fr. Pat. 335,692, Sept. 18, 1903.

The gases are subjected to the action of a luminous arc, extended in the form of a disc. The latter is obtained by producing the arc between electrodes in a powerful magnetic field, the disc being perpendicular to the lines of force. A vibratory movement is given to the electrodes, so as to produce a rapid series of pulsations of current; and, with a current of high tension, the electrodes are so fixed that a slight longitudinal and slow movement is imparted to them. A number of such luminous discs are produced between the poles of a powerful electro-magnet, and the air or gas to be treated is passed upwards and downwards alternately over the discs. The process is carried out in a furnace consisting of a narrow chamber formed of two walls of insulating and refractory material, the electrodes penetrating to the centre of the chamber and parallel to the two walls. The poles of a U-shaped electro-magnet are disposed one on each side of the furnace. The electrodes are made hollow for passing the air or gas to be treated, or for the circulation of water or oil for cooling. In the middle of the furnace, where the heat is most intense, there is fitted into each wall a safety plate, formed as a grill with bars of iron separated by sheets of mica, the edges of the latter projecting from the furnace. The interior walls are made of iron or other metal, with an internal lining of mica. With a current of high tension, several similar furnaces are disposed in series, each furnace being connected, in parallel, with a condenser; or the series of furnaces may be preceded by a single condenser of very high capacity.—B. N.

Oxides of Nitrogen; Electric Production of ——. Siemens and Halske Actien-Ges. Fr. Pat. 335,153, Sept. 21, 1903.

A mixture of nitrogen and oxygen in the proper proportions is circulated, under a pressure of 5 to 10 atmospheres, first through an apparatus containing an electric arc and then through a cooling or absorption apparatus. The residual gas is repeatedly circulated through the arc and cooling apparatus instead of allowing it to escape into the outer air. The circulation may be established automatically by the heating effect of the arc and the cooling effect of the refrigerator, or by means of a fan. Oxygen and nitrogen are introduced, under convenient pressure, by means of a junction pipe connected to a vessel containing these gases in the correct proportions, according to the consumption of nitrogen and oxygen within the apparatus.—B. N.

Air or Oxygen strongly Ozonised; Apparatus for the Production of ——. A. Déchaux. Fr. Pat. 335,092, Sept. 8, 1903.

The ozonising tubes consist each of a pair of metallic tubes, hexagonal in cross section, separated from one another by a cylindrical glass or porcelain tube, forming between the inner and outer tube a series of alternately angular and segmental spaces. The metal tubes are connected, through certain intermediate apparatus, one to each pole of a source of electricity. These ozonisers are packed within a rectangular box, having a space on one side for admission of air, and on the other side a chamber for reception of the ozonised air. Below the box is a bath containing a liquid at low temperature, and above it is a reservoir, perforated in certain parts, into which the liquid is pumped. The air to be ozonised is passed successively through sulphuric acid and caustic alkali, and then through a great number of very small tubes immersed in the cold liquid contained in the elevated reservoir. The cooled air is then conducted to the entrance chamber to the battery of ozonisers, themselves suitably cooled by a circulation of cold liquid. At suitable intervals, the battery of ozonisers and certain other parts of the apparatus are cooled externally.
—E. S.

Alkali Chlorides; Process and Apparatus for the Electrolysis of the ——. C. Kellner. Fr. Pat. 335,633, Sept. 29, 1903.

See Eng. Pat. 20,889 of 1903; this J., 1904, 24.—T. F. B.

Water; Apparatus for Purifying —— by Electrolysis. W. B. Hardy. Fr. Pat. 328,155, Nov. 26, 1902.

See Eng. Pat. 25,041 of 1902; this J., 1904, 67.—T. F. B.

(*B.*)—ELECTRO-METALLURGY.

Silver-Plating; Current Efficiency in ——. W. Pfanhauser. Zeits. f. Elektrochem., 1904, **10**, 68—70.

In examination of the results of Langbein (this J., 1904, 25), the author made, by the aid of a copper voltameter, measurements with the cyanide bath used commercially for heavy deposits. At a density of 0·3 ampère per sq. dcm. the values 99·99 and 99·96 per cent. were found, at 0·2 ampère per sq. dcm., 99·72 per cent. With a cathode kept moving up and down, efficiencies of 99·3—98·4 were obtained. The author shows by experiment that this is due to the re-solution of exposed parts of the cathode through oxidation, and that when this is quantitatively allowed for, the corrected current efficiencies are not less than 99·56 per cent.—W. A. C.

English Patent.

Metals from Ores and the like; Electrolytic Process for the Direct Extraction of ——, and for the Precipitation of the Metals from the Solutions, and Apparatus therefor. Meckwart, Coltri, et Cie., Milan. Eng. Pat. 2574, Feb. 3, 1903. Under Internat. Conv., Aug. 1, 1902.

See Fr. Pat. 328,850 of 1903; this J., 1903, 1004.—T. F. B.

United States Patents.

Metals, Precious; Extracting ——, by Electrolysis. H. R. Cassel, New York. U.S. Pat. 749,843, Jan. 19, 1904.

This invention constitutes a step in the process, and consists in simultaneously lifting the pulp and mercury by an air jet, distributing and circulating the pulp between vertical electrodes, and at the same time amalgamating the cathodes. This is accomplished by successively deflecting the rebounding mercury back upon or towards the cathode, and diverting the pulp towards the anode. The coarse amalgam is collected, purified, and neutralised by treatment with acid, and the mercury returned to the cathode.—B. N.

Metals, Precious; Apparatus for Extracting ——, by Electrolysis. H. R. Cassel, New York. U.S. Pat. 749,844, Jan. 19, 1904.

This invention refers to the apparatus for carrying out the process described in the previous abstract (U.S. Pat. 749,843). A tank, with an inclined bottom, is provided with enclosed vertical electrodes, with surrounding guards, the cathodes being flanked with a series of mercury deflectors, the latter being inclined towards the cathodes from top to bottom, and approaching the same at their lower ends. Pulp-guards project from the deflectors, and serve to divert the pulp towards the anodes, an elevated pulp box communicating with distributing launders above each anode. An elevated mercury pot communicates with a perforated movable mercury trough extending over the cathodes, and a reciprocating movement is imparted to the trough. The latter communicates with an enclosed filter and an acid box provided with transverse open partitions, the mercury being admitted at one end and discharged by suitable means at the other end. A jet of air returns the pulp and mercury from the inclined bottom of the tank to the pulp box and mercury pot, and means are provided for circulating the mercury and for separating it from the cathode.—B. N.

Iron or Steel; Electro-metallurgy of ——. H. Harmet, St. Etienne, France. U.S. Pat. 750,361, Jan. 26, 1904.

The ore, mixed with an excess of reducing carbon, is charged into the upper portion of an electric blast-furnace, the base of the latter being heated by means of electrodes, so as to form a fusion zone or crucible. The gas, escaping near the top of the furnace, is conveyed to and forced through the fusion zone adjacent to the electrodes, and the heat is thereby diffused, the zone extended, and the gas converted into carbon monoxide. The latter is forced by pressure through the charge, and thus forms a reducing zone above the fusion zone.—B. N.

French Patent.

Alkaline Earth Metals, especially Calcium; Electrolytic Process for Obtaining ——. Elektro-Chem. Werke, G. m. b. H. Fr. Pat. 335,568, Sept. 26, 1903.

See Eng. Pat. 20,655 of 1903; this J., 1903, 1299.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Sesamé Seed; Substances which Accompany the Oil in ——. F. Canzoneri and F. Perciabosco. Gaz. chim. ital., 1903, **33**, [2], 253—260. Chem. Centr., 1904, **1**, 45. (See this J., 1897, 1045.)

Sesamé seeds were extracted for 7—8 days with boiling 93 per cent. alcohol, the greater part of the alcohol was evaporated from the solution, and the residue repeatedly extracted with ether and light petroleum spirit. The greater portion of the sesamin remains in the alcoholic residue, whilst the light petroleum extract contains the higher alcohol discovered by Villavecchia and Fabris (*loc. cit.*), and a new substance, X. This latter substance, which readily changes to a rubber-like mass, is accompanied by a small quantity of a yellow oil of strong aromatic odour, which is volatile with steam, and is probably a decomposition product of X. The compound X forms broad tablets; it contains 66·62 per cent. of carbon, and 5·89 per cent. of hydrogen; it melts at 91°—92° C., and is soluble in alcohol, ether, and chloroform. When X is treated with hydrochloric acid, two new compounds are obtained: (*a*) a red oil which is readily soluble in alcohol and ether, insoluble in light petroleum spirit, gives a strong reaction with furfural, and immediately reduces ammoniacal silver nitrate solution; and (*b*) a resinous mass which does not give the furfural reaction. On exposure to the air, the red oil is converted into a product which crystallises from alcohol in leaflets, melts at 185°—186° C., and does not give the furfural reaction. The authors state that the higher alcohol discovered by Villavecchia and Fabris has the composition $C_{26}H_{44}O + \frac{1}{2}H_2O$. If the red solution obtained by treating a mixture of sesamé oil and hydrochloric acid of sp. gr. 1·18 with furfural, be shaken for 2—3 minutes with 3 vols. of ether, the red colour disappears. The abnormal behaviour of old sesamé oils when tested by means of Baudouin's reaction is due to the fact that the compound X, which is probably the cause of the red coloration, when heated with hydrochloric acid, imparts a green coloration to the latter; this green coloration is also produced when alcoholic solutions of the red oil or of the other oxidation products of X are treated with hydrochloric acid.—A. S.

Butter Fat; Interdependence of the Physical and Chemical Criteria in the Analysis of ——. T. E. Thorpe. Proc. Chem. Soc., 1904, **19**, 12.

In the course of an investigation of the chemical nature of butter produced within the British Isles, which was instituted by the Board of Agriculture for the information of a Departmental Committee, observation has shown that the chemical nature of butter fat is dependent, to a certain extent, on the climatic influences to which the cows are exposed, on the nature and amount of the food supplied, and on the breed, period of lactation, and idiosyncrasy of the individual cow.

Linseed Oil; Determination of Unsaponifiable Matter in ——. C. Niegemann. XXIII., page 207.

English Patents.

Fatty Acids of the Oleic Series and Derivatives thereof; Process for Converting ——, into Lactones. A. A. Shukoff, St. Petersburg. Eng. Pat. 1570, Jan. 22, 1903.

See Fr. Pat. 328,604 of 1903; this J., 1903, 1006.—T. F. B.

Soaps, Medicated, or Ointments; Production of Readily Resorbent ——. R. Reiss, Charlottenburg, Germany. Eng. Pat. 24,240, Nov. 9, 1903.

A melted mixture of fatty acids and hydrocarbons is treated with a ley of fixed alkali in insufficient quantity for saturation, and the resulting soap base heated to expel water, and incorporated with the required medicated substance. The removal of the water is stated to prevent the gradual decomposition that occurs in ordinary medicated soaps.—C. A. M.

United States Patents.

Fatty Substance; Process of Making ——. O. Liebreich. Berlin. U.S. Pat. 746,638, Dec. 8, 1903.

See Ger. Pat. 136.917 of 1900; this J., 1903, 149.—C. A. M.

Oils; Process of Treating ——. F. B. Pope, Augusta, Ga., U.S.A. Assignor to M. Swenson, Chicago, and L. L. Fleming, New York, U.S.A. U.S. Pat. 749,322, Jan. 12, 1904.

The oil is heated to a high temperature as it leaves the press, and passed, whilst hot, through a filter bed and refining apparatus, where the free acid is neutralised and separated. The process is carried out continuously.

—C. A. M.

Oil; Process of Refining ——. J. C. Fleming, New York. U.S. Pat. 749,925, Jan. 19, 1904.

"Oil" is agitated with a solution of borax, and carbon dioxide is blown through the mixture, which is then "subjected to a sucking and forcing action, whereby it is atomised." The mixture is allowed to stand and the oil is separated.—T. F. B.

French Patents.

Hydraulic Press for Oils. B. Santisteban, Lopez. Fr. Pat. 335,139, Sept. 10, 1903.

The material is placed in alternate layers with perforated plates in the cylinder of the press, in which is a central guiding rod. The wall of this cylinder is constructed in three parts, so arranged that the conduit holes for the oil can be opened or closed by rotatory motion from outside. The head of the press is screwed to a movable support fixed to the platform, and can be removed at the end of the expression to allow the piston to expel the pressed cake from the top of the cylinder. The apparatus is specially intended for the expression of olive oil.—C. A. M.

Soap containing Alcohol. Lebreton-Deshayes. Fr. Pat. 335,126, Aug. 10, 1903.

Fats or oils are saponified with a mixture of pure alcohol and caustic soda ley at a temperature of 40° to 50° C.

—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

Zinc-White Paints; Substitution of* ——, *for White Lead Paints. J. L. Breton. Ann. Chim. Phys., **30**, 554—574. Chem. Centr., 1904, **1**, 201.

As an additional reason, from the hygienic standpoint, for the use of zinc-white paints in place of white-lead paints (see this J., 1903, 807), it is stated that freshly-applied white-lead paint yields an exhalation containing lead, the presence of the lead being detected by means of tetramethyldiaminodiphenylmethane, $CH_2[C_6H_4.N(CH_3)_2]_2$, with which the smallest trace of lead peroxide gives a blue coloration.

—A. S.

United States Patent.

White Lead; Manufacture of ——. J. W. H. James, Philadelphia, Pa., U.S.A. U.S. Pat. 750,541, Jan. 26, 1904.

As an improvement in the process of making white lead which consists in submitting lead oxide to the action of acetic acid and carbon dioxide, the lead oxide is first heated to about 200° F. The oxide is then treated with acetic acid to convert into a salt any metallic lead which may be present, the mixture is heated, then subjected to the action of acetic acid and carbon dioxide, and the resulting lead carbonate is exposed to the action of oxygen gas.—M. J. S.

French Patent.

Bronze Colours and Tinsel; Manufacture of ——. Soc. G. Benda. Fr. Pat. 335,112, Sept. 10, 1903.

To obtain bronze powders, tinsel, and the like, the suitable metal or alloy is melted and run upon the cylinders by which it is to be laminated, dispensing with the customary intermediate process of first casting the metal or alloy in rods. The thinly-rolled metal is subjected to usual processes to form it into powder, &c.—E. S.

(*B.*)—RESINS, VARNISHES.

United States Patent.

Varnish Substitutes; Process of Manufacturing ——. R. Blume, Magdeburg. U.S. Pat. 750,575, Jan. 26, 1904.

See Fr. Pat. 333,602 of 1903; this J., 1903, 1358.—T. F. B.

(*C.*)—INDIA-RUBBER.

French Patent.

Caoutchouc Substitute; Process of Manufacturing a ——. E. H. Fayolle. Fr. Pat. 335,584, Sept. 26, 1903.

Two kilos. of sulphuric acid (66° B.) are added to 1 kilo. of glycerin, the mixture is allowed to cool, and from 1 to 1½ kilo. of formalin (40 per cent.) is then added. The mixture is again cooled, and, after adding ½ kilo. of water, 1—1·4 kilo. of commercially pure phenol are slowly poured into it, with constant stirring and external cooling. The mixture is then left at rest for 20 hours, when the new product will be found as a layer on the surface of the liquid. The substance gradually hardens on exposure to the air, and before it has become too hard it must be subjected to prolonged kneading. The formaldehyde may be replaced by methylal and the phenol by cresol. The new substance may be used for rendering fabrics waterproof or as an electric insulator.

—M. J. S.

XIV.—TANNING; LEATHER, GLUE, SIZE.

Infusions of Tanning Materials; Notes on the Changes which take place in ——. E. Nihoul and L. van de Putte. Bull. de l'Assoc. Belge des Chim., 1903, **17**, 390—398.

Extractions of oak-bark (27 grms.), pine bark (17·8 grms.) and sumac (17·5 grms.), were made in Koch's apparatus, adjusted to 1 litre with the usual precautions, and entirely filtered, the first 100 c.c. being rejected and the rest thoroughly mixed in each case. From these filtered liquors (about 900 c.c. each) four lots each of 150 c.c., were drawn off, and the remainder at once analysed by the official method. The 150 c.c. lots were treated as follows:—

Process (*a*).—Diluted with 150 c.c. of water and analysed at once.

Process (*b*).—Diluted with 150 c.c. of water and analysed after standing for three days.

Process (*c*).—Diluted with 150 c.c. of water, preserved with a trace of thymol, and analysed after three days.

Process (*d*).—Diluted with 100 c.c. of water in a 300 c.c. flask, which was plugged with wool, boiled on three successive days for a few minutes, and on the third filled up to the mark, cooled, and filtered.

None of these liquors became turbid within three days, apparently because of the increased dilution. The general conclusions from these parallel experiments on the three different liquors are as follows:—(1) Dilution of the liquors before analysis appreciably lowers the amount of total soluble matter and organic soluble matter. Procter's opinion, that liquors must be sensibly of the same strength to secure concordant results, is fully supported. In two of the three cases (pine bark and sumac) the loss in tannin (1·19 and 0·96 per cent.) is greater than the loss of total soluble matter (0·98 and 0·68 per cent.); so that a direct action of the water on the tannin, promoting its volatility (*cf.* sugar and glycerin evaporations) appears to be indicated. This conclusion is arrived at after giving full weight to the loss caused by precipitation of less soluble tannins during the long filtration of the original liquor, which has not been proved to exceed 0·3 per cent., and in some cases does not take place (mangrove). In all cases the difference between loss in tannin found in processes (*b*) and (*c*) on the one hand and (*a*) on the other, shows that precipitation is responsible for only a small part of the loss. (2) Substances which in the official method are soluble in the warm infusions and slowly separate on cooling may remain dissolved when the proportion of solvent is increased, *i.e.*, when the concentration is diminished. (3) To obtain concordant analytical results, extractions must be at once analysed (*cf.* also Paessler, this J., 1904, 71 and 123).—R. L. J.

Tanning Analysis; Notes on ——. G. Schweitzer. XXIII., page 207.

Hide Powder; Determination of Acidity in ——. J. Paessler. XXIII., page 207.

English Patent.

Adhesives; Manufacture of ——. H. Arledter, Garston, Lancs. Eng. Pat. 1049, Jan. 15, 1903.

Resin (up to 80 per cent. of the final mass) is dissolved in soap, oils, fats, hydrocarbons, or other organic solvents at 180° F., and mixed with glue or other adhesive, with or without the addition of a phenol.—R. L. J.

French Patents.

Deliming and Degreasing Agent for Skins, and Mode of Employment. C. Paton and C. Pujol. Fr. Pat. 335,178, Sept. 12, 1903.

Chromic acid solution, the effect of which is moderated, if desirable, by the addition of sodium bisulphite, metabisulphite, or similar substance, is used for removing lime and grease from skins, (1) as a weak solution, the skins being soaked in it for 2—4 hours with milling, or about 12 hours without milling, and then washed freely; or (2) as a strong bath, in which case 3—4 minutes' immersion, followed by lengthy washing, is sufficient.—R. L. J.

Coriaceous Substance [Leather Substitute]; Manufacture of a New ——. A. Menesdorffer. Fr. Pat. 335,543, Sept. 24, 1903.

See Eng. Pat. 20,488 of 1903; this J., 1903, 1300.—T. F. B.

Adhesive [Glue and Resin]. F. Arledter and F. Dobler. Fr. Pat. 328,162, Dec. 2, 1902.

See Eng. Pat. 1049 of 1903; see under Eng. Pat. in foregoing.—T. F. B.

XV.—MANURES, Etc.

Potash in Soil; Distribution of ——. J. Dumont. Comptes rend., 1904, **138**, 215—217.

The author has investigated the distribution of potash among the different elements of two soils—one from Grignon, containing 8·53 of total potash per 1,000, and the other from La Creuse, with 8·94 of potash per 1,000—varying widely in their physical composition. In the Grignon soil, more than 5/6 of the total potash occurs in the finer portions, and the clay only contains the fifth part of it. In the La Creuse soil, however, the coarse sand includes 7/10 of the potash present, and the fine sand nearly the whole of the remainder, since the clay only contains 2·7 per cent. of the total. Admitting that the chemical activity of the soil is exercised most effectively by means of the very fine particles, it will be understood why potash manures are generally found to be inefficacious with the Grignon soil, whilst they act favourably on granitic soils, which are rich in passive potash but too poor in fine elements. The quantity of potash rendered active, under natural conditions and in the same time, being very different for the two soils, it follows that the needs of the vegetation are not equally well satisfied, so that the use of potash manures is rendered necessary whenever the fine sand and clay occur in the soil in less proportion than 25 per cent. —T. H. P.

Phosphorite; Increased Solubility of ——, in presence of "Physiologically Acid Salts." J. W. Schulow. Biel. Centr., 1904, **33**, 79—80; from Jour. exper. Landw., **3**, 711—719.

The term "physiologically acid salts" is applied to salts which (as ammonium salts, for example) are decomposed in the soil, the base being taken up by the plant and the acid left behind. The results of pot experiments with barley showed that much larger yields are obtained when a mixture of phosphorite and ammonium salt is used as a manure, than when the two substances are separated. This is attributed to the action of the acid of the ammonium salt on the phosphorite.—N. H. J. M.

Organic Matter [Determination of ——] in Soils and Subsoils. F. K. Cameron and J. F. Breazeale. XXIII., page 207.

English Patent.

Yeast; Manufacture of certain Products from Waste Brewery or Distillery ——. P. Schidrowitz and F. Kaye. Eng. Pat. 6604, March 21, 1903. XVII., page 200.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugars; Synthesis of —— from Trioxymethylene. Seyewetz and Gibello. XXIV., page 209.

Molasses; Barbados and Porto Rico ——. Imp. Dept. of Agriculture for the West Indies. Pamphlet No. 28, 1903.

As the result of enquiries made in the United States markets as to the relative values of Barbados and Porto Rico molasses, the Commissioner states that Barbados molasses is equivalent to the second quality of Porto Rico molasses, termed "choice." The best quality of "fancy" Porto Rico molasses is worth 7 cents per gallon more, and there is a market for larger quantities. At the present average prices of muscovado sugar and Barbados molasses, the planter obtains 1·45 cents per lb. for the saccharose in his sugar, and 2·09 cents per lb. for the saccharose in his molasses. It would therefore pay to convert the whole of the cane crop into a golden-coloured table syrup equal to the Porto Rico "fancy" molasses, until the limits of demand were reached. On estates provided with vacuum pans, the Commissioner recommends bleaching the cane-juice with sulphur dioxide, "tempering" with lime almost to neutrality, evaporating the juice in the "taybes" (teaches) to a thin syrup, with the addition, if necessary, of a little citric acid, clarifying the syrup by settling, and concentrating to a table syrup in the vacuum pan. The presence of a little free acid in the syrup is advantageous, for the following reasons: it preserves the pale colour during boiling; it inverts some of the saccharose, thus preventing crystallisation; and it imparts "baking" properties, *i.e.*, reacts with the sodium carbonate in the flour when the syrup is used for making cakes, &c. The syrup should be packed in casks which have been sterilised, first by steaming, and then by burning lumps of sulphur inside them until the oxygen in the cask is exhausted.—J. F. B.

French Patents.

Saccharine Juices or other Matters from Plants, Roots, &c.; Extraction and Utilisation of ——. A. Montupet. Second Addition, dated Aug. 18, 1903, to Fr. Pat. 329,947, March 1, 1903 (this J., 1903, 1058).

The juices prepared by this process, being very concentrated, may be sterilised by boiling at temperatures of 100° C. and over, in order to destroy all ferments, and to preserve them in a suitable condition for subsequent fermentation, with or without the addition of marcs of a similar origin. In the case of beet juices defecation may also be performed. A form of apparatus with a heating jacket and means for the circulation of the heating medium through the centre of the bulk is also described.—J. F. B.

Sweetening Agent; A New ——. A. H. Tissot. Fr. Pat. 335,379, Sept. 14, 1903.

The "edulcorant Porchère" is a liquid with a great sweetening power in relation to its weight and volume. This substance, previously perfumed if desired, is converted into a plastic body by incorporation with powdered gum arabic. Tablets and pastilles are then prepared from the mixture, suitable for making sweetened drinks.

—J. F. B.

Carbohydrates in General; Process of Dissolving ——. A. Boidin. Fr. Pat. 335,366, Sept. 18, 1903.

The dialkali phosphates and phosphates of magnesium in grains have the effect of retarding the solution of the carbohydrates on boiling in the open air or under pressure with water; some of the alkali phosphates also promote caramelisation. These phosphates are converted into primary phosphates or into inert calcium phosphate by steeping the meal in cold or warm water to which an acid or a metallic salt, such as calcium chloride, has been added in such proportions that, after one or two hours, no free acid can be detected by a suitable indicator.—J. F. B.

Organic Acids contained in the "Vinasse" of Molasses; Process for the Extraction and Utilisation [*as Mordants*] *of the* ——. H. Schrader. Fr. Pat. 328,160, Dec. 1, 1902.

See Eng. Pat. 20,851 of 1902 and U.S. Pat. 735,599 of 1903; this J., 1903, 920 and 993 respectively.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Malting; Carbon Dioxide in ——. C. Bleisch. Zeits. ges. Brauw., 1904, **27**, 45—50.

The Pneumatic Drum (*Galland's System*).—In the large pneumatic malting drums a distinct proportion of carbon dioxide can always be detected. If the ventilation be stopped, the proportion of carbon dioxide in the air inside the drum rises rapidly, and the rapidity and extent of this rise afford a measure of the intensity of the respiration. This is at a maximum on the fourth day, when a proportion of carbon dioxide of about 0·5 per cent. before the ventilation is stopped, may increase to 4·5 per cent. after 30 minutes without aeration. During malting with continuous ventilation the proportion of carbon dioxide in the air of the drum amounts to an average of about 0.5 per cent., rising towards the fourth day to 0·7 per cent. The recent improvements in the drums, by increasing the number of ventilating pipes from eight to nine, have had the effect of ensuring a remarkable uniformity in the composition of the air in different parts of the drum, so long as the latter is kept in motion. During the periods of rest an accumulation of carbon dioxide does take place, to a slight extent, in the places behind the air-channels.

Kilning.—In the Bavarian system of malting, the green malt is withered on the upper floor of the kiln at a temperature of 25°—28° C., during which process growth continues for a few hours. A sample of air taken from the mass of malt after four hours on the upper floor of the kiln contained from 0·7 to 1·1 per cent. of carbon dioxide resulting from this continued respiration; the loss of malt substance at this stage is not, however, very considerable. The present series of investigations has led the author to the conclusion that the presence of even comparatively high proportions of carbon dioxide in the growing mass is quite unimportant; the malt always manages to get as much air as it requires. The proportion of carbon dioxide in the air taken from the couches of malt on the floor is about 1·5 per cent. higher than that contained in the air from the pneumatic drum. But in the chest system of pneumatic malting, the carbon dioxide in the air in the mass of grain sometimes amounts to five or six times that found in the floor system of malting, and yet the growth of the malt does not appear to suffer. An accumulation of carbon dioxide in pneumatic drums or chests can be removed by full ventilation in a few minutes. The main object of ventilation in the pneumatic systems is, therefore, to cool the grain. This method of cooling possesses the drawback of removing large quantities of moisture from the grain, and it would be distinctly advantageous if it were possible to perform the necessary cooling by some other means, since the means for replacing the moisture so lost are somewhat imperfect in their action.—J. F. B.

Malt; The Polishing of ——. J. Fries. Zeits. ges. Brauw., 1904, **27**, 61—63.

If the work of a malt-polishing machine be examined it will be found that the waste consists of two kinds of products. On the one hand is the coarse waste, consisting of husks, coombes, and dust, and on the other hand there is a greyish-brown, very fine, flour-like dust, which collects chiefly in the pipes leading to the exhauster. This latter consists of very minute splinters of husks, together with a considerable proportion of malt starch, which is also found to some extent in the coarse waste. It therefore follows that some of the good malt is destroyed and wasted by the polishing operation. But at the same time, malt, even if properly cleaned, still contains a certain amount of impurities, which, if not separated, may have a bad effect on the flavour and quality of the beer. This is shown by mashing the two kinds of waste from the polishing machine; the mash from the coarse waste has an odour of brewed malt-germs, whilst that from the fine dust is distinctly disagreeable. The polished malt is heavier by about 0·4 kilo. per hectolitre than the unpolished malt, and it requires about 71 brews of unpolished malt to make the same quantity of beer at the same strength as is obtained from 70 brewings of polished malt. This is an important factor in countries like Bavaria, where the excise is levied on the malt. The proportion of waste removed during the polishing operation is about 1·4 per cent. of the malt by volume, and the extract value of this waste is about 40 per cent. of that of the malt. The value of the waste by polishing is estimated at 4·8 pfennige, and the cost of running the machine is 2 pfennige per hectolitre of malt. The superiority of the quality of the beer from polished malt, however, cannot be denied. If the polishing machine be kept in perfect working order, the destruction of good malt can be kept down to a minimum, but without care more harm than good may be done.

—J. F. B.

Potatoes; Method of Improving the Fermentation of Difficultly Fermentable ——. P. Jensch. Zeits. Spiritusind., 1904, **27**, 38.

The experiments here described were made with "Fürst Bismarck" potatoes containing 20·7 per cent. of starch. Mashes of 26°—27° Balling were readily obtainable, but could not be fermented, while those having the gravity 22°—24° Balling never fermented lower than 1·5°. The effect of aëration was tried, air being passed into the sweet wort for an hour after the addition of the yeast. When cooled to 19° C. the mash was introduced into the fermenting vat, the yeast beginning to act after about an hour, and the temperature rising to 29·5° C. in 15 hours' time. There was a vigorous formation of foam and a brisk after-fermentation, but the increase in acidity only amounted to 0·3 in spite of the infection to which the wort was subjected by the aëration. The attenuation reached was 1·0° Balling, the yeast employed being Race XII.—T. H. P.

Reverted Starch; Formation and Saccharification of ——. L. Maquenne. Comptes rend., 1904, **138**, 213—214.

Solutions containing increasing amounts of starch, gelatinised in a boiling water bath, and afterwards heated at 120° C. for 15 minutes, were allowed to undergo reversion for four days at 9° C., and were then saccharified at the same temperature by the addition of equal amounts of malt extract. The relative amounts of amylo-cellulose obtained were estimated by comparison with similar solutions saccharified immediately after removal from the autoclave

In these check solutions the weight of soluble matter formed is proportional to that of the starch taken, but with the reverted solutions the concentration of the filtered liquid increases less rapidly than the amount of starch employed. It is clear from this why a weak starch solution becomes turbid less readily than a stronger one, and why amylo-coagulase acts more especially on concentrated starch solutions. On allowing malt extract to act at temperatures of from 22°—70° C. on starch solutions after reversion, it is found that the effect of rise of temperature is to facilitate the solution of the reverted starch, but that this solution never becomes complete, as is the case at all temperatures with fresh starch paste.

It is concluded that amylo-cellulose is not a single principle, but a mixture of several different condensation products, which have the common property of giving no coloration with iodine, but which offer varying resistances to the dissolving action of amylase.—T. H. P.

"Spring" Mashing Process; Regulation of the Final Attenuation of the Beer by the ——. W. Windisch. Woch. f. Brau., 1904, **21**, 65—68.

The underlying principle of the "spring" mashing process is the avoidance of those intermediate mashing temperatures at which saccharification takes place so rapidly that it is almost impossible to restrict the formation of highly fermentable products by the selection of a high temperature for the saccharification proper. These intermediate temperatures are entirely avoided by establishing the desired high saccharification temperature by a process of cooling down instead of heating up as heretofore. The grist is mixed with water at so low a temperature that no saccharification can take place; the thick, cool mash is then "sprung," *i.e.*, dropped rapidly, into a sufficient quantity of water near the boiling point, until the temperature of the mixture is that at which the restricted saccharification is desired to take place. Subsequent operations then depend on the general policy of mashing, whether by infusion or decoction, adopted. This power of restricting saccharification to a definite extent enables the brewer to obtain a wort of any fermentability he may desire, and the attenuation of the beer may, if desirable, be kept down to a degree hitherto unattainable. Such a restriction is, however, only advantageous if the type of malt is such that it will yield good, full-bodied beers of small attenuation. The "spring" mashing process is only to be used as one of the factors in producing such beers; the mere fact of small attenuations will not impart "body" to beer made from malt unsuitable for that kind of beer, since the "body"-forming carbohydrates are only produced on the malting floor. The "spring" mashing process is the means by which the qualities of a suitable malt may be developed to a fuller extent than by other processes. The preparation of such a malt is perhaps a matter of some difficulty; the author, without laying down any exact specification, describes it as one having an average length of acrospire of two-thirds the length of the corn, *i.e.*, a short-grown malt; it must nevertheless be perfectly modified, and must be kilned at a high temperature. Perhaps the Bohemian type of malt most nearly approaches the type desired. Above all, the restriction of the fermentability of the wort must not be pushed too far, otherwise difficulties will occur in the secondary fermentation and clarification of the beer. For German lager beers it is not advisable to curtail the final attenuation below 65 per cent.; and a "standard" beer may be defined as one brewed from an 11 per cent. wort with a final attenuation of 65 per cent., and racked off at a gravity corresponding to 3·85 per cent. of apparent solids.
—J. F. B.

"Spring" Mashing Process; Regulation of the Attenuation by the ——. O. Kleinke. Woch. f. Brau. 1904, **21**, 68—73.

The author, having practised the "spring" mashing process from its inception, concludes that the fermentability of the wort can easily be restricted thereby to any desired limit; very low attenuations are obtained by "springing" the mash at temperatures above 75° C. The grist should be mixed with water at a temperature insufficient to permit of the saccharification of the still ungelatinised starch, but sufficient, if desirable, to permit of the activity of the proteolytic enzyme. For the preparation of beer with an abnormally low proportion of alcohol, wort having a final degree of attenuation of only 28—30 per cent. is mashed as follows:—The grist is mixed with water at about 52° C., and digested for 15—30 minutes; it is then "sprung" into water at 88° C., the clear mash being "sprung" first, until the temperature falls to 77·5° C. Heat is then applied so as to keep the temperature constant until the whole of the cool mash has been "sprung," saccharification being then allowed to proceed at a temperature of 80° C. Such worts are, however, only intended for special purposes; for ordinary beers they should be combined with worts mashed carefully in the ordinary way, so as to have more fermentable sugar. Worts from "spring" mashes made exclusively at very high temperatures (77·5°—80° C.) are liable to give abnormal iodine reactions, and the beers never clarify of their own accord. Such difficulties do not occur if the restriction of the fermentability be not pushed below 40—45 per cent. Worts with very restricted fermentability require very high fermentation temperatures, *viz.*, about 25° C.; if the temperature be 15° C. or lower, the fermentation is liable to proceed with a series of somewhat lengthy and dangerous pauses. It is therefore better, except for extraordinary purposes, to keep the fermentability of the wort above 40 per cent., and to ferment at lower temperatures; in fact, for ordinary beers from original worts of medium strength, the attenuation should not be restricted below 55 per cent. The unfermentable extract obtained by restricted saccharification is composed almost entirely of dextrins, which do not have any perceptible influence on the flavour of the beer, and cannot in any sense replace the nitrogenous constituents, which are so important for full-flavoured beers.—J. F. B.

Fermentation Energy in Highly Concentrated Salt Solutions. A. J. J. Vandervelde. Bull. de l'Assoc. Belge des Chim., 1903, **17**, 398—411.

The author has already shown that fermentation energy, as gauged by the time taken by yeast to decompose a known weight of sugar, is not impaired by neutral salts (*i.e.*, non antiseptic), even when rather highly concentrated. He has now determined the rate of decomposition of 5 grms. of sugar by 5 grms. of yeast in solutions of 18 different single salts, the strengths being 2, 4, 6, 8, and 10 grms. of salt per 100 c.c. The loss of carbon dioxide was determined at set intervals of 5, 16, 40, 64, and 96 hours; the molecular concentration and osmotic pressure were calculated in the usual manner, and the fermentation energy found by interpolation. As the rate of decomposition is much less in the final stages than the mean rate, the energy is defined as the number of hours required to decompose only a portion of the sugar, *viz.*, three-fourths of the whole, or the hours required to evolve 2·56 × 0·75 = 1·92 grms. of carbon dioxide, instead of the 2·56 grms. possible. The salts employed were chlorides and nitrates of potassium, sodium, ammonium, calcium, strontium, and magnesium; the sulphates of ammonium, magnesium, and zinc; phosphates of potassium and ammonium; and barium chloride. The general conclusions arrived at are that the fermentation energy is independent of the concentration and of the osmotic pressure of the salts present, and, consequently, of the life of the cell (which must be influenced by these factors), and is the result of enzymatic processes in accordance with Buchner's theory.—R. L. J.

Fermentation Tuns; Treatment of ——. W. Windisch. Woch. f. Brau., 1904, **21**, 49—53. (See also this J., 1903, 1302.)

When wild yeast turbidities occur in beer, the source of infection is almost invariably traced to badly lacquered fermenting tuns. Infection of the fermenting tuns is far more general than is supposed, but this infection does not always succeed in establishing a "sickness" sufficient to spoil the beer. It may safely be assumed that a very large proportion of all the beer made suffers infection by wild yeasts in a potentially virulent condition. Whether turbidity follows such infection, depends on the nature and the power of resistance of the beer. Strong beers, fully fermented, rich in alcohol and carbon dioxide, well matured under pressure, and properly treated, may be fairly expected to resist the infection to which they are exposed in the fermentation tuns. The tun question concerns those breweries which produce thin beers far more closely. With lacquered tuns it is not, as a rule, a question of avoiding infection, but rather of maintaining conditions favourable to resistance, which, however, is constantly liable to be broken down.

Pitch.—The efficacy of pitch depends on the maintenance of a perfect coating. This coating must be as thin as possible, and can only be applied satisfactorily by a suitable form of spraying apparatus. The great advantage of pitch lies in the fact that, when defects are detected, a fresh coat can be applied in a minimum of time without disturbing the tun, whereas a lacquered tun which has become defective has to wait until the annual re-lacquering. The application of a perfect coat of pitch requires some skill; the coating is more easily damaged than lacquer, but can often be repaired by the hand-lamp. Above all, great care is requisite in cleaning out the tuns; the men must wear rubber shoes. An addition of paraffin to the pitch is sometimes advantageous.

Solid Paraffin.—This appears to be the most favourable material, in the author's opinion. The wax must be made to penetrate deeply by heating the tun, but not to such an extent as to crack the wood. Only the very best quality of paraffin is admissible; the melting point should be fairly high.

Lacquer.—Alkaline reagents for removing the old lacquer are objectionable; if they be used, the wood should be planed down every two years. Scratching or sand-papering is preferable to alkaline treatment, but very laborious. The tun must be dry before applying the fresh coat, but on no account should either the wood or the lacquer be hot. Heat causes a too rapid evaporation of the alcohol, leaving the shellac in the form of films across the pores and cracks. For the same reason, the concentration of the lacquer solution should not be too great; dilution assists the penetration of the lacquer into the smaller pores. It cannot be denied that a perfect coating of lacquer is as good as any other; the whole question turns on the resistance to wear and tear and to the ease of renewal. In the last respect lacquer leaves much to be desired, and paraffin would appear to be the most promising material for general satisfaction. Brand strongly recommends paraffin for preserving the exteriors of the tuns. The new tuns, perfectly dry, should be painted with a coat of paraffin, applied at a temperature of 150° C. with a large brush; the coat of wax should then be melted with the hand-lamp until strong frothing occurs; such a coating is said to last for years.—J. F. B.

Fermentation Tuns; Internal Coating of ——. A. Vogel. Zeits. ges. Brauw., 1904, 27, 78—81.

The operation of coating is very much easier in the case of new tuns than in the case of tuns which have been in use without a coating or which have been coated with a different material.

Lacquer.—The tuns must be thoroughly dried before treatment, and this drying should on no account be hurried by the use of steam or the heat of a fire. The tuns should be placed in a draughty position, sheltered from the sun, and allowed to dry naturally. The old wood should then be planed off, or preferably scraped with a special tool. The lacquer should be diluted with alcohol, spirit of the purest and strongest quality being used for this purpose. For the first coating, the lacquer as purchased should be diluted with an equal quantity of spirit, in order that it may penetrate deeply into the pores of the wood. The second coat must be applied only when the first is perfectly dry, and this also should be diluted. The final coat is applied in the undiluted condition. The tuns must be re-lacquered every year, and the old lacquer should be removed, not by heat or chemicals, but by the scraper. The burning-in of the coating of lacquer is not desirable. Above all, the lacquer used must be a solution of genuine shellac in pure alcohol; no rosin or turpentine should be present.

Paraffin.—This has the advantage of very deep penetration, provided the wood be dry. The paraffin should be heated to 180°—190° C: the tun must be well heated and supported in a slanting position, the paraffin is then run down the sides by means of a ladle; the spraying apparatus is also advantageous. Re-paraffining can be done in the fermentation cellar, the tuns being first cleaned, scraped slightly, and heated by steam.

Pitch.—This has many advantages in presenting an absolutely impervious surface to the beer, so long as the coating is undamaged. The spraying apparatus is absolutely necessary, the wood must be perfectly dry, and a certain amount of penetration is essential in order to hold on the external surface-coating, which should be no thicker than a sheet of paper. Re-pitching is very easily performed, but it is desirable that the tuns should be removed from the cellar for the purpose. They should be returned whilst still warm, since the pitch is then in a condition sufficiently elastic to resist the shocks caused by moving them.—J. F. B.

Filtering Material [*for Beer*]; *Purification of* ——. E. V. Zeits. ges. Brauw., 1904, 27, 65—66.

Whether the filter be used constantly or only occasionally it is absolutely necessary, for the preservation of the beer, that the filtering-pulp should be sterile. A large number of machines are available for cleansing the pulp by beating it up with water and washing off the greater part of the albuminoid deposit and yeast cells by a stream of water. But no amount of mechanical washing can ensure sterility, and it is therefore necessary to boil the mass. Direct steam is used for this purpose, but the steam should be clean and should not be raised in boilers containing disincrustants with a penetrating odour. The steaming produces a thorough agitation of the mass, and 10 minutes' boiling is sufficient for sterilisation. Steaming is necessary every time the pulp comes out of use to be washed, otherwise it may be found that the unfiltered beer remains clear in bottle longer than the filtered beer. Chemical disinfectants are to be avoided on account of the difficulty of removing their odour from the pulp. When the mass has been purified it should be pressed into thin cakes and dried in the air, or if a press be not available, the water should be squeezed out by hand, and the lumps should be broken into small flakes before drying.—J. F. B.

Barley and Malt; Relations between the Percentage of Extract and Protein in ——. Merz. Zeits. ges. Brauw., 27, 63—65.

In the collection of analytical statistics with the endeavour to trace some relationship between the percentage of protein in barley and malt, and that of the extract obtainable, the conclusions may be entirely vitiated by the fact that the samples of malt received, frequently do not represent averages of the bulk. This may be due to inequalities in the working of the kilos. The author has frequently found differences of temperature taken in different places in the same kiln, of 17°—25° C., and the malt varies in composition correspondingly. In recording the curing temperature, it is generally considered sufficient to take the readings in four or five different places; the author considers, however, that readings should be taken in at least 17 places, and the thermometers should remain in the malt for 20

	Maximum and Minimum Temperatures registered out of 17 simultaneous Readings.			
	Kiln E. 116°—94° C.		Kiln R. 104°—84° C.	
Sample taken at	94° C.	116° C.	84° C.	104° C.
Moisture	3·75 %	2·1 %	3·1 %	2·9 %
Extract on dry substance	75·3 %	71·7 %	77·6 %	76·4 %
Maltose : non-maltose	1:0·50	1:0·84	1:0·51	1:0·60
Colour on 10 per cent. wort.	4·5 c.c.	14 c.c.	5·2 c.c.	11·7 c.c.
Yellow-coloured corns	6 %	43 %	11 %	29 %
Scorched corns	..	3	..	..
Aroma	Very faint	Scorched	Very moderate	Aromatic

minutes before reading, the bulbs being about 1 cm. from the floor. The foregoing table shows the differences in composition and character of the malt caused by the irregular distribution of heat in the kiln.—J. F. B.

"Poussé" Wines; Ferment of ——. J. Laborde.
Comptes rend., 1904, **138**, 228—231.

In April 1901, two young wines, one white and the other red, containing a small quantity of reducing sugar, were each inoculated with the three following organisms:—(1) Gayon and Dubourg's mannitic ferment. (2) The ferment from a wine previously become "poussé" or "tourné." (3) The ferment isolated from an 1890 "poussé" bottled wine. These samples and also non-inoculated samples of the wines were kept at the ordinary laboratory temperature until October 1903, when estimations of the volatile acidity (calculated as sulphuric acid) and of the residual reducing sugar gave the following results.—

	Volatile Acids.		Reducing Sugars.	
	White Wine.	Red Wine.	White Wine.	Red Wine.
Non-inoculated	0·75	0·83	2·90	2·00
Inoculated with (1)....	0·94	1·08	1·60	0·90
" " (2)....	1·02	1·27	1·40	Traces
" " (3)....	1·08	3·38	Traces	"

Microscopic examination showed that the three organisms had developed the usual appearance of the "poussé" ferment, both in the white and red wine, the activity being greater in the latter case. As the activity is seen to vary for the three organisms, these must be regarded as distinct. Of the six inoculated samples, only number (3) could be considered as "poussé": not only had its reducing sugar completely disappeared, but the cream of tartar (not attacked in the other wines) had diminished by 1 grm. per litre, and its volatile acids consisted of a mixture of 4·53 grms. of acetic with 0·47 grm. of propionic acid. Ferment (2) was less active than in the 1899 wine, from which it was isolated, for in that wine it had given 3·01 grms. of acetic and 0·30 grm. of propionic acid, while the cream of tartar was reduced in quantity by 0·86 grm. per litre. All three organisms were living in the inoculated wines, and were introduced into yeast water containing 20 grms. per litre of (1) dextrose and (2) levulose, and allowed to develop until all the sugar had disappeared, after which the three dextrose solutions were found to have the same composition, as also were the three levulose solutions. That the three organisms are really different, however, was shown by further analysis of the levulose solutions two months later, the following being the results:—

	(1)	(2)	(3)
	Grms.	Grms.	Grms.
Mannitol	9·86	9·15	Traces
Fixed acid	2·22	1·47	2·80
Volatile acid	2·88	3·76	5·44

As shown under (3), after the levulose has disappeared, it is possible for the mannitol to be attacked and completely destroyed.—T. H. P.

Wine; Production of Mannitol by the Disease Organisms of ——. P. Mazé and A. Perrier. Ann. de l'Inst. Pasteur, 1903, **17**, 586; through Woch. f. Brau., 1904, **21**, 85.

The authors have studied the micro-organisms present in "turned" bitter and viscous wines, especially the bacterium which produces mannitol in the course of its activity. This organism possesses the same physiological properties as the mannite ferment of Gayon. It secretes zymase, a lactic acid enzyme, and apparently a third enzyme, which splits up sugar into three molecules of acetic acid. In the presence of fructose the bacterium produces mannitol, apparently by the decomposition of water, the oxygen of which converts the alcohol into acetic acid, whilst the hydrogen reduces the fructose to mannitol. The authors therefore place this organism in a special group, which apparently contains other representatives. Many bacteria, notably the butyric acid bacteria, produce hydrogen, but the gas, when evolved in presence of fructose, does not reduce the latter to mannitol. It is true that these latter bacteria also decompose mannitol, but the excess of hydrogen developed ought, if a direct reduction were possible, to reproduce mannitol in presence of fructose, so that it would be detected in the liquid. The reduction of the fructose by the special bacterium is therefore independent of the direct action of the hydrogen.—J. F. B.

Methyl Alcohol; Determination of ——, *in Presence of Ethyl Alcohol.* T. E. Thorpe and J. Holmes. XXIII., page 208.

Corks; Impt. in ——. H. Helbing. XIX., page 202.

English Patents.

Beer; Brewing ——, *and Apparatus therefor.* A. G. Southby, Forest Gate, Essex. Eng. Pat. 4872, March 3, 1903.

The process and apparatus described in Eng. Pat. 2669 of 1902 (this J., 1903, 156) are applied to the mashing of raw grain. The ground grain is heated with water until the starch is gelatinised. The goods are cooled down to the mashing temperature and treated with a suitable proportion of ground malt or malt wort. The heating and cooling, with the addition of malt or malt wort, may be repeated until the whole of the starch is converted. The wort is then heated in a closed vessel above the boiling point of water, so as to impart to it the flavour of wort from kiln-dried malt.—J. F. B.

Yeast; Manufacture of Certain Products from Waste Brewery or Distillery ——. P. Schidrowitz and F. Kaye, London. Eng. Pat. 6604, March 21, 1903.

Waste yeast is pressed and then partially or wholly dried by heat, with or without an admixture of unslaked lime. The product is transferred to retorts, preferably of a type similar to those used for distilling bones, and subjected to dry distillation with or without the addition of a small quantity of unslaked lime. There are then obtained an aqueous ammoniacal yeast liquor, a yeast tar somewhat similar to bone tar, and a yeast coke rich in potash and phosphates.—J. F. B.

Beer and other Casks, and Beer and other Bottles; Purifying and Drying ——. J. D. Noble, Bristol, and H. J. Hamblin, Ashwick, Bath. Eng. Pat. 6758, March 24, 1903.

The casks or bottles, after being washed or rinsed, are cleansed, purified, and dried, by subjecting them to the suction action of a vacuum.—R. A.

French Patents.

Absolute Alcohol; Industrial Production of ——.
R. Sunyé. Fr. Pat. 328,143, Nov. 15, 1902.

Hydrated manganese protoxide is mixed with calcium hydroxide and the mixture is oxidised by air. The mixture of "calcium manganites" obtained, is then triturated with a suitable proportion of coke. By the fusion of this mass, a polycarbide of manganese and calcium is said to be obtained. This carbide is treated with steam and the original mixture of hydrated oxides is thereby regenerated for future use, and acetylene, methane, hydrogen, and steam are evolved, and are said to be suitable for the synthetical production of alcohol. (See also this J., 1903, 1361.)—J. F. B.

Vinegar; Apparatus for Making ——. R. Douglas. Addition, dated July 17, 1903, to Fr. Pat. 332,816, May 19, 1903.

See Eng. Pat. 11,526 of 1903; this J., 1903, 1144.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A*.)—FOODS.

English Patent.

Milk and other Liquids; Process and Apparatus for Sterilising ——. C. de Jong, Nieuwer Amstel, and J. K. van der Heide, Amsterdam. Eng. Pat. 5446, March 9, 1903.

The milk or other liquid is forced at a high speed through a suitably heated pipe, where its temperature is raised to 130° C. or higher. It then passes into another coil or pipe surrounded by a cooling liquid. A stopper for a storing vessel, permitting sterilised liquid to be introduced into the vessel without liability of infection from the air, is also claimed. It consists of two perforated discs or plates capable of being rotated over each other on a pin, one of which is provided with an india-rubber washer in combination with an india-rubber ring placed between the plates. A cam-lever mounted on the pin serves to close the stopper.—W. P. S.

United States Patents.

Butter; Process of Testing ——. M. Vogtherr. U.S. Pat. 749,343, Jan. 12, 1904. XXIII., page 208.

Butter; Process of Making ——. J. Estep, Tacoma, Wash., Assignor to R. L. Bloom, Lakeview, Wash. U.S. Pat. 749,853, Jan. 19, 1904.

Fresh cream is treated with alum, pepsin, lactose, and potassium nitrate, and then churned. After removing the butter-milk, the butter is washed to free it from these added substances, salted, and worked.—W. P. S.

Casein Compound, and Process of Producing same. H. K. Brooks, Bellows Falls, Vt., Assignor to Casein Company of America, New Jersey. U.S. Pat. 750,048, Jan. 19, 1904.

The compound claimed consists of dry casein containing about 5 per cent. of ammonium persulphate. The latter s dissolved in its own weight of water and thoroughly ncorporated with the casein.—W. P. S.

French Patent.

[*Casein Substitutes*] *Decolorised Albuminous Substances; Manufacture of* ——. Aktien-Gesellschaft für Chemische Industrie. Fr. Pat. 335,359, Sept. 11, 1903.

Casein-like proteids are prepared from blood-clot, pulverised bone, &c., by treating the same with chlorine, hydrochloric acid, or hypochlorites, and compressing the resulting mass, with the previous addition, if necessary, of milk of lime or other alkalis. Alternatively, potassium permanganate is used as a bleaching agent, the precipitated manganese oxide being dissolved out with sulphuric acid before alkalis are added. Sulphurous acid is further employed when a specially light colour is desired.

—R. L. J.

(*B*.)—SANITATION; WATER PURIFICATION.

English Patent.

Sedimentation Tanks or the like, especially for Sewage Treatment. W. J. Dibdin, London. Eng. Pat. 16,851, July 31, 1903.

The sedimentation tank is packed with ribbed plates, of glazed earthenware, arranged horizontally or inclined, laid upon each other so as to break joint irregularly. When the liquid is run off, it flows off the plates without the formation of any specific currents, the sediment being undisturbed and subject to aëration as the liquid drains away. It is preferred that each plate should be very slightly arched, so as to entrap a little air when the tank is full. The packing may be effected with slate refuse, the plates being kept apart by suitable slate fragments, and prevented from shifting by means of thick slate slabs or the like.

—E. S.

(*C*.)—DISINFECTANTS.

French Patent.

Disinfectants; Process of Making Solutions of ——, *hitherto considered Insoluble or Slightly Soluble.* Chem. Werke Hansa G. m. b. H. Fr. Pat. 335,306, Sept. 15, 1903.

Solutions containing free thymol, salol, menthol, &c., suitable for disinfecting purposes, are obtained by dissolving the disinfectant in, or mixing it with, a neutral solution of soap, and adding formaldehyde to the mixture; such solutions can be diluted without precipitation taking place. For example, 325 grms. of thymol are dissolved in "860 grms. of a neutral soap solution," and formaldehyde is added until a specific gravity of 1·025 is reached; the solution will then contain about 25 per cent. of thymol and 10 per cent. of formaldehyde.—T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

Cotton-Rag Papers; Knots in ——. M. Papier-Zeit., 1904, **29**, 371. (See also this J., 1904, 127.)

The specific tendency of the cotton fibre, especially in the unsized state, to roll and curl up so as to form clots is well known. These clots are not, however, "knots" in the true sense of the word, and they are easily disintegrated by gentle agitation, such as pouring the pulp from one vessel to another. The rolling up of the fibres is caused on the one hand by the friction of the arms of the stirrer on the pulp, but, on the other hand, in a far greater degree, by the friction of the pulp against the sides and bottom of the stuff-chest. The trouble will be greater the rougher the internal surface of the chest, and it can be obviated to a large extent by lining the stuff-chest with glazed tiles. The fibres will then tend to slide over the glazed surface instead of rolling. Reducing the speed of the stirrer and discharging the pulp into the chest simultaneously with a large volume of water will reduce the evil, but will not prevent it entirely. The ease with which the clots are disintegrated in presence of water enables them to be disposed of in the knotter. If the knotter be adjusted so as to give it the greatest possible vertical motion, *i.e.*, to work with a heavy "jog," the beating action of the knotter plates on the pulp will completely unroll the clotted bundles of fibres. It is true that a violent action of the knotter permits a few of the true knots, *i.e.*, unreduced particles of rag and thread, in the pulp to pass through into the paper, but a pulp which has been carefully and thoroughly prepared in the beater ought not to contain a serious proportion of such knots.—J. F. B.

China Clay [*for Paper Manufacture*]; *Moisture Content and Fineness of* ——. Winkler. Papier-Zeit., 1904, **29**, 259.

In England, china clay is purchased with 5 or 6 per cent. of moisture, but in Germany there appears to be no agreed limit to the proportion of moisture sold with the clay. After long exposure to the air various samples of china clay were found to retain from 0·5 to 3 per cent. of moisture, and variations according to the hygrometric state of the atmosphere were scarcely perceptible. A certain degree of moisture in the clay is desirable, since it facilitates its admixture with water when required for use; a proportion of 6 per cent. is therefore quite reasonable. Certain German traders have supplied china clay containing as much as 17 per cent. of water, and have contended that in the determination of the moisture, the sample should not be dried at temperatures above 40° C. This contention is quite erroneous, since the chemically combined water of crystallisation in kaolin, which does not exceed 5 per cent., is not expelled below a red heat. As regards fineness, a normal, well-levigated china clay, when passed through the finest sieve procurable, containing 3,600 meshes to the sq. cm., should not leave a residue exceeding 0·33 per cent. of its weight.—J. F. B.

Corks; Impt. in Quality of ——. H. Helbing. Chem. and Druggist, 1904, **64**, 189.

The cork is impregnated with a solution of casein, and then the latter is fixed and rendered insoluble by treatment with formaldehyde.—A. S.

Cellulose and its Nitrated Derivatives; Optical Activity of ——. L. Vignon. Bull. Soc. Chim., 1904, **31**, 105—108.

Nitro Derivatives.—Cotton, dried at 110° C., was nitrated by immersion for 24 hours at 16° C. in a mixture of the following composition:—Sulphuric acid (H_2SO_4) 38·95, nitric acid (HNO_3) 42·15, water 18·90 per cent. The purified product, in the dry state, contained 10·5 per cent. of nitrogen and had a composition approximating to the formula $C_{24}H_{32}(NO_2)_8O_{24}$. It may therefore be regarded as practically consisting of a dinitro-oxycellulose [C_6 basis]. Its solutions in ether-alcohol mixture and in acetone were turbid. The nitrated product was therefore boiled with a 1 per cent. solution of ammonium persulphate, slightly acidulated, for five minutes. The resultant product contained 10·68 per cent. of nitrogen, and its solubility in the above solvents was slightly increased; the solutions were then transparent. Examined in the polariscope, a solution in ether-alcohol, at a concentration of 1·4943 grms. per 100 c.c., showed a specific rotatory power of $[\alpha]_j = +19\cdot3$; a solution in acetone (at a concentration of 3·848 grms. per 100 c.c.) showed $[\alpha]_j = +21\cdot1^{\circ}$.

Cellulose Thiocarbonate.—A filtered solution of "viscose" containing nearly 2 per cent. of cellulose was precipitated by sodium chloride, and the precipitate was washed, first with brine, and then with diluted alcohol, until it was no longer alkaline. The product was dissolved in water, treated with animal charcoal, and filtered perfectly clear. A solution containing 0·998 per cent. of cellulose thiocarbonate appeared to have a very feeble dextro-rotatory power, which however, could not be ascertained with certainty.—J. F. B.

English Patents.

Paper-making Machines; Impts. in ——. O. M. Farwell, Kaukauna, Wis., U.S.A. Eng. Pat. 18,030, Aug. 20, 1903. Under Internat. Conv., Aug. 20, 1902.

The ordinary method of water-marking paper by a dandy roll situated between the suction boxes does not give satisfactory results with long-fibred thin papers and tissues. According to this invention, with a single drying cylinder machine, a type-bearing roll is caused to press upon the paper against the drying cylinder shortly after the paper has first come into contact with the hot cylinder. The water-mark impressions are obtained by the interposition of a fabric, such as the top felt of the paper machine, between the type roll and the paper; the marked paper does not leave the drying cylinder until the impressions have been fixed by drying.—J. F. B.

Compounds having a Nitrocellulose and Casein Base; Manufacture of ——. H. Ensminger, Talmontier, France. Eng. Pat. 3045, Feb. 6, 1903.

See Fr. Pat. 326,576 of 1902; this J., 1903, 817.—T. F. B.

United States Patent.

Paper, and Method of Making Same, for Obtaining Fast Copies from Writings of Aniline Inks. M. H. Chapin, Bridgeport, Assignor to Wyckoff, Seamans, and Benedict, Ilion, N.Y. U.S. Pat. 749,681, Jan. 12, 1904.

In order to render copies taken from "aniline inks" fast, the copying paper is impregnated with a suitable mordant, thus causing a lake to be formed on the paper with the ink in the presence of moisture.—T. F. B.

French Patent.

Rosin Size; Manufacture of ——. M. Erfurt. First Addition, dated Aug. 29, 1903, to Fr. Pat. 325,901, Oct. 24, 1902. (See this J., 1903, 757.)

The hot rosin emulsion, prepared according to the original specification, shows a tendency to coagulate when it is cooled. This tendency it not manifested when the emulsion is cooled rapidly. The emulsion prepared with hot water by means of a steam "atomiser" is therefore injected directly into a tank containing cold water; the size then shows no tendency to deposit.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Sulphates of Tetravalent Cerium. R. J. Meyer and A. Aufrecht. Ber., 1904, **37**, 140—153.

When cerium dioxide is treated with excess of sulphuric acid, the anhydrous ceric sulphate $Ce(SO_4)_2$ is formed exclusively. In presence of water, however—as when the acid reacts on moist cerium dioxide or on ceric hydroxide—a product is obtained the solution of which yields, first, an acid cero-ceric sulphate, which probably has the composition $2Ce(SO_4)_2.Ce_2(SO_4)_3.H_2SO_4.26H_2O$, and which is to be regarded as the cerous salt of a ceric-sulphuric acid, $H_4Ce(SO_4)_4$. A better yield of this salt is obtainable by partial reduction of an acid solution of ceric sulphate by the calculated amount of sulphur dioxide. It can be crystallised unchanged from 1:5 sulphuric acid; but from diluted, feebly acid solutions, on slow crystallisation, there separates the ordinary dark orange-red salt, which contains rather less sulphuric acid. On recrystallising several times from very weakly acid solutions, the proportion of sulphuric acid falls further, and the proportion of trivalent cerium increases. The authors have not obtained a neutral cero-ceric sulphate, which Rammelsberg and others supposed to exist: these experimenters explained the acidity of their preparations as being due to the tenacity with which the supposed neutral salt retained free acid from the mother-liquors, whereas the authors regard it as due to the fact that the salt—really an acid salt—is stable only in solutions of a certain acidity.—H. B.

Aldehydes; New General Method of Preparation of ——. A. E. Tschitschibabin. Ber., 1904, **37**, 186—183.

Aldehydes may be readily and conveniently prepared by the action of organo-magnesium compounds on the esters of orthoformic acid. The first step in the reaction is the formation of an acetal—

$$HC(OR)_3 + R_1MgI = ROMgI + R_1.HC(OR)_2,$$

which is converted into the corresponding aldehyde by saponification with a dilute acid. The *modus operandi* of the method is as follows:—Ethereal solutions of the formic ester and the organo-magnesium compound are mixed together, and the ether then distilled off, the solid or thick oily product obtained being decomposed by faintly acidified water, by which means the acetal separates out as an oil; the latter may be purified by fractionation, after which hydrolysis with dilute acid yields the aldehyde. The acetals and aldehydes already prepared in this way are the following, the figures representing the percentage yields obtained in each case:—Acetal, 25; butyraldehyde, 22; acetal of isopropylacetaldehyde, 80; acetal of benzaldehyde, 45; acetal of phenylacetaldehyde, 62; *p*-bromobenzaldehyde, 40; anisaldehyde, 15.—T. H. P.

Cotarnine and Hydrastine; Condensations of —— with Ketones. C. Liebermann and F. Kropf. Ber., 1904, **37**, 211—216.

Cotarnine and hydrastine readily combine with acetone with the elimination of water, the acetone residue joining up with the –CHO (or the tautomeric form –CH.OH) group of the alkaloid. Ten grms. of powdered cotarnine are suspended in 30 c.c. of acetone, and a few c.c. of a saturated solution of sodium carbonate are added. In a short time, with vigorous agitation, the whole of the cotarnine enters into solution, and crystals begin to separate out. After 6—8 hours' repeated agitation, the excess of acetone is driven off and the product is separated. This product is *anhydro-cotarnine-acetone*, which forms large crystals, m. pt. 83°C., from dilute acetone; it differs from cotarnine in being insoluble in presence of excess of sodium carbonate. The hydrochloride melts at 171° C. and the methiodide at 144° C.

Cotarnine and hydrastine unite in exactly the same way with other ketones; compounds have been prepared with methylpropyl ketone and with acetophenone. The reaction is probably general with all methyl ketones, and apparently also with compounds containing a methylene group, since an analogous product has been obtained by the condensation of cotarnine with ethyl malonate.—J. F. B.

Santal-*Wood Oil.* E. J. Parry and C. T. Bennett. Chem. and Drug., 1904, **64**, 292.

The authors have examined authentic specimens of pure English, Dutch, and German santal-wood oil. The acetylated oil which must be prepared in order to determine the content of santalol, has the following characters:—Sp. gr. at 15° C., 0·9860 to 0·9885; optical rotation (in a 100 mm. tube), from −13° 50′ to −14° 30′; and refractive index at 20° C., 1·4894 to 1·4916. Four of the samples of oil were distilled under reduced pressure, and 10 per cent. fractions collected. The individual fractions gave the following results:—Sp. gr., 0·954—0·988; optical rotation, −14° to −22°; refractive index, 1·5038—1·5123. The conclusions drawn are that no fraction should be obtained with a refractive index below 1·5000, and that the optical rotations of the individual fractions should only vary within narrow limits. The refractive index of pure santal-wood oil is about 1·5060, and should never fall below 1·5030; in eight samples examined, it varied between 1·5040 and 1·5075.—A. S.

Boldo (Boldoa fragrans, Pneumus boldus, of the order Monimiaceæ), Essential Oil from ——. E. Tardy. J. Pharm. Chim., 1904, **19**, 132—136.

The essential oil distilled from the leaves contains a dextro-rotary terebenthene-like hydrocarbon; a terpene which is lævo-rotary and present in large amount; somewhat smaller proportions of cuminic aldehyde and inactive terpineol and possibly a little eugenol. Acetic acid and a lævo-sesquiterpene were also found.—F. S.

Papaw and Papaïn. F. Watts. Agricultural News; through Chem. and Drug., 1904, **64**, 185.

Papaïn is obtained from the fruit of the papaw-tree (*Carica Papaya*). An incision is made in the rind of the fruit with a bone or wooden instrument, and the juice or milk which flows out is collected in earthenware or glass vessels. The fruit is not removed from the tree, and may be tapped several times at intervals of two or three days. The juice soon coagulates, and the coagulum is spread on sheets of brown linen stretched on light wooden frames and dried in a drying-stove. The drying must be effected as soon as possible after the coagulum is obtained, as the latter rapidly undergoes decomposition. The coagulum is dried at as low a temperature—if possible, not above 100° F.—as is consistent with the obtainment of a dry product, before decomposition sets in. The papaïn shrinks considerably during drying. When it is quite dry, it is finely ground whilst still slightly warm; it should yield a white or cream-coloured powder with a characteristic but not putrid smell. It is packed in tins or bottles and carefully preserved from contact with the air.—A. S.

Iboga. Landrin and Dybowsky. Schweiz. Woch., **42**, 819. Pharm. J., 1904, **72**, 117.

Iboga, a woody plant of low growth, with a large root, is found in the Congo, and is stated to possess properties similar to those of coca and kola. All parts of the plant, but especially the root, are used by the natives. The active principle of the plant is an alkaloid named *ibogaïne*, $C_{26}H_{33}N_3O$, which is obtained from the powdered root (yield, 6—10 grms. from 1 kilo) by treating with milk of lime, extracting with ether, and taking up the alkaloid from the ethereal solution by means of sulphuric acid. Ibogaine is insoluble in water, but soluble in alcohol, ether, chloroform, and benzene. It is readily oxidised when exposed to the air, acquiring a yellowish-brown colour and becoming uncrystallisable. The hydrochloride crystallises well, especially from an acid solution.—A. S.

Epinephrine; Constitution of ——. H. A. D. Jowett. Proc. Chem. Soc., 1904, **20**, 18.

"Epinephrin" is the name given by Abel and Crawford to the active principle of the suprarenal glands, and the substance is identical, when pure, with the "adrenalin" of Takamine and the "suprarenin" of von Fürth. As Abel and Crawford were the first to isolate the active principle, although in an impure condition, the author has adopted the name proposed by them. On oxidation with potassium permanganate, methylamine and oxalic and formic acids are formed. By fusion with potassium hydroxide, a small amount of a crystalline substance is obtained which gives the protocatechuic acid reaction with ferric chloride. On methylation with methyl iodide and sodium in methyl alcohol, and subsequent oxidation with potassium permanganate, trimethylamine and veratric acid are obtained. The most probable formula is considered to be the following:—$C_6H_3(OH)_2(CH.OH.CH_2.NH.CH_3)(1:2:4)$.

Methyl Alcohol; Determination of ——, *in Presence of Ethyl Alcohol.* T. E. Thorpe and J. Holmes. XXIII., page 208.

Hydrazine and its Derviatives; Determination of —— [*and of Mercury*]. E. Rimini. XXIII., page 208.

Antipyrine and Salophene; New Reactions for ——. G. M. Bérenger. XXIII., page 207.

Alkaloids; Analysis [*Detection*] *of* ——. P. Kley. XXIII., page 207.

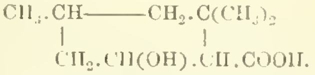
English Patents.

Odoriferous Substance ["*Farnesol*"] *suitable for Perfumery; Manufacture of an* ——. A. G. Bloxam, London. From Fab. Prod. de Chimie Organique de Laire, Paris. Eng. Pat. 540, Jan. 8, 1903.

See Fr. Pat. 328,146 of 1903 among Fr. Pats. hereinafter following.—T. F. B.

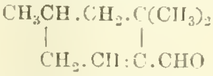
Perfume; Manufacture of Artificial ——, *and of Intermediate Products therefor.* O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/Main. Eng. Pat. 3173, Feb. 10, 1903.

Cyclogeraniolidene-acetone, which, when concentrated, has an odour of cedar, and, when dilute, smells of violets, is prepared as follows:—Trimethylcyclohexanone is treated in ethereal solution with sodium and carbon dioxide, trimethylcyclohexanone carboxylic acid being formed; on reduction with sodium amalgam, this latter gives trimethylhydroxycyclohexane carboxylic acid, of the probable constitution—



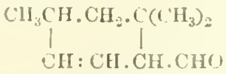
$$\begin{array}{l}\mathrm{CH_3.CH{-}{-}{-}{-}CH_2.C(CH_3)_2}\\ \qquad\quad |\qquad\qquad\qquad |\\ \qquad\mathrm{CH_2.CH(OH).CH.COOH.}\end{array}$$

On distilling the calcium salt of this acid *in vacuo* with calcium formate, cyclogeraniolene aldehyde is produced in two isomeric modifications, probably—



$$\begin{array}{l}\mathrm{CH_3CH.CH_2.C(CH_3)_2}\\ \quad |\qquad\qquad |\\ \quad\mathrm{CH_2.CH:C.CHO}\end{array}$$

α modification.



$$\begin{array}{l}\mathrm{CH_3CH.CH_2.C(CH_3)_2}\\ \quad |\qquad\qquad |\\ \mathrm{CH:CH.CH.CHO}\end{array}$$

β modification.

These modifications have not been separated. By condensing cyclogeraniolene aldehyde with acetone, cyclogeraniolidene acetone, $C_9H_{15}.CH:CH.CO.CH_3$, is obtained as a colourless oil, b. pt. 132°—134° C. (10 mm.). —T. F. B.

Pharmaceutical Compounds [*Alkyloxyalkylidene Esters of Salicylic Acid*]; *Production of* ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld. Eng. Pat. 5772, March 12, 1903.

See U.S. Pat. 740,628 of 1903; this J., 1903, 1306.—T. F. B.

Oxalates; Preparation of —— [*from Formates*]. G. W. Johnson, London. From R. Koepp and Co., Oestrich, Germany. Eng. Pat. 9327, April 24, 1903.

See Fr. Pat. 331,498 of 1903; this J., 1903, 1147.—T. F. B.

Aromatic Esters [Bornyl Esters]; Manufacture of New ——, and of Useful Products therefrom. G. B Ellis, London. From Chem. Fabr. von Heyden, Akt.-Ges., Radebeul. Eng. Pat. 26,785, Dec. 7, 1903.

Esters of borneol, of the general formula—

$$C_{10}H_{17}O.CO.R.OH.$$

R being an aromatic radical, are prepared by heating aromatic monohydroxycarboxylic acids with terpenes, particularly pinene or camphene, or substances containing these. For instance, bornyl salicylate is obtained by heating equal weights of turpentine oil and salicylic acid to about 120° C. for about 50 hours. The esters thus produced possess anti-rheumatic properties, particularly bornyl salicylate and *p*-cresotinate; they are decomposed by alkalis to borneol and alkali salt of the acid used, thus being suitable as intermediate products in the preparation of camphor from turpentine oil, since borneol on oxidation is converted into camphor.—T. F. B.

Soaps, Medicated, and Ointments; Production of ——, readily Resorbent. R. Reiss. Eng. Pat. 24,240, Nov. 9, 1903. XII., page 195.

United States Patents.

Geraniol Derivative. F. Hofmann, Elberfeld, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 746,703, Dec. 15, 1903.

Alpha-substituted geraniol derivatives of the general constitution—

$$(CH_3)_2C : CH.CH_2.CH_2.C(CH_3) : CH.CH(R).OH$$

are prepared by treating with water the product formed by the interaction of citral and the addition products of alkyl- or alphyl-magnesium halogen compounds and ethers. Thus α-methylgeraniol is prepared by adding an ethereal solution of citral (1,400 parts) to the product of the reaction of magnesium (240 parts), methyl iodide (1,420 parts), and anhydrous ether (1,500 parts). The iodo-magnesium compound of geraniol is decomposed by adding ice water and the ethereal solution is dried and distilled off, when α-methylgeraniol is obtained, b. pt. 112°–113° C. (12 mm.), having an odour similar to that of rose oil, and suitable for use in perfumery. When heated with acids these compounds split off water, forming unsaturated hydrocarbons, that from α-methylgeraniol being 2.6-dimethyl-2.6.8-nonatriene—

$$(CH_3)_2C : CH.CH_2.CH_2.C(CH_3) : CH.CH:CH_2.$$

—T. F. B.

Propiolic Acid: Homologous ——, and Process of Making same. C. Moureu, Paris. U.S. Pat. 749,800, Jan. 19, 1904.

See Eng. Pat. 23,727 of 1900; this J., 1902, 188.—T. F. B.

Amyl Propiolic Acid; Ether of ——. C. Moureu, Paris. U.S. Pat. 750,212, Jan. 19, 1904.

See Eng. Pat. 23,727 of 1900; this J., 1902, 188.—T. F. B.

[Hexyl] Propiolic Acid; Ether of ——. C. Moureu, Paris. U.S. Pat. 750,213, Jan. 19, 1904.

See Eng. Pat. 23,727 of 1900; this J., 1902, 188.—T. F. B.

Acetyl Salicylic Acid; Process of Making ——. B. Balthazard, Assignor to Soc. Chim. des Usines du Rhône, ancien. Gilliard, P. Monnet et Cartier, St. Fons. U.S. Pat. 749,980, Jan. 19, 1904.

See Eng. Pat. 14,699 of 1902; this J., 1903, 880.—T. F. B.

Dialkyl Barbituric Acids; Process of Making ——. M. Engelmann, Elberfeld, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 750,627, Jan. 26, 1904.

See Eng. Pat. 21,833 of 1903; this J., 1904, 76.—T. F. B.

French Patents.

Odoriferous Substance ["Farnesol"]; Process of Obtaining a New ——. Fabr. Prod. de Chimie Organique de Laire. Fr. Pat. 328,146, Nov. 19, 1902.

A sesquiterpene alcohol, "Farnesol," $C_{15}H_{26}O$, is a constituent of certain essential oils, either in a free or combined state, notably in cassia oil and in ambrette oil. If it be present in combination, the oil is saponified, and then fractionated; if, on the other hand, it be present uncombined, the saponification is dispensed with; the fraction containing it comes over between 150° and 200° C., and is treated with an acid anhydride (*e.g.*, phthalic anhydride); the "Farnesol phthalate" thus obtained is saponified and the product distilled with steam and fractionated. "Farnesol" is a colourless oil: b. pt. about 160° C. (10 mm.), sp. gr. (18° C.) 0·885: it has an agreeable floral odour, and can be used for the preparation of perfumes.

—T. F. B.

Perfume from Citrylidene Aceto-acetic Ether; Process for Making a ——. E. Knoevenagel. Fr. Pat. 335,380, Sept. 15, 1903.

Citrylidene aceto-acetic ether, obtained by condensing aceto-acetic ester with citral, may be heated for 5 or 6 hours at 160° C., with or without water. If the ether obtained, and thus "isomerised," be gradually run into 5 to 6 times its weight of 80 per cent. sulphuric acid, the temperature being kept at or below 0° C., and the whole allowed to stand for some hours and then poured on to ice, the product, on distillation with steam, gives an oil of which the fraction distilling between 150° and 190° C. (12 mm.) is applicable to perfumery, having an odour resembling that of the lupin, but at the same time recalling that of ionone. Acids other than sulphuric acid may be used for this reaction.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Silver Chloride Sensitive to Colour. E. Baur. Zeits. physik. Chem., **45**, 613—626. Chem. Centr., 1904, **1**, 13.

Emulsions were prepared by treating 1 per cent. solutions of Carey Lea's golden brown modification of silver with varying amounts of chlorine water, and then adding 5 per cent. gelatin to the mixtures of silver chloride (AgCl) and sub-chloride (Ag_2Cl) produced. Plates coated with these emulsions reproduce, after one hour's exposure, the solar spectrum in its natural colours. The last traces of sub-chloride can only be dissolved out from the "photo-chloride" of silver with difficulty by nitric acid, corresponding to the last traces of silver in a gold-silver alloy. The melting points of the photo-chlorides rich in sub-chloride appear to be higher than that of pure silver chloride; the melts are always clear and of uniform colour. In the author's opinion, the "photo-chlorides" represent an uninterrupted series of homogeneous mixtures of silver chloride and sub-chloride.—A. S.

English Patents.

Multicoloured Photographs; Process for the Production of ——. A. Lemberger and G. L. Böhm, Munich. Eng. Pat. 372, Jan. 6, 1903.

The relief positive formed by exposing under a negative, paper coated with gum arabic and sensitised with bichromate, and subsequently developed in water, is coloured by hand in suitable colours, the portions which are not to be coloured being covered with a layer of gum arabic.

—T. F. B.

Polychrome Printing on Calico and other Materials. E. Rolffs. Eng. Pat. 1583, Jan. 22, 1903. V., page 184.

Meta-amido-ortho-oxybenzyl Sulphonic Acid [Photographic Developer]; Manufacture and Production of ——. H. E. Newton, London. From the Farbenfabr. vorm. F. Bayer & Co., Elberfeld. Eng. Pat. 3545, Feb. 14, 1903.

See U.S. Pat. 729,051 of 1903; this J., 1903, 881.—T. F. B.

United States Patent.

Photographic Prints; Process of Preparing ——, for Toning. T. Baker, Melbourne. U.S. Pat. 750,014. Jan. 19, 1904.

See Eng. Pat. 21,019 of 1902; this J., 1903, 319.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

Explosives in Coal Mines Order, Dec. 10, 1903. A. Akers-Douglas, one of H.M. Principal Secretaries of State.

The following have been added to the list of "permitted explosives" under above date:—

Ammonal.—Ammonium nitrate (93—97 parts), aluminium (4—6 parts), moisture (0—1 part). The explosive to be contained in a case of paper and tinfoil thoroughly waterproofed.

Bobbinite (1st Definition).—Potassium nitrate (62—65 parts), charcoal (17—19½ parts), sulphur (1½—2½ parts), ammonium sulphate and copper sulphate (15—17 parts), moisture (0—2½ parts).

Bobbinite (2nd Definition).—Potassium nitrate (63—66 parts), charcoal (18½—20½ parts), sulphur (1½—2½ parts), rice or maize starch (7—9 parts), paraffin wax (2½—3½ parts), moisture (0—3 parts).

Each pellet to be thoroughly coated with paraffin wax, and contained in a wrapper of brown paper.

Faversham Powder (1st Definition).—Ammonium nitrate (84—86 parts), trinitrotoluene (10—12 parts) ammonium chloride (1—2 parts), sodium chloride (2—3 parts), moisture (0—½ part).

Faversham Powder (2nd Definition).—Ammonium nitrate (87—93 parts), trinitrotoluene (9—11 parts), moisture (0—1 part). The explosive to be enclosed in a case of an alloy of lead, tin, zinc, and antimony thoroughly waterproofed.

Geloxite.—Nitroglycerin (54—64 parts), nitrocotton (4—5 parts), potassium nitrate (13—22 parts), wood meal (4—7 parts), ammonium oxalate (12—15 parts), red ochre (0—1 part). The explosive to be contained in a non-waterproofed wrapper of parchment paper.—G. W. McD.

United States Patent.

Explosive. H. Dreany. Sudbury, Canada. U.S. Pat. 750,175, Jan. 19, 1904.

See Eng. Pat. 26,802 of 1902; this J., 1903, 1208.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Vacuum Distillations; Attainment of High Vacua without Mercury Pumps or Liquid Air. P. Krafft. Ber., 1904, **37**, 95-100.

The following procedure, though not likely to supersede the use of mercury pumps and liquid air where these are obtainable and in skilled hands, yet allows of exhaustion sufficient for the production of cathode rays, and requires but little supervision. The successful working of the apparatus depends entirely on the perfect tightness of the stopcocks and stoppers, which the author lubricates with a mixture of 2 parts of white wax and 1 of wool grease. The distillation-flask is stoppered, and has also a side-tube close to the stopper, provided with a stopcock. The receiver communicates, on the side away from the distillation-flask, by means of a tube carrying as appendages a mercury manometer and a Hittorf's tube, with an apparatus for evolving carbon dioxide. A branch from this connecting-tube divides in its turn into two branches, one communicating with a small reservoir for caustic potash solution, the other leading, through a mercury-valve to prevent air-return, to the water-aspirator. This latter branch carries a connection to a mercury manometer, and also a by-pass communicating with a large vacuum-reservoir, which can be shut off at will. Stopcocks are provided so that there can be separately shut off—the distilling flask, the receiver, the carbon dioxide apparatus, the caustic potash apparatus, and the aspirator. The apparatus is put together, and the vacuum-reservoir is exhausted. When ready, the rest of the apparatus is opened to this and the pump; soon the vacuum-reservoir is shut off, and the exhaustion is continued to 15—20 mm. Carbon dioxide is admitted, and the residual air expelled as completely as possible by opening the outer stopcocks and allowing the carbon dioxide to stream through for a while. The apparatus is again exhausted, refilled with carbon dioxide, and this cycle repeated three or four times. After the last exhaustion, strong caustic potash solution is admitted to the reservoir by the tall tap-funnel connected with it. When absorption is complete at the ordinary temperature, the potash-reservoir is cooled by ice and salt, or carbon dioxide and ether; with the latter mixture, exhaustion to cathode-rays in the Hittorf-tube is attained. With good stopcocks, the apparatus will retain its vacuum for days.

—J. T. D.

English Patent.

Burners for Testing Gas. W. T. Sugg. Eng. Pat. 4052, Feb. 20, 1903.

To avoid the inconvenience of changing the burner when a different quality of gas has to be tested, a number of burners are fixed by means of branches to a hollow barrel rotating on a hollow plug fixed to the gas-supply pipe. The hollow plug is provided with a lateral opening, and by rotating the barrel, any desired burner may be connected with the gas supply.—L. F. G.

INORGANIC—QUALITATIVE.

Cobalt and Nickel Salts, Distinctive Reaction for ——. G. Guérin. J. Pharm. Chim., 1904, **19**, 139.

If a solution of a cobalt salt is precipitated by excess of caustic potash and then treated with an excess of iodine in potassium iodide, after a few moments, the whole of the cobalt is precipitated as a black hydrated sesquioxide. Nickel gives a light green hydroxide. The same behaviour is shown by cobalt and nickel when already precipitated by other radicles, except when precipitated as ferricyanides. In this case the potash alone produces a black precipitate of cobalt hydrated sesquioxide.—F. S.

Molybdenum; A New Reaction of ——. E. Lecocq. Bull. de l'Assoc. Belge des Chim., 1903, **17**, 412—414.

Diphenylcarbazide in alcoholic solution produces a characteristic coloration when added to ammonium, potassium, or sodium molybdate in the presence of a trace of acid. (See Cazeneuve, this J., 1900, 1007 and 1040). A single drop of the reagent, when not too freshly prepared, causes a magnificent indigo-violet colour, which increases as more is added, and finally a violet precipitate is formed. The test is sensitive to 0·007 part of ammonium molybdate per litre, but strong acids in excess and alkalis destroy the colour. Tungsten, titanium, and vanadium do not respond to the test, copper gives a violet-brown colour, and mercury a strong blue. Mercury, however, also reacts with a benzene solution of diphenylcarbazide which molybdenum fails to do. This last fact and the distinct influence of age in the sensitiveness of the reagent suggests that the reaction is due to an interaction of the alcohol with the carbazide. A small quantity of carbazide was dissolved in methyl, ethyl, propyl, butyl, isobutyl and amyl alcohols, and each in turn added to ammonium molybdate solutions (0·5 grm. in 10 c.c. of water and 2 drops of hydrochloric acid. A regular scale of colours, from indigo-blue to rose, was obtained, but not sufficiently defined to afford a means of identifying any one alcohol, except amylic alcohol, which gave two layers of liquid, the upper rose-coloured, and the lower colourless.—R. L. J.

Carbon Dioxide in Air; Nile Blue Base as a Reagent for; and Action of Colour-Acids on Cellulose, Alcohol, and Acetone. M. Heidenhain IV., page 183.

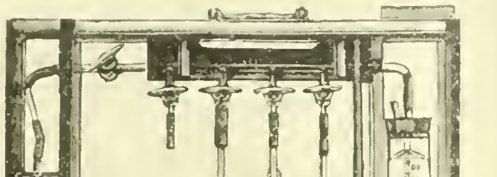
INORGANIC—QUANTITATIVE.

Titanium; Sensitive Reaction of ——. A. Jorissen. Bull. Acad. Roy. Belg., 1903, 902–907. Chem. Centr. 1904, **1**, 55.

A small quantity of the solid substance is mixed with six times its weight of potassium bisulphate, and the mixture fused in a platinum loop till the fused bead becomes clear and does not effervesce. The bead is then broken up and treated with 0·01—0·02 grm. of salicylic acid dissolved in 20—30 drops of concentrated sulphuric acid. If titanium be present, the pieces of the bead are coloured red, and the liquid also gradually acquires a red colour. The reaction is applicable in presence of cerium, iron, aluminium, beryllium, lanthanum, didymium, thorium, zirconium, chromium, and silicon compounds, but not in presence of vanadium, molybdenum, or tungsten compounds.—A. S.

Unburnt Products in Chimney Gases; Determination of ——, *by a Modified Orsat Apparatus.* W. H. Sodeau. Chem. News., 1904, **89**, 61–62.

For the determination of the hydrogen, carbon monoxide and carbon dioxide, the author uses a modified Orsat apparatus, provided with a Winkler combustion pipette, O, by means of which the use of cuprous chloride can be dispensed with. The sample of gas is measured in L in the ordinary way except that instead of pinching the tube it is convenient to use the stopcock S (connected at one side with the measuring tube L, at the other, with the reservoir M R), when adjusting the pressure of the gas in L before reading the volume. The carbon dioxide is absorbed by potash solution in K, and the residual gas after measurement is then passed into O (the current having previously been switched on) and back to K for absorption of the carbon dioxide formed by the explosion, and thence to L for measurement of the contraction due to combustion of hydrogen and carbon monoxide. In cases where it is desirable to know the percentage of oxygen originally present, this may be done by finally absorbing with phosphorus or pyrogallol solution in the pipette P, and adding to the result the amount of oxygen required to burn the combustible gas.—D. H. J.



Chlorates, Bromates, and Iodates, Volumetric Determination of ——. L. Débourdeaux. Comptes rend., 1904, **130**, 147.

A solution of oxalic acid containing 5 grms. of manganese sulphate and 12 c.c. of concentrated sulphuric acid per 100 c.c. of solution (see this J., 1903, 883) reacts quantitatively with chlorates and bromates thus—

$$HClO_3 + 3H_2C_2O_4 = HCl + 6CO_2 + 3H_2O,$$

and with iodates thus—

$$2HIO_3 + 5H_2C_2O_4 = I_2 + 10CO_2 + 6H_2O.$$

Hence chlorates, bromates, and iodates can be determined by heating with an excess of the oxalic acid mixture, and titrating the undestroyed oxalic acid with permanganate. Silver iodate, however, is an exception, since silver iodide is partially formed. The reacting liquid must be slowly heated to about 94° C., and the concentrations given above rigidly adhered to. In titrating back with permanganate the evil influence of halides is guarded against by previously adding excess of silver nitrate.—W. A. C.

Uranyl Compounds; Iodometric Method of Determining Uranium in ——. B. Glasmann. Ber., 1904, **37**, 189—191.

The method depends on the reaction of neutral solutions of uranyl salts on a mixture of potassium iodide and iodate:—

$$3UO_2(NO_3)_2 + 5KI + KIO_3 + 3H_2O =$$
$$3UO_2(OH)_2 + 6KNO_3 + 3I_2.$$

Any excess of acid in the solution must be neutralised with sodium carbonate, which is added till a precipitate begins to be permanent; this precipitate is then just redissolved in dilute acid. Place the solution in a 300 c.c. distillation flask provided with a ground stopper carrying a funnel with stopcock, the tube of which reaches to the bottom of the flask. Insert the exit-tube of the flask into the receiver containing potassium iodide solution, add to the uranyl solution the requisite amount of iodide and iodate mixture, dilute to 120 c.c., close with the stoppered funnel, and slowly heat on gauze to boiling. When boiling, cool the receiver with water, and lead a stream of hydrogen through the boiling liquid. When the liquid is reduced to 50 c.c. withdraw the flask from the receiver, remove the burner, wash the delivery tube into a beaker, rinse the contents of the receiver into the same beaker, and titrate with thiosulphate. With 0·2—0·3 grm. of uranyl compound the whole operation requires 20 minutes. The results are accurate, and are not affected by the presence of alkaline-earth chlorides.—J. T. D.

Aluminium from Iron, Separation of ——. A. Leclère. Comptes rend., 1904, **138**, 146.

In the somewhat dilute solution of mixed iron and aluminium salts, slightly acidified with sulphuric acid, the iron is first reduced to the ferrous state by ammonium thiosulphate. A large excess of ammonium formate is then added, together with more ammonium thiosulphate, and the whole boiled. The aluminium is thrown down as basic formate, mixed with a little sulphur; in drying the precipitate nitric acid is added to prevent carbonisation. The iron in the filtrate is precipitated by a soluble sulphide and weighed as iron sulphide.—W. A. C.

Rubidium and Cæsium [*and Potassium*]; *Determination of* ——. C. Montemartini and G. Mattucci. Gaz. chim. ital., **33**, 189—201. Chem. Centr., 1904, **1**, 119.

For the determination of rubidium and cæsium, the authors use the following method, described by K. Gilbert (Inaug. Diss., Tübingen, 1898), for the determination of potassium. Two solutions are prepared:—(*a*) 10 grms. of cobalt carbonate are dissolved in the smallest possible amount of acetic acid, the solution is boiled to expel carbon dioxide, and after cooling, is made up to 1 litre; (*b*) a solution containing 150 grms. of sodium nitrite, free from potassium, per litre. For the precipitation of the potassium, a mixture of equal volumes of these two solutions are used (60 c.c. for each 0·1 grm. of potassium). A solution of potassium chloride (0·4 grm. in 25 c.c.) was treated with 140 c.c. of the sodium-cobalt reagent, the mixture heated for 6—7 hours at 40° C., allowed to stand overnight, filtered, and the precipitate washed first with the sodium-cobalt reagent and then with 80 per cent. alcohol, and dried at 110° C. It was then decomposed by heating to 300° C., the residue treated repeatedly with hydrochloric acid, a few c.c. of 30 per cent. perchloric acid added, the excess of free acid expelled by heating, the residue treated with absolute alcohol, the insoluble portion washed with alcohol till neutral, then dried at 110° C. and weighed. Rubidium and cæsium are determined in a similar manner. The authors point out that not only sodium as stated by Gilbert, but also small amounts of other metals are precipitated with the potassium, rubidium, and cæsium, and the efficacy of Gilbert's method depends not only upon the quantitative precipitation of potassium, rubidium, and cæsium by the sodium-cobalt reagent, but also upon the fact that whilst perchlorates in general are soluble in absolute alcohol, the perchlorates of the metals named are insoluble in that medium.—A. S.

Gold in Cyanide Solutions; Colorimetric Method for the Determination of the ——. A. Prister. J. Chem., Met. and Min. Soc. of S. Africa, 1903, **4**, 235—237.

The cyanide solution to be assayed is first heated with hydrochloric acid to destroy the free potassium cyanide, ferrocyanides of zinc and copper and thiocyanates (sulphocyanides) being precipitated. To decompose the double cyanide of gold and potassium, a few drops of a solution obtained by boiling cupric sulphate solution with sodium chloride and copper shavings, and after cooling adding acetic acid, are introduced, with boiling, followed by addition of a little sodium sulphide. The first reaction is—

$$2KAuCy_2 + 2CuCl = 2AuCuCy_2 + 2KCl,$$

followed by a secondary reaction in which copper sulphide is formed. The double cyanide of copper and gold ($AuCuCy_2$), as well as the copper sulphide, are insoluble, and mix with the other precipitated salts. These are collected, redissolved in potassium cyanide solution, and the gold is precipitated by digestion with zinc powder. Silver, some copper, and the excess of zinc, accompany the gold. The precipitate, after separation, is treated with hydrochloric acid, and after filtering off the zinc chloride solution, with *aqua regia.* The solution is then treated with stannous chloride solution, the shade of the Cassius purple produced being compared against a standard. The process is stated to be capable of giving higher results than the fire assay.—E. S.

Lead Dioxide, Electro-deposition of ——, in Quantitative Analysis. A. Hollard. Comptes rend., 1904, **138**, 142.

When lead dioxide is deposited from solutions of lead salts on an anode of blackened (platinised) platinum, it contains more oxygen than corresponds to the formula PbO_2, so that the analytical factor is less than 0·866. The factor varies regularly with the concentration of the electrolyte, from 0·740 for a bath containing 0·01 grm. of lead in 300 c.c. to 0·861 in one containing 10 grms. If the platinum anode be merely sand-blasted, the composition of the deposit is practically independent of the concentration, the mean factor being 0·853, with limits of 0·857 to 0·848. This holds good both for baths of lead nitrate and of lead sulphate dissolved in ammonium nitrate, with excess of nitric acid in either case.—W. A. C.

ORGANIC—QUALITATIVE.

Antipyrine and Salophene; New Reactions for ——. G. M. Bérenger. Amer. J. Pharm., **75**, 435. Pharm. J., 1904, **72**, 117.

If antipyrine be treated with sodium hypochlorite solution, the odour of chlorine disappears and is replaced in a few minutes by that of bitter almonds. If chlorine water be substituted for the sodium hypochlorite solution, the odour of chlorine disappears in a similar manner, whilst an abundant white precipitate is formed. If 1 grm. of salophene (acet-*p*-aminophenyl salicylate) be boiled with a dilute solution of caustic soda, and, after cooling, 5 c.c. of sodium hypochlorite solution added, a green coloration is immediately produced, which changes finally to a mahogany brown, the change of colour taking place slowly in the cold, but rapidly if the liquid be boiled. On adding excess of acid to the green or brown solution, a scarlet colour, changing to orange red, is produced.—A. S.

Alkaloids; Analysis [Identification] of ——. P. Kley. Rec. trav. chim. Pays-Bas, **22**, 367—384. Chem. Centr., 1904, **1**, 123.

The author has devised a rapid and reliable method, by means of which, with the aid of the polarising microscope, the different alkaloids can be identified by their refractive indices. A very small crystal, which acts to some extent as a convex lens, is placed on the object-glass of the microscope, together with a liquid of known refracting power. In making the examination, parallel light is used; on adjusting the microscope, one can recognise by certain phenomena whether the liquid is more or less refracting than the crystals. The liquid is then replaced by another and so on, until, when the refractive indices of the crystals and of the liquid are identical, the contour of the crystal can no longer be perceived, but only coloured rings. In this manner definite values can be obtained for the various alkaloids, without determining the crystalline form, angles of the two optical axes, &c. The author examined in the above manner the alkaloids of strychnos, of opium and of cinchona bark; cocaine, atropine, hyoscyamine, hydrastine, berberine, cytisine, physostigmine, sparteine sulphate, aconitine, delphinine, veratrine, cantharadine, piperine, caffeine, and theobromine. By setting out the results graphically, a right-angled field is obtained, in which the different alkaloids are represented by points; the diagonal separates the positive and negative crystals; and the distance from it indicates the intensity of the double refraction. The points representing different alkaloids coincide only in a few cases, and then only when the alkaloids in question can be easily distinguished by other means. On the other hand, alkaloids which can only be distinguished with difficulty by other means (*e.g.*, strychnine and brucine) are represented by points widely removed one from the other.—A. S.

ORGANIC—QUANTITATIVE.

Linseed Oil; Determination of Unsaponifiable Matter in ——. C. Niegemann. Chem.-Zeit., 1904, **28**, 97.

The author has found in 18 determinations on pure linseed oil that the maximum amount of unsaponifiable matter was 2·15, the minimum 0·74, and the average 1·35 per cent., this average being exceeded in seven of the samples. The author therefore concludes that it is not justifiable to condemn a linseed oil solely because the amount of unsaponifiable matter exceeds the highest limit (1·3 per cent.). —C. A. M.

Tanning Analysis; Notes on ——. G. Schweitzer. Collegium, 1904, 21—23.

The author proposes to attach close fitting covers, like those on platinum crucibles, to the flat-bottomed nickel basins employed for evaporations in tanning analysis so as to avoid increase of weight during weighing. He uses flat-bottomed glass dishes with a rim 5—7 mm. wide and covered with a glass plate.—R. L. J.

Hide-Powder; Determination of Acidity in ——. J. Paessler. Collegium, 1904, 23—24.

The acidity of hide-powder is tested at the Research Station at Freiberg in the following manner:—2 grms. of air-dried powder are left to soak in 50 c.c. of water for about two hours. Azolithmin solution is added to colour the whole distinctly red, and the contents of the beaker are titrated with decinormal sodium hydroxide solution till a permanent blue colour is obtained, the result being calculated as acetic acid. It is usually about 0·15 per cent.—R. L. J.

Organic Matter [Determination of ——] in Soils and Subsoils. F. K. Cameron and J. F. Breazeale. J. Amer. Chem. Soc., 1904, **26**, 29—45.

A comparative examination of the various methods in use for determining organic matter in soils indicated that oxidation by means of chromic acid gave the most reliable results. The method used was as follows:—About 10 grms. of the soil were mixed with 5—10 grms. of potassium bichromate, and concentrated sulphuric acid added gradually. The volatile oxidation products were passed first through a slightly acidified solution of silver sulphate (to arrest hydrochloric acid, sulphur dioxide and trioxide) and the carbon dioxide absorbed by potassium hydroxide. A stream of air, freed from carbon dioxide, was aspirated through the apparatus during the operation. The amount of organic matter is taken as being the weight of carbon dioxide obtained × 0·471, this factor appearing to be the most suitable. The method is slightly modified when chlorides are present in the soil, the bichromate being dissolved in the acid and added to the soil; it was found that, in this way, no hydrochloric acid, chlorine, or chromyl chloride was evolved. When carbonates are present, they may be determined separately by treatment with dilute acids. This method was found to give, in all cases, results lower than those obtained by dry combustion in a current of oxygen.—T. F. B.

Methyl Alcohol; Determination of ——, in Presence of Ethyl Alcohol. T. E. Thorpe and J. Holmes. J. Chem. Soc. (Trans.), 1904, **85**, 1—6.

The process is based upon the fact that on treating methyl alcohol with a mixture of potassium bichromate and sulphuric acid under certain conditions, it is wholly decomposed into carbon dioxide and water: with ethyl alcohol under the same conditions, 0·5 per cent. is converted into carbon dioxide and the remainder into acetic acid. On making the determination, the sample is diluted with water till 50 c.c. do not contain more than 1 grm. of methyl alcohol, or if ethyl alcohol be also present, not more than 4 grms. of the mixed alcohols. 50 c.c. of the diluted sample are then treated with 20 grms. of potassium bichromate and 80 c.c. of dilute (1 : 4) sulphuric acid in a stoppered flask fitted with a funnel and side tube, and the mixture allowed to stand for 18 hours. A farther quantity of 10 grms. of potassium bichromate and 50 c.c. of sulphuric acid mixed with an equal volume of water are then added, and the mixture boiled for about 10 minutes, the carbon dioxide evolved being carried over by a current of air and collected in weighed soda-lime tubes. From the total weight of carbon dioxide, 0·01 grm. must be subtracted for each grm. of ethyl alcohol present. The total amount of the two alcohols can be determined in the usual way by the aid of the same table of densities, the relative densities of the two alcohols being almost identical. The method may be used to determine whether tinctures or other medicinal preparations contain methylated spirits, and to what extent. The spirit from 25 c.c. of the sample, or from 50 c.c. if it contains less than 50 per cent. of alcohol, is freed from essential oils, &c., in the manner previously described by the authors (this J., 1903, 232); it is then distilled, diluted with water to 250 c.c., and 50 c.c. treated in the manner described above. If the weight of carbon dioxide does not exceed 0·01 grm. for each grm. of alcohol present, it may be concluded that the sample contains only spirits of wine. If the weight of carbon dioxide exceeds this amount, its equivalent in methyl alcohol by volume, must be corrected by subtracting 0·7—1 per cent. (depending on the amount of methylated spirit present), the percentage of methylated spirit being calculated on the assumption that the percentage of methyl alcohol in dehydrated methylated spirit does not exceed 8·8 per cent.—A. S.

Hydrazine and its Derivatives: Determination of —— [and of Mercury]. E. Rimini. Atti R. Accad. dei Lincei Roma, **12**, 376—381. Chem. Centr., 1904, **1**, 213.

If a known quantity of hydrazine sulphate be boiled in a Schulze-Tiemann's apparatus with a solution of mercuric chloride, and, after the air is completely expelled, a concentrated solution of alkali be introduced, an amount of nitrogen equivalent to the hydrazine present is evolved, the reaction proceeding according to the equation—

$$N_2H_4.H_2SO_4 + 6KOH + 2HgCl_2 =$$
$$K_2SO_4 + 4KCl + 2Hg + N_2 + 6H_2O.$$

In using this method for hydrazine derivatives the sample is boiled with a solution of mercuric chloride, acidified with hydrochloric acid. Semicarbazides are first hydrolysed by the acid, according to the equation—

$$NH_2.CO.NH.NH_2HCl + H_2O + 2HCl =$$
$$N_2H_4(HCl)_2 + NH_4Cl + CO_2.$$

Semicarbazones are split up into the corresponding ketone or aldehyde and the semicarbazide salt, the latter being then further decomposed in the manner shown above. The author has determined by this method the amount of hydrazine-nitrogen in the semicarbazones of menthone, fenchone, and tanacetone. By using an excess of hydrazine or semicarbazide, mercury may be determined by this method, even when considerable amounts of alkali salts are present. With solutions containing less than 1 per cent. of mercuric chloride, the determination is carried out in the Schulze-Tiemann apparatus, but with concentrated solutions or with the powdered salt, it is better to work in the cold, with a Lunge or Knop-Wagner nitrometer and measure the air displaced by the nitrogen evolved.—A. S.

United States Patent.

Butter: Process of Testing ——. M. Vogtherr, Berlin. U.S. Pat. 749,343, Jan. 12, 1904.

A known quantity of the melted butter is agitated with a definite quantity of "sulphuric acid containing 4 per cent. of amyl alcohol," and the amount of fat rising to the surface and the increase in the volume of the acid layer due to the water in the butter are measured.—C. A. M.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Radium Bromide; Gases Occluded or Emitted by ——. J. Dewar and P. Curie. Comptes rend., 1904, **138**, 190—192.

Radium bromide (0·1 grm.) left in a vacuous space for three months, gave off about 3 c.c. of gas showing the spectrum of hydrogen. This was transferred to a quartz flask, exhausted, the flask heated to redness so as to fuse the radium bromide, and the evolved gases collected after passage through tubes cooled by liquid air. These gases (2·6 c.c.) still contained some radium emanation, were radio-active and luminous. The light emitted showed in the spectroscope three lines belonging to nitrogen. The gas, transferred to a Geissler tube, gave with the induction coil the spectrum of nitrogen. The quartz flask was sealed while the salt was melted. Twenty days afterwards the gas within showed the complete spectrum of helium.—J. T. D.

Radium; Contribution to the Knowledge of ——. W. Marckwald. Ber., 1904, **37**, 88—91.

Separation of Radium from Barium.—By treating a concentrated aqueous solution of radium-barium chloride with a 1 per cent. sodium amalgam, a radium-barium amalgam is formed, in which the proportion of radium to barium is much greater than in the original solution.

Phosphorescence of Anhydrous Radium-Barium Chloride.—The different behaviour of anhydrous radium-barium chloride, which exhibits strong phosphorescence, and of the crystallised salt, which is practically non-phosphorescent, is due to the fact that anhydrous barium chloride is caused to phosphoresce by Becquerel, α-, and β-rays, whilst crystallised barium chloride is not affected in a similar manner.

Induced Radio-activity.—If strips of metal be immersed in a freshly-prepared solution of a radium-barium chloride as obtained direct from Joachimsthal pitchblende, the metal becomes radio-active, the maximum effect being attained in 15—30 minutes. The metals are not all affected to the same degree.—A. S.

Colloidal Metals of the Platinum Group. I. C. Paal and C. Amberger. Ber., 1904, **37**, 124—139. (See this J., 1902, 916, 994, 995, 996.)

By the aid of sodium protalbinate and lysalbinate, the authors have now succeeded in preparing colloidal solutions of platinum, palladium, and iridium.—A. S.

Radium Bromide; Influence of ——, on the Electrical Resistance of Bismuth. R. Paillot. Comptes rend., 1904, **138**, 139.

A SPIRAL of bismuth wire enclosed between thin mica plates was exposed to the emanation of 0·03 grm. of radium bromide of high activity, contained in a thin glass tube. At a distance of ½ mm. the resistance of the spiral was diminished by about 0·034 per cent. The effect is instantaneous and does not change with time; it rapidly falls off on increasing the distance, and at 1 cm. ceases altogether. When the radium bromide is removed, the spiral almost immediately returns to its original resistance.
—W. A. C.

Active Oxygen. IX. Autoxidation of Cerous Salts. C. Engler. Ber., 1904, **37**, 49—59. (See also this J., 1903, 969 and 1121.)

A REPLY to Baur. The author and others have made a large number of experiments, of which the details are given, on the lines indicated by Baur, and the results all confirm the view that one atom of cerium in the form of an alkaline cerous salt takes up only one atom of oxygen. The active oxygen present as peroxide in the autoxidised cerium solution was also determined by titration, the cherry-red solution being added to a known volume of arsenite solution until it was no longer reduced to the yellowish colour characteristic of ceric solutions. The results showed that one half of the oxygen taken up had been rendered active which is in agreement with the author's contention, and opposed to that of Baur.—H. B.

Colloidal Solutions. J. Duclaux. Comptes rend., 1904, **138**, 144.

THE author has studied the conditions under which colloids are produced by double decomposition. When dilute solutions of potassium ferrocyanide and of a copper salt are mixed, a copper ferrocyanide is formed which contains potassium and has a definite composition varying with the proportion of the reagents, which proportion also determines whether it will remain in solution or be coagulated; addition of one or other of the reagents displaces the equilibrium. The composition of this product may be represented by $K_nCu_mFeCy_6$, where $m + \frac{n}{2} = 2$; for cupric chloride n decreases from 1·3 to 0 as the copper increases from 0 to near infinity. If the proportion of ferrocyanide to copper is exactly molecular, n has a mean value of 0·4, though it varies with the dilution; at this "critical point" a minute excess of reagent, or an addition of foreign salt, causes a considerable change in the composition of the colloid; with excess of copper it remains in solution, whilst excess of ferrocyanide coagulates it. The composition of the dissolved colloid differs definitely from that of the precipitated body, and it may be concluded that the coagulation is not exclusively a physical phenomenon. In the case of "double colloids," such as copper and cadmium sulphides, all the four radicals of the two reagents are found in the precipitate
—W. A. C.

Indium; Studies on ——. A. Thiel. Ber., 1904, **37**, 175—176.

THE author has obtained metallic indium electrolytically, in regular crystals, of sp. gr. 7·12 (13°/4° C.) and m. pt. 155° C. The atomic weight, determined from the sublimed trichloride, was obtained as 115·08 ± 0·03, which figure was confirmed by researches on the tribromide and the oxide. The oxide is not absolutely fixed, and is hence not very trustworthy as a basis for such determinations. The following compounds have been prepared: *Oxide*, in chlorine-green shining crystals, apparently rhombohedra. *Sulphide*, In_2S_3, scarlet powder with metallic lustre, or cinnabar-red columnar crystals. *Sulphide*, In_2S, volatile; black-brown powder, or yellow-brown transparent microscopic crystals. *Fluoride*, $InF_3.3H_2O$, shining, strongly double-refracting crystals, moderately soluble, easily decomposed. *Oxychloride*, white, slightly soluble powder. *Mono- and di-bromides*, like the corresponding chlorides. Also compounds which are perhaps a higher bromide and iodide. The electrolytically deposited metal is between silver and platinum in colour; it is extremely soft, and can be squeezed into wire in a sodium press.—J. T. D.

Formaldehyde; Presence of ——, in Atmospheric Air. H. Henriet. Comptes rend., 1904, **138**, 203—205.

RAIN-WATERS, especially those from fogs, were concentrated from 30—40 litres to 200 c.c., and the concentrates distilled. The distillates contained formic acid and formaldehyde. The presence of the latter was confirmed by tests with resorcinol, with peptone and ferric chloride, with hydroxylamine (formation of oxime and thence of hydrocyanic acid), and with dimethyaniline and sulphuric acid. Attempts to determine the amount of formaldehyde gave from 0·00001 to 0·00005 parts of the weight of the air. The antiseptic properties of this atmospheric formaldehyde are no doubt of great importance.—J. T. D.

Sugars: Synthesis of ——, from Trioxymethylene. Seyewetz and Gibello. Comptes rend., 1904, **138**, 150.

TRIOXYMETHYLENE (paraformaldehyde) is easily soluble in aqueous solutions of sodium sulphite. On boiling it with 20 parts of anhydrous sulphite in 10 per cent. solution, the aldehyde is completely decomposed after 10 minutes, with formation of sugars. The mixed osazones obtained from the resulting liquid yield a small quantity of *formosazone*, m. pt. 148° C., on extraction with boiling 80 per cent. alcohol. The residue is washed, dried on tiles, and boiled with benzene, On cooling the benzene solution, the osazone, m. pt. 131°, of *glycerose* separates. The residue, insoluble in benzene, after repeated crystallisations from 50 per cent. alcohol, yields shining yellowish laminary crystals, of which the composition has not yet been determined.—W. A. C.

Fermentative Action of Manganous Salts in presence of Colloids. A. Trillat. Comptes rend., 1904, **138**, 274—277.

MANGANOUS salts in presence of colloids and a trace of alkali (this J., 1904, 138), show among others the following reactions, noteworthy for their similarity to the actions of oxydases:—1. Exposed to air, the solution oxidises and turns brown, though without precipitation. 2. With tincture of guaiacum, out of contact with air, no reaction, or a very faint one is shown; while when air has access, an intense blue colour is formed. 3. Quinol (hydroquinone) is converted into quinone. 4. Added to solution of pyrogallol, and air passed through, these solutions yield purpurogallic acid, in quantity six times as great as is yielded in the same time by pyrogallol and alkali alone. 5. The successive formation and reduction of manganese dioxide in these experiments can be seen and followed by the reaction with the tetramethyl derivative of diphenylmethane (this J., 1903, 761). 6. The oxidation of phenols is accompanied by evolution of carbon dioxide. 7. In certain cases, the active portion of the colloidal solution can be isolated by precipitation, and can be then redissolved to form an active solution. 8. The properties of the solution are destroyed by heating for 20 minutes to 105° C., though it slowly regains them after cooling. 9. The action on gallic acid shows that heat destroys the activity due to the manganese compound, but does not affect that due to the alkali.—J. T. D.

Soluble Ferments; Emission of Blondlot Rays during Action of ——. Lambert. Comptes rend., 1904, **138**, 196—197.

FIBRIN, acted on in a test-tube by pancreatic juice rendered active by kinase, showed on a calcium sulphide screen an emission of N-rays, which ceased after the fibrin was dissolved. A similar result was given when an artificial gastric juice was substituted for the pancreatic juice. Photographic as well as visual evidence of this was obtained. These results are possibly analogous to those obtained by M. Blondlot from tissues under constraint.
—J. T. D.

Camphor; Formation of ——. H. Shirasawa. Bull. Coll. Agric., Tokio. Pharm. J., 1904, **72**, 77.

ACCORDING to the author, oil cells appear very early under the vegetative point of the camphor plant. In the young organs, the oil cells contain an essential oil, formed in the layer called by Tschirch, the "resinogenous" layer. In tropical countries the oil and the "resinogenous" mass in that layer are of a thicker consistence than in the temperate climate of Southern Europe. Old leaves contain more oil than young ones. The transformation of the oil into camphor does not take place until some time after the formation of the oil. In the old wood the oil is more frequently colourless and crystals of camphor are more abundant than in the young wood, in which the oil is often yellow. The oil cells do not exist in the woody parts, fibro-vascular bundles, or in the epidermis; there are more oil cells in the secondary than in the primary bark, but they are more abundant in the wood parenchyma than in any other tissue. The parenchyma also yields more colourless oil and crystals than other tissues. In the young pith, the oil cells are numerous, but diminish in number with age. The autumn wood contains more oil than spring wood.—A. S.

Living Cells; Functions of Peroxides in the Chemistry of ——. VII. The Chemical Nature of the Oxydases. R. Chodat and A. Bach. Ber., 1904, **37**, 36—43.

Aso (this J., 1903, 1097) has suggested that the principles in the plant organs which yield the blue reaction with guaiacum tincture on the one hand and liberate iodine from potassium iodide on the other, are not identical, but that the latter reaction is due to nitrous acid, which he has detected in the buds of *Sagittaria sagittifolia*. The authors point out that if it were a matter of oxidation by nitrous acid, all the usual reactions of the oxydases (such as the bluing of guaiacum resin, the oxidation of pyrogallol, &c.) would also be attributable to that acid. As a matter of fact, a series of quantitative experiments shows that the oxidation of pyrogallol by nitrous acid follows exactly the same mechanism, as regards the influence of time and proportions of oxidising agent, as the oxidation by oxydases. It may fairly be assumed, therefore, that oxidations by nitrous acid are effected by means of an intermediate hypothetical peroxide of the type ON.O.O.NO. [Compare this J., 1904, 60, col. 1, four lines from bottom.] In view of the great similarity between the oxidising properties of nitrous acid and those of the oxydases, the authors have applied a number of tests to a very active, purified, preparation of *Lactarius* oxydase. The solution of this oxydase reacted very powerfully with guaiacum tincture and with potassium iodide and starch. It gave, however, no coloration with diphenylamine and concentrated sulphuric acid nor with *m*-phenylenediamine in presence of sulphuric acid [Griess' test]. There can, therefore, be no possibility of the active principle being identical with nitrous acid. With *m*-phenylenediamine in presence of very dilute acetic acid, a coloration, violet at first, and subsequently an intense blue, was formed. This coloration is characteristic of oxydases, as also of peroxydases in presence of hydrogen peroxide. A dark violet-blue coloration was developed with *a*-naphthylamine and sulphanilic acid in presence of dilute acetic acid. The oxydases prepared from fungi yielded the reactions of the albuminoids only to the slightest extent, and their albuminoid nature is very questionable. In investigating the nature of all preparations of this sort, it must be borne in mind that the composition of the active products always partakes of the nature of the substrata from which they have been isolated.—J. F. B.

Aromatic Haloid Derivatives; Direct Reduction of ——, by finely divided Nickel and Hydrogen. P. Sabatier and A. Mailhe. Comptes rend., 1904, **138**, 245—248.

Monochlorobenzene vapour and hydrogen, passed over finely-divided nickel at 160° C., give cyclohexane and nickel chloride, and the action ceases when the whole of the nickel has been converted into chloride. At 270° C., however, the products are benzene and a little diphenyl, and the action is continuous, for the nickel chloride is reduced by the excess of hydrogen. The more highly chlorinated benzenes give mixtures of benzene and lower chlorinated derivates and no doubt could be completely reduced by longer exposure or by a repetition of the process. Haloid derivatives of alkylated or hydroxy-benzenes are more readily reduced than the corresponding derivatives of benzene; haloid-amino-derivatives are still more easily reduced, while haloid-nitro-derivatives have the nitro-group reduced and the halogen removed simultaneously. Bromo-derivatives are reduced less easily than chloro derivatives, and iodo-derivatives only by passing their vapour alternately with hydrogen over the metal, as the vapour of the iodo-derivative prevents or hinders the reducing action of the hydrogen on the nickel iodide.—J. T. D.

Specific Rotation of strongly Optically Active Compounds; Influence of Temperature on the ——. H. Grossmann and H. Pötter. Ber., 1904, **37**, 84—88.

As the temperature rises, the specific rotation of ammonium molybdenylbimalate, $MoO_2(C_4H_5O_5NH_4)_2$, increases to a maximum at about 35° C., and then continuously falls with the further rise. Thus, for a solution containing 19·313 per cent. of the complex salt, the values of the specific rotation at 10°, 35°, and 95° C. are −57·0°, −60·5°, and −55·5° respectively. As the dilution of the solution increases, the difference between the initial and maximum values of the specific rotation becomes less, but the diminution at higher temperatures becomes more and more marked. A similar behaviour is met with in the case of the corresponding sodium salt, the specific rotation of which reaches its maximum at about 50° C. This phenomenon is perhaps analogous with that exhibited by nicotine, which shows a minimum rotation at a certain concentration. With potassium molybdenyltartrate, no such maximum is observed, the specific rotation diminishing continuously as the temperature rises.—T. H. P.

Nickel Carbonyl; Chemical Reactions of ——. Part II. Reaction with Aromatic Hydrocarbons in presence of Aluminium Chloride. Synthesis of Aldehydes and Anthracene Derivatives. J. Dewar and H. O. Jones. Proc. Chem. Soc., 1904, **19**, 6.

Nickel carbonyl does not react with either aluminium chloride or benzene separately, but with a mixture of the two substances, a violent reaction begins immediately, hydrochloric acid being evolved.

From benzene at the ordinary temperature, benzaldehyde is produced together with traces of oils having high boiling points. At 100° C., the quantity of benzaldehyde is much smaller, and anthracene, which is now the chief product, is produced in considerable quantities. The reduction is probably due to the action of the nickel produced by the decomposition of the nickel carbonyl.

Toluene gives *p*-tolualdehyde and 2 : 6 dimethylanthracene (m. pt. 215—216°). *m*-Xylene similarly yields 2:4-dimethylbenzaldehyde and a tetramethylanthracene melting at 280° C., which is in all probability 1 : 3 : 5 : 7-tetramethylanthracene. Mesitylene yields an aldehyde only, condensation to an anthracene derivative being in this case impossible.

Naphthalene behaves in an entirely different way; no aldehyde is formed either in the cold or at 100° C., and a hydrocarbon, $C_{10}H_{12}$, is produced together with oily or resinous substances having very high boiling points.

New Books.

Karl Heumann's Anleitung zum Experimentiren bei Vorlesungen über Anorganische Chemie, zum Gebrauch an Universitäten, Technischen Hochschulen und höheren Lehranstalten. Von Prof. Dr. O. Kühling. Dritte Auflage. Friedrich Vieweg und Sohn, Braunschweig. 1904. M. 19 (paper); M. 20 (cloth).

8vo volume containing preface, table of contents, 808 pages of subject-matter, illustrated with 104 engravings. At the end is an alphabetical index of subjects. The great feature of this work consists in the illustrated descriptions of methods of preparation and apparatus used therein. I. Introduction. The Auditorium for Experimental Chemistry. General Remarks on the Preparing of Experiments, &c. Mechanical Operations. II. Metalloids.

II. METALS. The author is specially indebted to the folowing for communications of value and other assistance :—Buchner, Bunte, Erdmann, E. Fischer, Giesel, Harries, . Knorre, Lange, Landolt, Marckwald, Miethe, and Peters.

THE PHASE RULE AND ITS APPLICATIONS. By ALEX. FINDLAY, M.A., Ph.D., &c. Together with an introduction to the Study of Physical Chemistry by Sir WILLIAM RAMSAY, K.C.B., F.R.S. Longmans, Green, and Co., 39, Paternoster Row, London; New York and Bombay. 1904. Price 5*s.*

SMALL 8vo volume containing preface, table of contents, ntroduction by Sir William Ramsay (17—64), and 302 ages of subject-matter on the main question, subdivided as ollows :—I. The Phase Rule. II. Typical Systems of One Component. III. General Summary. IV. Systems of Two Components. Phenomena of Dissociation. V. Soluions. VI. Solutions of Solids in Liquids, only One of he Components being Volatile. VII. Solutions of Solids n Liquids, only One of the Components being Volatile. VIII. Equilibria between Two Volatile Components. X. Solid Solutions; Mixed Crystals. X. Equilibrium etween Dynamic Isomerides. XI. Summary; Applicaons of the Phase Rule to the Study of Systems of Two Components. XII. Systems of Three Components. XIII. Solutions of Liquids in Liquids. XIV. Presence of olid Phases. XV. Isothermal Curves and the Space Model. XVII. Systems of Four Components. APPENDIX. Experimental Determination of the Transition Point. There s finally an index of names and one of subjects. The book s one of a series of text-books of physical chemistry, dited by Sir William Ramsay. The introduction above eferred to may be had separately bound, as a small 8vo olume of 48 pages, at a price of 1*s.*

LEMENTS OF INORGANIC CHEMISTRY. By HARRY C. JONES, Assoc. Professor of Physical Chemistry in the Johns Hopkins University. The Macmillan Co., New York and London. 1903. Price 6*s.* 6*d.*

MALL 8vo volume containing preface, table of contents, 26 pages of subject-matter, and the alphabetical index. here are 59 illustrations, and the subject is treated of nder the following heads :—I. The Science of Chemistry. I. Oxygen. III. Hydrogen. IV. Water. V. Chlorine. I. Laws of Chemical Action. VII. Ozone and Hydrogen ioxide. VIII. Compounds of Chlorine with Hydrogen nd Oxygen. IX. Nitrogen and Compounds. X. Neutralision of Acids and Bases. XI. Atmospheric Air also ertain Rare Elements in it. XII. Determination of elative Atomic Weights. XIII. The Periodic System. IV. Bromine, Iodine, Fluorine. XV. Sulphur, Selenium, ellurium. XVI. Phosphorus, Arsenic, Antimony, also ismuth, and Compounds. XVII. Carbon, Silicon, and oron. Rôle of Carbon in Producing Light. XVIII. The Metals. XIX. Calcium Group. XX. Magnesium Group. XI. Aluminium. XXII. Iron, Cobalt, Nickel. XXIII. anganese Group. XXIV. Copper, Silver, Gold. XXV. ead, Tin. XXVI. Ruthenium, Rhodium, Palladium, smium, Iridium, Platinum. XXVII. General Relations ithin the Groups of the Periodic System and between e Compounds of the Metals; Nature and Rôle of Ions in hemistry.

Trade Report.

I.—GENERAL.

MONTHLY TRADE ACCOUNTS FOR 1904; CHANGES IN THE ——.

Bd. of Trade J., Feb. 11, 1904.

The Board of Trade desire to direct attention to the fact at several important changes have been introduced into e statements relating to imports and exports to be conined in the *Monthly Accounts of Trade and Navigation*, r 1904. A comparison of the accounts for January with ose issued during each month of 1903 will show that the incipal of these changes, so far as they relate to the specification of new headings or to changes in previously existing ones, are as follow:—

I. *Import Section of the Accounts.*—In Group II., relating to imports of "Raw Materials," the imports of "Linseed Oil," "Cotton Oil," "Rape Oil," and "Other Sorts" of seed oils are to be separately distinguished instead o being included under the general head of "Seed Oil," a formerly.

Several alterations have also been made in Group III. ("Articles wholly or mainly manufactured"). New headings are introduced under "Chemicals" for "Coal Tar Products, not Dyes," "Cream of Tartar," "Muriate of Ammonia," "Sulphuric Acid," and "Tartaric Acid"; and the sub-division of the former heading for "Chinaware or Porcelain and Earthenware," so as to show separately particulars of the imports of "Porcelain, Chinaware, and Parian," "Earthenware (including Semi-Porcelain, Majolica, and Glazed Hearth or Wall Tiles)," "Jet, Rockingham, and Glazed Terra Cotta Ware," "Red Pottery, Stoneware, Brown, and Yellow Ware," and "Other Sorts (including Electrical Ware and Door Fittings, and Chemical Ware)." "Oil Seed Cake" is also sub-divided so as to show "Linseed Cake," "Cotton Seed Cake," "Rape Seed Cake," and "Oil Seed Cake of Other Sorts" separately.

Additional information is also given under various headings in this section of the accounts in respect of the countries from which goods are imported.

II. *Section relating to Exports of British and Irish Produce.*—In this section of the accounts, in addition to various alterations as regards the statement of countries to which goods are exported, the following changes are noticeable:—

Under the head of "Seed Oils" the exports of "Linseed Oil," "Cotton Oil," "Rape Oil," and "Other Seed Oil" are now separately distinguished. Considerable changes have also been made in the classification of "Chemicals, Drugs, Dyes, and Colours," particulars now being shown separately for "Cream of Tartar," "Muriate of Ammonia," "Sulphuric Acid" and Tartaric Acid," while the heading for "Coal Tar Products, not Dyes," has been sub-divided into "Aniline and Coal Tar Oils," "Carbolic Acid," "Naphthalene and Anthracene," and "Other Sorts." Under "Chinaware or Porcelain and Earthenware," separate particulars are given for the different heads enumerated above as among the changes introduced into the Import Section of the Accounts, and similar alterations to those specified in that Section are also made in respect of exports of "Oil-Seed Cake."

It is further intended to publish each quarter an account of the value of the re-exports (*i.e.*, the exports of goods previously imported (to each Foreign Country and British Possession, as is already done in the case of imports and of exports of British and Irish Produce.

SWITZERLAND; TRADE OF ——, IN 1902.

Foreign Office Annual Series, No. 3111.

The total imports of druggists' sundries and chemicals in 1902 amounted to 1,538,000*l.* (55,000*l.* from the United Kingdom). The principal imports from the United Kingdom consisted of :—varnishes, 6,600*l.*; stearin, 6,000*l.*; arsenical acid, sugar of lead, borax, and salts of soda, 5,000*l.*; and pharmaceutical preparations packed for wholesale and for retail, 4,000*l.*

Out of a total import of 53,000*l.* for porcelain and china, the United Kingdom only supplied to the value of 1,200*l.*, and of the imports of superior pottery (total 57,000*l.*), only 2,000*l.* The total importation of lavatory fittings of porcelain was 13,000*l.*, of which 8,000*l.* came from the United Kingdom, an increase of 3,000*l.* on the previous year's figures.

The total imports of paper, &c., amounted in 1902 to 365,000*l.*, an increase of 18,000*l.* on the imports of 1901. The imports from the United Kingdom amounted only to 12,500*l.*, a decrease of 1,300*l.* More packing-paper and common cardboard were imported than hitherto.

The import of brandies, rums, &c., from the United Kingdom was 3,000*l.*, out of a total import of 34,000*l.*

The total imports of oils, soap, and fats amounted to 568,500*l.*, of which the United Kingdom supplied 22,500*l.*, or 8,000*l.* more than in 1901. The imports of oils for various trade purposes amounted to 18,000*l.*, an increase of 8,000*l.*, while the value of the imports of cod liver oil and soaps decreased. The importation of the latter article is greatly decreasing as the factories established in Switzerland are now fully able to supply home requirements.

The following articles were imported into Switzerland from India :—Chemical products, 64,700*l.* ; tin in bars, 52,500*l.* ; oil seeds and oil fruits, 4,700*l.*

Switzerland's exports to India included chemicals, 41,500*l.*

SARDINIA ; BRITISH TRADE WITH ——, IN 1902.

Foreign Office Annual Series, No. 3110. *Dec.* 1903.

Imports at the Various Ports of Sardinia during the year 1902.

Articles.	Africa.	America.	Austria Hungary.	Belgium.	France.	United Kingdom.
	£	£	£	£	£	£
Spirits, beverages, and oils	758	5,756	1,278	21	278	45
Colonials, drugs, and tobacco	2	18,323	176	10	72	67
Chemicals, medicines, resins, and perfumery	1,129	..	..	1,245	201	655
Colours, paints, and dyes	..	..	..	..	152	594
Metals, manufactures of, and minerals	215	2	525	1,983	1,899	3,223
Stones, earthenware, and glass	247	..	24	382	239	10,526

Though in 1902 the United Kingdom has been foremost in the imports into the province of Cagliari, that is due to the amount of coal entered, as there still is but a trifling trade in British industrial products, which once was of great importance.

The principal causes of the fall are :—the heavy duties imposed on British industrial imports ; the successful competition of other countries, especially of Germany and France ; the refusal of British manufacturers, traders and merchants to use the decimal system for weights and measures for the sales here.

MEXICAN TRADE IN 1902.

Foreign Office Annual Series, No. 3112, *Jan.* 1904.

Imports.

The value of all kinds of chemicals and drugs imported into Mexico in the year 1902 was 552,594*l.*, as against 508,181*l.* in the preceding year.

The principal articles imported under the heading *Chemicals* in 1902 were colours of all kinds, prepared, and in powder or crystals, valued at 92,926*l.* ; drugs of all kinds, including patent medicines and pills, valued at 92,345*l.* ; caustic soda and potash, valued at 52,720*l.* All kinds of perfumery and soaps are included under this heading, as well as a number of smaller and less important articles.

Stones and Earths, including Lime, Hydraulic Lime, and Cement.—The total quantity was 44,332 tons, valued at 90,722*l.*, as against 30,034 tons, with a value of 59,677*l.*, in 1901. This increase is accounted for by a greater demand for cement, not only for street paving but also for buildings.

China and Earthenware were imported into Mexico during the year 1902 to the value of 66,198*l.*, compared with 66,006*l.* in the year preceding. Most of the china and earthenware comes from France and Germany, and though it is not, perhaps, of such good quality as that of British manufacture, it is more suited to the wants of the market, as on account of its being lighter it pays less duty, and is consequently in greater demand, as it is so much cheaper.

Glassware.—The importation of glassware may be divided into several headings, the principal of which are common glass bottles for wines, beers, and vinegar, &c., representing a value of 87,628*l.*, the greater part of which is supplied by Germany. Fine glass for table and other purposes was imported to the value of 70,872*l.*, mostly from France and Germany, but this amount includes a fine quality of moulded glass from the United States in imitation of the best kind of cut glass. The value of the imports of plate glass was 25,615*l.* The new glass factories recently erected in the city of Puebla are turning out all kinds of glassware, which is not only superior to any that has been made in the country before, but is copied from the best styles, and the prices are very much lower than foreign glass.

Fire-arms, &c.—The value of all kinds of fire-arms and ammunition imported in the year 1902 was 315,996*l.*, as against 292,739*l.* in the preceding year. Of the former amount, 168,163*l.* represents the value of dynamite and other explosives, the remainder being the value of fire-arms, mining fuse and mining powder.

Leather Goods.—Prepared hides and skins represent a large portion of the value of the imports of leather goods, the value in 1902 being 46,863*l.* Most of these come from Germany, and are in all probability those exported from Mexico in a dry or salted condition, and which are nearly all sent to that country for preparation.

Petroleum.—Although several petroleum springs are said to have been found in many parts of the country, the importation of both crude and refined petroleum in 1902 amounted to 120,493*l.*, as compared with 102,716*l.* in 1901.

Paper.—The importation of paper, and the manufacture thereof, including cardboard, in 1902 show a decrease on the previous year, the value in 1902 being 388,355*l.*, as compared with 401,152*l.* in 1901.

Exports.

The exports of gold amounted, in 1902, to 1,926,241*l.*, as against 1,817,960*l.* in 1901. Of this, the greater quantity was in bullion, and amounted to 1,839,665*l.*, as compared with 1,666,675*l.* in the previous year. The gold ore represented a value of 60,796*l.*, the gold coin 25,780*l.*, of which 21,123*l.* was Mexican, and the remainder foreign gold coin re-exported.

The export of silver in the year 1902, as compared with the previous years, is as follows :—

——	1900.	1901.	1902.
	Dols.	Dols.	Dols.
Silver ore and dust	12,495,524	9,668,042	4,108,089
" bullion	43,517,899	38,860,104	47,975,236
" coin—			
Mexican	22,239,953	11,769,213	17,621,700
Foreign	430,704	267,948	131,825
Total	78,693,080	60,565,607	69,836,850

The increase in the exports of copper is proof of the increased development of the mining industry of Mexico. The quantity exported in 1902 amounted to 62,087 tons, as compared with an export of 42,017 tons in 1901 ; of this quantity only 5,000 tons were exported in the shape of ore. The value reported in the official returns for the exports in 1902 was 18,230,268 dols., which, converted into sterling at the rate of 1*s.* 8⅜*d.* to the dollar, gives a sterling value of 1,566,713*l.*, as compared with 1,295,434*l.* in 1901, when the price of silver was at 1*s.* 11⅝*d.* to the dollar.

The greater part of the copper exported, either as ore or matte, finds its way to the United States, which acts as the principal distributing centre of the world. The only other country which supplies that market with copper in any quantity is British Columbia ; but it is now said that the production of Mexico exceeds that from the latter country.

A further increase in the quantity and value of the lead exported in 1902 is also visible. The amount exported in 1902 was 105,783 tons (of which only 116 tons were in the shape of lead ores), and was valued at 527,697*l.*, as compared with 78,241 tons, valued at 447,931*l.*, in 1901. The lead is nearly all sent to the United States.

Many other metals are also found throughout the country, including antimony, iron, tin, mercury, and zinc, and it is quite probable that others also exist, as also sulphur deposits and coal and salt beds.

There was a decrease in the value of the exports of dyewoods in 1902, but this is in all probability due to the lower rate of exchange at which the silver values have been converted into sterling. The only two woods of any importance which are covered by this heading are logwood and fustic; 34,718 tons of the former and 5,504 tons of the latter having been the total amount exported in 1902.

Indigo, cochineal, and orchil were at one time exported in sufficient quantities from Mexico, but since the introduction of the aniline dyestuffs the cultivation of the indigo plant, the moss for the extraction of orchil, and the cactus on which the cochineal was propagated, have almost entirely died out; it is to be expected, however, that if any impulse is given to agriculture in general, these particular industries will also come in for a share. the more so as it appears that none of them require very expensive or arduous labour for their cultivation.

The cultivation of vanilla is now being more extended, and as it grows luxuriantly in the warm lands along the coast there seems no reason why the exports should not show a greater increase. The amount exported in 1902 was 113,576 lb., as compared with 43,991 lb. in 1901, and the values of these exports were respectively 98,550*l*. in 1902 and 57,426*l*. in 1901.

III.—TAR PRODUCTS, PETROLEUM, Etc.

Petroleum; Russian ——.

Chem. and Druggist, Jan. 30, 1904.

The production of petroleum in the Baku district during 1903 shows a considerable falling-off as compared with the years immediately preceding it. It is calculated that the output amounted to 595 million poods, as against 637 millions in 1902, 672 millions in 1901, and 600 millions in 1900. During the first eight months of 1903 the prices of naphtha remained low, but in the later months a perceptible improvement took place.

VII.—ACIDS, ALKALIS, Etc.

Arsenic; Production of ——, in 1903.

Eng. and Mining J., Jan. 14, 1904.

The production of arsenious oxide in the United States during 1903 was 590 short tons, as compared with 1,353 short tons in 1902 and 300 short tons in 1901. The sole producer of white arsenic is the Puget Sound Reduction Company, at Everett, Washington, which has recently passed into the control of the American Smelting and Refining Company. Prior to 1899 the world's supply of arsenic and its compounds was derived mainly from the mines in Cornwall and Devon, and near Freiberg, Germany. The closing down of the Devon Great Consols mine in 1901 led to the exploitation of deposits in other countries, Canada becoming a new producer in 1900 and the United States in 1901.

Although arsenical pyrite occurs in many places in Ontario, Canada, the total output of arsenic has been derived from the mines of the Canadian Gold Fields, Ltd., at Deloro, Hastings county, the production of which continued to increase until April, 1903, when the mines were closed down pending negotiations, with the view of consolidating the arsenic properties at and near Deloro into a single company in order to produce a largely increased annual output at a smaller cost per ton.

The United States Arsenic Mines Company has been developing an arsenic deposit at Pilot Mountain, 17 miles from Christiansburg, Va. An adit 215 ft. has been driven into the hillside, and from it a drift of 55 ft. extends to an 8-ft. vein of arsenic ore reported to average 25 per cent. of arsenic, which can be mined at a cost of 70c. per ton. A building 300 ft. by 70 ft. has been erected for the mills and furnaces, and a colony of dwelling-houses for the labourers, a store, blacksmith's shop, saw-mill, office, laboratory, &c., have been put up. The plant is equipped with a 125-h.p. Westinghouse engine, two 75-h.p. return tubular boilers, four dynamos (one of 75-h.p., one of 15-h.p., and two of 2-h.p.), a 10 by 20-in. Blake crusher, a 27-ft. Howell-White calcining furnace, a set of rolls for pulverising the product, pumps, &c. The capacity of the plant, when finished, will be 70 tons of refined arsenic per day. The region is wild and mountainous, and a traction engine was used to transport the machinery from Christiansburg. The company expects to begin producing white arsenic early in 1904.

The Mineral Creek Mining Company, owning an arsenic property at Mineral Creek, Washington, reports a large body of regular ore which can be mined and converted into white arsenic very cheaply. About 1,000 tons of ore have been mined and are held in stock awaiting the completion of the smelter, which is nearly ready for operation. Mineral Creek is situated not far from Elba, which is on the line surveyed for the Tacoma Eastern Railroad.

A recent discovery of metallic arsenic has been made at Washington Camp, Santa Cruz county, Arizona. The metal occurs in masses attached to the walls of small pockets in a dolomitic limestone, and in some instances the pieces of arsenic weighed several pounds each. From one pocket more than 50 lb. of metallic arsenic was obtained.

VIII.—GLASS, POTTERY, AND ENAMELS.

Glass Making in Germany and Austria.

Bd. of Trade J., Feb. 11, 1904.

The Technical Instruction Committee of the Staffordshire County Council has issued a pamphlet containing extracts from a report by Mr. Frederick Carder (of the Wordsley School of Art), on a visit to the glass-making districts of Germany and Austria.

At works near Koepenick the furnaces are worked on the Siemens' regenerator system, the gas being produced from anthracite; they are oblong in shape, with five pots on each side. The men work on a stage or platform of wood, about 2 ft. 6 in. in height and 7 ft wide, erected round the furnace.

At Tschernitz there are six Siemens' regenerative furnaces, some with 12 pots and others with 10 pots in each furnace, all the pots being open.

In the cutting and grinding shop, with one or two exceptions, all the mills run horizontally and not vertically as in England, and vary in diameter from 2 feet up to 5 feet.

X.—METALLURGY.

Platinum Production of Russia.

Eng. and Mining J., Jan. 21, 1904.

The production of platinum in 1903 is reported by the Russian Department of Mines to have been 389 poods 3 funts, which is equivalent to 204,892 troy oz., as compared with 446 poods, or 234,878 troy oz., in 1902.

Mining in Spain.

U.S. Cons. Reps., No. 1868, *Feb.* 4, 1904.

The *Finanz Chronik* states that the revival of Spanish industries, which is usually not sufficiently appreciated, is especially noticeable in the mining and metallurgical branches. The production of silver ores, manganese, lead, and sulphur is constantly increasing; that of copper has increased but little during the past few years; that of silver-bearing lead ore has decreased. The Somorrostro Mine deserves special mention as a big producer, with about 350,000 tons per year. The copper mines of Cordoba, Huelva, and Seville, as well as those of Tharsis, and Rio Tinto, have a world-wide reputation. The latter has a production valued at about 550,000*l*. per annum. The lead mines of Jaen, Murcia, Almeria, and Linares yield an annual output of nearly 100,000 tons. Santander and Murcia produce 86,000 tons of zinc per year; Oviedo, Huelva, and Seville, 30,000 tons of manganese; and Caceres, 10,000 tons of phosphorite. Of the mercury mines in the province of Ciudad Real, the most important one, operated by the Government, is the Almaden. During the year 1901, 443 new borings were made in this mine, and the total production of pure mercury amounted to 630,689 lb.

Gold; Occurrence of ——, in Great Britain and Ireland.

J. M. Maclaren. Trans. North England Inst. Mining and Mech. Eng., 1903, **52**, 437—510.

The author gives a description of the conditions under which gold occurs in Great Britain and Ireland. A bibliography is appended to the paper. The yield of gold in

Great Britain and Ireland is estimated as follows:—England: North Molton, 581*l.*; Wales, since 1844, 280,547*l.*; Scotland: Leadhills, 100,000*l.*; Sutherland (1868—1869), 3,000*l.*; Ireland, 28,855*l.*; total, 412,983*l.* Of the total production, almost all, except that from the Leadhills, has been obtained during the nineteenth century, and nearly half of it during the last 14 years. For the present century the outlook is by no means promising, except in North Wales, where, in the author's opinion, there is no reason why the veins should not be worked with commercial success, provided that when a "bonzaoa" is encountered, a large reserve fund be set aside in order that the vigorous prospecting which should be the distinctive feature of "patchy" mines, can be carried on.—A .

XII.—FATS, FATTY OILS, Etc.

Soap and Perfumery; Hints to Exporters of ——.

Ch. of Comm. J., Feb. 1904.

The following particulars as to the trade in perfumery and soap in various countries have been collated by *Handels Museum*:—

Roumania.—The import duties are so high that only the best and second best descriptions can be imported. Native-made soaps are dear, and there is an important demand for foreign goods, particularly the French article. Perfumery and cosmetics have to pay a duty of 100 lei (4*l.*) and toilet soap 180 lei (7*l.* 4*s.*) per 100 kilos.

Russia.—In Russia also the high tariff allows of the import of the finer perfumes only. The native soap industry, however, only produces the cheaper qualities.

Finland.—Finland imports cheap as well as the better qualities of perfumery. The demand is to a great extent limited to the former, but at the same time fancy goods suitable for presents are saleable if not too dear. As a rule, however, the Finns use fewer perfumes than the Russians. In their articles of toilet they prefer antiseptic preparations rather than scents. The home manufacture of soap is cheap. Importers in Helsingfors buy chiefly from commission agents in Berlin, Lubeck, and Hamburg. Toilet soaps have to pay 105·90 Finnish marks (about 85*s.*) per 100 kilos.

Sweden and Norway.—In Sweden, owing to large home manufactures of perfumery, the import trade is confined to small quantities of superior makes. Cheap perfumes, as well as finer scents, have to pay 2 kroner (2*s.* 2*d.*) per kilo. duty. The duty on toilet soap amounts to 0·50 kroner, (6½*d.*) per kilo. French, German, English, and United States manufactures are chiefly in request, and latterly German in particular. Norway, in spite of a considerable home production, imports a fair quantity of toilet articles, the cheaper kinds from Germany and better qualities from England and France. Toilet soaps are subject to a duty of 0·50 kroner per kilo. (minimum tariff).

Zanzibar.—The Austro-Hungarian Consul reports that in Zanzibar, owing to the stringent regulations in respect of the sale of spirits to the natives, the introduction of alcoholic perfumes and essences is difficult.

China and Korea.—In China, European perfumery and soap is mostly too dear and insufficiently known. The European population at Foochow obtain their supplies chiefly from England and America. Into Hankow imports consist chiefly of very cheap lines, principally rouge and scent. Korea, in respect of its capital, Seoul, obtains its supplies of perfumery and soap (chiefly fine and medium goods) *viâ* Shanghai or Japanese ports. In 1900, Custom statistics showed an import of perfumery value 6,750 frs. (270*l.*) and of toilet soap value 11,025 fr. (440*l.*).

Switzerland.—Switzerland imports all kinds of fancy soaps and perfumes, but rarely cheap or medium articles. France is the chief supplier of perfumery, and Germany of soap.

Turkey.—Turkey imports all the superior descriptions of toilet articles from France, England, and Germany. In the country itself only a small quantity of the cheaper kinds of scents is produced. Traders in Adrianople make their purchases—mostly cheap goods—principally from Constantinople. Inquiry for such goods at Monastir is limited, and chiefly in the direction of inferior goods; but, at the same time, the trade might be increased if a low-priced good article were introduced. In Salonika, a local manufactory competes keenly with foreign goods.

Aden and Beirut.—In Aden, the annual import, mostly of French origin, of toilet soaps, extracts, washes, and cosmetics amounts in value to 20,000 fr. (800*l.*). Cheap goods with a basis of musk, civet, rosewater, jasmin, or geranium are in good request.

XIII. C.—INDIA-RUBBER, Etc.

Rubber Production; The World's ——.

Ch. of Comm. J., Feb. 1904.

Figures published by *Handels Museum* show that the world's production of caoutchouc fell from 57,500 tons in the year 1900 to 54,000 tons in 1902. The largest diminution was shown in the case of East and West Africa, including the Congo—namely, from 24,000 tons to 20,000 tons. On the other hand, Brazil, Peru, and Bolivia show an advance from 25,000 tons in 1900 to 30,000 tons in 1902; and the Straits Settlements, whose production was unimportant in 1900, appear with 1,000 tons in 1902. The output of the Netherlands East Indies (1,000 tons in 1900), Madagascar and Mauritius (1,000 tons in 1900), India, Burma, and Ceylon (500 tons in 1900), was not, however, considered large enough to be recorded. The share of the South American States not specifically mentioned fell from 3,500 tons to 1,000 tons, and that of Central America and Mexico from 2,500 tons to 2,000 tons.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.], "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 2444. Dupont. Distilling apparatus. Feb. 1.

„ 2620. Tuckfield and Garland. Regenerative distilling apparatus. Feb. 2.

„ 2747. Tuckfield and Garland. *See under* XVII.

„ 2762. Grossmann. Method and apparatus for the condensation, absorption, or chemical combination of gases in the presence of liquids, or of liquid and solid substances. Feb. 4.

„ 2792. Haylock. Centrifugal separators. Feb. 4.

„ 3003. Slade. Process and devices for filtering liquids.* Feb. 6.

„ 3165. Suzuki. Piled vacuum evaporating apparatus.* Feb. 9.

[C.S.] 23,646 (1902). Knudsen. Apparatus for liquefying air and other gaseous fluids. Feb. 10.

„ 4173 (1903). Diedrich. Drying apparatus. Feb. 17.

„ 4612 (1903). Adam. Centrifugal separating apparatus. Feb. 17.

„ 11,943 (1903). Zachariasen. Apparatus for drying and aerating substances. Feb. 10.

„ 25,060 (1903). Haddan (Edson Reduction Machinery Co.). Drying apparatus. Feb. 10.

II.—FUEL, GAS, AND LIGHT.

[A.] 2456. British Thomson-Houston Co., Ltd. (Gen. Electric Co.). Machines for treating filaments for electric lamps. Feb. 1.

„ 2481. Brooks. Apparatus for the generation of gas.* Feb. 1.

„ 2547. Capitaine. Suction gas producers.* Feb. 2.

[A.] 2578. Roux and Gonin. Process of treating peat and other substances. Feb. 2.
,, 2790. Jordan. Burning and cooking gas. Feb. 4.
,, 3143. Liversedge. Furnaces. Feb. 9.
,, 3315. Pissarreck and Schmidinger. Apparatus for the manufacture of gas from mineral oils and other volatile liquids. Feb. 10.
[C.S.] 4988 (1903). Moor. Treatment of gas liquor. Feb. 17.
,, 5798 (1903). Thompson (Schweizerische Lokomotiv- und Maschinenfabrik). Gas-generating apparatus. Feb. 17.
,, 5866 (1903). Siemens. Regenerative gas furnaces. Feb. 17.
,, 7622 (1903). Lowden. *See under* VII.
,, 7770 (1903). Boult (Goldschmid). Manufacture of gas. Feb. 10.
,, 7783 (1903). Edelmann. Electrodes for arc lamps. Feb. 10.
,, 10,527 (1903). Blau. Process for making an oil-gas of high combustible value. Feb. 17.
,, 19,929 (1903). Catier. Generator for power gases. Feb. 17.
,, 28,761 (1903). Boult (Köneman). Manufacture of water-gas. Feb. 10.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 2468. Johnson (Badische Anilin und Soda Fabrik). Production of colouring matters of the naphthalene series. Feb. 1.
,, 2469. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matter especially suitable for the preparation of colouring matter lakes, and of intermediate products relating thereto. Feb. 1.
,, 2608. Johnson (Boehringer und Soehne). Manufacture of azo compounds. Feb. 2.
,, 2738. Imray (Basle Chemical Works). Manufacture of new basic dyestuffs.* Feb. 3.
,, 3096. Ransford (Cassella and Co.). Manufacture of azo dyestuffs. Feb. 8.
,, 3108. Johnson (Badische Anilin und Soda Fabrik). Manufacture of indigo paste for direct use in the fermentation vat. Feb. 8.
[C.S.] 7353 (1903). Imray (Meister, Lucius und Brüning). Manufacture of green dyestuffs of the anthraquinone series. Feb. 17.
,, 7394 (1903). Johnson (Badische Anilin und Soda Fabrik). Manufacture and production of anthracene colouring matters and intermediate products. Feb. 10.
,, 8405 (1903). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of sulphur dyes derived from indophenol. Feb. 17.
,, 8406 (1903). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of mordant-dyeing monazo dyestuffs. Feb. 17.
,, 8575 (1903). Lake (Oehler). Manufacture of dyes. Feb. 10.
,, 20,151 (1903). Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthracene colouring matters. Feb. 10.
,, 28,033 (1903). Imray (Soc. Chem. Ind. in Basle). Manufacture of tetrazo dyestuffs with the aid of 2.5.1.7-amidonaphtholdisulphonic acid. Feb. 17.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 2573. Ransford (Cassella and Co.). Means for discharging dyeings. Feb 2.
,, 3051. Calvert. Deep shades on animal fibres, developed and produced on the fibres themselves. Feb. 8.
,, 3067. Brougham (Kellner). Bleaching. Feb. 8.
,, 3203. Read Holliday and Sons, Ltd., and Turner. Production of fast colours on animal fibres. Feb. 9.
[A.] 3520. Mellor. Method of and means for cleaning silk and like yarns or thread. Feb. 12.
,, 3529. Pick and Erban. Bleaching and cleansing vegetable fibres. Feb. 12.
[C.S.] 3718 (1903). Dixon. Imparting rigidity or stiffness to ribbons, velvets, bunting, and other textiles, and to paper and pulp fabrics. Feb. 17.
,, 7891 (1903). Hendrie and Smith. Apparatus for starching or dressing and stentering fabrics. Feb. 17.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

[C.S.] 7954. Ransford (Cassella and Co.). Method of dyeing leather with sulphur colours. Feb. 17.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 2541. Hegeler and Heinz. The Glover tower process.* Feb. 2.
,, 2655. Keogh and Broughton. Methods of making aluminium compounds and by-products.* Feb. 3.
,, 2739. Bellot des Minieres. Apparatus for the manufacture of copper ammoniate.* Feb. 4.
,, 2827. Elworthy. Processes and apparatus for solidifying carbon dioxide. Feb. 4.
,, 3018. Davis. Process for the manufacture of hydrocyanic acid and cyanides. Feb. 6.
,, 3349. Bloxam (Administration der Alinen von Buchsweiler). Manufacture of sodium ferrocyanide. Feb. 10.
[C.S.] 3225 (1903). Brothers. *See under* IX.
,, 3347 (1903). Pearson. Process of producing carbon monoxide. Feb. 17.
,, 5230 (1903). Gin. *See under* X.
,, 7622 (1903). Lowden. Method of and apparatus for converting "gas" lime and other spent lime into a more marketable product. Feb. 10.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 2665. Ramford. Substitute for asphalt. Feb. 3.
[C.S.] 3225 (1903). Brothers. Manufacture of plaster of Paris. Feb. 17.
,, 3378 (1903). Jenkins. Manufacture of bricks, artificial stone, &c. Feb. 17.
,, 7566 (1903). Dobson. Fireproof building blocks. Feb. 10.
,, 7579 (1903). Gilmour, Morton, and Co., Ltd., Morton and Milloy. Manufacture of glazed bricks. Feb. 10.
,, 27,628 (1903). Herschbach. Manufacture of porous bricks or blocks. Feb. 10.
,, 28,103 (1903). Pratt. Brick kilns and the process of burning bricks. Feb. 17.

X.—METALLURGY.

[A.] 2430. Le Mesurier. Process for hardening copper or its alloys. Feb. 1.
,, 2460. Cadotte. Case-hardening compound. [U.S. Appl., April 16, 1903.]* Feb. 1.
,, 2661. Alzugaray. Treatment of complex ores. Feb. 3.
,, 2892. Alzugaray. Extraction of metals from their ores. Feb. 5.
,, 2894. Atkinson. Treating ores. Feb. 5.
,, 3231. Ogle. Extraction of metals from their ores. Feb. 9.
,, 3235. Schulte-Steinberg. Manufacture of briquettes from friable ores.* Feb. 9.
,, 3538. Cowper-Coles and Co., Ltd., and Cowper-Coles. *See under* XIII. B.
,, 3559. Crawford and Frith. Heating vessels, furnaces, and other receptacles for metallurgical and other uses. Feb. 12.
,, 3628. Brand. Extraction of zinc. Feb. 13.
[C.S.] 24,417 (1902). Webb. Extraction of precious metals from ores. Feb. 17.
,, 3194 (1903). Schwartz. Smelting ores. Feb. 10.

[C.S.] 5230 (1903). Gin. Manufacture of copper sulphate by direct sulphurisation of the ores. Feb. 10.
" 8026 (1903). Lash. Manufacture of steel. Feb. 10.
" 8298 (1903). Tresidder. Manufacture of steel. Feb. 10.
" 8299 (1903). Tresidder. Manufacture of steel plates with a hardened face. Feb. 10.
" 9346 (1903). Otto. Crucible furnaces, and the production of iron and steel by the direct reduction of iron ores. Feb. 17.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[C.S.] 5789 (1903). Dewar and Linoleum Manufacturing Co. Method of treating wood-oil to form products especially useful in the manufacture of linoleum and the like. Feb. 17.
" 22,580 (1903). Giessler and Bauer. Manufacture of non-caustic soaps developing active oxygen and having an antiseptic and bleaching effect. Feb. 17.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

[A.] 2414. Coppock. Paint for ships' bottoms and iron. Feb. 1.
" 26,903 (1903). Hall. Paint composition. Feb. 17.

(*B.*)—Resins, Varnishes.

[A.] 3538. Cowper-Coles and Co., Ltd., and Cowper-Coles. Protecting metallic surfaces from corrosion. Feb. 12.
[C.S.] 4851 (1903). Scott. Apparatus for use in the manufacture of inlaid linoleum. Feb. 10.
" 4855 (1903). Scott. Apparatus for use in the manufacture of inlaid linoleum. Feb. 10.
" 5789 (1903). Dewar and Linoleum Manufacturing Co. *See under* XII.

(*C.*)—India-Rubber.

[C.S.] 7313 (1903). Dancer. *See under* XIV.
" 28,353 (1903). Bourn. Process of vulcanising rubber. Feb. 10.

XIV.—TANNING; LEATHER, GLUE, SIZE, Etc.

[C.S.] 7313 (1903). Dancer. Adhesive solution for sticking all kinds of leather, rubber, cloth, and the like. Feb. 17.
" 28,020 (1903). Clark (Vaughan Machine Co.). Machines for treating hides and skins. Feb. 10.

XV.—MANURES, Etc.

[A.] 3170. Van Laer. Fertiliser, and process for making the same. Feb. 9.
" 3466. Mitchell. Manufacture of manure. Feb. 11.
[C.S.] 7921 (1903). Baker. *See under* XVII.

XVI.—SUGAR, STARCH, GUM, Etc.

[A.] 2928. Naudet. Process and apparatus for the diffusion and extraction of saccharine juices. [Fr. Appl., Feb. 6, 1903.]* Feb. 5.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 2663. Schidrowitz and Kaye. Manufacture of certain products from waste distillery material. Feb. 3.
" 2747. Tuckfield and Garland. Alcohol or marine distillery apparatus. Feb. 4.
" 3196. Vignier. Fermentation of wines, wash, or beer, and the making of yeast for distillers. Feb. 9.
[C.S.] 7658 (1903). Anderson. *See under* XVIII. B.
" 7921 (1903). Baker. Method of treating and drying brewers' and distillers' yeast for use as a manure. Feb. 17.
" 23,066 (1903). Chotteau and Disse. Ferment for the manufacture of wine vinegar. Feb. 10.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—Foods.

[A.] 2785. Muir. Manufacture of cacao or cocoa practically free from starch or sugar or both. Feb. 14.
" 3465. Faragó and Bartha. Manufacture of coffee extract.* Feb. 11.
" 3531. Hatmaker. Dry milk and milk-like products. Feb. 12.

(*B.*)—Sanitation; Water Purification.

[A.] 3341. Rawlins. Separation or treatment of town refuse. Feb. 10.
[C.S.] 7658 (1903). Anderson. Process of treating distillers' wash or dregs and other noxious organic effluents. Feb. 10.
" 8348 (1903). Spence, and Peter Spence and Sons, Ltd. Treatment of sewage, sludge, and the like matters. Feb. 17.

(*C.*)—Disinfectants.

[A.] 3669. Harris. Insecticides. Feb. 13.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 3191. Goldsmith and The British Xylonite Co., Ltd. Manufacture of celluloid. Feb. 9.
[C.S.] 24,532 (1902). Hutchinson. Method of preparing paper for manifolding copying purposes, and the preparation of printing surfaces therefrom with self-contained ink or colour supply. Feb. 17.
" 2420 (1903). Milne. Paper and pulp machines. Feb. 10.
" 3148 (1903). Dixon. *See under* V.
" 23,752 (1903). Fell (Casein Co.). Casein-cellulose composition, and process for producing same. Feb. 10.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 3190. Goldsmith and The British Xylonite Co. Ltd. Treatment of turpentine oils and production therefrom of camphor and other hydroaromatic bodies. Feb. 9.
[C.S.] 3189 (1903). Langfield. Preparation of natural mineral salts for medicinal purposes. Feb. 17.
" 7363 (1903). Roux. Manufacture of cream of tartar. Feb. 17.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 2505. Cherrill. Photographic printing. Feb. 1.
" 2693. Hewitt and Miles. Photography. Feb. 3.
" 3107. Penrose. Photographic processes and emulsions. Feb. 8.
[C.S.] 3729 (1903). Jumeaux and Davidson. Trichromatic photography and optical projection. Feb. 17.
" 3730 (1903). Jumeaux and Davidson. Trichromatic photography. Feb. 17.
" 25,390 (1903). Hoffsümmer. Process for preparing photographic printing paper, &c. Feb. 10.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 2735. Tulloch. Manufacture of mining explosives. Feb. 3.
" 2736. Tulloch. Manufacture of propellent explosives. Feb. 3.
" 2319. Boyd. Explosives. Feb. 4.
" 3253. Haddan (Führer). Explosives. Feb. 9.
" 3301. Führer. Explosives.* Feb. 10.
[C.S.] 3420 (1903). Nathan, Thomas, and Rintoul. Manufacture of nitro-glycerine. Feb. 17.

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Notices.

ANNUAL GENERAL MEETING, NEW YORK, 1904.

The Annual General Meeting will be held in New York City on Thursday, Sept. 8th, and following days. Members who contemplate attending are requested to communicate with the General Secretary as soon as possible, in order that suitable travelling arrangements may be made. A programme appears in the Jan. 30 issue of the Journal.

ST. LOUIS EXHIBITION, 1904.

The St. Louis Chemical Society has established a Bureau of Information for the benefit of members of foreign chemical societies who may visit the World's Fair. Any members of such societies who desire information in regard to the Exhibition are invited to write to the Secretary, Prof. E. H. Keiser, Washington University, St. Louis, Mo.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

Barratt, J. Treeby, l/o London; Bronheulog, Mostyn, North Wales.

Bragg, E. B., l/o Michigan Avenue; 1745, Chicago Avenue, Evanston, Ill., U.S.A.

Brown, Arthur H., l/o London, Ont.; c/o Daly Reduction Co., Hedley, B.C., Canada.

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Burkhardt, Dr. G. A.; communications to c/o Soc. Romana de Produse Chimiche, Valea Calugareasca, Roumania.

Burls, Herbert T., (Journals) c/o Royal Societies Club, St. James' Street, S.W., and (communications) 11, Foulis Terrace, Onslow Gardens, London, S.W.

Butters, Chas., l/o Johannesburg; 220, Crocker Building, San Francisco, Cal., U.S.A.; subscriptions and index 1903 as before.

Calvert, Jos. E.; communications to 293, Butler Street, Etna, Pa., U.S.A.

Caspari, Dr. W. A., l/o Langham Villas; 5, Park Lane, Teddington.

Cholerton, A. F.; all communications to 40½, Belgrave Gate, Leicester.

Collins, W. Hepworth, l/o Manchester; retain Journals.

Davis, Bernard F., l/o Argentina; c/o Borneo Co., Boedok, Sambas, Borneo.

De Wilde, Prof. P., l/o Brussels; Société Anonyme de Produits Chimiques et d'Exploitations Minières, Bône, Algeria.

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Hudson, Dr. E. J., l/o Gladstone; c/o Pioneer Iron Co., Marquette, Mich., U.S.A.

Kelf, Henry C., l/o Leyton; retain Journals.

Lessing, Dr. R.; Journals to 98, Milton Avenue, East Ham, E.

Levi, Louis E., l/o Buffalo; c/o Pfister and Vogel Leather Co., Milwaukee, Wis., U.S.A.

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Whatmough, Dr. Wm. H.; communications to 127, Wath Road, St. Helens.

Liverpool Section.

Meeting held at the University, on Wednesday, February 24th, 1904.

MR. FRANK TATE IN THE CHAIR.

THE MANUFACTURE OF SULPHURIC ACID FROM ARSENICAL PYRITES.

BY W. ROSCOE HARDWICK, B.SC., F.I.C.

Some years ago I was asked to go to a sulphuric aci works that were in difficulty. The "difficulty" tha presented itself was far beyond anything that I ha expected to encounter, for in every part of the plant I sa arsenious acid, or rather oxide, As_4O_6. Crystals of arseniou oxide were on the doors and drum plates of the burne that were not working hot. Quantities of pasty mass were raked from a horizontal pipe connecting the pottin oven with the Glover tower. From the Glover tower itse came a dirty rather milky liquid, which deposited arseniou oxide in the cooler shoots as it gradually became colder a colder. Many connecting pipes, especially those carryi cold strong liquor to the strong egg cistern were stopped up, and on being cut, the filling, so hard did it appear, seemed like a piece of flint.

On examination, the eggs themselves were found to be encrusted with arsenious oxide, especially the strong acid egg, which was so much so that its capacity was thereby halved. Many inches of a white deposit of the oxide were in the cisterns on the Gay-Lussac tower, and the distributing shoots and lutes on the tower top were so filled with the deposit that the liquor found its way into the tower by one or two channels only. But by far the worst effect of arsenious oxide, in fact the fatal effect, to the possible working of the ore under normal conditions was seen in the Gay-Lussac tower itself. The coke had acted as a filter for the oxide which eventually and effectually choked up the tower. A strong pressure on the last chamber resulted, and this soon told upon the whole plant's working, even to the burners themselves—in short the works had stopped. Such was the state of things that I was invited to remedy.

The working of liquors saturated with arsenious oxide is possible (though by no means easy or agreeable) in all parts of the plant except the Gay-Lussac tower, for as soon as the oxide gets on to the coke, the draught is impeded, and the working of the whole plant is thus upset. It was therefore to the prevention or cure of the ill effects due to the arsenious oxide in the Gay-Lussac tower that my attention was primarily directed. By what means does the arsenious oxide get into the Gay-Lussac tower? Let us trace its course from the burners. When the ore is burned the sulphur comes off as sulphur dioxide, and the arsenic as arsenious oxide. It is stated in treatises on the subject that, of the total arsenic present in the ore when the ore is burned, 20 per cent. is left in the cinders, 20 per cent. is absorbed by the chamber acid, 30 per cent. is trapped in the Glover tower, and 30 per cent. passes through the plant and is caught in the Gay-Lussac tower. With these figures my experience has made me entirely disagree. Considering that arsenious oxide is volatile at something above 300° F., it cannot in any great quantity escape solution in the Glover tower, much less escape condensation in the large cool chamber space through which it must needs pass to the Gay-Lussac tower. Of the 20 per cent. left in the cinders I may say that I have frequently, in properly working burners, burned the ore down to one quarter of that amount.

From observations and tests of the Glover liquor I am of opinion that from 70 to 75 per cent. of the total arsenic present is volatilised and caught in the Glover liquor. I have therefore come to the conclusion that practically the whole of the deposited oxide in the Gay-Lussac tower had been precipitated there by the filtering action of the coke on the strong liquor from the Glover tower, which was being run down for the ordinary absorption purposes.

The first idea that occurred to me was that the ore could have been burned under normal conditions of working, had care been taken to keep the plant generally as clean as possible, *e.g.*, by flushing the Glover tower at regular intervals, and rejecting the muddy washings for Gay-Lussac purposes and like precautions, of which I shall speak later.

To put this system of working to the test it was necessary to make a clean sweep of all obstructions and to start afresh. To make a clean sweep of arsenious oxide is more easily suggested than effected, an arrangement having been made by the management of the works to have this cleaning operation carried out by contract. You will realise the difficulties met with when I tell you that I found the workmen at some fused deposits in the burner pipe, with sharpened bars and sledge hammers vainly endeavouring to remove the deposits, or, as I found them, endeavouring to remove the incrustation on the eggs by making a fire inside. But the most obstinate of all obstructions was the Gay-Lussac tower itself. The coke having become locked by the cementing action of the arsenious oxide, and all attempts to tickle the coke out proving futile, the use of blasting powder was resorted to.

Hot liquor will dissolve arsenious oxide, and can in many instances be resorted to as a solvent to remove the oxide in parts of the plant. When, however, there is a complete block, and there is no channel, however small, for the liquor to follow, it is useless as a cleaner. The best and in every way most effectual method of loosening if not removing deposits of arsenious oxide I found to be by the use of steam.

In the case of deposits in the burner pipes, *e.g.*, a small hole was made by a sharpened bar and sledge, and steam applied through an iron nozzle, and in a short time the whole mass was softened and readily split up. In the case of the Gay-Lussac tower the inlet and outlet were dampered off (this to avoid draughts, whereby the steam would be condensed) and steam introduced at the bottom. In a few hours the whole tower was perceptibly warm to the touch, and an examination showed the coke to be in a perfectly loose state.

Having at length cleaned the plant to my satisfaction I repacked the Gay-Lussac and started working on the lines above indicated—that is to say, by using every precaution to ensure the freedom of the strong liquors from arsenious oxide. My great hope lay in the utilisation of two large tanks holding about 20 tons each, as settlers for the strong liquors. But after fixing cans over the plug holes of the vats; after avoiding all undue disturbance of the liquors (for example, by taking the precaution of allowing the strong liquors entering the vats to break their fall by running on to a baffle plate); in short, after taking all precautions to ensure a precipitation and separation of the oxide, two facts militated against the success of the operation. First, the exposure of strong liquor seriously affects the specific gravity, and secondly, the rapid precipitation of arsenious oxide depends not only upon the cooling of the liquor, but upon its agitation, and cold liquor such as that lying in the settling tanks only threw down its arsenious oxide, when it became churned in the egg and in the cisterns on top of the Gay-Lussac. But even with the above precautions, and all care being taken with the flushing of the Glover tower, it soon became evident that some radically different *modus operandi* had to be instituted. I might here mention the trouble caused by the arsenious oxide in the antimony jag valve used on the eggs. The valve consists of an antimony plug and seating; the latter being bolted on to the flange of the egg, the plug is driven into the seating by a screw lever, by means of which great force can be applied. These valves I have found generally satisfactory. Now one would have understood that any gritty matter being entrapped between the plug and the seating when the valve is screwed down would cause it to leak, but one would have thought that a light flocculent precipitate would be harmless in its effect; but this was not so, for so coagulated and flint-like did the oxide become that the valves became leaky by undue pressure brought to bear in an attempt to stop the blowing back into the strong liquor cistern.

Character of the Ore.—The ore, to all outward appearance, seemed a clean sound ore containing about 10 per cent. of smalls. In colour it was of a decidedly pale appearance. I have learned to look upon what I might call "silvery" ores with suspicion. When riddled and freed from the smalls, and thrown on the burners in lumps not larger than a man's fist, it burned with a slight explosion that was merely sufficient to split and not shatter the lumps. There resulted at the end of 12 hours, the time for recharging, a bright red bed of well-burned ore; so that as regards the actual burning of the ore no great difficulty was encountered.

Analysis of the Ore.—It contained arsenic, 1·7; sulphur, 45; copper, 3·5; silica, 2·5 per cent. Suppose, then, that 42 of the 45 per cent. of sulphur was burned off and formed 156 parts by weight of sulphuric acid of 150° Tw. Again, of the 1·7 per cent. of arsenic let us assume that 1·5 per cent. is burned off, and of that 1·5 per cent. 1·1 per cent. is entrapped in the Glover tower, the remaining 0·4 per cent. going over into No. 1 chamber. We have then 1·1 parts by weight of arsenic, or 1·45 parts by weight of arsenious oxide, to be dissolved by twice the make of sulphuric acid, *i.e.*, the sulphuric acid coming down the Glover tower. The sulphuric acid made equals 156 parts by weight of 150° Tw.; therefore 1·45 parts by weight of arsenious oxide has to meet 2 × 156 or 312 parts by weight of 150° Tw. liquor in the Glover tower; so that, in order that the arsenious oxide may be dissolved and retained in solution, sulphuric acid of 150° Tw. ought to absorb 0·46 per cent. of As_4O_6.

Laboratory experiments were then made to ascertain the solubility of arsenious oxide in sulphuric acid at different strengths and different temperatures. I might here just indicate the method employed. As I have already stated, agitation, as might be expected, has much to do with the precipitation of arsenious oxide. It therefore became necessary, in making laboratory experiments, to imitate as closely as possible the condition of things actually occurring in the plant. An indefinite quantity of acid of known strength was taken, and arsenious oxide added in quantity well over that required to saturate it at the highest temperature to be dealt with. The acid was then heated to such an extent that when cool it formed a supersaturated solution. The solution of oxide was then cooled in a water-bath kept for some hours at a definite temperature with repeated agitation. The liquor was then filtered through glass wool, and the clean filtrate tested for arsenious oxide. The operation was repeated afresh for the determination of the solubility at other temperatures and other strengths. The results are as follows: Generally, the hotter the acid the more soluble the oxide, and the stronger the acid the more soluble the oxide, particularly in the case of liquor of 150° Tw.; 0·36 per cent. is dissolved at 60° F., 0·50 per cent. at 80° F., 1·00 per cent. at 110° F. From these figures it is shown that an ore of the burning quality above indicated cannot retain in solution all the arsenious oxide that must necessarily be caught in the Glover tower.

As Dr. Harger, who was working in my laboratory at the time that I was engaged upon this work, pointed out to me, arsenic oxide, As_2O_5, is soluble in strong sulphuric acid, and arsenious oxide in solution can be converted into arsenic oxide by heating the liquor with the theoretical quantity of strong nitric acid at 190° F., the reaction taking place according to the equation $As_2O_3 + 2HNO_3 = As_2O_5 + H_2O + N_2O_3$. Theoretically, therefore, where strong sulphuric acid containing arsenious oxide is treated with nitric acid, the nitrogen trioxide evolved is absorbed by the sulphuric acid, and no loss of nitre ensues. The fact that the sulphuric acid must necessarily be at a high temperature for the reaction to take place does not mean an expulsion of oxide of nitrogen, because the sulphuric acid is present in so large an excess.

My first idea was to treat the liquor immediately issuing from the Glover tower, which it does at a temperature of 300° F., with sufficient nitric acid to convert the insoluble excess of arsenious oxide into arsenic oxide. This had to be done by dropping nitric acid at a definite rate into the basin at the bottom of the tower.

The uncertainty of the amount of arsenious oxide present in the acid, which was always found to increase before the time of flushing, which operation had to be still carried out, together with the difficulty of making a serviceable apparatus for delivering regular drops—both these things necessitated the constant attention of a chemist or skilled workman, or the application of some automatic action for the successful carrying out of the process, which were not found feasible.

The method eventually worked consisted of heating up the liquor in tanks, treating with nitric acid and cooling down again. For this purpose two tanks were erected side by side just above the strong acid egg, so that any liquor that they contained would gravitate naturally to the egg. The tanks were each 4 ft. deep and 5 ft. square, and lined with 10 lb. lead. The bottom was covered with bricks laid a few inches apart to allow of the circulation of the liquor. On these a lead pipe of about 1 inch internal diameter was coiled, and the inlet, strapped to the side of the tank, was provided with a Y-piece and two valves, by means of which either steam or cold water could be admitted to the coil. The outlet was carried from the centre of the coil out at the side to waste.

A staging was erected alongside, and rather higher than the tanks, whereon were placed carboys containing strong nitric acid. The strong liquor from the Glover tower was cooled in the ordinary way in the shoots and then run into the big settlers of which I have spoken above. By running in at the far end, much of the precipitate was enabled to settle out. When a big deposit had accumulated, the mud was blown up into the last chamber, thus saving a loss of liquor, and at the same time draining the liquor from the other parts of the vat.

The mud, then very largely free from liquor, was run below by lifting a plug in the bottom of the tank.

One of the tanks supplied with a coil was then about three-quarters filled with strong liquor, a sample taken, and the amount of arsenious oxide ascertained. The arsenious compound only being required, the test is quickly carried out by neutralising partly with sodium carbonate, and finally with sodium bicarbonate, and titrating the arsenious compound with standard iodine with starch as indicator.

To oxidise the arsenious acid that was present in excess of that which the sulphuric acid was capable of dissolving, the requisite amount of nitric acid was added. This addition had to be carefully carried out; a glass syphon was employed to introduce the nitric acid, the long limb dipping some two or three inches below the surface of the liquid. The temperature of the acid should be raised to about 180° F., and then the required amount of nitric acid run in with stirring and the temperature raised to 200° F. If the liquor in the tank was not kept stirred, or if the delivery limb was not below the surface of the liquid, it fumed, and there naturally resulted a loss of nitric acid.

The steam valve was then closed and the water valve opened, and the liquor allowed to cool with occasional agitation. The water for this purpose was taken from the cistern that supplied the cooler shoots. Whilst the one tank was cooling the other was being filled and treated, so that the Gay-Lussac tower never wanted clear liquor.

The amount of oxides of nitrogen in the strong liquor consequent on this action of nitric acid was never so great as to seriously affect the absorbing power; for, suppose we had 0·25 per cent. of As_4O_6 over and above that capable of solution by the sulphuric acid, we had in the tank 3 tons of liquor = 0·15 cwt. of arsenious oxide, and this required for oxidation 0·235 cwt. of nitric acid evolving 20 lb. of nitrous oxide. So that by such action the strong liquor contained only 0·3 per cent. of nitrous oxide, which is so far from saturation that the acid may be safely used in the Gay-Lussac.

The process thus worked did not do all that I, at first, was sanguine enough to hope for it, but it did make the burning of a highly arsenical ore possible in the ordinary way, and with a considerable reduction in the consumption of nitre.

The cost of the process over and above that of the ordinary working of the plant consists in the cost of steam, which, I believe, works out to a shade over one penny per ton in raising 150° Tw. liquor 150° F., together with the difference in cost of sodium nitrate and nitric acid for the equivalent of oxides of nitrogen obtainable.

DISCUSSION.

Mr. MANNINGTON said that he thought the method adopted by Mr. Hardwick a very ingenious one. The ordinary Spanish pyrites contained, he thought, about $\frac{3}{4}$ per cent. of arsenic, and it seemed that double that amount produced an extremely unpleasant effect in the work of the chambers. He asked whether all the mass of precipitate occurring in the tower was almost exclusively arsenious oxide; it seemed so extraordinary that such an amount of arsenious oxide travelled through the Glover, and a series of chambers, and was landed in the Gay-Lussac to such an extent as to choke it up in the thorough manner mentioned. He thought that arsenious oxide in the presence of nitric acid would go into solution almost at normal temperature to some extent. If sulphuric acid which contained any nitrogen compounds, and also sulphide of arsenic, were allowed to stand, one would very often find included in the precipitate a sulphide which would apparently oxidise the arsenious sulphide, and the arsenic would go into solutio again. It vitriol, which might be apparently freed b sulphuretted hydrogen from arsenic, were allowed to stan one would generally find that some arsenic had gone int solution again. That was the point which had to b attended to in the removal of arsenic by sulphurette hydrogen, and that he had known to take place at normal temperatures.

Mr. **Eustace Carey** suggested that if the vitriol were to be used for making sulphate of soda, it might be advantageous to add nitrate of soda, instead of nitric acid, to the vitriol.

Prof. **Campbell Brown** said that as a consumer of sulphuric acid to some considerable extent, the securing of sulphuric acid absolutely free from arsenic was of the greatest importance to him, and it was exceedingly difficult to get it. Sulphuric acid dissolved arsenic out of the bottles in which it was stored. The matter was of very great importance also to manufacturers and the public. In the course of investigation of the Arsenic Commission a good many occurrences of arsenic in the most unlooked-for places had appeared, and lately he had traced it in other most unexpected places, and he believed that it had all gone back originally to pyrites acid, but if it could be produced practically free—less than 0·001 per cent.—it would relieve their minds from all fear. In the last few months he had been very much impressed with the necessity of getting pure sulphuric acid. Sulphuric acid and things made from it were used for so many different purposes, that if arsenic were allowed to get into circulation at all one never knew where it might or might not crop up, so that all the methods that could be employed in improving sulphuric acid were well worthy of most serious consideration, and he had no doubt that manufacturers would find that the increased price would be exceedingly well-spent money.

Mr. **Towers** said that, in connection with the storing of the acid, he had experienced a good deal of trouble. When absolutely pure acid was put into a Winchester, and stored for a short time, traces of arsenic were found in it. In order to overcome this difficulty he had had bottles made from special glass in a clean pot, from special materials, and no arsenic put into it, so that if he did happen to produce any good acid it remained good.

Dr. **Colman** said Mr. Hardwick had told them that he dissolved up the arsenious oxide in his acid in the form of arsenic oxide, but he did not tell them how he got rid of the arsenic oxide eventually. Did it stay in the acid, or was there a further process of getting rid of it?

Mr. **Leighton Edwards** said it seemed to him, in view of the remarks passed, that Mr. Hardwick had been experimenting in the direction of putting more arsenic into the acid than it would have had in it if he had not treated it.

Dr. J. T. **Conroy** said that from certain figures which had come before his notice he felt that certainly between 50 and 60 per cent., at least, of the arsenic was taken out in the Glover tower. From other figures he could also state that somewhere about 98 per cent. of the remaining arsenic was retained in the first three chambers out of a system of seven chambers. The towers were certainly a very effective means of getting the arsenic out of acids, and this method of removal, which he believed had been brought to a very great degree of perfection by some German firms, was, he understood, simply by a very careful washing with water and vitriol. He had read an article by a French scientist, who had been examining living organisms, both plant and animal, and he stated that he had not yet examined a living substance in which arsenic was not present, and he believed that it was an essential constituent of all living matter.

Mr. W. R. **Hardwick**, in reply, said that Mr. Mannington had remarked on the fact that, whereas Spanish pyrites containing 0·75 per cent. of arsenic worked very well, it was an extraordinary thing that so small a difference as 1·00 per cent. should give such results. It was this extra 1·00 per cent. that made the insoluble excess of As_4O_6. The strong sulphuric acid would dissolve a certain amount and no more. With regard to the As_4O_6 in the Gay-Lussac tower, in his opinion the As_4O_6 did not travel through the chambers, but was precipitated there by the cooling of the Glover liquors. The white deposit contained only traces of lead. In answer to Dr. Colman and Mr. Edwards, his object had not been the elimination of arsenic, but the conversion of insoluble arsenic into soluble, and thereby rendering an otherwise unburnable ore burnable. Mr. Carey's remarks as to nitrate of soda being used instead of nitric acid were well worth consideration, for in all probability the nascent nitric acid would be very active.

London Section.

Meeting held at Burlington House, on Monday, February 22nd, 1904.

MR. WALTER F. REID IN THE CHAIR.

THE NEED OF DUTY-FREE ALCOHOL FOR INDUSTRIAL PURPOSES.—PART II.

BY THOMAS TYRER, F.I.C., F.C.S.,
Past President.

For the paper on this subject read last year no originality was claimed. So now, obligations are due to the same gentlemen, and especially to officials and experts of the Excise branch of Inland Revenue. It will be conceded that the present time is appropriate for further consideration of a subject so important to chemical industry, partly because of the effect of recent modifications of the patent law—still however, ineffective for the promotion of industries in Great Britain—and partly on account of considerations involved in changes in the fiscal system of this country. Without being tempted into controversy, one may safely and fairly assume that, whether change in fiscal principle results or not, attention is directed as never before to the relation of the State to industry, means of transit, charges, freight, classification, taxation, merchandise marks, patent laws, and technical education. Owing to the labours of the joint committee of Chambers of Commerce and our Society, the question we have under consideration has become not the least pressing. It may broadly be stated that no progress can be made in the production of a large class of bodies employed freely in medicine and the arts in this country, and for exportation to our colonies and dependencies, unless large facilities are given by the State. The drawback or rebate on exporting medicinal spirituous preparations and perfumery was referred to in a former paper. Little remains to be granted, except as regards some simple mixtures of plain spirit with medicaments, such as chloroform and ether, solid and liquid extracts, and some concessions as to samples. These facilities, let it be emphasised, are accompanied by the very smallest possible inconvenience or interference, whether exported from manufacturers' warehouses under drawback, having been first made from duty-paid spirit or from manufactories of perfumery in bond (with unpaid duty spirit). It may be noted that this concession by the Excise has materially increased British trade abroad by causing accompanying orders for products other than spirituous. The total rebate over the period from 1889 to March 31, 1902, was given as 489,076 proof gallons, or 261,375*l.* 1*s.* 6*d.* value. For the year ended March 31, 1903, the quantity exported was 118,357 proof gallons and the rebate 65,137*l.* It should always be remembered that the principle underlying the concessions just referred to existed long ago, when specified preparations were permitted by the Customs for exportation under drawback in 9-gallon casks. The principle was there, but the extension of it was an act of official confidence and generosity which will ever stand to the credit of the Revenue. In this connection it may be stated, as a check on large expectation, that duty-free spirit is not likely to be conceded for the manufacture of medicinal preparations for internal use in which any portion of potable spirit remains in the finished product, or in a form in which it can be extracted by distillation or liberated by any cheap chemical process. This can hardly be expected, and to ask for it is to jeopardise the whole question. It is but fair to be reminded that quite recently in Germany, where so much is conceded, prohibition as regards medicinal preparations has taken the place of freedom in pharmacies.

With regard to the last expression of opinion the question may arise, "What is a manufacturing pharmacist?" As a medicinal spirituous preparation maker he has to-day all he can desire for exportation. Does he want internal excise control and supervision in bond, and duty payable on exit from bond? Then he will, as regards the class of preparations referred to, be worse off, particularly when he remembers that an agreed and acceptable allowance for waste of spirit in the liquid class of spirituous preparations is now made. Logically, the same benefit should be extended to the manufacturers of medicinal and other chemical products if made in bond or under supervision, namely, that whatever the concession as to duty it must extend to the inevitable waste in process of production. In Germany and Switzerland the form of spirit accounts in factories is simple but clear; recovered spirit is entered as such and accounted for as new or freshly supplied spirit, showing on balance of account the true ultimate waste. This is obviously fair—as would be the necessary visit of competent superior and properly paid officials to the factory itself—for the purpose of verifying processes and usage. This is no more nor less than is already done in our own country by the chemical staff of Inland Revenue. If manufacturers desire facilities of the kind we are discussing, it will be the height of folly to interpose any objection on the ground of secresy or fear of communication. Many of us are officially visited already by other State departments, notably the Home Office, under the Alkali and Factory Acts, and one ventures to assert that no evil has resulted from such visits, and consequently it is germane to refer to the conditions laid down in the Finance Act, 1902, and embodied in the 46th Report of the Commissioners of His Majesty's Inland Revenue tor the year ended 31st March, 1903. In the former paper on this subject, of 1903, the author briefly discussed these conditions, and has but little additional comment to make. Yet one must reiterate the difficulty of proving absolutely that the use of methylated spirits is "unsuitable or detrimental." It has been done in a few cases, and one can but believe that the ventilation of this subject coupled with a sincere desire to promote British interests as far as the existing law allows, and recognition of a latitude given by the Act of 1880 (43 & 44 Vict. c. 24. s. 123. ss. 3) as to denaturing by "some other substance approved for the purpose" has contributed to such result. It is clear that the onus of proof as to "slight or immaterial advantage" is with the authorities. A case in point is that of an important manufacture which last year replied to the questions issued by the Joint Committee that in a period "5,000 galls. of methylated spirit were employed. Of that 5,000, 500 were unnecessary, being crude, unpotable wood-spirit, which was positively harmful, giving a tint to the British product which prevented its extended sale, and throwing some proportion of business into the hands of foreign competitors." Upon representations under the concessions of the Excise under the Finance Act, 1902, the manufacture in question is now conducted with a spirit suitably denatured. A considerable increase of business, involving a very considerable increase in the use of that spirit, has resulted. In this case supervision exists, for three excise officers are employed at a total cost of about 400*l.* a year. Convenient and suitable lodging has been provided. No interference with processes or limitation of hours takes place, and the Finance Act of 1902 is acclaimed a benefit. This case is a practical comment on the reply of the Chief Inspector and Dr. Thorpe to the deputation of the Joint Committee some time ago and on the official Memorandum specially quoted last year as to denaturing. The industry is large and special. The denaturing agent is not prejudicial in any way to the manufacture. The supervision is complete, and can be borne. In this connection a trade journal stated that the manufacture of a now dutiable article—saccharin—is now carried on here, under supervision, and with no inconvenience whatever. The results increase trade. Another case exists, in which fulminate of mercury is now made with a suitably denatured spirit. Concessions for using methyl alcohol were made to more than one British manufacturer, which differed but little from the freedom of their foreign competitors, but considerations altogether dissociated from the duty or supervision prevented them being utilised. In this connection one is informed that enquiry was, and is, being pursued as to the use of *absolute* alcohol, duty-free. It is known that enquiries are at this time being made under the Act for suitably denatured spirit by an artificial silk company and by a great industrial corporation. A case of refusal is known, where the conditions of magnitude, of wealth and necessity exist, namely, in the application of perfumes to soap. We regret the official refusal, but we hope for the best. One is—with Sir Wm. Ramsay last year—not delighted to learn that alcohol in quantity, if at all, is not made in this country. It cannot be made except under the licence of a compounder and rectifier, and under the working conditions of such licence as laid down in the Act of Parliament of 1880. Now, why cannot one of the British licensed rectifiers make alcohol? Surely the operation is not beyond his skill, certainly not his means (for the distiller's riches are popularly supposed to be beyond the dreams of avarice). Squibb at least has taught some of us a good deal about absolute alcohol, and scientific fractionation is not a lost art, as Dr. Sydney Young has indicated in valuable papers to the Chemical and other societies. It must be the small quantity—trivial when compared with the millions of gallons at proof; but after all it is about 25 tons, surely not too small a quantity for one distiller, by arrangement with his fellows, to produce, and when spirit is to-day cheaper in England than in Germany. We may quote an official reply to an enquiry on the subject.

"It will be observed that these provisions of the law do not in any way prevent the production of absolute alcohol in the United Kingdom, but that they merely confine such production to certain specified classes of persons. The Board are not given any discretionary power in the matter, and they feel, therefore, that they would not be justified in allowing any departure from the Act.

"If the persons who are authorised to produce pure alcohol in the United Kingdom do not find it worth their while to do so, the reason must, in the opinion of the Board, be sought, not in any restrictions imposed for the security of the Revenue, but in the insignificance of the demand for the article in this country."

The Spirits Act, 1880, Part I., section 5, clause 7, says:—

No person may, without being licensed to do so, or on any premises to which his licence does not extend,—

(*a*) have or use a still for distilling, rectifying, or compounding spirits; or

(*b*) brew or make wort or wash, or distil low wines, feints, or spirits; or

(*c*) rectify or compound spirits.

Clause 2.—If any person contravenes this section he shall for such offence incur a fine of 500*l.*, and all spirits, and vessels, utensils, and materials for distilling or preparing spirits in his possession shall be forfeited.

By section 8 (1) "A person shall not have a licence to keep a still of less capacity than 400 gallons unless he has in use a still of that capacity or produces to the Commissioners a certificate, signed by three justices for the county or place, that he is a person of good character and fit and proper to be licensed to keep such a still, and that the premises in which he proposes to erect the still and of which he is in actual possession are of the yearly value of 10*l.* at least." Under licence surely there can be no reason why a chemical manufacturer should not make absolute alcohol from duty-paid spirit; but according to this Act he may not.

It is said that the over-production of spirit from grain for whisky resulted in the shutting down of some Scotch distilleries whose supply would have drenched the London markets to ruination point—hence cheap spirit. Over-production always effects something of the kind, and it would be well if this capacity for over-production was considered by both the distiller and the Excise—and the Board of Agriculture of Great Britain and Ireland too—from the industrial point of view. Encouragement of British manufactures will go a long way to make supply and demand equal, and, if the facts are as stated and commonly believed, there is in them a convincing case for the exemption of the *British* surplus from the differential duty on spirit for selected manufacturing purposes. It was said by Mr. John C. Umney last year, in reference to the differential duty, "that it is a form of compensation." Undoubtedly it is, and of the nature of a bargain for hindrances to free working imposed by law. Mr. Umney intimated that we had better do away with the distiller, who wanted compensation, so that we get duty-free alcohol for industries. He probably said more than he meant, for he, as an industrial, would be no party to killing a cognate industry. But the conditions may without difficulty be altered, and, while retaining that protection as against the usually cheaper conditions of foreign production, free our distilling industry from hampering restrictions as to production. There is no question of the growing importance of the use of alcohol for motors. Suitable petroleum is said to be a diminishing quantity, and the use of alcohol on the Continent lends force to the opinion that the distiller may look favourably in this direction for an outlet. This may well form the subject of a useful paper; in fact it will.

One intended to describe and discuss the conditions of Continental distillation, material, plant, and supervision. These were indicated sufficiently in the former paper, to show that they were not beyond the possibility of imitation in Great Britain and Ireland; but Dr. Squire has expressed his intention to deal with "Distillery Systems"; and at an early date we may expect, from his expert knowledge and skill, much information as to—

(*a*) A change in the mode; processes of fermentation and distillation, with perfect freedom as regards "residuals."

(*b*) An extension of materials in the direction of both cheapness and nature.

Suffice it here to state that the production of spirit from materials such as potatoes, &c., cannot be effected by rectifying apparatus of the Coffey still type; hence a difficulty as to a form of plant which is an exceedingly expensive apparatus to scrap without adequate cause. Perhaps there is no need now to further pursue the arguments, but it is clear that the reply to the Somerset House deputation quoted last year anticipated the Finance Act of 1902, and undoubtedly definite action has resulted; methylation has received wider application, and more widely still may it be with the illustrations then given of denaturing agents. Consideration has been given to the possibility of manufacturing, not any or one special substance, such as those instanced, but the large class of medicinal, pharmaceutical, and photographic products now chiefly made abroad. Syndicated or combined manufacture, under reasonable supervision, was referred to because of the definite terms of the official memorandum. We were seeking to add to the uses for spirit; we admitted that the probable dimensions of these industries could not be stated, but the known extent of increasing applications and of imports provides a sufficient argument against their "trivial importance" or "as in the purely personal interest of individuals" (we quote from the Official Memorandum). Now collectively the value and quantity is considerable. Some values are now less, owing to lapsing of patents and competition between Continental rivals, chiefly in this country, which from its internal consumption, but more because of its free position as an exporting centre. New products are week by week being patented (and protected from being made, under our illogical laws) and registered, in the production of very many of which alcohol in some form has been used, either chemically or physically. If "magnitude" is a factor, here is that element in force, and we may boldly claim that "the magnitude and importance" of industrial enterprise in colouring matters and artificial dyestuffs on the one hand, and fine chemicals and therapeutic agents on the other, is such as to give the consideration of their economic production, public interest for national trade. Conditions of unpotability, supervision, and guarantee of good faith, will be readily acquiesced in by individual capitalists where the industry is large enough, or by syndicates or companies where co-operation is desirable. The authorities need have no fears on these points.

Now, by implication, "no recovery of spirits or redistillation can be allowed." This is an impossible condition —for two reasons: first, it is economically unsound; second, waste must be allowed for, as in the drawback on manufactured spirituous preparations, where the allowances are: (*a*) The duty on alcohol per proof gallon. (*b*) The differential duty of 5*d.* per proof gallon. (*c*) An allowance for waste in production, which has been ascertained by actual working by excise examination at the works of producers. (*d*) A margin for error in estimation or assay. Here we have precedents on all points. On the Continent, we repeat, the supervision and control is effective, and we submit that, given guarantees by respectable people and necessary oversight, for which a large single industry or a composite one can probably afford to pay, the question of difference in values in spirit on the Continent should not be raised as almost the one and only answer. We referred in our first paper to the position of the distiller, and we submit that it is not at this moment a question of over-production, but of absorbing the surplus for industries—not for drinking; and we urge that the quantities required for *bona fide* manufacturing should be free from two loads—one the duty itself. Second, as regards the quantity employed, in industries, of the differential duty. It may be admitted that there is no pressing need for anything cheaper than the existing methylated spirit for many purposes, such as polish, &c.

This great economic question presses as severely in our New York Section, which is at present co-extensive with the United States of America. The movement in America for duty-free alcohol has gained in force; but one does not claim freedom here for such a range of products as our friends desire, many of which would be classed as polish, lacquer, varnish, &c.

> In support of the Bill these manufacturers claim that the use of alcohol in the industrial arts is only limited by its cost. The number of articles of which it is an important element in their manufacture are too numerous to be given in detail.
>
> Alcohol is also used in automobiles, yachts, launches, and for small power plants: in rural and farm engines and motors for all purposes: for heating and lighting; for preserving and a large number of domestic uses; for massage, medicinal, and many other purposes
>
> Alcohol, if free from tax, could be used with advantage as a preservative of food products in their fresh state, such as fruits, nuts, meat, &c., in a manner similar to the effect of cold storage.
>
> Further, this agent could be made use of with great economy for the purpose of evaporating moisture in general industrial pursuits where the vacuum pan is used, such as in the manufacture and refining of sugar, the condensing of milk and other similar liquids, and in the manufacture of chemical salts and many other substances in the heavy chemical lines.

They ask for a drawback on exportation, so that they may have an outlet for their ever expanding production, and as an offset against their comparatively high internal duty. Is it improbable that for some of these purposes no relief will be granted? Yet it is quite odd to read how our friends assume that Great Britain has manufacturing facilities in common with Germany, France, and Russia: they credit this country with the advantage of methylated spirit, which they have not. In fine and pharmaceutical chemicals their troubles are similar to ours. They cry out for opportunities for export trade and a bigger share in the world's commerce, and the chances are they will get facilities in cheap spirit and drawback on products exported sooner than we shall.

A United States trade organ says:—

> "The failure of the Ways and Means Committee to make a favourable report upon the Joy Bill reducing the tax on alcohol to 70 cents per gallon was not a surprise to those who were familiar with the situation. The committee was practically pledged at the beginning of the last session not to report any revenue legislation, the intention being to carry the whole question over until the Fifty-eighth Congress. The demand for cheaper alcohol, however, has been general, and the work done in its behalf so effective that it is safe to say that four-fifths of the members of the next House of Representatives now stand committed in writing to a reduced tax, a majority favouring the 70-cent rate. Hand in hand with the effort to secure a lower tax on distilled spirits will go a movement for free alcohol in the arts, and it can be stated positively that the outlook for success is better than at any time since these important questions were first broached in Congress. As heretofore stated, the Ways and Means Committee to-day stands ready to permit the use of domestic alcohol free of internal revenue tax for the export trade as an independent measure, and it is believed that this concession will be much broadened in scope during the coming Congress."

So late as January of this year a report appeared in a United States trade organ of the text of the Bill to provide untaxed denatured alcohol. We quote it:—

> Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled. That distilled spirits of an alcoholic strength of not less than one hundred and

sixty per centum proof, as defined by sections thirty-two and forty-nine of the Revised Statutes of the United States, may, when rendered unfit for drinking purposes, or for use as a beverage, be removed from distillery warehouses free of tax under such regulations as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe: Provided, That sulphuric ether, wood alcohol, methylic alcohol, wood naphtha, or other substances approved by the Commissioner of Internal Revenue and the Secretary of the Treasury, shall be mixed with such distilled spirits so as to render the same unfit for drinking purposes, or for use as a beverage.

Sec. 2. That distilled spirits, before being removed from distillery warehouses free of tax under the provisions of this Act shall be marked or branded as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe, and shall have affixed to each cask or package an engraved stamp indicating that such distilled spirits have been rendered unfit for drinking purposes, or for use as a beverage, said stamps to be provided and furnished by the several collectors as in the case of other stamps, and to be charged to them and accounted for in the same manner; and for the expense attending the providing and affixing of such stamps, ten cents for each stamp shall be paid to the collector of the district on making the entry for such removal.

Sec. 3.—That any person who shall rectify or purify distilled spirits which have been removed from distillery warehouses free of tax under the provisions of this Act, by removing or separating the sulphuric ether, wood alcohol, methylic alcohol, wood naphtha, or other substances from such distilled spirits, by any process whatever, shall, on conviction, be subject to a fine of not less than five hundred dollars nor more than five thousand dollars, and be imprisoned not less than six months nor more than three years.

Sec. 4.—That distilled spirits, removed free of tax from distillery warehouses under the provisions of this Act, shall not be stored or deposited on any premises in which the business of a distiller, rectifier, wholesale liquor dealer, or retail liquor dealer is carried on, or on any premises connected therewith by any private or internal communication. And every distiller, rectifier, wholesale liquor dealer, and retail liquor dealer who shall store or deposit, or cause to be stored or deposited, such distilled spirits on the premises in which such business is carried on, after such distilled spirits have been removed from distillery warehouses, shall, on conviction, be fined not less than two hundred dollars nor more than one thousand dollars, and imprisoned for not less than six months nor more than two years.

The organisations of farmers throughout the country, and especially the big Granges of the middle and far West, have been prompt to see the importance to them of the adoption by the Government of a liberal alcohol policy, and are already petitioning Congress in behalf of the Boutell bills, which reduce the tax on pure spirits from 1·10 dols. to 70 cents per gallon and grant free denaturised alcohol for use in the industrial arts.

The important interest which the farmer has in this question, and which will make him the strong ally of the manufacturer in this campaign, is succinctly set forth in a memorial just received by the Ways and Means Committee, which is in part as follows:—

> "The lack of any provision in our revenue laws for the use, free of tax, of alcohol which has been rendered unfit for drinking purposes is an injury to the American farmer, restricting his markets, lessening the selling price of the largest crop, increasing the cost of living, and preventing him from enjoying the benefits to be derived from the general use of alcohol in the domestic and industrial work of the farm.
>
> "We would ask your especial attention to the highly successful operations during a period of nearly 20 years of the liberal legislation relating to the alcohol now in force in Germany. In that country, under laws providing for untaxed denaturised alcohol, that is, alcohol mixed with some noxious substance so as to render it unfit for use as a beverage, about 60,000,000 proof gallons of tax-free alcohol are annually used for industrial purposes. All the materials from which this great quantity of alcohol is produced are grown by German farmers, who also benefit by the opportunity to secure cheap fuel, light, and power for farm machinery, &c.
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> "We are confident that the proposed system would work equally well in this country, and that the consumption of alcohol for manufacturing purposes and as a motive power would be so greatly increased as to create a new market for many millions of bushels of corn annually. The low price at which untaxed denaturised alcohol, suitable for use in lighting, heating, and as a motive power, would be furnished would greatly benefit the farmers of the whole country, apart from their special interest as the producers of the material from which alcohol is distilled.
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> "We would also submit that the farmers are directly injured by our antiquated laws relating to alcohol through their effect in checking our export trade in many articles in the manufacture of which alcohol is an important material. Germany practically controls the export trade to neutral markets in all articles of this kind, our manufacturers being unable to compete successfully, owing to the prohibitive cost of their alcohol as compared with that of their German rivals. The result is that millions of dollars' worth of goods that should be made in this country are now made in Germany, the German workers who make these goods buying the products of German farmers. Under the proposed changes in our laws, American workmen would make these goods, and would buy the products of American farmers.
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> "Believing that this is a matter of far-reaching importance to the farming interests of the country, and that the enactment of the proposed legislation would be of very great benefit to them, we would ask that you favourably report House Bill 9302, so that it can become law at the present Session.
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> "The German farmer not only has this market for his produce, but, in addition, untaxed alcohol gives him cheap light, heat, and power. The German farmer lights and heats his house and buildings, cooks his food, threshes his grain, runs his creamery and machinery for other purposes, and markets his products in a motor waggon, all with alcohol.
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> "If the German farmer, why not the American farmer? The only obstacle is the United States internal revenue tax, which makes alcohol artificially dear to both the American farmer and manufacturer, thereby prohibiting its use."

The oddest thing about the matter as affecting the States is that the opposition is a "women's temperance" affair, and probably the influence of this body of "enthusiasts" has been very great. This on the authority of the esteemed chairman of our New York Section, Prof. Coblentz, whose paper in this month's Journal on "Newer Remedies" is timely for our contention.

A consideration of profound importance arises. If now Germany competes under conditions such as we ask for, and America obtains them in the near future—and both are protected countries, with facilities for drawback on exportation—where does Great Britain come in? This is not a "fiscalitis" meeting, but it is obvious and logical, whatever becomes of home supplies, that existing Acts, notably the Customs Consolidation Act of 1876, involving duties, must have consideration as regards the scope of their operation. We quote the clauses of the Acts again:—

Customs Consolidation Act, 1876 (*not repealed*).

Appendix 39th and 40th Victoria, Chap. 35.

"Goods not prohibited to be imported into or used in Great Britain and Ireland, composed of any article liable to duty as a part or ingredient thereof, shall be chargeable with the full duty payable on such article, or if composed of more than one article liable to duty, then with the full duty payable on the article charged with the highest rate of duty."

"Upon the importation into Great Britain and Ireland of any articles in the manufacture of which spirit has been used, there shall be charged in respect of such quantity of spirit as shall appear to the satisfaction of the Treasury to be used in the manufacture of such articles, a duty equivalent to that which would be chargeable on the like quantity of spirit on its importation into the United Kingdom."

Note also—Finance Act, 1902, *Chap.* 7, *Part I.*, *Sec.* 7.

"Where any manufactured or prepared goods contain, as a part or ingredient thereof, any article liable to any duty, customs duty shall be charged in respect of such quantity of the article as shall appear to the satisfaction of the Treasury to be used in the manufacture or preparation of the goods, and in the case of goods so containing more than one such article, shall be charged in a similar manner on each article liable to duty at the rates of duty respectively applicable thereto, unless the Treasury shall be of opinion that it is necessary for the protection of the revenue that duty should be charged in accordance with the Customs Tariff Act, 1876."

"Any rebate which can be allowed by law on any article when separately charged shall be allowed in charging goods under this section in respect of the quantity of that article used in the manufacture or preparation of the goods."

The principle of duty *pro rota* is no new one. As regards obvious spirituous preparations there can be no doubt. Examination is not a novelty. In 1902 156,987 samples of wines, spirits, and compounded spirits were examined, besides innumerable other things—tea, chicory, sugar, tobacco, &c. Parenthetically it may be stated that 972 samples of wood naphtha, for methylating, representing 381,509 galls., were examined at the Government laboratory. Of these 36 samples, representing 14,231, were rejected as unsuitable. So also for the benefit of traders and others the methods employed for determining the amount of alcohol in medicinal preparations, essences, and perfumes has been published in the Journal of the Chemical Society, 1903, p. . So again, and notably, 26 samples of special "petroleum ether" for use in certain manufacturing operations in conjunctio with methylated spirit were also examined. 25 samples representing 1,032 galls., were approved.

The quantity in proof gallons of foreign plain spirit (or "unenumerated, not sweetened," as it is classed) cleared for home consumption in 1902—1903 was 1,629,924, duty 888,729*l*. Of this quantity 1,196,711 were for methylating, under a duty of 23,661*l*.

It should be remembered that in consequence of the imposition of the corn duties the Finance Act of 1902 placed an additional duty of 1*d*. per gallon upon foreign spirits other than rum and brandy, as from the 17th June 1902. The spirit duties are based upon a rate of 10*s*. per proof gallon on home-made spirits, to which there had been added a surtax of 4*d*. per proof gallon on imported spirits. In 1890 6*d*. per gallon was added for certain purposes connected with local taxation, and in 1900 a further 6*d*. was added for the expenses of the South African war. Spirits imported in bottle, other than unenumerated unsweetened spirits, were subjected to an additional duty of 1*s*. per proof gallon in 1899.

One may remark that for spirit which would here be classed as methylated, in Germany and Switzerland the price is at least 40 per cent cheaper; therefore, on the quantity indicated they pay 14,197*l*., as against our 23,661*l*. Molasses figure in the returns as freed from duty in accordance with the provisions of the Finance Act, 1902, to the extent of 445,283 cwts. (see 47th Report of Customs), surely a concession to an industry protected somewhat already. It is stated that there is available a very large quantity of molasses—practically for the getting. Thus drawback is familiar to the revenue departments, on substances for internal consumption in a degree, but vastly more so on exportation. Beginning with cocoa, chicory, and ending with wine, the returns naïvely put the "total amount of duty that would have accrued thereon" as 5,724,764*l*.—so that for reasons, presumably for excellent reasons, this concession is made, and among the substances are manufactured goods; of course the majority are for re-exportation. Drawback repayments, &c., are nothing new, and they amount to 1,337,225*l*. for 1903 (47th Customs Report), and this out of a gross aggregate of total receipts, 35,798,095*l*. Including the amounts collected on behalf of the Inland Revenue Department, the Customs collected 39,785,212*l*., and the net produce, after deducting drawbacks, &c., was 38,746,339*l*., at a cost of 954,608*l*., equal to 2*l*. 8*s*. 0*d*. per cent. on gross, or 2*l*. 9*s* 3*d*. per cent. on the net. In 1894 the gross was 23,168,696*l*. net, after drawbacks 22,979,183*l*.; at a cost of 3*l*. 17*s*. 3*d*. and 3*l*. 17*s*: 9*d*. respectively. These figures are quoted to show that the cost of doing work by this able department has not increased with the increase, and stress is laid upon the fact in case the Customs Consolidation Act, 1876, should be put in force upon importing a further selection of articles alcoholic in themselves, or containing ethyl or methyl radicles, or in which these alcohols have been employed in their production. The list now is not extensive, and is quoted here, but it is clear that, in view of existing and increasing and possible competition from other quarters, action may have to be taken. No departure from principles already acted on is involved, only their extension—internally on the one hand and externally on the other. If by adequate concessions internally we can compete fairly; if not by these, then externally, to the extent of refund or drawback. In either case, neither manufacturers nor officials will, we feel sure, flinch from the labour imposed. But it surely is the patriotic way to promote internal industry.

——	1902.	1903.	Increase.	Decrease.
	£	£	£	£
Chloral hydrate..........	1,393	1,204	..	189
Chloroform..............	35	14	..	21
Collodion................	3	5	2	..
Ether, acetic............	211	319	108	..
„ butyric..........	394	509	115	..
„ sulphuric........	281	127	..	154
Ethyl bromide.........	5	6	1	..
„ chloride..........	291	379	88	..
Soap, transparent......	104	122	18	154

Confessedly the task of the Government Chemical Departments, now united in one staff and head, will not be light or easy, but it may rely upon the honest and intelligent, if interested, assistance of the manufacturers of the country. The distilling industry, somewhat nurtured in the atmosphere of restrained privilege, will, we are sure, not be less patriotic than its fellow countrymen. The Excise can, if it will, indicate what restrictions—admittedly necessary in 1880—can now be dispensed with.

A quotation from Scarisbrick's "Spirit Manual" may be useful at this point:—

"The distiller was required to produce 1 per cent. at proof for each 5° attenuated in the case of wash from grain or potatoes, and for each 4 in the case of sugar wash.

"The use of mangold wurtzel in preparing wort was sanctioned in 1833,[*] the old regulation still being continued that no two kinds of material (except malt and unmalted corn) were to be used in combination. This restriction was justified by the fact that worm-ends and spirit store were open and under the distiller's absolute control. The subject was pressed on the attention of the country in 1846. It was found that the restriction to use only one class of material at one time, together with the exaction of a Customs duty on sugar, virtually prohibited distillation from any material except grain. This attracted attention, owing to the complaints of West Indian planters, who happened to be the largest sugar producers. They strongly urged the impolicy and injustice of excluding their produce from the breweries and distilleries of this country, and it became a question of moment to determine whether the use of sugar and molasses, mixed or unmixed with other materials, could be allowed without impairing the security of the revenue. Experiments for this purpose were commenced by Messrs. Dobson and Phillips, in the Excise laboratory, where the comparative values of barley, malt, sugar, and molasses to the distiller and brewer were accurately ascertained. An Act[†] was therefore passed in 1847 authorising the use of sugar in distilleries, with drawback of the Customs duty, excepting so much as would be sufficient to countervail the duty on the small quantity of malt necessarily used by distillers. In the following year molasses and treacle were allowed.

"As the trade wished an allowance for deficiencies in spirit store, it was found necessary, in 1853, to insist upon the worm-end being enclosed, and the stock placed under the officer's control.[‡] Decreases from natural waste, filling, &c., not exceeding 1 per cent., were then exempt from duty. The contents of casks were to be determined by gauge or weight, and the distillation process of determining original gravity of beer was extended to distillers' wash. In 1855 all materials were allowed to be used duty free, thus ending the frauds in connection with the drawback on materials. The duties in England and Scotland were equalised in 1856, and in the United Kingdom in 1858, the rate being 8*s*. per proof gallon.

"Owing to the higher character of the trade, and the revenue safeguards furnished by closing the worm-end, and the system of determining original gravities, the time had come for concessions. It was considered safe to abolish the following prohibitions: (*a*) against grinding malt with stones; (*b*) use and sale of yeast; (*c*) continuous running of common stills. It was also found that the following could be granted without impairing revenue security: (*a*) giving up the annual balance account; (*b*) larger allowance for waste in warehouse; (*c*) greater facilities for obtaining remission of duty on spirits lost by accident; (*d*) dispensing with certain regulations which increased the expense of making malt for distilling purposes; (*e*) allowing the use of any materials in making wort, provided gravity of extract could be obtained by saccharometer; (*f*) 2½ per cent. yeast to be removed from wash; (*g*) beginning of brewing period as soon as last back of preceding period removed to wash-charger; (*h*) removal of spirits from receiver when depth amounted to 15 ins.; (*i*) limit of decrease in store raised to 1½ per cent.

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[*] 2 and 3 William IV., c. 74 (1833).

[†] 10 Victoria, c. 6.

[‡] 16 and 17 Victoria, c. 37.

"These were embodied in an Act of 1860,* which consolidated the spirit laws of the United Kingdom and removed any restriction not absolutely necessary to secure the revenue. Their being granted enabled the distillers to compete with foreigners on terms of greater equality, and thus merely carried out Free Trade principles to their logical conclusion.

"Besides settling the question of restrictions, the Act also dealt with another important matter. It became known in February 1860, from the Chancellor's financial statement, that, owing to the commercial treaty with France, foreign spirits would be admitted for consumption into the United Kingdom at the same rate of duty as British spirits *plus* a small surtax of 2*d.* per gallon—same as that charged on Colonial spirits imported from 1848. The distillers became alarmed, as 2*d.* per gallon was considered an insufficient compensation for the disabilities under which they laboured. Deputations represented trade views to the Government, and put forward certain claims. It was admitted by the Board of Inland Revenue that Excise restrictions increased the cost of manufacture by 5½*d.* per gallon. There was also a claim made on account of the difference in the mode of charging duty on foreign spirits, which obtained in the Customs, said to favour importers to the extent of 4*d.* per gallon. The full claim would not, therefore, have been met by a lower differential rate than 9½*d.* per gallon.

"The restrictive operation of Excise regulations was modified by abolishing the prohibitions already detailed and granting the concessions enumerated, with the net result that 5*d.* per gallon was considered sufficient to meet trade claims.

"Distillers and rectifiers had established the fact that restrictions caused a loss of 2*d.* or 3*d.* per gallon, and naturally considered that they had a claim to allowance on exporting, so that they might compete with foreign distillers in Colonial and other markets. By resolution of the House of Commons, on 5th March, export allowances of 2*d.* per gallon on plain spirits and 3*d.* on compounds were granted, the duty on British spirits being raised 1*d.* per gallon, to make up for the decrease thus caused in the revenue. The surtax on foreign spirits was imposed at 5*d.* per gallon, and that on Colonial spirit continued at 2*d.*

"The claims advanced and allowed are shown in the following schedule :— *

	1860. Amount claimed by		Amount allowed in 1860.	1860. Considered by the Inland Revenue Board to be admissible.	
	Scotch Distillers.	English Distillers.		For Uncoloured Spirits.	For Coloured Spirits.
	d.	*d.*	*d.*	*d.*	*d.*
1. Compensation for duty on foreign grain	0¾	0¾	0¾	0¾	0¾
2. Prohibition against brewing and distilling at same time	1½	1½	1	1	1
3. Against distillers mixing worts in several vessels while in process of fermentation	0¼	0¼	0¼	0¼	0¼
4. Loss of duty on rectification and flavouring spirits in separate premises	3	3	1	2¼	2¼
5. Colouring matter in foreign spirits	2	2	2	Nil	2½
6. Increased expense in making malt consequent on Excise restrictions	0¾	0¾	Nil	Nil	Nil
7. Difference in mode of charging duty in favour of foreign spirits	1	1¼	Nil	Nil	Nil
8. Duty evaded upon foreign spirits, and by samples drawn in bond	0¼		Nil	Nil	Nil
	9	9½	5	4¼	6¾

"The estimate of 1*d.* per gallon in the second item of the schedule was in respect of extra cost, owing to plant lying idle, repairs, lighting, coal, wages, &c. In the fourth item 1¼*d.* was considered an equivalent for the waste which occurs in rectifiers' stocks from the time of delivering spirits from the distillery until they reach the consumer. The loss is supposed to be 1 per cent.; the other 1*d.* is on account of being bound to use separate premises for rectifying, thus incurring expenses of rent, plant, cartage, wages, &c. The seventh item was found to be groundless. Experiments were made with a large number of consignments of foreign spirits, and it appeared that the Customs charge was rather above than below that of the Excise.

"Since 1860, the changes have been few and unimportant. They include (*a*) increased percentage of yeast allowed to be taken from wash; (*b*) shortening of interval between brewing and distilling periods; (*c*) extended range of warehousing strengths; (*d*) repeal of limitation as to smallest still being 40 gallons; (*e*) concessions in respect of bub, use of spent wash, yeast pressings, &c. The spirit laws were again consolidated in 1880 (43 and 44 Victoria, c. 24)."

We think we have made out a case, stated thus in our former paper:—(*c*) A rebate of surtax to distillers for spirit destined and *certified for certain uses in a "licensed" and approved factory, and consideration for inevitable loss in manufacture.* (Remembering always that the *present* output will not be affected.)

It may be desirable to state what has been done to expedite this matter since the passing of the Finance Act, 1902. The Associated Chambers of Commerce passed a resolution (this Journal, 1903, 286). The Manchester Chamber, acquiring precedence, drafted a memorial to the late Chancellor of the Exchequer, in accordance with practice of the Chambers. In this memorial, reading as follows :—

Manchester Chamber of Commerce.
1903.

SIR,

I AM instructed on behalf of the Association of Chambers of Commerce of the United Kingdom to invite your attention to the serious disability imposed upon chemical and other manufacturers who use imported pure spirit as a raw material of their industry by Section 8 of the Finance Act, 1902.

The section provides that such spirit "may not be received or used until the difference between the duty of Customs chargeable thereon and the duty of Excise chargeable on British spirits has been paid."

The "difference thus prescribed to be paid, though apparently small, is in reality a differential duty which constitutes a special and repressive charge on certain British industries from which their foreign competitors are entirely free." The consequence is that the production of perfumes and of some pharmaceutical requisites, which has attained important dimensions on the European continent, is effectually kept in check by this duty in the United Kingdom. The manufacture of perfumes by chemical process is rapidly superseding the extraction of them from flowers, and this new and profitable industry cannot become an important one in this country so long as the disability remains.

So urgent has the question of its removal become, that at the annual meeting of the Association of Chambers of Commerce, held in London in March last, the following resolution was unanimously adopted :—

"That the provision of Section 8 of the Finance Act, 1902, requiring the payment of duty on imported pure spirit for manufacturing purposes at a rate equivalent to the difference between the Customs and the Excise duty on spirit, adds about 50 per cent. to the original value of such spirit, and that this addition places British manufacturers who use it in a position of serious disadvantage in relation to their continental competitors, who are able to purchase it entirely duty-free; and that representations be made to the

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* 23 and 24 Victoria, c. 114.

* Twenty-eighth Report of Commissioners of Inland Revenue.

proper Governmental Department with a view to the removal of this disadvantage."

In pursuance of this resolution, I am respectfully to urge that you will, at the earliest possible opportunity, take such steps as may be necessary for relieving the industries in question of this respective burden.

I have the honour to be,
Sir,
Your most obedient Servant,
EDMUND W. FITHIAN.
Secretary.

Rt. Hon. C. T. Ritchie, M.P.,
Chancellor of the Exchequer.
The Treasury, London.

Reference to "perfumes" is made. A correction suggested at the time appears to have escaped attention, for the word "synthetic" was inserted before "perfumes" in the third paragraph. Mr. Ritchie's reply, through the secretary, was as follows:—

Treasury Chambers.
Whitehall, S.W.,
25th August 1903.

SIR.

THE Chancellor of the Exchequer has under consideration your letter of the 4th instant and the resolution contained therein, which was passed by the Association of Chambers of Commerce last March, on the subject of the duty on spirits used in manufactures, and especially in the preparation of perfumes, &c.

He does not altogether understand the reference in your letter to Section 8 of the Finance Act, 1902, inasmuch as the provisions of that section have not as yet been applied to the manufacture of perfumes: nor does he understand how the manufacturers of perfumes in this country are subject to any disability either in the home or in the foreign market, as competing perfumes from abroad are liable to Customs duty on importation here, and when perfumes made at home are exported a full equivalent of duty paid is given in the shape of drawback or allowance.

Mr. Ritchie does not think that it will be practicable to abolish the differential duty on spirits used in manufactures, nor would it be equitable to the home producers of spirits. He proposed to remedy certain anomalies in this connection in the Revenue Bill which has just become law: but the clause on this subject unfortunately met with opposition, and it proved impossible to carry it through Parliament.

I am, Sir,
&c., &c.

Now it is quite clear that the Chancellor's reply as regards perfumes is right, and fulfils all the conditions we desire. "Compounded perfumes" ready for sale were not meant, but "synthetic" perfumes, such as we saw under Mr. Gordon Salamon's guidance at Courbevoie on our visit to Paris in 1900. As regards the "differential duty," we agree that as then advised the Chancellor had little choice. Things have changed, and we think a powerful case is made out for consideration, but we should like to know about the opposition to the correction of "anomalies"—what the anomalies were, and who opposed. We have unsuccessfully tried to discover; we shall yet know. Pursuing our enquiry as to what has been done, the committees have conferred jointly and separately. It was suggested by Mr. Umney to ask members to set out the actual amount of ethyl and methyl entering into the composition of certain typical bodies much in demand, upon which, under the Customs Consolidation Act of 1876, duty would have been imposed on entry into this country, but which the present general conditions of trade have made it necessary should not be imposed, but rather, preferably, in order to protect the trade of the country, should be made capable of being produced from duty-free alcohol. Also, to set out the amount of alcohol wasted.

The queries were set out as upon a 100*l*. value—some replies have been received, not all upon values, and are tabulated:—

TABLE I.

Contributed at the request of the Joint Committee by A. G. Green, Professor of Tinctorial Chemistry, Yorshire College, Leeds.

Name of Dyestuff.	Percentage of Methyl Alcohol.	Percentage of Ethyl Alcohol.	Price per Lb. (Wholesale for Pure Product.)	Unpaid Duty per £100 Value.	Estimated Annual Imports.
			s. *d.*	£	
Malachito Green	27	..	2 3	34	10 tons
Methyl Violet	40	..	1 6	75	Difficult to estimate
Gallocyanine	21	..	2 0	30	5 tons (?)
Methylene Blue	33	..	3 6	26	Difficult to estimate
Auramine O	40	..	1 11	59	45 tons
Victoria Blue R	28	10	1 10	59	30 "
Brilliant Green	..	38	2 3	48	10 "
Patent Blue V	..	34	2 3	13	45 "
Rhodamine B	..	38	5 0	21	15 "
Rhodamine 6 G	..	30	20 0	4	30 "
Chrysophenine	..	13	1 8	22	Difficult to estimate, but very large.

TABLE II.

Table showing Spirits used per 100l. Import Value.

Product.	Import Price per lb.	Weight per 100*l*.	Alcohol 95 Per Cent. used: in 1 lb. Finished Product.	for 100*l*. Import Value.	Foreign Value of Alcohol, 1900.	English Value per Lb.	Methyl Alcohol used: in 1 lb. Finished Product.	for 100*l*. Import Value.	Value of Methyl Alcohol.
	s. *d.*	Lb.	Lb.	Lb.	£ *s.* *d.*	£ *s.* *d.*	Lb.	Lb.	£ *s.* *d.*
Antipyrine	5 6	364	0·933	339	2 16 6	34 12 2	0·448	163	4 8 3
Ethyl chloride	0 11	2,182	1·00	2,182	18 3 6	222 2 10	..	..	..
Phenacetine	3 0	667	2·082	1,389	11 11 6	141 15 10	..	..	..
Salipyrine	5 0	400	0·89	356	2 19 4	36 6 10	0·288	115	3 2 3
Dermatol	0 15	133	2·13	283	2 7 2	28 17 9	..	..	..
Salol	0 10	200	2·3	460	3 16 8	46 19 2	..	..	..
Heliotropine	12 6	160	0·506	81	0 13 6	8 5 5	..	..	..
Vanilline	12 6	160	1·608	256	2 2 8	26 2 8	..	..	..
Kryofine	21 0	95	1·63	155	1 5 10	15 16 6	1·474	140	3 15 10
Guaiacol carbonate	11 0	182	6·63	1,203	10 1 0	122 2 3	2·77	504	13 15 0
Dimethylaniline	0 10	2,400	..	..	..	..	0·676	1,622	43 18 7
Gallocyanine, 10 %	0 5	4,800	..	..	..	..	0·174	835	22 12 3
" powder.	4 4	461	..	..	..	..	1·683	776	21 0 4
Gallopurple	5 6	364	..	..	..	..	2·67	792	26 6 6
Tartrazine	1 6	1,334	0·233	311	2 11 10	31 15 0	..	..	..
Chrysophenine	1 6	1,334	0·209	278	2 6 4	28 7 6	..	..	..
Dianisidine base	5 6	363	0·82	298	2 9 8	30 8 3	..	..	..
Ketone	2 6	800	..	..	..	..	1·24	992	26 17 4

TABLE II.—*continued.*

Product.	Import Price per Lb.	Weight per 100*l.*	Alcohol 95 per Cent. used: in 1 lb. Finished Product.	for 100*l.* Import Value.	Foreign Value of Alcohol, 1900.	English Value per Lb.	Methyl Alcohol used: in 1 lb. Finished Product.	for 100*l.* Import Value.	Value of Methyl Alcohol.
	s. *d.*	Lb.	Lb.	Lb.	£ *s.* *d*	£ *s.* *d.*	Lb.	Lb.	£ *s.* *d.*
Methane base	..	..	0·11	..	..	..	0·71	..	..
Auramine O	2 3	888	0·109	97	0 16 2	9 18 0	0·704	625	16 18 6
Victoria Blue B	1 9	1,143	..	..	..	..	0·496	566	15 6 7
" " 4 R	2 0	1,000	..	..	..	..	0·7125	712	19 5 11
Benzopurpurin 10 B	2 6	800	0·19	152	1 5 4	15 10 5	..	..	..
Rhodamine B	4 0	500	0·045	22	0 3 8	4 4 11	..	..	..
" G	5 0	400	0·047	19	0 3 2	1 18 9	..	..	..
" 6 G	6 0	334	0·764	255	2 2 6	26 0 7	..	..	..
Dimethyl acid	..	..	..	..	..	..	0·548	..	..
Rhodine 6 G R	6 0	334	1·76	588	4 18 0	60 0 6	..	..	..
" 11 G	6 0	334	0·448	150	1 5 0	15 6 4	0·114	38	1 0 7
" 12 G	6 0	334	0·55	184	1 10 8	18 15 8	0·14	47	1 5 5
" 12 G F	6 0	334	0·626	209	1 14 10	21 6 8	0·476	159	4 6 1
" G W	6 0	334	..	..	.	..	0·719	240	6 10 0
" 3 G W	6 0	334	0·114	38	0 6 4	3 17 17	0·425	141	3 16 4
" 12 G M	6 0	334	0·4	133	1 2 2	13 11 6	0·109	36	0 19 6
" 3 G	6 0	334	0·074	25	0 4 2	2 11 0	0·268	90	2 8 9
Methylene Blue	2 6	800	..	..	..	..	0·981	785	21 5 2
Crystal Violet	3 6	571	..	..	..	..	0·754	430	11 13 11
Vert pour Noir	6 0	334	..	..	..	..	0·223	74	2 0 1
Indazurine B	1 9	1,143	0·075	86	0 14 2	8 13 6	..	..	..
" G M	2 0	1,000	0·104	104	0 17 4	10 12 6	..	..	..
" B B	2 0	1,000	0·1	100	0 16 8	10 4 2	..	..	..
" G	2 0	1,000	0·09	90	0 15 0	9 3 9	..	..	..
" N G	2 0	1,000	0·092	92	0 15 4	9 7 10	..	..	..
" 5 G M	2 0	1,000	0·66	66	0 11 0	6 14 9	..	..	..
Direct Violet B B	2 0	1,000	0·11	110	0 18 4	11 4 7	..	..	..
Direct Blue 6 B	2 0	1,000	0·068	68	0 11 4	6 18 9	..	..	..
" " 7 B	4 0	500	0·0602	31	0 5 2	3 3 3	..	..	..
Rhodine B S	6 0	334	0·338	113	0 18 10	11 10 8	0·265	89	2 8 2
Tartrachromine G G	3 0	667	0·55	367	3 1 5	37 12 5	..	..	..
Dioxyrubine G	2 3	889	0·852	575	6 6 2	77 5 6	..	..	..
Rhodine 5 G	6 0	334	0·174	58	0 9 8	5 18 5	0·2462	82	2 4 8
Phenocyanine, 10 °/o	1 0	2,000	0·139	278	2 6 4	28 7 7	..	..	..

With regard to Table I. Prof. Green observes that the calculations are for the *pure* dyestuffs and that some brands of the commercial dyestuffs are more or less diluted with dextrin, salt, &c. Also that there would in addition be a considerable loss of alcohol in the process of manufacture. Prof. Green reminds us that while the calculations are for the most important brands—and these brands vary—hence the alcohol requirement will vary. Further, one alcohol may be substituted for another. For example Auramine O contains methyl groups, Auramine G ethyl groups. Roughly speaking the alcohol tax would vary from one-fourth to one-half of the dyestuff. Methyl alcohol is more important than ethyl alcohol in colour making. It must be remembered that methyl alcohol is dutiable to the same extent as ethyl alcohol, and is intrinsically dearer.

A case is given by a member of gingerine, which may be extracted with methylated spirit; but, assuming duty paid spirit to be employed, 48*l.* per 100*l.* value would go in duty, as against probably only 4*l.* in Germany or Switzerland.

Take the case of rebate on methylated spirit on exportation—3*d.* per proof gallon. Why cannot the exporter of home-made ether or chloroform get a rebate of 3*d.* per proof gallon on the quantities of methylated spirit used?

The comparison between production with duty-free spirit and taxed spirit is convincingly shown by Table II., and examples, most kindly placed at disposal by Mr. P. Leuthardt-Thornton, and who alone is responsible for them.

The spirit value of Table II. is based on 2*d.* per lb. of German or Swiss spirit, 95 per cent. by weight, in 1900. British spirit of same strength and date at 2*s.* 0½*d.* per lb. The writer may point out that to-day, 1904, 95 per cent. by weight alcohol is about 2*s.* 7*d.* per lb., so that the values of British spirit, duty-paid, required would be considerably enhanced.

For a rough calculation of the resultant at 2*d.* per pound of 95 per cent. spirit abroad in 1900 is multiplied by 12·50, an approximation to the British spirit equivalent will be arrived at.

Excepting Rhodamine B, G and 6 G (Table III.), all the other products of this group are sold as "Rhodine."

TABLE III.

Bulk of spirit used in manufacture, without deductions. Read figures as so many pounds.

	Products.		Alcohol 95 Per Cent.	Methyl Alcohol.
611	Alcohol 100 per cent.		800	..
467	Rhodamine B conc.		304	..
35	" 3 B "		104	..
1,044	Bromester		..	522
1,955	Chinizin base		910	..
		Acetic Ester.		
1,650	Antipyrine	914		
1,822	Acet-acetic ester	5,700	..	240
		6,614 at 55 °/o	= 3,637	..
1,520	Ethyl chloride		1,502	..
230	Ester for tartrazine		896	..
385	Rhodamine 4 G conc.		1,610	..
572	" 6 G "		2,028	..
765	" 4 G R conc.		7,135	..
267^5	" 6 G R "		3,180	..
107	" 11 G conc.		440	..
98	" 12 G "		324	..
111	" 12 G F conc.		324	363
46^5	" G W conc.		..	200
47	" 3 G W "		52	160
198	Methyl phenyl and naphtylamine		..	90
3,950	Dimethyl aniline		..	3,072
470	Rhodamine 3 G conc.		624	340
2,771	Methane base		303	..
462	Methyl sulphate		..	350
37^5	Guaiacol carbonate		250	..
150	Salipyrine		189	..
17	Dermatol		37	..
21	Salol		48^5	..
51	Rhodamine B S conc.		(nett)67	..
10^5	" 10 G conc.		40	..
813	Isosafrol		770	..
82^5	Glycollic acid		..	216
295	Kryofine		850	..
16	Thio base		200	..
149	Ester for gallo purple		..	360
5,160	Gallocyanine, 10 per cent. paste		..	4,485
207	Gallopurple		..	2,226
2,621	Nitrophenetol		2,080	..
1,840	Phenetidine		2,772	..
2,370	Phenacetine		4,700	..
115	Phenocyanine conc.		1,700	..
211	Dianisidine base		352	..

ALCOHOL, 1900.

The quantities here given have been actually employed in manufacture, the prices being those ruling in 1900:—

Alcohol 95 per cent. at 2*d.* per lb.
Alcohol 100 per cent. at 2·2¼*d.* per lb.
Methyl alcohol at 6·5 per lb.
Alcohol 95 per cent. is generally used, also in some cases alcohol 100 per cent.

1,345 lb. alcohol 100 per cent. require—

	1,762 lb. alcohol 95 per cent.,
of which are returned...	323 lb.
or nett	1,439 lb. at 2*d.* = 11*l.* 19*s.* 10*d.*

1 lb. alcohol 100 per cent. therefore costs 2·14*d.*

Antipyrine.

(*a*) 4,0[illegible]8 lb. acet. acetic ester require—

12,540 lb. acetic ester.
2,200 lb. being returned.

nett 10,340 lb. at 55 per cent. alcohol 95 per cent –	5,687 lb.
less returned	3,300 lb.
alcohol 95 per cent. used nett....	2,387 lb.

or for 1 lb. acet. acetic ester, 0·595 lb. alcohol 95 per cent.

(*b*) 1,044 lb. bromester require 522 lb. ethyl alcohol, or for 1 lb. bromester, 0·5 lb. ethyl alcohol.

(*c*) 4302 lb. quinizine base require—

3,740 lb. acet. acetic ester, at 0·595 lb.	2,225 lb.	alcohol	95 per cent.
add further	2,002 lb.	,,	,,
	4,227 lb.	,,	,,
less returned.....	1,848 lb.	,,	,,
nett used.........	2,379 lb.	,,	,,

or for 1 lb. quinizine base, 0·553 lb. alcohol 95 per cent.

(*d*) 3,630 lb. antipyrine require—

4,125 lb. quinizine base, at 0·553 lb.	2,281 lb.	alcohol	95 per cent.
2,010 lb. acetic ester, at 55 per cent	1,105 lb.	,,	,,
	3,386 lb.	,,	,,

or for 1 lb. antipyrine, 0·933 lb. alcohol 95 per cent. Further—

2,310 lb. bromester, at 0·5 lb...........	1,155 lb.	methyl	alcohol.
in addition.........	528 lb.	,,	,,
	1,683 lb.	,,	,,
less—bromester returned— 112 lb. at 0·5 lb.	56 lb.	methyl	alcohol
nett used..............	1,627 lb.	,,	,,

or for 1 lb. antipyrine, 0·448 lb. ethyl alcohol.

100*l.* import value at 5*s.* 6*d.* per lb. = 364 lb., for which were employed: 339 lb. alcohol 95 per cent. at 2*d.* = 2*l.* 16*s.* 6*d.*; 163 lb. methyl alcohol at 6·5*d.* = 4*l.* 8*s.* 3*d.*

Ethyl Chloride.

3,344 lb. require 3,344 lb. alcohol 95 per cent.; 1 lb. ethyl chloride = 1 lb. alcohol 95 per cent.

100*l.* import value at 11*d.* per lb. = 2,182 lb., for which were used 2,182 lb. alcohol 95 per cent. at 2*d.* = 18*l.* 3*s.* 6*d.*

Phenacctine.

(*a*) 5,765 lb. nitrophenetol require—

2,745 lb. ethyl chloride.............	2,745 lb.	alcohol	95 per cent.
in addition.................	4,576	,,	,,
	7,321	,,	,,
less returned..............	3,850	,,	,,
nett used	3,471	,,	,,
for 1 lb. nitrophenetol	0·602	,,	,,

(*b*) 4,048 lb. phenetidine require—

5,808 lb. nitrophenetol at 0·602 lb. .	3,496 lb.	alcohol	95 per cent.
in addition................	6,098	,,	,,
	9,594	,,	,,
less returned..............	4,510	,,	,,
nett used	5,084	,,	,,
for 1 lb. phenetidine	1,255	,,	,,

(*c*) 5,214 lb. phenacetine require—

4,158 lb. phenetidine at 1·255 lb....		5,218 lb.	alcohol	95 per cent.
in addition................		10,340	,,	,,
		15,558	,,	,,
less returned:				
66 lb. phenetidine at 1·255 lb.	83			
further.................	4,620			
		4,703	,,	,,
nett used		10,855	,,	,,
1 lb. phenacetine		2,082	,,	,,

100*l.* import value at 3*s.* per lb. = 667 lb., for which were used 1,389 lb. alcohol 95 per cent. at 2*d.* = 11*l.* 11*s.* 6*d.*

Salipyrine.

330 lb. require—

211 lb. antipyrine at 0·448 lb.	95 lb.	methyl	alcohol.
1 lb. salipyrine	0·288	,,	
further, at 0·933 lb.......	197 lb.	alcohol	95 per cent.
in addition	416	,,	,,
	613		
less returned	319	,,	,,
nett used	294	,,	,,
1 lb. salipyrine	0·89	,,	,,

100*l.* import value at 5*s.* per lb. = 400 lb., for which are used—115 lb. methyl alcohol at 6·5*d.* = 3*l.* 2*s.* 3*d.*; 356 lb. alcohol 95 per cent. at 2*d.* = 2*l.* 19*s.* 4*d.*

Dermatol.

38 lb. require 81 lb. alcohol 95 per cent.; 1 lb. dermatol = 2·13 lb. alcohol 95 per cent. 100*l.* import value at 15*s.* per lb. = 133 lb., for which are used 283 lb. alcohol 95 per cent. at 2*d.* = 2*l.* 7*s.* 2*d.*

Salol.

46 lb. require 106 lb. alcohol 95 per cent.; 1 lb. salol = 2·3 lb. alcohol 95 per cent. 100*l.* import value at 10*s.* per lb. = 200 lb., for which are used 460 lb. alcohol 95 per cent. at 2*d.* = 3*l.* 16*s.* 8*d.*

Heliotropine.

(*a*) 1,799 lb. isosafrol require:

	1694 lb.	alcohol	95 per cent.
less returned....	1320	,,	,,
nett used	374	,,	,,

1 lb. isosafrol = 0·207 lb. alcohol 95 per cent.

(*b*) 946 lb. heliotropine, crude, require 1,210 lb. isosafrol at 0·207 lb. = 250 lb. alcohol 95 per cent.; 1 lb. heliotropine, crude = 0·263 lb. alcohol 95 per cent.

(*c*) 130 lb. heliotropine, distilled, require 158 lb. heliotropine, crude, at 0·263 lb. = 42 lb. alcohol 95 per cent.; 1 lb. heliotropine, distilled = 0·323 lb. alcohol 95 per cent.

(*d*) 97 lb. heliotropine, crystallised, require 152 lb. heliotropine, distilled, at 0·323 lb. = 49 lb. alcohol 95 per cent.; 1 lb. heliotropine, crystallised = 0·506 lb. alcohol 95 per cent. 100*l.* import value at 12*s.* 6*d.* per lb. = 160 lb. for which are used 81 lb. alcohol 95 per cent. at 2*d.* = 13*s.* 6*d.*

Vanillin (made from Heliotropine).

(*a*) 886 lb. protocatechualdehyde require 1612 lb. helio-, tropine, crude, at 0·263 lb. = 266 lb. alcohol 95 per cent.; 1 lb. protocatechualdehyde = 0·3 lb. alcohol 95 per cent.

(*b*) 443 lb. aldehyde base require 827 lb. protocatechualdehyde at 0·3 lb. = 248 lb. alcohol 95 per cent.; 1 lb. aldehyd base = 0·56 lb. alcohol 95 per cent.

(*c*) 453 lb. vanillin, distilled, require 612 lb. aldehyd base at 0·56 lb. = 343 lbs. alcohol 95 per cent.; 1 lb. vanillin, distilled = 0·758 lb. alcohol 95 per cent.

(*d*) 214 lb. vanillin, crystallised, require 453 lb. vanillin, distilled at 0·758 lb. = 343 lb. alcohol 95 per cent.; 1 lb. vanillin, crystallised = 1·603 lb. alcohol 95 per cent. 100*l.* import value (present price) at 12*s.* 6*d.* per lb. = 160 lb., for which are used 256 lb. alcohol 95 per cent. at 2*d.* = 2*l.* 2*s.* 8*d.*

Kryofine.

(*a*) 182 lb. glycolic acid 100 per cent require 475 lb. methyl alcohol. 1 lb. = 2·61 lb.

(*b*) 649 lb. kryofine require 405 lb. glycolic acid 90·6 per cent. 100 per cent. = 2·61 ; 90·6 per cent. = 2·364 = 957 lb. methyl alcohol. 1 lb. kryofine = 1·474 lb. methyl alcohol.

Further—

493 lb. phenetidine at 1·255 lb. .	619	lb. alcohol 95 per cent.
in addition	1,870	,, ,,
	2,489	,, ,,
less returned	1,430	,, ,,
nett used	1,059	,, ,,
1 lb. kryofine	1·63	,, ,,

100*l.* import value at 21*s.* per lb. = 95 lb., for which are used 140 lb. methyl alcohol at 6½*d.* = 3*l.* 15*s.* 10*d.*, 155 lb. alcohol 95 per cent. at 2*d.* = 1*l.* 5*s.* 10*d.*

Guaiacol Carbonate.

(*a*) 462 lb. methyl sulphate require 350 lb. methyl alcohol. 1 lb. methyl sulphate = 0·76 lb. alcohol.

(*b*) 23½ lb. guaiacol dist. require 74½ lb. methyl sulphate at 0·76 = 56 lb. methyl alcohol. 1 lb. guaiacol dist. = 2·4 lb. methyl alcohol.

Further—

(*c*) 83 lb. guaiacol carbonate require 96 lb. guaiacol dist. at 2·4 lb. = 230 lb. methyl alcohol. 1 lb. guaiacol carbonate = 2·77 lb. methyl alcohol, and 550 lb. alcohol 95 per cent. 1 lb. guaiacol carbonate = 6·63 lb. alcohol 95 per cent.

100*l.* import value at 11*s.* per lb. = 182 lb. for which are used 504 lb. methyl alcohol at 6½*d.* = 13*l.* 13*s.* 0*d.*, 1206 lb. alcohol 95 per cent. at 2*d.* = 10*l.* 1*s.* 0*d.*

Dimethylaniline.

8,690 lb. require	6,758	lb. methyl alcohol.
less returned	880	,, ,,
	5,878	,, ,,
1 lb. dimethylaniline.	0·676	,, ,,

100*l.* import value at 10*d.* per lb. = 2,400 lb. for which are used 1,622 lb. methyl alcohol at 6½*d.* = 43*l.* 18*s.* 7*d.*

Gallocyanine.

(*a*) 1,000 lb. nitroso require 700 lb. dimethylaniline at 0·676 lb. = 473 lb. methyl alcohol, 1 lb. nitroso = 0·473 lb. methyl alcohol.

(*b*) 5,160 lb. gallocyanine paste 10 per cent. require—

602 lb. nitrose at 0·473 lb.	285	lb. methyl alcohol.
in addition	4,485	,,
	4,770	,,
less returned	3,872	,,
nett used	898	,,
1 lb. gallocyanine 10 per cent. paste .	0·174	,,

(*c*) 60 lb. gallocyanine in powder require 580 lb. gallocyanine 10 per cent. paste ; at 0·174 lb. = 101 lb. methyl alcohol. 1 lb. gallocyanine in powder = 1,683 lb. methyl alcohol.

100*l.* import value of gallocyanine 10 per cent. paste ; at 5*d.* per lb. = 4,800 lb. 835 lb. methyl alcohol at 6½*d.* = 22*l.* 12*s.* 3*d.*

100*l.* import value of gallocyanine in powder ; at 1*s.* 4*d.* per lb. = 461 lb. 776 lb. methyl alcohol at 6½*d.* = 21*l.* 0*s.* 4*d.*

Gallopurple (Prune).

207 lb. require 196 lb. ester, as follows :—

149 lb. ester require	360	lb. methyl alcohol.
less returned	281	,, ,,
nett used	79	,, ,,

1 lb. ester = 0·53 lb. methyl alcohol.

Therefore 196 lb. ester at 0·53 lb. = 104 lb. methyl alcohol.

Further are required

315 lb. nitroso at 0·473 lb.	149	,, ,,
in addition	2,226	,, ,,
	2,375	,, ,,
less returned	1,[illegible]	,, ,,
nett used	5[illegible]	,, ,,

1 lb. gallopurple = 2·67 lb. methyl alcohol.

100*l.* import value at 5*s.* 6*d.* per lb. = 364 lb., for which are used 972 lb. methyl alcohol, at 6½*d.* = 26*l.* 6*s.* 6*d.*

Tartrazine.

(*a*) 230 lb. ester for tartrazine require—

	896	lb. alcohol 95 per cent.
less returned	678	,, ,,
nett used	218	,, ,,

1 lb. = 0·948 lb. alcohol 95 per cent.

(*b*) 12 batches ester oil require—

180 lb. ester at 0·948 lb. =	170	lb. alcohol 95 per cent.
and 111 lb. acetic ester at 55 per cent.	61	,, ,,
in addition : 384 lb. alcohol 100 per cent., converted into 95 per cent.	404	,, ,,
	635	,, ,,
less returned	450	,, ,,
nett used	185	,, ,,

At 2*d.* = 1*l.* 10*s.* 10*d.*

(*c*) 795 lb. tartrazine require 12 batches ester oil = 185 lb. alcohol, 95 per cent. 1 lb. tartrazine = 0·233 lb. alcohol 95 per cent.

100*l.* import value at 1*s.* 6*d.* per lb. = 1,334 lb., for which are used 311 lb. alcohol 95 per cent. at 2*d.* = 2*l.* 11*s.* 10*d.*

Chrysophenine.

1,631 lb. require 342 lb. aethylchloride at 1 lb. = 342 lb. alcohol 95 per cent. 1 lb. chrysophenine = 0·209 lb. alcohol 95 per cent.

100*l.* import value at 1*s.* 6*d.* per lb. = 1,334 lb., or 278 lb. alcohol 95 per cent. at 2*d.* = 2*l.* 6*s.* 1*d.*

Dianisidine Base.

(*a*) 716 lb. orthonitroanisol require—

	875	lb. alcohol 95 per cent.
less returned	760	,, ,,
net used	115	,, ,,
1 lb. requires	0·16	,, ,,

(*b*) 211 lb. dianisidine base require—

440 orthonitroanisol at 0·16 lb. =	71	lb. alcohol 95 per cent.
in addition	352	,, ,,
	423	,, ,,
less returned	250	,, ,,
nett used	173	,, ,,
1 lb. requires	0·82	,, ,,

100*l.* import value at 5*s.* 6*d.* per lb. = 363 lb., or 298 lb. alcohol 95 per cent. at 2*d.* = 2*l.* 9*s.* 8*d.*

Ketone.

843 lb. require—

	2,700	lb. dimethylaniline.
less returned .	1,150	,, ,,
nett	1,550	,, at 0·676 lb. = 1,048 lb. methylalcohol.
1 lb. requires	1·24	,, ,,

100*l.* import value at 2*s.* 6*d.* per lb. = 800 lb., or 992 lb. methylalcohol at 6½*d.* = 26*l.* 17*s.* 4*d.*

Methane Base.

2,771 lb. require 2,912 lb. dimethylaniline at 0·676 = 1,968 lb. methyl alcohol. 1 lb. requires 0·71 lb. methyl alcohol.

Further are used—

303 lb. alcohol 95 per cent. 1 lb. requires 0·11 lb. alcohol 95 per cent., only made for manufacture, not obtainable.

Auramine O.

1,179 lb. require 1,169 lb. methane base ; at 0·71 lb. = 830 lb. methylalcohol ; at 0·11 lb. = 129 lb. alcohol 95 per cent. 1 lb. requires 0·704 lb. methyl alcohol : and 0·109 lb. alcohol 95 per cent.

100*l.* import value at 2*s.* 3*d.* per lb. = 888 lb., or 625 lb. methyl alcohol at 6½*d.* = 16*l.* 18*s.* 6*d.* 97 lb. alcohol 25 per cent. at 2*d.* = 16*s.* 2*d.*

Victoria Blue B.

650 lb. require 260 lb. Keton at 1·24 lb. = 322 lb. methyl alcohol; 1 lb. requires 0·496 lb. methyl alcohol.

100*l.* at 1*s.* 9*d.* per lb. = 1,143 lb.; or 566 lb. methyl alcohol at 6·5*d.* = 15*l.* 6*s.* 7*d.*

Victoria Blue 4 R.

(*a*) Methylphenyl-α-naphtylamine:

198 lb. require	90 lb. methyl alcohol	
and 90 lb. methylbromide at 0·5 lb.	45 lb.	
used	135 lb.	„
1 lb.	0·681 lb.	„

(*b*) 400 lb. Victoria Blue 4 R requires:—

160 lb. Ketone at 1·24 lb.	198 lb. methyl alcohol.	
and 128 lb. methylphenyl-α-naphtylamine at 0·681	87 lb.	„
used	285 lb.	„
1 lb.	0·7125 lb.	„

100*l.* at 2*s.* per lb. = 1,000 lb.; or 712·5 lb. methyl alcohol at 6·5*d.* = 19*l.* 5*s.* 11*d.*

Rhodamine B.

2,335 lb. require	304 lb. alcohol 95 per cent.		
less returned	200 lb.	„	„
	104 lb.	„	„
1 lb.	0·045 lb.	„	„

100*l.* at 4*s.* per lb. = 500 lb.; or 22 lb. alcohol, 95 per cent. at 2*d.* = 3*s.* 8*d.*

Rhodamine G.

1,140 lb. require 1,200 lb. Rhodamine B, at 0·045 lb. = 54 lb. alcohol 95 per cent. 1 lb. = 0·047 lb. alcohol 95 per cent.

100*l.* at 5*s.* per lb. = 400 lb. or 19 lb. alcohol 95 per cent. at 2*d.* = 3*s.* 2*d.*

Benzopurpurine 10 B.

63½ lb. require 15 lb. dianisidine base at 0·82 lb. = 12 lb. alcohol 95 per cent. 1 lb. = 0·19 lb. alcohol 95 per cent.

100*l.* at 2*s.* 6*d.* per lb. = 800 lb. or 152 lb. alcohol 95 per cent. at 2*d.* = 1*l.* 5*s.* 4*d.*

Rhodamine 6 G.

(*a*) 385 lb. Rhodamine 4 G pure require—

	1,610 lb. alcohol 95 per cent.		
less returned	900	„	„
nett	710	„	„

1 lb. Rhodamine 4 G pure = 1·84 lb.

(*b*) 572 lb. Rhodamine 6 G pure = 2,860 lb. 6 G ordinary quality require—

520 lb. Rhodamine 4 G pure—at 1·84 lb.	957 lb. alcohol 95 per cent.		
plus	1,352	„	„
and further	676	„	„
	2,985	„	„
less returned	800	„	„
	2,185	„	„

1 lb. Rhodamine 6 G requires 0·764 lb. alcohol 95 per cent.

100*l.* at 6*s.* = 334 lb. or 255 lb. alcohol 95 per cent. at 2*d.* = 2*l.* 2*s.* 6*d.*

Rhodine 6 G R.

(*a*) 765 lb. Rhodine 4 G. R. pure require:

	7,135 lb. alcohol 95.		
less returned	5,150	„	„
nett	1,985	„	„
1 lb. =	2·6	„	„

(*b*) 1,337·5 lb. Rhodine 6 G. R. require:

375 lb. Rhodine 4 G. R. pure: at 2·6 lb.	975 lb. Alcohol 95		
plus	2,250	„	„
and	930	„	„
	4,155	„	„
less returned	1,800	„	„
nett	2,355	„	„
1 lb. requires	1·75	„	„

100*l.* at 6*s.* per lb. = 334 lb.; or 588 lb. alcohol, 95 at 2*d.* = 4*l.* 18*s.*

Dimethyl Acid for Rhodines.

(*a*) 1,285 lb. dimethylmetoxy require 2,160 lb. dimethylaniline at 0·676 lb. = 1,460 lb. methyl alcohol. 1 lb. = 1·135 lb. methyl alcohol.

(*b*) 141 lb. dimethyl acid require 68·5 lb. dimethylmetoxy at 1·135 lb. = 77 lb. methyl alcohol. 1 lb. = 0·548 lb. methyl alcohol not obtainable.

Rhodine 11 G.

535 lb. require—

112 lb. dimethyl acid at 0·548 lb. = 61 lb. methyl alcohol
and 440 lb. alcohol 95 per cent.
less 200 „ „
nett 240 „ „
1 lb. Rhodine 11 G = 0·114 lb. of methyl alcohol.
and = 0·448 lb. alcohol 95 per cent.

100*l.* at 6*s.* per lb. = 334 lb.; or 38 lb. methyl alcohol at 6·5*d.* = 1*l.* 0*s.* 7*d.*; 150 lb. alcohol 95 per cent. at 2*d.* = 1*l.* 5*s.*

Rhodine 12 G.

490 lb. require 120 lb. 11 G pure = 600 lb. ordinary quality; at 0·114 lb. = 68 lb. methyl alcohol; and at 0·448 lb. = 269 lb. alcohol 95 per cent. 1 lb. Rhodine 12 G = 0·14 lb. methyl alcohol, and = 0·55 lb. alcohol 95 per cent.

100*l.* at 6*s.* per lb. = 334 lb.; or, 47 lb. methyl alcohol at 6·5*d.* = 1*l.* 5*s.* 5*d.*; 184 lb. alcohol 95 per cent. at 2*d.* = 1*l.* 10*s.* 8*d.*

Rhodine 12 G F.

555 lb. require—

445 lb. Rhodine 11 G at 0·114 lb.	51 lb. methyl alcohol.		
plus	363	„	„
	414	„	„
less returned	150	„	„
nett	264	„	„

1 lb. = 0·476 lb. methyl alcohol.

and at 0·448 lb.	199 lb. alcohol 95 per cent.		
plus	324	„	„
	523	„	„
less returned	175	„	„
nett	348	„	„

1 lb. 0·626 lb. alcohol 95 per cent.

100*l.* at 6*s.* per lb. = 334 lb.; or, 159 lb. methyl alcohol at 6·5*d.* = 4*l.* 6*s.* 1*d.*; 209 lb. alcohol 95 per cent. at 2*d.* = 1*l.* 14*s.* 10*d.*

Rhodine G W.

232 lb. require—

72·5 dimethyl acid at 0·548 lb.	40 lb. methyl alcohol.		
plus	200	„	„
	240	„	„
less returned	73	„	„
	167	„	„

1 lb. = 0·719 lb. methyl alcohol 95 per cent.

100*l.* at 6*s.* per lb. = 334 lb.; or, 240 lb. methyl alcohol at 6·5*d.* = 6*l.* 10*s.*

Rhodine 3 G W.

235 lb. require—

	52 lb. alcohol 95 per cent. and				160 lb. methyl alcohol.		
less returned	25	„	„	„	60	„	„
nett	27	„	„	„	100	„	„

1 lb. = 0·114 lb. alcohol 95 per cent. and 1 lb. = 0·425 lb. methyl alcohol 95 per cent.

100*l.* at 6*s.* per lb. = 334 lb.; or, 38 lb. alcohol 95 per cent. at 2*d.* = 6*s.* 4*d.*; 141 lb. methyl alcohol at 6·5*d.* = 3*l.* 16*s.* 4*d.*

Rhodine 12 GM.

27·5 lb. require 25 lb. rhodine 11 G. at 0·114 lb. = 3 lb. methyl alcohol, and at 0·448 lb. = 11 lb. alcohol 95 per cent.; 1 lb. rhodine 12 GM. requires 0·109 lb. methyl alcohol and 0·4 lb. alcohol 95 per cent.

100*l.* at 6*s.* per lb., 334 lbs., or 36 methyl alcohol at 6·5*d.* = 19*s.* 6*d.*; 133 lb. alcohol 95 per cent. at 2*d.* = 1*l.* 2*s.* 2*d.*

Rhodine 3 *G.*

2,350 lb. require—

332 lb. dimethyl acid at 0·548 lb. .. 291 lb. methyl alcohol
plus .... 340 " "
Total............... 631 " "
1 lb. = 0·268 " "
and .... 624 lb. alcohol 95 per cent.
less .... 450 " "
nett........................ 174 " "
1 lb. = 0·074 " "

100*l.* at 6*s.* per lb. = 334 lb., or 90 lb. methyl alcohol at 6^5*d.* = 2*l.* 8*s.* 9*d.*; 25 lb. alcohol 95 per cent. at 2*d.* = 4*s.* 2*d.*

Methylene Blue.

208 lb. require 303 lb. dimethylaniline at 0·676 lb. = 205 lb. methyl alcohol; 1 lb. = 0·981 lb. methyl alcohol.

100*l.* at 2*s.* 6*d.* per lb. = 800 lb., or 785 lb. methyl alcohol at 6^5*d.* = 21*l.* 5*s.* 2*d.*

Crystal Violet.

396 lb. require 420 lb. metban base at 0·71 lb. = 298 lb. methyl alcohol: 1 lb. = 0·754 lb. methyl alcohol.

100*l.* at 3*s.* 6*d.* per lb. = 571 lb., or 430 lb. methyl alcohol at 6^5*d.* = 11*l.* 13*s.* 11*d.*

Vert pour Noir.

121 lb. require 28 lb. Methylene Blue at 0·981 lb. = 27 lb. methyl alcohol; 1 lb. = 0·223 lb. methyl alcohol.

100*l.* at 6*s.* per lb. = 334 lb., or 74 lb. methyl alcohol at 6^5*d.* = 2*l.* 0*s.* 1*d.*

Indazurine B.

655 lb. require 60 lb. dianisidine base at 0·82 = 49 lb. alcohol 95 per cent.; 1 lb. = 0·075 lb. alcohol 95 per cent.

100*l.* at 1*s.* 9*d.* per lb. = 1,143 lb., or 86 lb. alcohol 95 per cent. at 2*d.* = 14*s.* 2*d.*

Indazurine G M.

713 lb. require 90 lb. dianisidine base at 0·82 = 74 lb. alcohol 95 per cent.; 1 lb. = 0·104 lb. alcohol 95 per cent.

100*l.* at 2*s.* per lb. = 1,000 lb., or 104 lb. alcohol 95 per cent. at 2*d.* = 17*s.* 4*d.*

Direct Violet B B.

227 lb. require 30 lb. dianisidine base at 0·82 = 25 lb. alcohol 95. 1 lb. = 0·11 lb. alcohol 95.

100*l.* at 2*s.* = 1,000 lb.; or, 110 lb. alcohol 95 at 2*d.* = 18*s.* 4*d.*

Indazurine B B.

370 lb. require 45 lb. dianisidine base at 0·82 = 37 lb. alcohol 95. 1 lb. = 0·1 lb. alcohol 95.

100*l.* at 2*s.* = 1,000 lb.; or, 100 lb. alcohol 95 at 2*d.* = 16*s.* 8*d.*

Indazurine G.

410 lb. required 45 lb. dianisidine base at 0·82 = 37 lb. alcohol 95. 1 lb. = 0·09 lb. alcohol 95.

100 lb. at 2*s.* = 1,000 lb.; or, 90 lb. alcohol 95 at 2*d.* = 15*s.*

Indazurine N G.

937 lb. required 105 lb. dianisidine base at 0·82 = 86 lb. alcohol 95. 1 lb. = 0·092 lb. alcohol 95.

100*l.* at 2*s.* = 1,000 lb.; or, 92 lb. alcohol 95 at 2*d.* = 15*s.* 4*d.*

Indazurine 5 G M.

1,300 lb. required 105 lb. dianisidine base at 0·82 = 86 lb. alcohol 95. 1 lb. = 0·66 lb. alcohol 95.

100*l.* at 2*s.* = 1,000 lb.; or, 66 lb. alcohol 95 at 2*d.* = 11*s.*

Direct Blue 6 B.

540 lb. require 45 lb. dianisidine base at 0·82 = 37 lb. alcohol 95. 1 lb. = 0·068 lb. alcohol 95.

100*l.* at 2*s.* = 1,000 lb.; or, 68 lb. alcohol 95 at 2*d.* = 11*s.* 4*d.*

Direct Blue 7 B.

182 lb. require 14 lb. dianisidine base at 0·82 = 11 lb. alcohol 95. 1 lb. = 0·0602 lb. alcohol 95.

100*l.* at 4*s.* = 500 lb.; or, 31 lb. alcohol 95 at 2*d.* = 5*s.* 2*d.*

Rhodine B S.

255 lb. require—

250 Rhodine 3 G at 0·268 = 67 lb. methyl alcohol,
and at 0·074......... 19 lb. alcohol 95
plus .... 67 "
86 "

1 lb. requires 0·265 lb. methyl alcohol and 0·338 lb. alcohol 95.

100*l.* at 6*s.* = 314 lb.; or, 113 lb. alcohol 95 per cent. at 2*d.* = 18*s.* 10*d.* 89 lb. methyl alcohol at 6^5*d.* = 2*l.* 8*s.* 2*d.*

Tartrachromine G G.

363 lb. require 159^6 lb. phenetidine, at 1·255 lb. = 200 lb. alcohol 95. 1 lb. = 0·55 lb. alcohol 95.

100*l.* at 3*s.* = 667 lb.; or, 367 lb. alcohol 95 per cent. at 2*d.* = 3*l.* 1*s.* 5*d.*

Dioxyrubine G.

(*a*) 16 lb. thio base require 200 lb. alcohol 95 per cent.
less returned .... 150 " "
nett .... 50 " "
1 lb. = 3·12 " "

(*b*) 81 lb. Dioxyrubine G required 22 lb. thio base at 3·12 = 69 lb. alcohol 95 per cent.; 1 lb. = 0·852 lb. alcohol 95 per cent.

100*l.* at 2*s.* 3*d.* per lb. = 889 lb.; or, 575 lb. alcohol 95 per cent. at 2*d.* = 6*l.* 6*s.* 2*d.*

Rhodine 5 G.

1,540 lb. require—

(*a*) 1320 lb. Rhodine 3 G at 0·268 = 353 lb. methyl alcohol; and at 0·074 = 98 lb. alcohol 95 per cent.; 1 lb. requires 0·23 lb. methyl alcohol; and 0·064 lb. alcohol 95 per cent.

(*b*) 180 lb. Rhodine 12 G at 0·14 = 25 lb. methyl alcohol; and at 0·55 = 99 lb. alcohol 95 per cent.; 1 lb. = 0·0162 lb. methyl alcohol; 1 lb. = 0·0643 lb. alcohol 95 per cent.

(*c*) 40 lb. Rhodine 6 G R, at 1·76 = 70 lb. alcohol 95 per cent.; 1 lb. = 0·0457 lb. alcohol 95 per cent.

100*l.* import value at 6*s.* per lb. = 334 lb.

—	Methyl Alcohol.	Alcohol 95 per cent.
	Lb.	Lb.
In Rhodine 3 G.	0·23	0·064
" 12 G	0·0162	0·0643
" 6 GR. ...	..	0·0457
	0·2462	0·1740
	82 lb. at 6^5*d.* = 2*l.* 4*s.* 8*d.*	58 lb. at 2*d.* = 9*s.* 3*d.*

Phenocyanine 100 *per cent.*

115 lb. require—

1700 lb. alcohol 95 per cent.,
less returned .... 1540 " "
nett .... 160 " "
1 lb. = 1·39 " " for 100 per cent.

Phenocyanine 10 *per cent. Paste.*

100*l.* at 1*s.* per lb. = 2000 lb. at 0·139 for 10 per cent., or 278 lb. alcohol 95 per cent. at 2*d.* = 2*l.* 6*s.* 4*d.*

P. Leuthardt-Thornton.

In Tables IV. and V. ordinary trade and chemically descriptive names are given—with the formula. The percentages of the equivalents of alcohol and methyl are given—by easy calculation by the factors previously given the comparative alcohol (95 per cent.) values can be approximately found. If Prof. Green's reminder and the Thornton illustrations as to returns and waste, a fair idea of our disadvantages may be gained.

TABLE IV.

Some Substances which have Ethyl or Methyl as a necessary Component.

			Percentage of Combined Ethyl as Alcohol.	Percentage of Combined Methyl as Methyl Alcohol.
Acetal	Ethylidene-di-ethyl-ether	$CH_3 - CH(OC_2H_5)_2$	78	
Ethyl chloride	.. .. ..	C_2H_5Cl	71	
„ bromide	.. .. ..	C_2H_5Br	42	
„ iodide	.. .. ..	C_2H_5I	12	
Ethyl formate	.. .. ..	$HCOOC_2H_5$	62	
Holocaine	Para-diethoxyethenyldiphenyl-amidine-hydrochlor.	$(OC_2H_5C_6H_4NH.C.CH_3:N.C_6H_4OC_2H_5)HCl$	27	
Homoarecolin	Methyl-tetra-hydro-nicotinic acid	$C_7H_{10}.(C_2H_5)NO_2$	27	
Mercury ethyl chloride	.. .. ..	HgC_2H_5Cl	17	
Phenacetin	Para-oxyethylacetanilid	$C_6H_4<\begin{matrix}OC_2H_5\\NH.CH_3CO\end{matrix}$	25	
Tetra ethyl ammonium hydroxide.	.. .. ..	$N(C_2H_5)_4OH$	12·5	
Tetronal	Diethylsulphonediethylmethane	$(C_2H_5)_2.C.SO_2(C_2H_5)_2$	96	
Anæsthesin	Ethylesterpara-aminobenzoic acid	$C_6H_4NH_2COO.C_2H_5$	28	
Subcutin	Anæsthesin-paraphenolsulphonate	$C_6H_4NH_2.COO.C_2H_5.HO.C_6H_4SO_3H$	13·5	
Codethyline	.. .. ..	$C_{17}H_{17}.ON[OH][OC_2H_5]$	21·6	
Dionine	Ethyl-morphine-hydrochloride	$(HO.C_{17}H_{17}.NO.OC_2H_5.HCl)$	13	
Valyl	Valeric acid diethyl-amide	$(C_4H_9CO.N(C_2H_5)_2)$	59	
Eupyrin	Para-phenetidine-vanillin-ethyl-carbonate.	$C_6H_4(OC_2H_5).N.CH.C_6H_3(OCH_3)O$	18	
Malarin	Acetophenone-phenetidine citrate	$C_6H_4<\begin{matrix}OC_2H_5\\N=C(CH_3)(C_6H_5)H_3C\end{matrix}$	18	25
Malakin	Salicyl-paraphenetidine	$C_6H_4(OC_2H_5.)N:CH:C_6H_4(OH)$	19	
Sulphonal	Diethyl-sulphonedimethyl-methane	$(CH_3.)_2C.(SO_2.C_2H_5)_2$	40	28
Sulphaldehyde	.. .. ..	.. ..		
Salipnonin	Salicyl-para-phenetidine	$C_6H_4(OC_2H_5)NH.C_6H_4(OH)CO$	20	
Thymacetin	.. .. ..	$\begin{matrix}CH_3\\C_3H_7\end{matrix}>C_6H_2<\begin{matrix}OC_2H_5\\NH.(CH_3CO)\end{matrix}$	22	15
Urethane	Ethyl-carbamate	$CO<\begin{matrix}NH_2\\OC_2H_5\end{matrix}$	52	
Bromalin	Brom-ethyl-formine	$(CH_2)_6.NHC_2H_5Br)$	22	
Euchinin	Quinine-ethyl-carbonic-ester	$(C_2H_5OCO.OC_{20}H_{23}N_2O)$	11·6	
Methyl chloride	.. .. ..	CH_3Cl		63
„ bromide	.. .. ..	CH_3Br		53·7
„ iodide	.. .. ..	CH_3I		22·5
Methyl loretin	Para-methylmetaiodoortho-oxy-quinoline-ana-sulphonic acid.	$CH_3I.OHC_9H_3N.SO_3H.H_2O$		8
Methyl urethane	Urethylan	$\begin{matrix}....NH_2\\C=O\\....OCH_3\end{matrix}$		42·5
Methacetin	Para-oxy-methyl-acetanilide	$C_6H_4OCH_3.NH.CH_3CO$		20·6
Methonal	Dimethylsulphonedimethyl methane.	$(CH_3)_2C.(SO_2CH_3)_2$		64
Methylal	Methylene-dimethyl-ether	$CH_2.O(CH_3)_2$		59

TABLE V.

Some Substances in which Alcohol is a necessary Factor though being decomposed.

			Percentage Ethyl Alcohol.	Percentage Methyl Alcohol.
Chloroform ⎫ Where not	.. .. ..	$CHCl_3$	37·4	
Iodoform.. ⎬ made from	.. .. ..	CHI_3	12·7	
Bromoform ⎭ acetone.	.. .. ..	$CHBr_3$	49·5	
Chloral orthoform	Chloral-amino-hydroxy-benzoic-methyl-ester.	$C_6H_3(COOCH_3).OH.N.CH.CCl_3$	15·5	10·8
Nirvanin	Diethyl-glycocoll-para-amino-hydroxy-benzoic-methyl-ester.	$HCl.(C_2H_5)_2.N.CH_2.CO.NH.C_6H_3(.OH)COOCH_3$	29	10
Eugenol acetamide	.. .. ..	$CH_3.C_3H_5(OCH_3)OCH_2CONH_2$	20·8	
Methenyl	Para-phenetidine	$C_2H_5OC_6H_4NH.CH.N.C_6H_4OC_2H_5$	32·5	
Hydrochloride of diacetic ester of morphine.	.. .. ..	.. ..		
Diacetyl morphine	.. .. ..	.. ..		
Chloral ammonia	.. .. ..	$C.Cl_3CH(.OH)NH_2$	28	
Chloralamide	.. .. ..	$CCl_3.CH(OH)NH.CHO$	24	16·6
Dormiol	Dimethyl-ethyl-carbinol	$C_2Cl_3CH(OH)OC(CH_3)_2C_2H_5$	18	23·5
Chloral acetophenone oxime	.. .. ..	$C_6H_5C.(CH_3)NO.CHOH.CCl_3$	15·7	
Iodoformol	.. .. ..	.. ..		
Forman	Chloro-methyl-menthyl-ether	$C_{10}H_{19}O.CH_2Cl$	..	16
Thymyloform	.. .. ..	$(C_6H_3.(CH_3.)(C_3H_7)O)_2CH_2$	..	20
Polyformin	Diresorcin-hexamethylin-tetramin	$(C_6H_4(OH)_2)_2.-(CH_2)_6N_4$	..	53
Galloformin	Hexamethylene-tetramin-gallic-acid	$[C_6H_2.(OH.)_3COOH.(CH_2)_6N_4.]$	..	58
Mercuric formamide	.. .. ..	$(HCO.NH_2)Hg$	..	13
Guiaform	Methylene-diguaiacol	$CH_2[C_6H_3(OH)OCH_3.]_2$	..	12
Guaethol	Mono-ethyl-ether of guaiacol	$C_6H_4<\begin{matrix}OC_2H_5(1)\\OH(2)\end{matrix}$	33	
Tannoform	Methylene-ditannin	$CH_2(C_{16}H_9O_9)_2$	13	
Tannocasum	.. .. ..	.. ..		
Cetarin	Anhydro-methylene-citrate of sodium	$(NaOCO.CH_2)_2CO<\begin{matrix}CH_2\\CO\end{matrix}>O$	13	
Caffeine ethylenediamine and similar caffeine substitution products and derivatives				

Table VI. illustrates the real need for alcohol in manufacture for solution—purification and crystallisation—

TABLE VI.

A few Substances the Manufacture of which could be greatly extended by Means of Alcohol Undenatured; or, if inevitable, Suitably Denatured.

Atropine.
Aconitine.
Aloin.
Agaracine.
Berberine.
Cantharidine.
Conine.
Cannabin.
Cimicifugin.
Cocaine.
Emetine.
Ergotine.
Eucaine.
Gelsemine.
Glycerophosphates.
Hydrastine.
Hyoscyamine.
Hydroquinone.
Iridine.
Jalapine.
Santonine.

Pancreatine.
Pilocarpine.
Tannic.
Thymol.
Salicylates.
Aldehyde.
Paraldehyde.
Bromoform.
Iodoform.
Ethyl bromide.
Ethyl chloride.
Ethyl iodide.
Pure caustic.
Oleo resins.
Ethyl acetate.
Ethyl butyrate.
Ethyl formate.
Ethyl benzoate.
Chloral hydrate, &c.
Many alkaloids and fine chemicals.

Now with these illustrations, what more convincing case can we build up for official information. Our last paper grew, so to say, as the case developed, and one is glad to believe it has been of service, for many enquiries and requests for copies of the paper have been made to the writer, indicating that the question of duty-free alcohol occupied the minds and was the subject of study with the energetic and aspiring officials who looked forward to promotion, and who probably may be numbered among the technical advisers of the Board of Inland Revenue, in, we hope, the not-distant future.

You are aware that special concessions were made under the Finance Act, 1902, and at the instance of a British Association Committee, headed by our first President, Sir Henry E. Roscoe, for the use of duty-free alcohol (the differential duty excepted) in approved laboratories, universities, or colleges. A letter was sent by the author to the collegiate authorities, thus:

> "*Re* Alcohol duty-free.—In view of the further action being taken in the matter of duty-free spirit for industrial use by the joint committee of the London Chamber of Commerce and the Society of Chemical Industry, it would be of service to know—
>
> "(*a*) How the regulations work?
>
> "(*b*) Whether the facilities afforded by the use of duty-free alcohol has answered your expectation?
>
> "(*c*) Whether the researches for which it was mainly intended have been of an industrial character or tendency as is stated to be chiefly the case in Germany?
>
> "(*d*) Any opinion or suggestion for duty-free spirit for industrial use."

The replies are interesting:—

Our President, Sir William Ramsay, writing from University College says—the regulations work well. It has proved a great convenience and enables work to be done, which was formerly shirked on account of expense. The researches have not been of an industrial character, though no doubt some of them may have an industrial bearing in future. The President affirms his conviction that chemical industry would reap great gain by having duty-free spirit—and ultimately the revenue—be in no way affected, but the reverse.

Prof. Armstrong goes so far as to say that all research ultimately leads to industrial application—hence the necessity for freedom.

The Secretary, at the Examination Hall, Victoria Embankment, replies approvingly, but says that the researches there are entirely of a scientific character in regard to bacteriology and pathology

Prof. M. M. Pattison Muir writes appreciatively and says that the alcohol has been used entirely for organic research. He says it would be an advantage if chemists could work with pure ether and ethereal salts.

Prof. Dixon, of the Owens College, Manchester, agrees in every point with others, and observes that "we have not consciously aimed at any industrial application of such researches. No doubt such applications will be made." Prof. Dixon then makes a criticism of profound interest. "We are somewhat astonished at the fact that so far we have not been able to obtain pure alcohol, except from German firms. When we have bought from an English dealer, it has come from Germany."

From Balliol College Laboratory, Oxford, confirmatory approval comes, with the remark "that the experience of industrial chemistry which would make an opinion (as to question II.) of any value."

Mr. Edmund White, late head of the Pharmaceutical Department of St. Thomas's Hospital, now of Messrs. Hopkin and Williams, writes similarly to the Secretary of the Examination Hall.

Prof. Henderson, of the Glasgow and West of Scotland Technical College, writes that the regulations have given no trouble whatever, that the permission has much facilitated our work, whilst a considerable saving has been effected. As regards (*c*) he writes: "The researches we have made with the aid of duty-free alcohol have not had any direct bearing on chemical industry." Now, observe the remark, which we all shall endorse: "The manufacturers in this country, as a general rule, do not communicate any problems they meet with to those who have time and opportunity for investigation, and therefore, while manufacturers themselves often cannot tackle the subjects on which they would like research work to be done, chemists are able and willing to do such work, do not know what manufacturers want. You know," he writes, "that manufacturers in Germany make much more use of the facilities for research afforded by the University Colleges there." Prof. Henderson also cannot see why the permission to use duty-free spirit should not be extended to all manufacturers where the use of pure alcohol is essential." No, he cannot, because he scarcely apprehends the intricate condition of the case. Yet once again we urge an attitude of a bold and brave attempt by the authorities to place us speedily in a position of equality with our at once energetic, able, and scientific rivals.

Dr. T. E. Thorpe writes—

> "The subject is one in which I am greatly interested. It is, as you know, surrounded with departmental difficulties, but these difficulties ought to be made subservient to the general convenience. Public departments, after all, exist for the benefit of the public. The difficulty is that, as regards alcohol, the revenue authorities are too apt to regard it solely as potential whiskey, and not as a chemical capable of being turned to account for the manufacture of innumerable articles which have no necessary relation to potable spirits. I am quite sure the revenue authorities are not unsympathetic. I am sure some modus vivendi can be found."

One cannot help referring to a very recent and not unimportant occasion, namely, a discussion under the auspices of the London Chamber of Commerce on "British Industrial Neglect of Applied Science." At our suggestion the metropolitan professors were invited, and interesting comments were made by them. One thing was clear, we were quite as learned and well equipped as our rivals. Our educational system and raw material for educating was all wrong. Our vice was "self-reliance," hitherto regarded as a virtue. We blundered on, never asking advice, nor taking it when given. Industrialists came last and late, and your Chairman, the writer, contributed some observations of a practical character, which are recorded elsewhere. We both agreed that manufacturers might well consult the "doctors" for their ailments, and frequently, but before all, the conditions must be equal for equal advance, and the opportunity was not neglected by us to urge the removal of obvious disabilities, notably that of the want of duty-free spirit suitably denatured for industries. What is wanted, is not so much technical schools for workmen—as, after all, a workshop is the best school of apprenticeship—as polytechnics for employers, foremen, managers, and superintendents. "They too often cling to old methods and are not so assimilative and adaptable as they ought to be." As several members of Parliament were present, one hopes recruits to our cause may have been gained. Last year Mr. Howard and Mr. Umney spoke to the positive danger, as well as the absurdity, of giving to research, facilities which were not given under proper conditions to industry. Here are unimpeachable testimonies to the value of free alcohol for scientific research, the direction of which is not industrial, because there is no demand. Give the facilities for utilising scientific industrial research and we shall be ashamed if the "self-reliance" of the British manufacturer does not take an active form. One must repeat the deep conviction that the pecuniary results to the Exchequer in other ways, will far outweigh any loss of revenue by concessions in the direction of new or seriously hampered existing but struggling industries. This, the time of the nation's industrial stocktaking, is scarcely that at which our able public servants, with sons of their own and inheritors of the nation's glories, shall hesitate to meet imperative and vital industrial conditions and to assist in restoring some which had birth in our land, and developing and maturing those whose inception is but now a matter of circumstance and opportunity. Let all put a hand to the wheel of industrial progress, the professor and his students, the business man, the manufacturer, the chemist, and last, but not least, our STATE. Again grateful acknowledgements are made to many contributors, and among them, greatly to my successor at the Chamber of Commerce, Mr. John C. Umney, the Joint Committee, my assistant Mr. Gosling, in the matter of diagrams, and, most appositely, to Mr. P. Leuthard-Thornton for his very useful technical matter.

Supplementary Material considered of Value.

In continuation of Table II. of last year's paper, the following figures may well be given :—

YEARS 1902–3.

Potato Crop Average 43,462 *millions of tons of* 1,000 *kilos. each.*

Whole spirit production from all materials	74·129
Potable spirits consumed	51·35
Free spirits consumed	28·36
Free spirits denatured	19·899
Free spirits for vinegar, and free spirits for other purposes by deduction	8·46
Export	8·28

of which 2·621 to Great Britain, British W.A., and British India.

All these are million gallons liquid 100 per cent. The stock at the end of 1903 was 6·6 million gallons liquid 100 per cent., as against 22·198 million gallons liquid 100 per cent. at the end of 1902.

To Table I. add :—

Raw Material used in German Distilleries.

Year.	Potatoes.	Molasses.
	Tons.	Tons.
1900–1	2,790,000	29,843
1901–2	3,088,000	32,303

The sale of motor spirit, which was in 1901–2 286,000 gallons liquid 100 per cent., has gone up to 528,000 gallons liquid 100 per cent. in 1902–3.

GERMANY'S TRADE IN DYES AND CHEMICALS.

Oil, Paint, and Drug Reporter, Sept. 16, 1903.

In recent years Germany has rapidly advanced to first place among the countries producing dyes and chemicals. Her success in the manipulation of coal tar reads like romance. Perkin, the English chemist, might discover that Germany alone has learned the art of exploiting. In 1892 the Empire exported 21,879,204 lb. of coal-tar dyes, of which England took 4,146,872 lb. and the United States 5,153,448 lb. In 1901, 51,060,7[illegible] lb. were exported—11,830,776 lb. to Great Britain, and 10,461,324 lb. to the United States. German price lists put the price of these coal-tar products at 57 cents per lb. in 1892 and 37 cents in 1901.

One hundred and twenty companies, working under the limited liability laws, with a paid-up capital of 83,931,914 dols., paid out 10,323,520 dols. as interest to the stockholders in 1901—at 12·3 per cent. dividend. This is a trifle less than the one paid in 1900, and a little more than 1 per cent. less than in 1899, when the dividend was 13·52 per cent.

Nothing in the long list of modern discoveries is more wonderful than Germany's investigations and success in the production of indigo. For a long time it had been the dream of dyers and chemists to find a substitute for India's natural product. They had driven French farmers to desperation when they destroyed the value of madder by substituting an artificial red won from coal tar. They expected to do nearly as much with a substitute for natural indigo. In 1892 the Empire had to import 3,556,740 lb. of natural indigo, valued at 4,450,600 dols.; in 1896, 4,026,756 lb., worth 4,926,000 dols.; in 1902, only 1,074,468 lb., valued at 833,000*l*. India, the Dutch East Indies, and parts of Central America were the great producers. They, too, were watching the work going on in the Empire's laboratories, for they were very much interested. At last, in May 1897, Baeyer, a great chemist at Munich, made the long-looked-for and longed-for discovery. Since then the exports of the German Empire have gone on increasing, while the exports of natural indigo from other countries have been diminishing. In 1897 the exports were 1,036,116 lb.; in 1902, 10,779,972 lb.; expressed in values, 1,142,400 dols. and 5,950,000 dols.; or nearly 500 per cent:—and this notwithstanding the fact that the effect of the discovery of artificial indigo was to reduce the prices of this dye. Germany paid for natural indigo an average of 2,737,000 dols. in the years previous to 1896; since that time, less than 238,000 dols.: last year, only 166,600 dols.; while it exports millions of dollars' worth of the artificial, Great Britain taking 710,124 lb. last year, and the United States 1,449,012 lb. Even the East Indies are down for quite a large quantity in 1902—85,476 lb. One company, the Aniline Factory at Ludwigshafen on the Rhine, is reported to be producing more than 1,000,000 marks' worth of artificial indigo every 12 months. Once familiar with the Empire's methods of investigation and experimentation, all wonder at results vanishes.—Textile Mercury.

ALCOHOL; CONGRESS ON ——, AT THE GENERAL MEETING OF THE ASSOCIATION DES CHIMISTES DE SUCRERIE ET DE DISTILLERIE DE FRANCE ET DES COLONIES.

Bull. de l'Assoc. des Chim. de Suer. et de Dist., 1903, **20**, [9], 943—944.

Germany produces four million hectolitres of alcohol and devotes 1,161,000 to industrial purposes; France produces 2,656,000 hectolitres, of which only 221,000 are used industrially, so that to reach the same proportion as in Germany (where the consumption of alcohol in beverages is stationary) 521,000 hectolitres more than at present would have to be denatured.

The principal object of the Congress was to indicate the means to be adopted and the reforms necessary to attain this result. The following are the chief recommendations to be submitted to the Agricultural Commission of the Chamber of Deputies :—

1. Abolition of the large dose of wood spirit now used as a denaturing agent and the adoption of a mixture of 2 litres of wood spirit bases, 1 litre of excise wood spirit, and $\frac{1}{2}$ litre of benzene per hectolitre of alcohol. This improvement would effect a saving of 6·45 frs. per hectolitre over the present method of denaturing.

2. Unification of the tariffs for the whole of the companies, and the return, free of charge, of packages used for the carriage of denatured alcohols.

3. That all alcohols considered as raw material of the various industries be exempt from duty; that the denaturing be suited to the use for which it is intended, and that for alcohols which are to undergo no denaturing there be established supervised factories.

4. That a special study be made of the various pharmaceutical and perfumery preparations with an alcoholic basis, in order to find out the possibility of adapting denatured alcohol to the whole or a part of these preparations.

5. That French manufacturers using denatured alcohol as a raw product in their manufacture have the right to establish works placed under the supervision of the excise, in which this alcohol can enter free of all inland duty.

Denaturising Alcohol in Argentina; Formula to be Used.

Bd. of Trade J., April 23, 1903.

In the *Boletin Oficial* of Argentina of March 11, a decree is published, to come into force three months from 5th idem, requiring all alcohol intended for illuminating, heating, and preparation of varnish to be denatured by the use of the following formula, *viz*:—

Pyridine, 45 per cent.
Acetone (commercial), 45 per cent.
Eucalyptus essence (commercial), 10 per cent.

The alcohol is then denatured by an addition of 1 part of the mixture so obtained to 50 parts of alcohol.

When, however, special systems of illuminating require for the best results of their plans the use of certain formulæ, the National Chemical Office will examine experimentally the necessity for the modification of the general formula just expressed and will report to the "Ministerio de Hacienda," who will decide.

From the *Civilian*.

There has been of late a decrease in the quantity of German cheap spirit imported into this country. Up to last week there had been a falling off, compared with the corresponding 11 months of 1902, to the extent of 70 per cent. Fifteen months ago this market was almost flooded with Continental neutral spirit. The Berlin Clerical organ, *Germania*, a few days ago called attention to the extent to which the revenue, which is not in a very healthy condition in the Fatherland, suffers by reason of studied laxity on the part of officials. The manufacturing tax on alcohol is 7*d.* per gallon, but by improved mechanical means makers produce so much more than the Government standard that the tax they pay amounts to less than 5*d.* In the old days when our own spirit duty was levied upon the capacity of the still, and on the assumption that it would be used from four to six times weekly, Scotch and Irish distillers, by altering the shape of the still, but without interfering with its capacity, were able to use it half-a-dozen times in the day, much to their profit. Although their German competitor has quite a number of taxes on his spirit—a maker's tax, an ingredients tax, and a distilling tax—he appears to manage very well, for while the three imposts cost him 5*d.* he receives from a paternal Government a "drawback" of 7*d.* on every gallon of spirit he exports or methylates, and in the former case he also receives a number of bounties, which, for a distiller who makes at least 100,000 gallons a year, amount to not less than 3*d.* per gallon, and probably much more. The working of a law passed eight years ago, by which the receipts from a new tax placed upon spirit were devoted in great part to encouraging the export of that article, is rather obscure, but it appears to be equivalent to a bounty of $\frac{3}{4}$*d.* per gallon. It would seem, then, that the exporter in Germany receives by way of gift from his Government between 5*d.* and 6*d.* on each gallon of spirit he sends here or elsewhere. As our differential duty is but 5*d.*, the German Government pay it and a little more for their exporters. It is not surprising therefore, to find that in their estimates for 1904, provision is made for a decreased receipt from spirit duty of 289,200*l.* The beer duty, too, is worked on somewhat similar lines. To exporters the Government give a drawback of the nominal duty, which is one-third greater than the actual duty. Under this head of receipt too, it is contemplated that there will be a decrease of 64,800*l.* next year.

Duty on Celluloid Articles: U.S. Customs Decision.

Dec. 2, 1903.

The Board of General Appraisers held that in assessing duty on articles composed in part and in chief value of celluloid, the whole weight of the articles, and not that of the celluloid alone, should be taken.

Salol and Phenacetin: U.S. Customs Decision.

Dec. 1903.

Salol, phenacetin and other medicinal preparations were assessed for duty at 55 cents per pound, under paragraph 67 of the Tariff Act, as "medicinal preparations in the preparation of which alcohol had been used." The importers endeavoured to show that alcohol was not necessary for their manufacture. The Board held this evidence to be insufficient and affirmed the assessment of duty. (See preceding decision.)

Chloral Hydrate and Salol: U.S. Customs Decision.

The United States Circuit Court of Appeals has rendered a decision regarding the dutiable character of salol and chloral hydrate which has an important bearing on the imports into the United States in the manufacture of which alcohol is used. The Court of medicinal preparations held that if alcohol is used in any way, and even if it is broken up or removed, the finished product is subject to a duty of 55 cents per pound under paragraph 67. In order to be dutiable at 25 per cent. *ad valorem* under paragraph 68, evidence must be submitted showing that alcohol was used at no stage of the process. This decision reverses numerous decisions of lower courts.

Potatoes: Ireland and Chemical Manufacturers.

It is hard for the average man to discover from amidst the volume of material which is being daily poured forth by the Press, whether we are in full career of decadence, or may still hold the old point of view of the pre-eminence of Great Britain. Is the man in the street to think that our career is one of headlong descent when he reads of industries killed by stupidities of legislature, or may he comfort himself with the thought that some decay of the sort is natural, and will by-and-by be filled up with new outlets to trade? The nation would be careless, indeed, were it to accept the optimistic view. The industries that are manifestly being lost and already lost to us, if to be regained by any sort of effort, are worthy a fight. Of all the industries in which German competition has almost completely ousted the British manufacturer, the trade in dyestuffs is a most conspicuous example. It is a favourite cry with many self-constituted authorities that the English have lost place in such trades through want of technical and scientific training. However much truth there may be in this statement—and there is doubtless a great deal—still it is not absolutely the sole cause of our retrogression. In this particular trade much has been done for the foreigner and against the British manufacturer by the English legislature itself. In the manufacture of aniline dyes and many chemical products, spirit is an essential adjunct. The German manufacturer can buy alcohol at 10*d.* a gallon for industrial purposes, the British manufacturer pays for his 21*s.* a gallon, for all spirit in this country, irrespective of the use to which it is to be put, has to pay excise duty. Is it surprising that Germany has appropriated the aniline dye trade? How can the British trader put any on the market in the face of such opposition? The political cry of the moment is free trade, but she hardly realises that she has long been playing the protective rôle, but in the wrong direction, towards the foreign trader. If free trade is such a boon, let us have it, but let us abolish protection of the foreigner. This intrusion of the synthetic substitutes for aniline has had a far-reaching effect. But a decade ago, the total output of natural indigo in the whole world was some 5,000,000 per annum. Of this, India contributed no less than three-quarters. That important source of Indian revenue of some millions sterling per annum no longer exists. The German artificial dyes have ousted natural indigo from India in the industrial market.

In this field, again, the Germans are the masters, nor can we hope to wrest it from them until the Chancellor of the Exchequer shall screw his courage to the sticking point, and make alcohol for industrial purposes duty-free. Our law makers at Westminster have been dealing tenderly with Ireland of late. Were they but to grasp the full significance of such an exemption from excise duty, they would add to their gift to Erin yet another infinitely great benefit. The demand for cheap alcohol for manufacturing purposes could well be supplied by a greater output of the potato. The House may consider the question of duty-free alcohol at an early date. Any continuance by Government of the present system of excise duty on all kinds of alcohol render irretrievable to a most important British trade a loss which has already assumed regrettable dimensions.

NEW IRISH INDUSTRY: ALCOHOL DRIVEN MOTOR-CARS.

Mr. R. J. Mecredy, the Irish motorist, whose scheme for the manufacture of alcohol in Ireland is now under the consideration of the Department of Agriculture, is very hopeful of a great success in regard to its use for motor-driving purposes.

The international race which he proposes should take place in Ireland next year should induce some wealthy supporter of motoring to offer a cup for the best alcohol-driven motor-car over the Gordon-Bennett course. Mr. Mecredy issued a circular setting forth the conditions a few days ago.

In the course of conversation with a correspondent in Dublin, he seemed full of enthusiasm. The idea occurred to him about a month ago, and he placed himself in communication with Sir Horace Plunkett, who told him that he thought the idea a splendid one, and that it would have his most careful attention.

"You see," said Mr. Mecredy, "it is a case of alcohol versus petrol, and at recent trials in France, the result demonstrated that there is no practical difference between the efficiency of alcohol-driven and petrol-driven motor-cars where the carburettors were specially designed to suit the occasion. To be sure, the consumption was greater, but once the duty is removed, the spirit would be so cheap that this difficulty would disappear."

"How do you propose to meet this difficulty of removing the duty?" he was asked.

That point, I understand, is having the consideration of Sir Horace Plunkett, and it could not be in abler hands.

"As regards the manufacture of alcohol from an industrial point of view, there are enormous possibilities for Ireland in it. A great impetus will be given to the growing of potatoes and beetroot, from which the alcohol could be extracted, and the Irish farmers will not be slow to see the advantage of taking it up. This in turn will make a vast field of work for factory hands and operatives. Light railways are also certain to come into line for propulsion by alcohol, so you see the possibilities for Ireland of the new industry are almost without limit."

FERTILISERS AND THE PREPARATION OF POTATO LAND IN GERMANY.

U.S. Cons. Rep., Oct. 17, 1903.

This, from the standpoint of German agriculture, is by far the most complicated and important portion of the subject. The three essential elements to be provided by artificial fertilisation are phosphoric acic, potash, and nitrogen. The first is obtained through the application of mineral phosphate, Thomas slag phosphate meal, or bone dust. Thomas meal is applied in the proportion from 1,000 to 1,200 lb. per acre, but being sparingly soluble, it acts very slowly on the growing crop, and in dry seasons hardly at all. It is most effective in moist soils and in seasons of abundant rainfall. Steamed bone-dust is used—300 to 400 lb. per acre—by being strewn over the land in late autumn, and ploughed in. Superphosphate fertilisers are used in the spring, and are deposited and covered with the seed at planting time. Far more important, however, for potato culture are the potash-bearing fertilisers, such as kainite and carnallite. The enormous development of potato production in this country during the past 30 years has been due to the exclusive possession of an unlimited supply of potash minerals. Many of what are now the best potato lands were, 20 years ago, deficient in potash, for the reason that the potato consumes that element in large proportion, so that the original natural supply had long been exhausted by ignorant, unskilful cultivation. What was needed was to restore the exhausted potash. But it was found that neither kainite nor carnallite—both of which contain traces of chlorine—could be used raw and directly as a manure for the growing crop without impairing the flavour and quality of the potato. To produce the best effect, these mineral fertilisers have to be digested and assimilated with other elements in the soil. To secure this result, they are applied during the preparatory process, one or two years before the land is planted to potatoes, and serve to nourish the clover, the lupine, or other fallow crops that are grown and ploughed under as manure. By this method the potash salts are not only digested, purified from chlorine, and mingled thoroughly with the soil, but it is enriched by the nitrogen of the buried vegetation, and prepared for the abandant growth of potatoes of the highest quality, rich in starch, and of standard flavour.

Nitrogen is applied in the form of stable manure worked into the soil during the one or two years previous to potato planting, and of nitrate of soda, which is used as a top-dressing, applied directly while the plants are growing. Nitrate of soda covered in the earth leaches away into the subsoil, and is thereby lost to the farmer. Used as a top-dressing, it has an immediate, and often important, effect, in reviving and stimulating a crop, but it should never be applied to the soil in autumn, nor in the spring before the potato sprouts have appeared above ground.

Reduced to its simplest terms, the secret of German pre-eminence in potato cultivation consists in the careful, patient scientific preparation of the soil, not only by the restoration of its exhausted elements, but by mellowing, enriching, and revivifying it by deep cultivation and the ploughing in of green manure crops, which have taken up and digested the crude mineral fertilisers. Land thus prepared will yield three, or even four, crops of potatoes before their quantity or quality will begin to deteriorate.

Potatoes.

It will astonish most people to hear that 28,856,637 acres are annually under potato-culture in Europe, and that the total yield therefrom is estimated at 2,329,211,560 cwt. The *Gardeners' Magazine* states that in the matter of area Russia occupies the highest position with 9,645,869 acres, Germany ranks next with 8,004.225 acres, and France occupies the third place with 3,818,378 acres. The potato areas in the other countries of Europe are as follows:—Austria, 2,802,677 acres; Hungary, 1,477,161 acres; United Kingdom, 1,203,184 acres; Italy, 516,000 acres; Holland, 386,049 acres; Sweden, 381,973 acres; Belgium, 348,398 acres; Denmark, 133,387 acres; Norway, 90,661 acres; Roumania, 28,642 acres; Servia, 15,549 acres; and Bulgaria, 1,481 acres.

Yield.

In the matter of yield, Germany is first with 855,277,805 cwt., Russia second with 519,045,932 cwt., and France third with 236,469,441 cwt. The yields of other countries are: Austria, 234,100,082 cwt.; United Kingdom, 118,398,380 cwt.; Hungary, 95,442,205 cwt.; Holland, 77,929,500 cwt.; Sweden, 54,821,800 cwt.; Belgium, 47,083,147 cwt.; Norway, 21,906,142 cwt.; Denmark, 21,177,681 cwt.; Italy, 13,818,293 cwt.; Roumania, 2,495,314 cwt.; Servia, 835,083 cwt.; and Bulgaria, 410,755 cwt. These figures illustrate the great difference in the yield per acre in the different countries. The United Kingdom, which is sixth in area, is fifth in yield, heading Hungary by nearly 23,000,000 cwt., although having an area of about 273,000 acres less.

DISCUSSION.

Mr. CHARLES UMNEY said he took some considerable part in obtaining the concession which had been alluded to, which was made to wholesale druggists some years ago, of a drawback upon exportation of medicinal tinctures. Experiments were then conducted in his Company's laboratory, because Dr. Bell, the then Head of the Somerset House Laboratory Department, said that if the drug trade could only convince the Inland Revenue what amount of alcohol on manufacture was lost on a large scale, the Department would take the matter into consideration. He immediately replied "come and see." Dr. Bell sent his officers, and they worked for two or three weeks, and at the end of that time the Department gave the trade more than they asked for, and the arrangements had worked without any friction whatever, to the great advantage of the exporting wholesale chemists and druggists. With this particular matter of free alcohol for manufacturing now referred to, he had had very little to do, but he failed to see why, the perfumery trade having had the concession of free alcohol, similar concessions should not be extended to other manufacturers. The perfumery trade now worked with duty-free alcohol, though there was no permission to recover from their residues the alcohol left therein. The perfumers did work, however, under Excise supervision in bond, and, as he had learned from manufacturing perfumers, without any undue friction. These, however, were very small matters compared with the large industry which Mr. Tyrer had alluded to, viz., the colour trade. The Customs seemed to have shirked their responsibility given in the Act of Parliament in not charging duty on many materials entering our ports. If the Customs were to put a duty on now, it would simply ruin the dyeing industry of the country when in keen competition with their continental opponents. So far as substances such as antipyrin, sulphonal, phenacetin, &c. were concerned, no doubt a duty could be imposed, but it never had been. Almost the whole of this class of chemical which the wholesale druggists distributed in England and abroad was made in Germany. He had been deeply depressed within the last few months at seeing some of the colossal works where these and other medicaments were made, when he knew that we had no facilities in England to enable us to compete. He thought Dr. Thorpe's letter which had just been read augured well for the future; his predecessor, Dr. Bell, and also the former Chief of the Revenue Department at Somerset House, had made in the past valuable concessions, and he still hoped there was a prospect of getting, at no distant date, free alcohol for manufacturing purposes.

Mr. David Howard said he was afraid that it was no use preaching to the House of Commons because they would not listen. The late Chancellor of the Exchequer did not even know that perfumes could be made synthetically, and yet he was a man who governed us. We were ruled by politicians who cared not one rap for the prosperity of the manufacturers and to whom it was much less trouble to tax manufacturers than to give them a chance. So the manufacturers were taxed, as only the Revenue Acts could tax them, rated as only mysterious decisions of judges could rate them, hampered with a Patent Law, made solely in the interest of the foreigner, and were deprived of alcohol except at a fabulous price. Let them have something like a fair chance. Too much self-reliance might be a mistake, but if they relied on the justice of their rulers, it would be a greater one. They must keep on putting these tremendous figures before their rulers and ask them, were they in the name of common honesty going to ruin English manufacturers by this monstrous system of protection of the foreigner at every turn. They had the power of taxing all these things, and why did they not do it?—because they dare not, that was the plain truth.

Dr. Squire said that, so far as he knew, the distillers were quite unaware of this agitation which was being engineered by Mr. Tyrer, and he did not think any opposition need be expected from them. There was no doubt, however, that the subject was attended with all kinds of difficulties—difficulties which had been created by mistaken regulations, starting almost from grey antiquity, and which were extremely difficult to alter. There was a parallel case in the matter of railways. Mr. Muspratt had taken up the question of carriage, and said the railways must lower their rates; the reply was that such enormous prices had been paid for land, at a time when land was worth a great deal more than at present, and in consequence of heavy capital accounts, that they could not see their way to lower the rates. In the matter of spirit, the difficulties arose mainly from an attempt made by the Government to check the actions and working of the distillers. The accurate working of the still, which was accurate, must be checked by something which was not accurate. The attenuation charge fixed by the authorities, *viz.*, that five degrees of gravity on 100 galls. of wort should produce 1 gall. proof of spirit, was not accurate. Usually about 8 per cent. more spirit was produced in practice. As many of them knew, the splitting up of sugar into alcohol and carbon dioxide could be expressed by a simple formula, but in practical working several other bodies were produced; glycerin, instead of attenuating the liquor, made it stronger, and lactic acid had a similar effect. Then there was a considerable increase of yeast in the manufacture of spirit. This was largely derived from the carbohydrates, in fact there were so many complications from disturbing causes that the attenuation charge was worth very little as an accurate check. If it were otherwise possible, he believed he could take 2,000 galls. of spirit every week out of a large distillery and the attenuation charge would not indicate it. This charge was the point around which the Spirit Act turned; all the regulations and restrictions were based upon it. He had no opinion of it, and many others, whose opinions ought to carry some weight, had no opinion of it either. But the unfortunate position was this: in order to work the attenuation charge the Government insisted on distillers making certain arrangements which were thought to be necessary. For example, to avoid fraud, before distilling could commence, everything connected with the wort must be locked up, and under the charge of the Excise officers. The same thing with the still; before mashing, the still must be locked up; in the case of pot stills the fire doors were locked up; in fact, nobody who had not worked in a large distillery had any idea of the number of excise locks. This was all for the purpose of the attenuation charge. The effect of these regulations was that, in as much as brewing and distilling, or mashing and distilling would not be done at the same time, the still was twice as big as it need be, and the mashing part of the plant was five times as big as it need be. In order to work the attenuation charge it was necessary to make use of more or less clear worts of which the gravity could be ascertained by the prescribed saccharometer. Whereas, in Germany, they mashed in a grain distillery 10 times in 24 hours, they could not do so more than six times in England to produce the same result. If that $2\frac{1}{2}$ was multiplied by 2, which represented the way in which the distilling operations were limited, that means that the mashing plant was five times as big as it need be. In consideration of all these restrictions there was a differential duty put on of 5*d*. In 1880 it went down to 4*d*. but it was 5*d*. again now. He was not prepared to say that that was the exact measure of the loss put upon the distiller; it might be a little more or a little less, but what was perfectly clear was that the distillers had been forced into an immense expenditure which would be entirely thrown away if these restrictions were removed. The capital account was three times what it need be, and therefore the distillers would say, no doubt—is it fair to take off these restrictions and allow us to double our already existing over-production, whilst other men are starting with about one-third of the capital, and doing as much work as we can do? Another question was the enormous stock of spirit, millions and millions of gallons, for it should be remembered distillers had been making two gallons where one was consumed. There must be an end to that some day, but if these restrictions were taken off and the general cost of spirit came down to 6*d*. or 7*d*., there would be a tremendous stock to be dealt with, which had cost very much more, and the distillers would require, and would insist upon, compensation for it. The capital employed in the spirit industry was about 30,000,000*l*., so that if they were to compensate distillers in anything like the degree they would be entitled to, it would cost 15,000,000*l*. or 20,000,000*l*. This coming on the top of the South African War and the Irish Land Purchase would be another considerable load on the Exchequer. He had been much impressed by the zeal and ability with which Mr. Tyrer had worked this problem out. He had shown that the free use of spirit was of the greatest possible importance in this country for chemical manufactures, but he had not attempted to deal with the enormous difficulties which had grown up in the last 100 years, which would have to be faced if spirit was to be made as cheap here as it was in Germany. The only way in which he thought it could possibly be done would be as follows:—In certain industries where it could be shown to be advisable and justifiable, there might be a drawback allowed on the spirit used; but to attempt to do away with the present regulations and to upset the whole system of excise would cause such complication and expense that no Government would face it. If Mr. Tyrer could persuade the Chancellor of the Exchequer to allow a drawback on every gallon used for certain purposes it would be a solution of the problem. Whether this would be granted was another question. He might allude incidentally to a statement he had heard made several times, and it occurred at the end of this paper, but he did not know where it came from. It was to the effect that there was a new field for Ireland, to come to the rescue of chemical manufacturers by distilling alcohol from potatoes. Supposing Ireland were allowed to make potato spirit free from all regulations, and Irishmen could make spirit for 8*d.* a gallon or less, what would they do? He thought if the Scotch distillers were getting about 1*s.* 2*d.* per gallon the Irishman would not sell it for 7*d.* or 8*d.* He felt perfectly certain that whatever regulations or allowances the Excise might think it right to recommend, they would never allow the use of pure alcohol. It must be denatured because of the heavy duty in England. 1*s.* 6*d.* duty in Germany was one thing, but 11*s.* per gallon was quite another. There were extremely honourable people, and the reverse. Honourable people would take care that no spirit was made use of in a fraudulent way, but others would not act in this manner. Many persons would remember the tricks that were played with methylated spirit. The incentives to fraud would be much greater if the spirit were pure and potable. The Excise, whose duty it was to protect the Revenue, would never see their way to recommend the free use of potato spirit. To meet the requirements of certain purposes the Excise had agreed to use any substance for denaturing provided it was efficient. Further than that they should not be asked to go. Indeed they could not.

Mr. **Helm** said there was one observation made by Mr. Umney which might lead to misapprehension. He said that duty-free alcohol was used for making perfumes, but that only applied to perfumes made for exportation; those made for sale in this country paid the ordinary duty. He had listened with great pleasure to this paper, and also read with great interest and profit the former one by the same author. This was about as complete a paper on the subject as could well be written, and he would venture to suggest that it should be printed separately as a pamphlet and circulated amongst the members of the House of Commons. The House of Commons was their master; they were not law makers, either at Somerset House or at the Government Laboratory; they had simply to carry out the laws which were laid down for them, and he might claim for the Government Laboratory that whenever they had to advise the Government, it would be found, as Mr. Tyrer had borne testimony, that the users of industrial alcohol had always met with the greatest sympathy and support from the heads of those branches. Mr. Tyrer alluded to the tinctures regulations in which Dr. Bell was engaged. He had had to do with the administration of those regulations since they were issued, and he was glad to say that they had worked very successfully and profitably to the home trade. The drawback had risen gradually, and was now 65,000*l.* per annum, and that represented a very great benefit to home manufacturers, who formerly had to send tinctures intended for the Colonies viâ Hamburg. In the drawing up of those regulations, Mr. Umney was assisted and advised by the then principal of the Department, Dr. James Bell, and no one who knew him would ever accuse him of being anything but broad-minded and liberal in anything he had to do with. The same might be said of their present chief, Dr. T. E. Thorpe. But, as Dr. Squire had pointed out, there were very many difficulties, and it was a rough and thorny question. In the first place 20 millions of revenue depended on it; in the second place much had been said about good faith, common honesty, and so forth, but there were in this country, people, who, as soon as an Act of Parliament was passed, attempted to drive a carriage and pair through it. If it were not so, their difficulties would be comparatively slight, and the road to duty-free alcohol would be much smoother. He had had a considerable amount of experience in these things—having been over 40 years in that branch. Taking that very beneficent Act, the Methylated Spirit Act of 1855, it was a grand advance in the way of alcohol for use duty-free; prior to that it was all duty-paid. The first Act simply allowed alcohol, on being denatured with one-ninth of its bulk of wood naphtha, to be used for certain purposes duty-free. But in six years they had to pass an amending Act. It was found that it was being purified, and being made fit for use as a beverage, and in 1861, they had to pass an Act forbidding under severe penalties methylated spirit to be coloured, flavoured, purified, or in any way made fit for use as a beverage. That was a grave abuse of the privilege Parliament intended to confer on the industrial community. But that was not all; after a little time it was found that alcohol was being purified for use as a medicine. In the ordinary course of things, perhaps this might not have been interfered with if the medicines had been ordinary ones, but they came upon medicines which were sold and extensively used in the North of England under the name of Indian brandee, Indian gindee, and Indian whiskee, preparations which were supposed to be medicines, but which were in reality sold and used as stimulants. The result was they had to have another Act passed forbidding methylated spirit to be coloured, flavoured, or prepared for use in medicine. This showed that the privileges which the Revenue tried to confer on industries had been stopped by these unscrupulous persons because the Revenue authorities had not the power to discriminate, for they could not examine into the moral character of a man who wanted to do what somebody else had the privilege of doing. They allowed methylated spirit to be sold without a licence when mixed with 3 oz. of gum resin per gallon; that went on some time, and then they found a large manufacturing chemist distilling finish, and getting methylated spirit in an irregular way and using it for manufacturing purposes. Whatever restrictions there were on the use of methylated spirit, or on any privileges that might be conferred, they were tied hand and foot, partly by law and partly by the abuses which crept in. He was quite sure that everyone connected with the Revenue sympathised in theory with the object Mr. Tyrer aimed at; but in the first place there was the very great revenue dependent on it, and the next difficulty was the great danger there would be of workpeople and others using it improperly, even with the best intentions on the part of the manufacturer. They had had a great deal to do with various denaturing agents. The Act allowed either wood spirit or any other approved denaturing agent, but they had never been able to come on any denaturing agent quite so effective as wood spirit. Many others at one stage or another, either by acidification or making it alkaline, could be distilled and got rid of, but with wood spirit there was always some of the methyl alcohol remaining in the recovered alcohol. He should advise that any measures that might be taken for getting duty-free alcohol might be combined very well with measures for cheapening methylated spirit. With regard to the use of duty-free alcohol, it had to be proved that methylated spirit was detrimental or unsuitable, and there was no doubt that as between the two, methylated spirit would always be considered detrimental and unsuitable. He did not know any case where it would be more effective than alcohol itself, irrespective of the fact that it is double the price. But he did not see why measures should not be taken to cheapen methylated spirit. He should much like to see methylated spirit as cheap here as alcohol was abroad, for that would be a very great benefit. He thought they might fairly go to the Chancellor of the Exchequer and propose that he should pay the cost of denaturing alcohol; it was denatured for Revenue protection, and why should not the Revenue bear the charge? If he could give the differential duty back on the alcohol in methylated spirit as well as on alcohol itself when exported, why should he not allow the differential duty on alcohol used for manufactures in this country, whether as ordinary alcohol or as methylated spirit. It was no secret that in 1860 the exporters of alcohol wanted an allowance of 2*d.* or 3*d.* a gallon from Mr. Gladstone. He said, "No, the Revenue cannot afford it"; but he said, "I will give it if you will assent to an extra duty of 1*d.* per gallon on alcohol," and he did so. This differential duty was allowed and the Revenue lost nothing, but the consumers of alcohol had to pay an extra 1*d.* per gallon. He did not see any injustice in that to the spirit trade, because anything that improved the general trade of this country was sure to increase the consumption of potable spirit. They saw that every day: if trade went down, down went the revenue from beer and spirits; when trade went up, up went the revenue. Therefore anything that would increase the trade of this country and give the working classes better wages, was sure to redound to the profits of the distiller, the spirit merchant, and the publican. Many times they had knocked at the door of Inland Revenue and at the door of the Government Laboratory, but they had always been knocking at the wrong door. In 1902 they found out that the right door to knock at was the door of the Treasury and the Chancellor of the Exchequer. If the Chancellor of the Exchequer wanted advice, he could assure them that he would get advice sympathetic from their point of view. Mr. Howard had spoken about knocking at the door and getting tired of knocking, but he could give them an illustration of where knocking was at least likely to come to something. The cigar manufacturers asserted that they had a very inadequate drawback granted them in 1863 by Mr. Gladstone: simply 1*d.* per lb. more than the duty, when by his own showing the differential duty should have been from 3½*d.* up to about 1*s.*, but he would only allow 1*d.* For the last 40 years the cigar manufacturers had been knocking at one door and another to try to get an increased drawback, until last year they went to the Government, and convinced Mr. Ritchie that they had a case for enquiry. It was referred to an inter-departmental committee of which he was a member. The committee had not yet reported, and of course he could not disclose any official secrets. It was better in this matter not to go as single manufacturers, but to go through their Chambers of Commerce. So far as he was concerned he wished them all success, but he could see there were very narrow limits within which it would be safe for the Revenue to allow the use of duty-free alcohol, and should advise them to combine with it a claim for a reduction in the cost of methylated spirit.

Dr. Ormandy read as follows from a letter from Dr. Markel, of Messrs. Crosfield and Sons, Ltd. "If you get an opportunity to take part in the discussion of Mr. Tyrer's paper, I should be glad if you would mention that you and Mr. Allan represent Messrs. Crosfield and Sons, Ltd., and that you were specially sent to this meeting in order to express the importance which we attach to this subject, and to welcome Mr. Tyrer's efforts to bring the matter before that class, which is the one that could grasp the national importance of the subject most rapidly, namely, the class of chemical manufacturers. So much are we impressed with the importance of the matter that we are determined to second Mr. Tyrer's efforts by bringing the matter before that part of the public which Mr. Tyrer does not address." The speaker then pointed out that the greater part of Mr. Tyrer's remarks were addressed more particularly to the interests of manufacturing and pharmaceutical chemists, but the great future in the utilisation of alcohol, at least in the eyes of the continental governments, seemed to lie more in the direction of its utilisation for lighting and heating purposes, and as a source of power. He might say that he had that day called upon Dr. Boverton Redwood, who, in answer to an enquiry, stated that, if our automobile industry advanced at the rate it was doing, unless fresh sources of petrol were discovered, the price was bound to advance, and that rapidly. In that case the English people would be very badly situated. It was not likely the Americans would send their petrol over here, as their own consumption was growing, and at present they were practically the only manufacturers, since practically no petrol was obtainable from Russian petroleum. The Continent would be able to utilise cheap alcohol, but we should be left far in the background, with no other course than to use such expensive petroleum as we could get, or we should be amateur manufacturers of alcohol, starting at the points which Germany and France had left behind years ago. The remark made by Mr. Helm was very pertinent. He thought it would be easier to get reductions in the cost of methylated spirit, and the method suggested of appealing to the Chancellor of the Exchequer to remit this additional tax of 5*d.* on that portion of the alcohol which was used for industrial purposes, was a very good one. It was on these lines that the German Government tackled the problem. They put a special additional tax on the manufacture of alcohol, and the money accruing from that special tax was applied solely in diminishing the cost of alcohol used, when denatured, for industrial purposes. He had recently paid a visit to Germany to specially enquire into this subject, and he found that the amount of money spent in that way, in reducing the cost of alcohol for industrial purposes, was approximately 1,000,000*l.* This seemed a large sum, but a large portion of it was raised by increasing the tax on alcohol used for potable purposes. If the statement which had been made, that as trade increased the amount of potable alcohol consumed increased, were correct, they might hope that the duty arising from that increased use of alcohol might be expended in diminishing the cost to manufacturers and those who wished to use it for motive purposes.

Dr. Silberrad said that there seemed to be two principal difficulties in the way of duty-free alcohol. The first was referred to by Dr. Squire, and was based on the fact that the removal of duty and consequent excise control would double the output from the distilleries and so flood the market. It seemed to him that if the duty were once removed chemical industry would grow to such an extent that the quantity of spirit required would rapidly become far more than double that used at present. The second difficulty was that bogey, the 18 millions revenue, which was so forcibly brought up by Mr. Grant Hooper in discussing the paper read by him (Dr. Silberrad) rather more than a year ago. With regard to this it was self-evident that the money was paid by the British Public. This in itself, seemed, at first sight anyhow, a good deal worse than making foreigners pay it by the introduction of a preferential tariff, but surely some better means of raising it could be found than this which so completely crippled so large and important an industry. Were the duty removed, doubtless drunkenness would be more prevalent at first, but soon it would probably lead to the elimination of inveterate inebriates and so exercise a purging effect on society. Statistics showed that drunkenness varied with the duty on alcohol, and in Switzerland, where the duty is negligible, drunkenness was very seldom met with.

The Chairman said they were much indebted to Mr. Tyrer for the great amount of trouble he had taken in connection with this matter, and in preparing this paper, which was upon thoroughly broad lines. Since the question had been raised by this Society, they had gained very material advantages and considerable concessions, especially in regard to tinctures, in connection with which an enormous amount of money had been saved to British manufacturers. Then there were the more modern cases of fulminate of mercury and nitro-cellulose manufactures, in which they had been very much behind because they could not compete with foreign manufacturers, who were placed by their Governments in a more favourable position. In England they rather objected to State assistance or State help of any kind, but that view arose when the State was outside and beyond the people. The State was the people in this country at the present time, and its action was simply the co-operation of the whole body of the community, or it ought to be. By using that pressure which Mr. Howard indicated, they ought to be able to persuade those officials at the head of affairs to do what the nation required. From that point of view he did not think at all that State assistance should be rejected by any trade; it did not in any way eliminate self-help. Abroad, especially in Germany, people interested in various industries united and formed guilds. Their action was felt here commercially, but in their own country they were powerful politically, and unless we combined in some similar way we should have great difficulty in putting the requisite pressure on those at the head of affairs. Mr. Tyrer had foreshadowed one point which perhaps might weigh with them in the future, and that was the action of their colleagues and fellow members in the United States. If they should come in first, and obtain privileges from their Excise that we did not have, it would be good-bye to our industries in which alcohol was used, because they had manufacturing facilities which we could not dream of. In the first place they had cheap land, and that meant cheap alcohol if it were not taxed too highly. With regard to the taxes which were imposed on some of these chemicals, it was a most difficult subject, because many of the materials mentioned in the tables were the raw materials of other industries. If they taxed acetic ether they made it impossible to use it in connection with the celluloid industry, and there was a great celluloid industry which could not be carried out in this country because acetic ether and similar solvents used for it were heavily taxed. The dyes in which either ethyl or methyl alcohol were used as constituents were very largely employed by dyers, and to put a tax on them, as Mr. Tyrer had pointed out in his previous paper, would render it impossible for many of our producers of cotton fabrics to sell their goods in competition with foreigners. They must, therefore, not move rashly in the matter; but if they all put their heads together, and especially if they formed joint committees of those concerned, as had already been done, with the London Chamber of Commerce and other Chambers, he thought they might easily find a *modus vivendi* and strike an average which would be reasonably satisfactory to all parties. He was glad to hear that the distillers were, to a very great extent, with them in this matter. He believed, at the commencement of Mr. Tyrer's work, there was some antagonism shown by some gentlemen connected with the distilling industry, but as they had gone into it they saw that the production of alcohol was bound to grow enormously if people were allowed to obtain it at a price bearing some reasonable relation to the cost of production for certain purposes which would not affect the Revenue. As Dr. Squire had pointed out, there was quite enough spirit produced for potable purposes—more than could be drunk under existing conditions. He said that two gallons were made where one would suffice, and he was afraid there was at present no way of getting rid of the surplus. They would always produce more than could be drunk—at least he hoped so—and the only way would be to have a free year every now and then. He was not quite sure whether, on the principle of the survival of the fittest, it would not be ultimately better. At any rate he had noticed that where alcohol was perfectly free, and one could have it for the making, there was no drunkenness. He knew that of his own experience, for he had seen it in more than one country. He thought a good deal of the excess in drinking which took place in this country was because drink was a thing that cost a good deal of money, and people looked upon it as a kind of luxury to be proud of.

Mr. R. F. **Nicholson** said his was one of the four distilleries now at work in the London district, which showed that the trade could not be in a very prosperous state, and anything which would produce a larger consumption would receive the greatest approbation from those connected with the manufacture, and he was quite sure they would render assistance in trying to bring about a better state of affairs. In the first place the spirit law as at present existing was rather an anomaly. The law itself was made in 1821, and for the last 80 years had been almost exactly the same. It was cleverly worked out at the time, no doubt, but the conditions had altered, and there was now room for an immense amount of improvement. First of all, the spirit duty was probably imposed on moral grounds; it was not merely a question of an ordinary tax, and the House of Commons could not be expected to view with approval any proposal for diminishing that duty. The Excise, who had to collect it, had very great difficulties in carrying out the law, and preventing smuggling, of which a certain amount still went on. People got sugar and water, and fermented it with yeast, and distilled it off in a small still, and made a rough spirit. The duty was so high that there was a great temptation for a certain class of people to smuggle if they could. He quite agreed that it would be possible for manufacturing chemists to work in bond, as perfumers did for export; but, as one who had had a certain amount of experience, he could warn them of the difficulties in working under a Government body like the Excise. He wished to speak well of the Excise in every way, for they were most considerate in listening to anyone's complaint; still it was not their business to learn your trade; if you wanted to make any improvement, you had to teach them, and if you made an improvement in the distillery the officers were moved on from one place to another, and there was always a chance that your invention would be at the disposal of your competitors. It was not possible to work a secret or private process. He was quite sure that chemists would not find it at all acceptable to be obliged to disclose their quantities and processes to the world at large, because it was not merely to the chemists of this country, but for chemists all over the world. If they could manage to attain the object of getting cheaper alcohol without working in bond, he thought they would be wise. Mr. Howard had spoken strongly about pushing the matter forward on all occasions, in season and out of season, but if they would take a word of advice from him it would be not to make themselves a sort of Irish party, or they would not be listened to at all. First of all, if they could thoroughly master the whole situation as it was at present, and state how many gallons of alcohol were used by manufacturing chemists in the United Kingdom at the present time, it would be of great assistance in showing the magnitude of the trade, and they would have then more chance of being listened to. Then he thought if they could get a remission of some of the differential duty on methylated spirit it would be a great advantage, but they would not get the 5*d.*; that was absolutely certain, because the 5*d.* was made up of various small items, 2*d.* of which stood for rectification in the rectifier's premises under duty-paid conditions; so that the actual drawback that they would be able to obtain would only be 3*d.*; that would be equivalent to the duty refunded to the distiller if he exported the same amount of alcohol, and he thought they might ask to be put in the same position as if they were working in a duty-free country such as the Channel Islands. Then they would get the 3*d.* This was a very important question, and he thought he could speak for the London distillers in saying that they would be happy to co-operate in any way whatever. They had always been successful in any application to the Excise, for many years past, they had interviewed every Chancellor of the Exchequer at some time or another, and he thought if they could only come to some arrangement a good deal might be done. He cordially agreed with the gentleman from Somerset House who put forward the suggestion of applying for some repayment of the differential duty on methylated spirit.

Mr. **Tyrer** said the discussion had exceeded his anticipations, and ventured to think that if it had taken place on the reading of the last paper it would not have been so practical or so useful for the object in view. A good deal had happened in 12 months: the Society, the Chambers of Commerce, and the trade papers had been educated. Although the distillers were stated to have been out of touch with them it had only been apparent, for it was clear that Mr. Nicholson apprehended the position and saw where the surplus spirit could go. It was a welcome sign of that co-operation which received so signal an illustration from Mr. Helm, and he hoped the same spirit would continue. He was quite sure that if there were a board of green cloth round which all the interests concerned could meet, something could be done, and they should not be sent away empty from the Chancellor of the Exchequer's door. The cost of spirit in Germany was 2*d.* per lb. according to the figures which Mr. Leuthardt-Thornton gave for 1900. Spirit here cost to-day 2*s.* 7*d.* per lb. for 95 per cent. alcohol by weight, or 15½ times as much. The figures as to the dye trade were taken from the American statistics, furnished by American Consuls; they showed the trade that might have been done by England. The figures showed the amount of the German production and exportation in 1901 to Great Britain and America, each taking about an equal quantity—11,000,000*l.* to Great Britain, and America 10,000,000*l.* This business was done chiefly because of the cheapness of raw material. So far as the products were concerned, they had been turned out, not only by the aid of cheap labour and science, but they had been made in Germany under conditions which our laws did not allow. That was an argument which no Chancellor of the Exchequer could afford to ignore. Mr. Helm's contribution to the discussion was of the highest importance, and it showed the spirit in which these matters were viewed officially. The suggestion to reduce the differential duty allocation on methylated spirit for industrial use was one originally made by Mr. Alfred White, a well-known manufacturer. With regard to Dr. Ormandy's remarks he was much interested the other day to see a paper which referred to this very matter from someone largely interested in the question of alcohol for motors, where there was a reference to a mixture of certain proportions of alcohol and petrol which was found to be extremely useful. He hoped that, when this paper was printed, particular attention would be paid to the tables to which he referred, which showed the broad principle that in the production of a great many articles a certain percentage of alcohol had to be used which cost only 2*d.* in Germany. In conclusion, he disagreed with Dr. Squire as to the loss of so great a capital by distillers in certain eventualities. Had the common practice of depreciation been neglected in distilleries? He should think otherwise, and understood that much of the plant was of an unusually stable character, possibly least affected by wear and tear of any chemical plant. In a word, most distilleries had written off very considerably by this time. If so, the capitalisation argument failed. Dr. Squire would no doubt be equal to the occasion when cheap spirit was granted. It must be granted if the common sense exhibited by the distillers represented by Mr. Nicholson prevailed. An important advance was made when they or he was willing to meet matters by relinquishing 3*d.* of the surtax. He thanked all who had so generously helped in this matter.

Newcastle Section.

Meeting held on Thursday, February 4th, 1904.

DR. J. T. DUNN IN THE CHAIR.

NOTES ON THE PRODUCTION AND USE OF LIQUEFIED CARBON DIOXIDE.

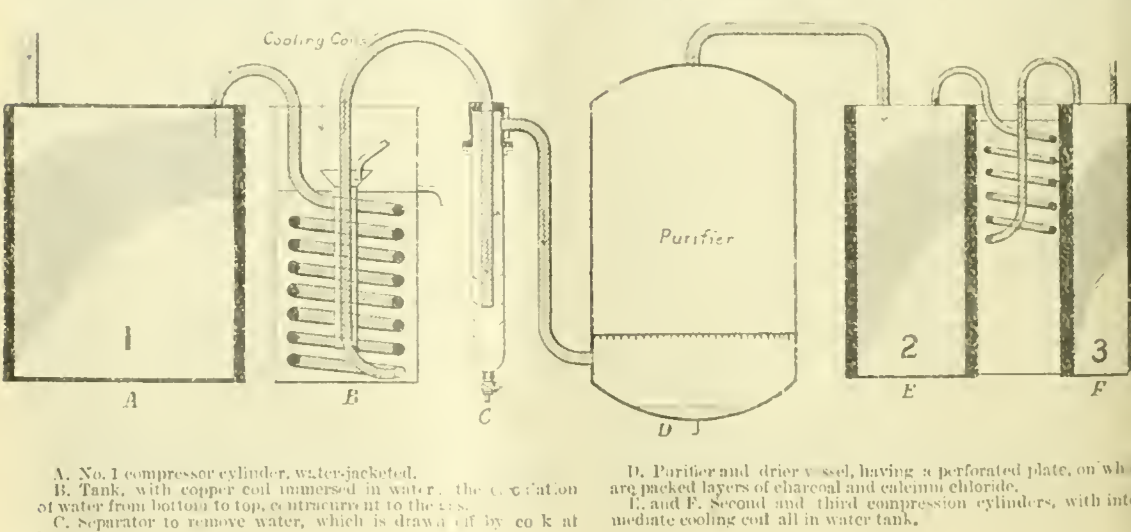
BY GEORGE SISSON.

Before describing the use of liquid carbon dioxide, it may be interesting to give a short account of the nature of the machinery used to liquefy and store the gas in such a condition that it may be easily and safely transported and handled. The gas, after being produced, is best stored in a holder built in an exactly similar manner to an ordinary gas-holder, the tank being filled with water on which is a layer of about $\frac{1}{4}$ in. or $\frac{1}{2}$ in. of mineral oil free from smell or action on the plates of the holder. The object of the mineral oil is to prevent absorption of the carbonic acid, which would cause the water to have a strong action on the plates of the holder: it also has the further advantage of protecting the outside of the holder from rusting, as every time it moves up and down the metal comes into fresh contact with the layer of oil, which obviates the necessity of painting the holder, with the exception, of course, of the top. The compression itself is best done in three stages—the first stage up to about 5 atmospheres, the second to about 15 atmospheres, and the third up to whatever pressure is required to liquefy the gas at the temperature at which the machinery is working. Between each two stages, the gas passes through a cooling coil surrounded by water, or other apparatus by which the heat of each compression is abstracted before the gas passes on to the next cylinder. The first cylinder receives a small injection of water along with the gas, the water acting partly as a lubricant and partly to reduce the temperature of the first compression: this water is separated by means of a receiver before the gas passes on to No. 2 cylinder. Cylinders Nos. 2 and 3 work in leather rings similar to a hydraulic packing, and are lubricated by means of an injection of glycerin, the glycerin being separated by a special receiver before the liquefied gas is passed through cooling coils into the tubes in which it is stored. With reference to the working of such a compressor, it is well known that if the final temperature be above 31° C. (which is the critical temperature for carbon dioxide), no liquid will be formed; consequently, it is necessary, especially in warm weather, to have a large final cooling surface, which is most conveniently made in the form of a copper coil in a tank of cold water. From this the gas is led into a long copper tube having several attachments so that several bottles can be filled at the same time. The course of the gas through the apparatus is shown in the diagram.

As these bottles have to stand a very considerable pressure (varying from about 800 to 1,200 lb. per square inch according to the temperature of the air) and are also sometimes subjected to a large amount of rough usage, it is necessary that there should be a large factor of safety and that they should be made in a special manner. The modern practice in this country is to make them of solid-drawn, soft steel, either from a plate or a bloom, the average composition of the steel being:—

	Per Cent.
Iron	99·2
Manganese	0·5
Phosphorus	0·04
Sulphur	0·04
Carbon	0·2 to 0·25

The neck of the tube is welded up, and screwed to receive the valve. Prof. Ferrier, of the Durham College of Science, made several tests of strips cut from one of the bottles so manufactured, and found the metal to have a breaking strain of 35 tons per square inch. After manufacture, the tubes are carefully annealed by heating to a dull red heat and allowing to cool gradually, after which they are subjected to a hydraulic test of 3,360 lb. ($1\frac{1}{2}$ tons) per square inch. The weight of a tube to contain 28 lb. of the liquid is



A. No. 1 compressor cylinder, water-jacketed.

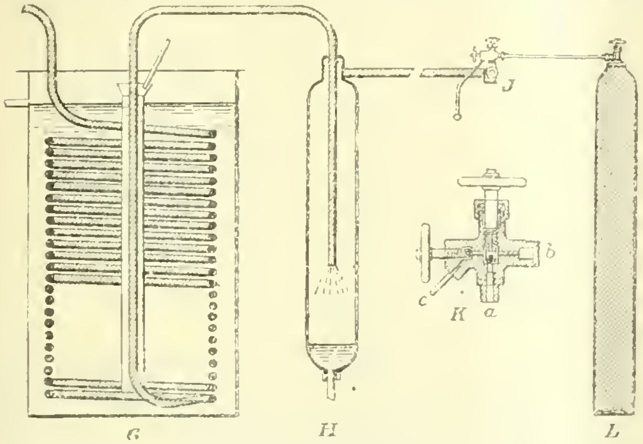
B. Tank, with copper coil immersed in water, the circulation of water from bottom to top, contracurrent to the gas.

C. Separator to remove water, which is drawn off by cock at bottom.

D. Purifier and drier vessel, having a perforated plate, on which are packed layers of charcoal and calcium chloride.

E. and F. Second and third compression cylinders, with intermediate cooling coil all in water tank.

from 70 to 80 lb. and the capacity of such a tube is about 38 lb. of water, that is to say that for ordinary use three-quarters of the weight of water which the tube will contain is the amount of gas which ought to be filled into the tube, while for tropical climates or stokeholds of vessels, the weight of gas ought to be two-thirds of the water capacity, allowing a larger margin for expansion. The process of annealing and hydraulic testing is repeated about every three years, and any tubes which show an appreciable amount of permanent expansion are rejected. For example, the usual amount of stretch of such a tube when under 3,360 lb. pressure is about 10 cb. ins., or 1 per cent. of total volume. When the pressure is relieved, the amount of permanent expansion must not exceed 1 cb. in. With fair treatment, the loss of weight by corrosion in such cylinders is extremely small, the principal damage being from outside rusting through exposure to weather or salt water. Some of the tubes used by the Washington Chemical Co., Ltd., were protected on the outside by the Cowper-Coles cold galvanising process, in which process the iron is cleaned without the use of sulphuric acid by means of a sand-blast and the zinc deposited electrolytically. The valves are made from dense brass or gun-metal. Fig. 1 shows a section, *a* being screwed into the neck of the steel tube, *b* screwed outlet. A vulcanite inserted plug, actuated by a wheel on spindle, opens or closes the communication between *a* and *b*. Fig. 2 shows a form of valve fitted with Carty's safety disc, which, on excessive pressure, bursts and allows escape of gas through hollow spindle. Fig. 3 shows a section of Hall's safety disc valve, *a* being the steel tube communication, *b* the outlet, and *c* having a closing disc of copper, adjusted to burst at excessive pressure. These two latter forms of valve are particularly suitable for the tropics and for use on board ship. It is one of the regulations of the railway companies that a woven mat protection be used when full carbonic acid tubes are sent by rail.



G. Final cooler, where the liquefying takes place.

H. Separator, to remove any glycerin which passes over from the cylinders.

J. A long copper tube fitted with several valves, similar to K, by which several store bottles may be filled simultaneously.

K. Filling valve :—*a*. Liquid gas inlet from compressors. *b*. Outlet to store tube. *c*. Communicates with gas-holder and serves to discharge residual gas from filling-tube, before detaching tubes.

Unlike liquid air, it is not possible to have liquid carbon dioxide at atmospheric pressure, as the liquid, when released from pressure, become partly gasified and partly solid. This is shown by allowing an escape from one of the tubes, the valve of which has a pipe dipping down inside to the bottom of the bottle.

The commercial uses of the liquid are: first, in the manufacture of various aërated drinks, the apparatus for which is no doubt familiar. Another use of the tube gas, which is almost universal in Germany, is for forcing beer from the casks to the taps. The advantage of this over pumping is that the beer is constantly kept aërated, or rather carbonated, and that no foul air from the cellar is drawn into the cask as in the ordinary method of pumping; on this account, I understand, such a method is compulsory in Germany.

The next great use is for refrigeration; this use depends, of course, upon the fact that the whole of the heat given out in compressing and liquefying the gas is abstracted on the evaporation of the liquid, also that the work done in the expansion of the gas absorbs heat, as is shown by the small engine which can be worked by the carbonic acid stored in the tube. The two substances principally used in refrigerating machinery are ammonia and carbonic acid gas; each material has its advantages and disadvantages, the advantage in the case of ammonia being low liquefying pressure (under ordinary circumstances about six atmospheres, while carbonic acid requires about 40 or 50), but the poisonous nature of any escape from an ammonia machine in a confined space (as, for example, on board ship) may lead to serious accident, while the same amount of escape of carbon dioxide is quite harmless, especially as the escape being at high pressure, the gas mixes to a considerable extent with the air. The principle of the carbonic acid refrigerating machine is entirely based upon the evaporation of the liquid.

Some experiments have recently been made by the London Fire Brigade with a jet of water propelled by means of high-pressure carbonic acid, as a means of extinguishing fires. With such an injector it would be possible to force water up to a great height without any mechanical pumping, or to supplement the deficiency of pressure in the hydrants, and, of course, the carbonic acid would tend to extinguish the fire, apart from the water.

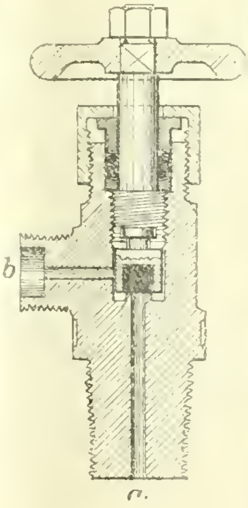


Fig. 1.

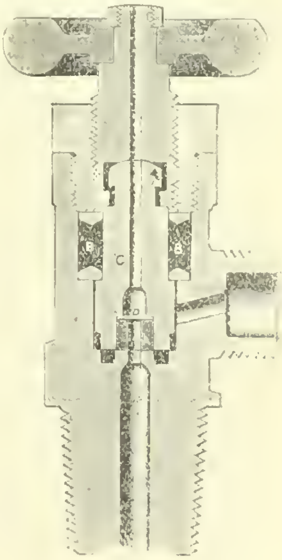


Fig. 2.

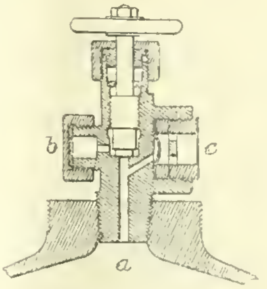


Fig. 3.

Finally, I might draw attention to the Westinghouse electro-gas method of railway signalling, described in "Engineering" of Dec. 4 last. Here a tube of gas is used at outlying stations to supply motive power for working the signals in order to avoid the expense of having compressing machinery or long lengths of connecting pipes. The carbonic acid tube is connected to the piston working the signal, and the valve admitting the gas is controlled by an electric current which is transmitted by wire to any distance. The details given in the above named paper show that with a working pressure of 25 lb. per square inch in the expansion chamber (which pressure can, of course, easily be obtained by the use of a regulator), an average of 215 signal movements to each pound of liquid gas was obtained, so that one tube, containing 28 lb. of gas, will suffice for about 6,860 movements.

Scottish Section.

Meeting held on Tuesday, February 23rd, 1904.

MR. T. L. PATTERSON IN THE CHAIR.

THE ESTIMATION OF CYANATES.

BY THOMAS EWAN, PH.D.

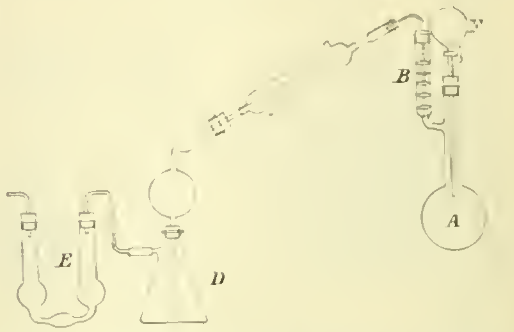
When potassium or sodium cyanide is heated in presence of air, oxidation takes place and a cyanate is formed. For this reason commercial cyanides frequently contain small quantities of cyanate. Owing to the difficulty which I experienced in determining the quantity of this substance in samples of cyanide I was led to investigate the sources of error in the known methods and to try to eliminate them. The quantitative determination of a cyanate may be based on (1) the insolubility of the silver salt, (2) the decomposition of an aqueous solution of cyanic acid into carbon dioxide and ammonia.

1. Silver cyanate is somewhat soluble in water. I found that 100 c.c. of water at 12° C. dissolve 0·006 grm. of it; the precipitation of small quantities of cyanate is, therefore, by no means complete. The separation of silver cyanate and cyanide by means of dilute nitric acid is also unsatisfactory: silver cyanate dissolves somewhat slowly in cold 5 per cent. nitric acid, whilst the hot acid dissolves silver cyanide. It is therefore difficult to make sure of dissolving all the cyanate without dissolving some of the cyanide. The following analysis of a sample of sodium cyanate will serve as an example. The only impurities present were sodium cyanide and a little water. The cyanate and cyanide were precipitated together by an excess of N/20 silver nitrate solution and the excess of silver determined in the filtrate by titration with ammonium thiocyanate. The silver cyanate was then dissolved by digestion with cold 7 per cent. nitric acid, and the dissolved silver titrated with ammonium thiocyanate. This gave NaCNO = 90·10 per cent.; NaCN = 5·15 per cent. Direct titration of the cyanide by Liebig's method gave 4·53 per cent. NaCN, hence the silver cyanate would appear to have been incompletely dissolved by the nitric acid. The excess of silver nitrate used in precipitating the silver cyanate diminishes its solubility to some extent; an approximate calculation showed that the filtrate and washings contained silver cyanate equivalent to 2·75 per cent. of the substance used. These two errors therefore make the determination of the cyanate about 3·5 per cent. too low, or the real content would be 93·65 per cent. The average of several determinations made by the method described below was 93·7 per cent.

The sources of error mentioned become of greater importance when the quantity of cyanate is small compared with that of cyanide, and in presence of hydroxides and some other substances giving silver salts soluble in nitric acid the method was found to be incapable of giving even approximately accurate results.

2. The method based on the decomposition of cyanic acid, $HCNO + H_2O = NH_3 + CO_2$, was found to possess the advantage of being applicable in presence of any of the substances which usually occur along with cyanides. The accuracy is not very great, but it is sufficient for most purposes.

The apparatus used, which has proved very serviceable in several other cases in which a quantitative distillation has to be made, is shown in Fig. 1. About 1 grm. of the sample, dissolved in 50 c.c. of water, is brought into the 100 c.c. distilling flask A, the side tube of which is bent upwards and sealed to a "rod and disc" fractionating column B about 4 inches long. This is very effective in preventing splashes or spray from the distilling flask being carried over into the condenser. The flask D and the U-tube E contain a dilute solution of caustic soda and baryta free from carbonate. A quantity of alkali equivalent to 40—50 c.c. of normal caustic soda is sufficient; a large excess makes it difficult to wash the precipitate of barium carbonate completely. The pressure within the apparatus is kept slightly below that of the atmosphere during the distillation. The determination is made by adding (by means of the funnel F) hydrochloric or sulphuric acid to the liquid in the distilling flask until it is acid to methyl orange, avoiding a large excess of acid, and then distilling off 30—40 c.c. of liquid, finally sweeping out the apparatus with a slow current of air free from carbon dioxide. The $BaCO_3$ formed in D and E is filtered off, washed, and titrated with N/10 HCl. The amount of carbonate present is determined in another portion of the sample by precipitating with barium chloride in the cold (since barium cyanate decomposes when boiled). It is of course equally possible to remove the carbonate from the cyanate solution before distillation.



The hydrocyanic acid passes over quantitatively along with the carbon dioxide, and may be determined by titrating the filtrate from the precipitate of barium carbonate in the usual way. The following estimations were made in this way:—

Real Percentage of NaCN.	NaCN found by Distillation.
47·02	46·86
32·94	33·14
16·49	16·87

The solution remaining in the distilling flask contains the whole of the ammonia, formed by the decomposition of the cyanate, in the form of chloride or sulphate. After addition of caustic soda it is distilled off and collected in N/10 hydrochloric acid, when, as is usually the case, there is no other substance present which can form ammonia by boiling with caustic soda. This is a very useful check on the figure obtained from the carbon dioxide. If more ammonia is found than corresponds with the carbon dioxide the presence of some nitrogenous substance other than cyanide or cyanate may be inferred.

The following analyses will serve to indicate the degree of accuracy which may be obtained with the method described:—

Percentage of NaCNO present.	Percentage of NaCNO found.	
	From CO_2.	From NH_3.
28·87	..	26·29
20·19	..	19·12
42·54	43·67	..
42·54	41·41	..
..	92·60	94·25
..	93·17	94·25
3·86	3·47	3·57
3·66	..	3·62
3·06	2·84	3·72
3·06	3·09	3·72
..	3·10	3·57

The samples analysed contained most of the impurities which are usually to be found in commercial cyanides. It may be pointed out that if sodium or potassium carbamate were present it would behave in the same way as cyanate.

I am indebted to the Directors of the Cassel Gold Extracting Company for permission to publish these results.

Yorkshire Section.

Meeting held on Monday, January 25th, 1904.

MR. JAS. E. BEDFORD IN THE CHAIR.

NOTE ON "SOME RECENT METHODS OF TECHNICAL WATER ANALYSIS," BY PROF. H. R. PROCTER.

(This J., 1904, 8—11.)

BY L. ARCHBUTT.

The method of determining free carbon dioxide in water by titrating with a standard solution of sodium carbonate,* attributed to me by Prof. Procter, I first heard of by reading a paper by Leeds (J. Amer. Chem. Soc. 1831, page 98), abstracted in this Journal, 1891, page 726. Having been in want of a good simple method, and finding this answered my purpose, I adopted it, and mentioned it in a discussion which took place at a meeting of the Yorkshire Section in April 1892, which I happened to attend, in answer to a question put to me. The process has since been thoroughly investigated by Seyler (Chem. News, Vol. 70, 1894, pp. 104, &c.), and again in the Analyst (Vol. 22, 1897, p. 312), and by Ellms and Beneker (Chem. News, Vol. 84, 1901, p. 145, from the J. Amer. Chem. Soc., Vol. XVIII., No. 6.).

The method was also described by Trillich, of Munich, in 1890, and is sometimes referred to as the Lunge-Trillich method; but Leeds, working independently, was the first to make it known in this country.

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* H. Bretel (J. Pharm., 23, 339—341), abstracted in Chem. Soc. 1891, 862, recommended standard K_2CO_3 solution for the above purpose. This is practically the same method.

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French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3e).

I.—PLANT, APPARATUS AND MACHINERY.

Factory Chimneys; Wind Pressure on ——. A. Ostenfeld. Ingeniøren, 1903, 199; Proc. Inst. Civil Eng., 1903, **154**, 61—62.

THE following conclusions are drawn, as the result of an examination of the dimensions and details of several factory chimneys damaged by a gale in Denmark on Dec. 25—26, 1902:—(*a*) The empirical rules for calculating the stability of chimneys from their dimensions are unreliable; (*b*) the wind pressure should be taken as 150 kilos. per sq. m. (31 lb. per sq. ft.) acting, for round chimneys, on two-thirds of their external diameter; (*c*) for hard-burnt brick laid in cement mortar, the greatest crushing strain, when free from wind pressure, should not be allowed to exceed 15 kilos. per sq. cm. (220 lb. per sq. in.), unless the crushing strength has been directly proved to be not less than 250 kilos. per sq. cm., in which case a crushing strain of not more than 25 kilos. per sq. cm. is permissible.—T. F. B.

ENGLISH PATENT.

Drying Apparatus; Impts. in ——. H. J. Haddan, London. From The Edson Reduction Machinery Co., Ohio, U.S. America. Eng. Pat. 25,059, Nov. 17, 1903.

THE dryer is composed of a number of renewable and interchangeable annular cylindrical chambers, surrounded by a steam heating jacket, and provided with suitable flanges, so as to be bolted together and threaded on to a central horizontal shaft passing through their midst, to which are attached stirring arms, radially arranged. Openings are provided for the admission of the substance to be dried, for drainage, and for the escape of the hot vapours.—L. F. G.

UNITED-STATES PATENTS.

Motive Power; Process of Generating ——. A. Schütt, Charlottenburg, Germany. U.S. Pat. 750,493, Jan. 26, 1904.

METHYL chloride is mixed with water and heated, the methyl chloride vapours being used to drive a motor. —L. F. G.

Motive Power; Generation of ——. A. Schütt, Charlottenburg, Germany. U.S. Pat. 750,194, Jan. 26, 1904.

SULPHUROUS acid is mixed with a mineral oil and the mixture heated, the sulphurous acid vapour being used as a driving medium.—L. F. G.

Furnace. G. Garrett, Coatbridge, Scotland. U.S. Pat. 750,635, Jan. 26, 1903.

A HOLLOW annular casing, with its inner side perforated, is placed beneath the furnace and supporting its side walls. The casing is connected with an air-blower and water-boxes placed in the side walls of the furnace.—L. F. G.

Flask for Volatile or other Liquids. H. Goetz, Frankfort-on-Maine, Germany. U.S. Pat. 750,637, Jan. 26, 1904.

A COLLAR is cemented to the neck of a flask, and a sleeve, divided into two parts by a perforated partition, screwed on to it. A washer is placed between the partition and the neck, and a flanged capillary tube passed through the partition into the flask, the flange resting upon the partition in the sleeve. Above this is placed another capillary discharge tube containing a plug of absorbent material, and the whole closed air-tight by a cap screwed on to the sleeve. —L. F. G.

Centrifugal Apparatus. A. Liedbeck, Stockholm. U.S. Pat. 750,668, Jan. 26, 1904.

THE apparatus contains an outer drum, tapering upwards, and a similar inner drum, provided on its outer surface with screw threads, these fitting closely to the inner surface of the outer drum. Outlets are arranged near the bottom of the inner drum between the threads, and discharge apertures at the bottom of the outer drum, the liquid being thus subjected to the action of the centrifugal force for a long period.—L. F. G.

Suspended Matter; Apparatus for Removing —— from Liquids by Continuous Decantation. T. R. Wollaston, Manchester. U.S. Pat. 751,038, Feb. 2, 1904.

INSIDE a precipitating vessel are arranged a series of pivoted parallel depositing shelves, with corrugations running transversely to the path of the liquid, and to the pivots, and provided alternately with openings at the ends, so that the liquid circulates over them in zigzag fashion. —L. F. G.

Filtering Machine. J. W. Osborne, Winchester, Ill., U.S.A., Assignor to C. Smithson and S. Hainsfurther. U.S. Pat. 751,805, Feb. 9, 1904.

THE apparatus consists of a cylinder with a filtering diaphragm at one end, a piston and a piston rod; this latter extends through the other end, and is connected by a rack and pinion to a handle, by means of which it can always be returned to its initial position. Steam, admitted through a pipe, forces the piston towards the diaphragm, and a liquid, which is admitted through suitable supply pipes, is thus filtered through under pressure.—L. F. G.

FRENCH PATENTS.

[illegible] Copper (Heat-retaining) Vessel. I. Rosberg and Co. Fr. Pat. 335,178, Sept. 21, 1903.

THE apparatus consists of an inner and an outer cylindrical vessel, the intermediate space being filled with some non-conducting material, such as wood shavings or paper clippings. An insulating cover, with a grooved rim, fits hermetically on the outer vessel.—L. F. G.

Incrustation of Boilers; Means for Preventing the ——. W. Gawlikowski. Fr. Pat. 335,597, Sept. 28, 1903.

To remove, and prevent scale forming in boilers, coal or charcoal dust is mixed with the feed-water. Before using a boiler, after an interval of rest, $1\frac{1}{2}$ litres of coal-dust are put into it.—L. F. G.

II.—FUEL, GAS, AND LIGHT.

Incandescent Gas Mantle; Unbreakable ——. Sysoyeff. J. Usines à Gaz, 1903, 178. Proc. Inst. Civil Eng., 1903, **154**, 45.

IT is stated that, by adding fragments of old mantles to the thorium-cerium impregnating bath, mantles of great strength are obtained, whilst the luminous efficiency is in no way diminished.—T. F. B.

Osmium [Electric] Lamps; Efficiency and Colour of ——. F. G. Baily. Electrician, 1904, 646.

THE average results obtained by the author with a number of 32 candle-power 55-volt osmium lamps (see Eng. Pats. 13,116 and 17,580 of 1898, 7210 and 7211 of 1900; this J., 1899, 571, 746; 1901, 32, 236) were as follows:—

E.M.F.	Current.	Candle Power.	Watts per Candle.	Candles per Watt.	Resistance.
Volts.	Amperes.				Ohms.
30·3	0·744	2·30	9·80	0·102	40·7
35·4	0·812	4·81	6·00	0·167	43·7
40·4	0·900	8·76	4·26	0·235	45·0
45·5	0·970	14·50	3·04	0·330	46·8
50·5	1·032	22·00	2·37	0·422	48·8
55·6	1·106	32·60	1·89	0·529	50·2
60·6	1·178	45·40	1·57	0·637	51·4

With regard to the life of the osmium lamps, Wedding found that of 18 lamps, the average life was over 1,900 hours, whilst some of them lasted for upwards of 4,000 hours. The average candle-power at the end of the life was about 80 per cent. of the initial value. The author considers that though the low resistance of the osmium lamps renders them inconvenient for use as single lights, yet their high efficiency (1·9 watts per candle at the normal E.M.F. of 55 volts) may allow of their being used advantageously in place of carbon filament lamps, when groups of lights are required. Taking into consideration the life and maintenance of efficiency of the osmium lamp, it may be considered to have at least double the efficiency of the carbon lamp under equivalent conditions. The colour of osmium lamps appears to be similar to that of carbon lamps having an efficiency of 2·1 watts per candle. Osmium lamps are suitable for use as secondary standards of light, owing (1) to the whiteness of the light; (2) to the small deterioration of the candle-power; and (3) to the smaller variation of candle-power with change of E.M.F., rendering error of adjustment of E.M.F. less serious than in the case of the carbon lamp. When used as standards, the lamps should be adjusted to a definite E.M.F., not to a definite current.—A. S.

Mercury Arc-Lamp of Quartz Glass [Mercury Vapour Lamp]. M. Bodenstein. Zeits. für Elektrochem., 1904, **10**, 123.

THE author describes an H-shaped mercury vapour lamp of fused quartz, with iridium electrodes fused into the quartz. The capillary passages around the iridium are protected by external mercury cups, which prevent ingress of air. The arc—2 amperes at 100 volts—plays between the two mercury surfaces, along an almost horizontal tube, 1 cm. diameter and 17 cm. long. The striking of the arc is effected by electrically heating one of the side tubes, the pressure of mercury vapour causing the mercury to flow along the tube and make contact with the metal contained in the other limb, after which the heating current is automatically cut out.—R. S. H.

Gas-Analysis by Combustion ; Calculation of ——. A. Wohl. XXIII., page 269.

ENGLISH PATENTS.

Coking Hydrous-Bituminous Combustibles ; Method and Apparatus for ——. P. Höring, Berlin, and J. A. Mjöen, Christiania. Eng. Pat. 21,968, Oct. 12, 1903.

EE Fr. Pat. 334,448 of 1903 ; this J., 1904, 54.—T. F. B.

Water-Gas ; Process of and Apparatus for Generating ——. F. Bauke, Ufer, and C. Fuchs, Berlin. Eng. Pat. 4019, Feb. 20, 1903.

EE Fr. Pat. 329,028 of 1903 ; this J., 1903, 990.—T. F. B.

Gas Producers ; Stoppers for ——. E. and S. Tweedale and J. Smalley, Castleton, Lancs. Eng. Pat. 6438, March 20, 1903.

HERE is described a device for facilitating the opening and losing of the poke holes of gas producers, consisting of an djustable spring plug or stopper, controlled by a handle or ever, and held in the closed position against the face of the oke hole by means of a spring point and catch.—H. B.

Gas-Lime and other Spent Lime ; Method of and Apparatus for Converting —— *into a more Marketable Commodity or Product.* J. Lowden. Eng. Pat. 7622, April 2, 1903. IX., page 253.

ncandescent Mantles ; Manufacture of ——. G. H. Maisch, Baltimore, U.S.A. Eng. Pat. 24,815, Nov. 14, 1903.

EE U.S. Pat. 712,562 ; this J., 1902, 1527.—H. B.

Electrodes for Arc Lamps. A. Edelmann, Charlottenburg. Eng. Pat. 7783, April 3, 1903.

EE Fr. Pat. 327,156 of 1902 ; this J., 1903, 861.—T. F. B.

UNITED STATES PATENTS.

Fuel Blocks [Briquettes] ; Artificial ——. M. W. Cottle, St. Louis, Mo., U.S.A., Assignor to Coaleo Fuel Manufacturing Co. U.S. Pat. 751,468, Feb. 9, 1904.

EIGHTY-FIVE parts of powdered coal, 8 parts of sawdust. parts of rosin, and 2 parts of glue are intimately mixed ogether, heated by steam, and moulded while hot into riquettes.—L. F. G.

Gas ; Manufacture of ——. W. A. Könemann, Chicago, Ill. U.S. Pat. 749,302, Jan. 12, 1904.

STEAM is introduced into a producer containing a bed of arbonaceous material, briquetted carbonaceous fuel, or fuel briquettes composed of an agglutinated mixture of anthracite and bituminous coals, whilst surplus heat, practically free rom nitrogen, from an operating electric furnace is conducted into the producer ; the arc generates gas and upplies more heat to the producer than is abstracted by dissociation of the water-vapour ; alternatively the materials are fed into the producer, air being excluded.—J. K. B.

Carbonic Acid in Gases ; [Electrical] Method of Determining the Quantity of ——. G. Bodländer. U.S. Pat. 751,897, Feb. 9, 1904. XXIII., page 273.

FRENCH PATENTS.

Gas Retorts ; Manufacture of ——. R. J. P. Cottancin. Fr. Pat. 335,625, Sept. 14, 1903.

To prevent the iron or steel framework of furnaces from being carbonised by the action of the oxides of carbon diffusing through the refractory lining, the steel or iron columns are surrounded by a protective casing of copper, or some other metal which does not get carbonised, and the space between filled in with some oxidising material, either in the form of powder or mixed with clay. The furnace is built up of square hollow iron boxes, filled with a refractory material, and clamped or hinged together, and to the framework by suitable means. Or, the iron boxes may be dispensed with, and the bricks embedded in some refractory clay. The bricks may be perforated or hollow, so as to allow any desired oxidising, reducing, or carbonising material to be filled in.—L. F. G.

Gas Scrubber. L. Valette. Fr. Pat. 335,803, Sept. 19, 1903.

THE scrubber comprises three concentric vertical casings, the middle and outer casings being closed by means of dome-shaped tops ; the inner casing is filled with coke or the like, and water is distributed over both the coke and the exterior of the middle casing. The gas to be purified is led up through the coke, whereby most of the impurities are eliminated ; it then passes down the annular space between the inner and middle casings, and finally passes up the outer annular space, where it is further purified by the descending water. A readily accessible water-seal device is provided at the base of the apparatus for removing the collected dirt and letting the wash-water pass off.—H. B.

Gas-purifying Materials ; [Automatic] Revivification of ——, *used in Gas Works.* E. E. Delcourt. Fr. Pat. 335,647, Sept. 30, 1903.

THE main gas-meter of the works is connected by means of a chain and cog-wheels to a smaller meter, the rate of transmission being such, that the latter admits 14 litres of air into the purifiers for every cubic metre of gas that passes. This amount of air is sufficient to continuously revivify the spent materials. To compensate for the loss in illuminating power caused by dilution with this amount of air, the gas may be bubbled through a mixture of water and benzol ; thereby the naphthalene is retained, and choking of the pipes prevented.—L. F. G.

Mantles ; Incandescence ——. L. Faucillon. Fr. Pat. 335,811, Oct. 5, 1903.

MANTLES are strengthened by interweaving into the impregnated fabrics strong longitudinal threads, of ramie or the like, which have been impregnated with a solution of nitrates of thorium, cerium, and didymium.—H. B.

Carbons of Electric Arc Lamps. A. Blondel. Addition, dated Dec. 22, 1902, to Fr. Pat. 323,924, Aug. 22, 1902.

SEE Eng. Pat. 23,262 of 1902 ; this J., 1904, 112.—T. F. B.

Arc-Lamp Carbons ; Utilisation [as Pigments] of Waste ——. R. Peters. Fr. Pat. 335,795, Sept. 16, 1903. XIII. A., page 260.

Fats and Fatty Acids ; Treatment of —— *[for Candle Material].* O. Hausamann. Fr. Pat. 335,768, Oct. 6, 1903. XII., page 260.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Liebermann's Thiophene Reaction. C. Schwalbe. XXIII., page 273.

Syrian Asphaltum for Printing Plates and Window Transparencies. C. Fleck. XXI., page 268.

ENGLISH PATENTS.

Evaporating Apparatus [for Naphtha, &c.]. H. J. Haddan, London. From E. R. Edson, Cleveland. Eng. Pat. 7520, March 31, 1903.

SEE U.S. Pat. 723,849 of 1903 ; this J., 1903, 561.—T. F. B.

Shale Oil and Similar Substances ; Method of Treating [Desulphurising] ——. A. Adiassewich, London. Eng. Pat. 4431, Feb. 25, 1903.

SHALE oil and other mineral oils are desulphurised by heating under pressure successively with dilute sulphuric acid, caustic soda, and aluminium chloride. For example, the burning oil obtained by the distillation of shale oil is heated with about 0·75 per cent. of its weight of 60 per

cent. sulphuric acid, to 40°—50° C., under a pressure of 15 to 20 lb. per sq. in., for about half an hour, the whole being agitated during the process. The oil is separated, washed, and treated with about 0·3 per cent. of its weight of caustic soda liquor (sp. gr. about 1·32) at a temperature near the boiling point of the oil, the pressure being maintained at 25 to 30 lb. per sq. in. This treatment is continued until the mixture is completely emulsified. The oil is then washed, dried, and heated with about 2 per cent. of aluminium chloride to about 150° C., under reflux condenser. The pressure is then raised to 10—12 lb. per sq. in., and maintained for about three hours, when the oil is separated, washed with water containing a little lime, and finally distilled. The temperatures and pressures used, vary, in general, with the boiling point of the oil to be treated.
—T. F. B.

United States Patent.

Wood Distillation; Apparatus for——. J. W. Spurlock, Tyty, Ga. U.S. Pat. 751,698, Feb. 9, 1904.

A vertical retort is provided at its bottom with a tar-discharge pipe, and at the top with a vapour-outlet pipe; the condensed creosote is drawn off through a pipe leading from the vapour-outlet pipe, and the more volatile portion of the distillate passes to a separator, where a further portion of the vapour is condensed and removed; the vapours pass thence through a series of condenser pipes "forming a circuitous passage," and discharging into a tank. Just below the upper end of the condenser pipes there is fitted a valve-controlled water-discharge pipe.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Symmetrical γ-dihydroxy-γ-diphenyl Anthracene Dihydride from Anthraquinone. A. Haller and A. Guyot. Comptes rend., 1904, **138**, 327—329.

The authors have, with the aid of magnesium phenyl, prepared this substance, which bears the same relation to phthalic green and kindred derivatives (this J., 1903, 1240) that triphenylcarbinol does to the triphenylmethane derivatives. To magnesium powder suspended in ether are added a fragment of iodine and the calculated amount of monobromobenzene. When reaction is complete, anthraquinone suspended in ether, is very gradually added. Ultimately a pasty mass is formed, which is treated with water acidulated with hydrochloric acid, and purified by a long series of treatments with boiling methyl alcohol. Colourless brilliant needles are formed, which quickly lose alcohol of crystallisation, and effloresce to a white powder, m.pt. 242° C. The substance dissolves in strong sulphuric acid with a fine indigo colour, which becomes orange-yellow on heating on the water-bath.—J. T. D.

Anthraquinone-α-monosulphonic Acid. M. Dünschmann. Ber., 1904, **37**, 331—333.

It is usually supposed that in sulphonating anthraquinone for "blue shade," β-sulphonic acid is formed with varying quantities of α- and β-disulphonic acid, depending on the strength of sulphuric anhydride employed and the temperature used. The author, however, shows that α-monosulphonic acid is simultaneously produced, though only in small quantity, whilst, owing to oxidation, hydroxysulphonic acids are formed, especially hydroxyanthraquinone disulphonic acid. The isolation of the α-acid was effected by removing the main portion of "silver salt" (sodium anthraquinone-β-monosulphonate) and concentrating the filtrate by evaporation to separate a further batch of crystals, so that the final solution contained chiefly the 2:7-disulphonic acid. The middle fraction is a mixture of the sodium salts of the following acids:—2:6-anthraquinone disulphonic acid, α- and β-anthraquinone monosulphonic acids, and hydroxy anthraquinone-sulphonic acids. On treating a hot saturated solution with 10 per cent. of a 45 per cent. solution of caustic soda and cooling to 50°—55° C., the greater part of the 2:6-disulphonate salt crystallises out with the "silver salt," whilst the mother liquor on further cooling deposits the sodium salt of α-monosulphonic acid, which, when purified by repeated recrystallisation from dilute caustic soda solution, forms golden-yellow, lustrous laminæ. On treating the alpha salt with ammonia and zinc dust, a deep reddish-yellow coloration is obtained, whilst the beta salt gives, under similar conditions, a brownish-yellow colour reaction. The α-position was further confirmed by the formation of erythrohydroxyanthraquinone according to a method recently patented, and consisting in heating the salt with lime under pressure. The conversion takes place at 130°—140° C., at which temperature the "silver salt" fails to react with lime.—D. B.

Bisulphites; Action of —— on Aromatic Amino and Hydroxy Compounds. H. T. Bucherer. J. für Prakt. Chem., 1904, **69**, 49—91.

If aromatic amino compounds be heated with aqueous sodium bisulphite to a moderate temperature, ammonia is evolved, and products are formed which appear to be sulphurous acid esters, *e.g.*, *m*-phenylenediamine gives aminophenol sulphurous acid ester, and also dihydroxybenzene esters; the equation in the first case being $H_2N.C_6H_4.NH_2 + 2NaHSO_3 = H_2N.C_6H_4.O.SO_2H + Na_2SO_3 + NH_3$. These esters are easily saponified by alkalis, and thus it is possible to convert amino groups into hydroxyl groups. Similar esters are produced by the action of sodium bisulphite on aromatic hydroxy compounds, as shown by the following example:—$C_{10}H_6(OH)(SO_3H) + 2NaHSO_3 = Na_2SO_3 + H_2O + C_{10}H_6(O.SO_2H)(SO_3H)$. If aromatic hydroxy compounds are heated with ammonium sulphite and ammonia, the hydroxyl groups are replaced by amino ones, sulphurous esters being formed as intermediate products, *e.g.*, β-naphthol gives β-naphthylamine. The ammonium sulphite appears to act as a carrier, thus—

$$\begin{aligned}C_{10}H_7OH + (NH_4)_2SO_3 + NH_3 &= C_{10}H_7.O.SO_2.NH_4 + 2NH_3 + H_2O\\ &= C_{10}H_7.NH_2 + (NH_4)_2SO_3 + H_2O.\end{aligned}$$

—A. B. S.

Betaïnes; Some Aromatic ——. R. Willstätter and W. Kahn. Ber., 1904, **37**, 401—417.

The behaviour on warming of the trimethyl-betaïnes of *o*-, *m*- and *p*-aminobenzoic acids, and of the betaïne from phenylglycocoll, was investigated, and it was found that they all behaved in a similar manner, being converted by intramolecular transformation into the corresponding dimethylaminobenzoic acid methyl ethers, whilst the betaïne from phenylglycocoll formed the methyl ether of phenylmethylglycocoll. In the case of the betaïne from anthranilic acid, the transformation was accompanied by a bye-reaction, a certain amount of dimethylaniline being formed. Whereas *m*- and *p*-aminobenzoic acids are readily methylated by means of methyl iodide to the corresponding betaïnes, the preparation of the betaïne of anthranilic acid requires much more energetic alkylation.—E. F.

Nitro Compounds of the Naphthalene, Anthracene, and Phenanthrene Series; Electrochemical Reduction of——. J. Möller. XI. A., page 257.

English Patents.

Indigo [Indigo Dyestuffs], Soluble; Manufacture of——. B. Bury, Church, and B. W. Gerland, Accrington. Eng. Pat. 5328, March 7, 1903.

Refined natural or artificial indigo is heated with one to three times its weight of concentrated sulphuric acid. The temperature may be finally raised to 120°—140° C. The resulting product sets to a dry or stiff pasty mass on cooling, containing 50—70 per cent. of indigo disulphonic acid, or a mixture of mono- and disulphonic acids, which dyes in brighter shades than the soluble indigo ordinarily used, and is more completely absorbed by the fibre.—E. F.

Indigo; Purification of ——. J. Y. Johnson. From The Badische Anilin und Soda Fabrik, Ludwigshafen a. Rh., Germany. Eng. Pat. 7395, March 30, 1903.

Indigo is purified by dissolving out the impurities with phenol or a phenolic ether, such as α-naphtholethyl ether.

It may also be purified by heating it to temperatures below its sublimation or decomposition point, for instance to 270° C. By this means the red admixtures are destroyed and partially escape as gas.—E. F.

[Azo] Dyes ; Manufacture of ——. H. H. Lake, London. From K. Oehler, Offenbach-on-Main. Eng. Pat. 8575, April 15, 1993.

See U.S. Pats. 740,767 and 740,768 of 1903 ; this J., 1903, 1191.—T. F. B.

Tetrazo- [Azo-] Dyestuffs ; Manufacture of New Substantive ——. O. Imray, London. From Society of Chemical Industry in Basle, Basle, Switzerland. Eng. Pat. 27,630, Dec. 16, 1903.

One molecule of the tetrazo-derivative of an azoxyamine of the type $NH_2.R.N_2O.R.NH_2$, or of the tetrazo-derivative of an azoamine of the type $NH_2.R.N_2.R.NH_2$ is combined with 2 mols. of 2.5.7-aminonaphtholsulphonic acid or 2.5.1.7-aminonaphtholdisulphonic acid, or with 1 mol. of either of these sulphonic acids, and 1 mol. of a sulphonic or carboxylic derivative of a phenol or naphthol or of an aminoalphylacidyl-derivative of 2.5.7-aminonaphtholsulphonic acid, or 2.5.1.7-aminonaphtholdisulphonic acid. The products dye cotton directly in reddish-orange shades, which, on diazotisation on the fibre and development with β-naphthol, produce Bordeaux tints, fast to washing.—E. F.

French Patents.

Benzyl Compounds ; Preparation of New ——. Cie. Parisienne de Couleurs d'Aniline. Fr. Pat. 328,170, Dec. 9, 1902.

Mono- and dichlorobenzylsulphonic acids are obtained by treating benzylsulphonic acids in aqueous solution with chlorine or chlorinating agents. Dichlorobenzylsulphonic acids are also obtained by treating monochlorobenzylsulphonic acids in the same manner. The products are intended for use in the preparation of dyestuffs after being nitrated and reduced or treated with ammonia, amines, or caustic soda.—E. F.

Indigo Dyestuffs derived from Benzene and from Naphthalene, and Intermediate Products ; Preparation of ——. C. and H. Dreyfus. Second Addition, dated Aug. 25, 1903, to Fr. Pat. 326,168, Nov. 8, 1902 (this Journal, 1903, 792 and 903).

Hydrocyanocarbodialphylamides, prepared by the methods described in the main patent and its first addition, are converted into their thioamides by treating them with a mixture of sulphur and an aqueous solution of a sulphide (such as sodium or potassium sulphide). α-Derivatives of naphthisatins are prepared by heating the corresponding hydrocyanocarbodialphylamides or their thioamides with concentrated sulphuric acid, cooling, and pouring into ice and water. Sulphonated α-derivatives of naphthisatins are obtained from the corresponding hydrocyanocarbodialphylamides or their thioamides by a more vigorous treatment with concentrated sulphuric acid and subsequent pouring into ice and water. By suitable reducing agents they are converted into sulphonated indigos. α-Derivatives of isatins or their salts are converted into indigos, derived from benzene or from naphthalene, by the action of hydrogen sulphide in presence of alkali carbonates or other alkaline substances.—E. F.

Sulphide Dyestuff, Blue, derived from p-Hydroxy-p′-amino-m′-methyldiphenylamine ; Production of ——. Fabr. de Prods. Chim. ci-devant Sandoz. First Addition, dated Sept. 26, 1903, to Fr. Pat. 332,560 of May 28, 1903 (this J., 1903, 1241).

Alphyl-*p*-amino-*p′*-hydroxydiphenylamines and their homologues are heated to 160°—200° C. with sulphur, with or without addition of hydrated chromium oxide. Indigo-blue to greenish-blue dyestuffs are so obtained, fast to washing and to light.—E. F.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Flax Retting ; The Bacteria which are concerned in ——. M. W. Beijerinck and van Delden. Mitt. Konigl. Akad. Wissensch. Amsterdam, 1903, 673 ; through Woch. f. Brau., 1904, **21**, 85—86.

The retting of flax involves essentially a fermentation of the pectose in the layers of cells above and below the system of bast fibres, whereby the latter are loosened. The specific bacterium of the process of "water-retting" is *Granulobacter pectinovorum,* which is accompanied by a less powerful species, *G. urocephalum.* According to Behrends the active agents in the "dew-retting" process are, mould fungi. Certain aerobic bacteria, notably species of the group of hay bacilli, also known as potato bacilli, are likewise capable of effecting the retting of flax with full exposure to the air. The acetic and lactic acid bacteria and certain species of yeast-like organisms, which are also found in the retting waters, have no retting action. The retting depends on the secretion by the bacteria of the enzyme pectosinase, which acts on the pectose after the manner of a hydrolysing acid, converting it first into pectin and the latter into sugars. These are fermented, in the case of *G. pectinovorum,* with the production of hydrogen, carbon dioxide, and a little butyric acid, but in the case of the hay bacilli they are assimilated and respired. The sugars produced, are most probably galactose and xylose, perhaps in some cases also glucose and arabinose. Pectosinase can be extracted by water and precipitated by alcohol, but the isolated enzyme is feeble in its action as compared with the living bacteria. The authors have found that the active retting bacteria are best favoured by removing the soluble matters of the flax stems by changes of water in the early stages of retting. In this way the butyric and lactic acid bacteria are suppressed by the removal of their nutrients. The species of *Granulobacter* then gain the ascendancy, since, owing to their great proteolytic power, they are able to utilise the sparingly soluble protoplasmic albumin of the flax. The best practical process for the retting of flax is that of water-retting in vats. The flax is packed tightly in deep wooden vats provided with false bottoms. The quantity and temperature of the water can thus be controlled, and the water can be discharged from time to time for the purpose of aerating the goods and removing the lactic and other bacteria. The first steep water containing the soluble matters should be discharged after 24 hours ; the second steep should consist of a mixture of fresh water and good retting liquor from a previous fermentation. This may be replaced on the third day with fresh water, since the true retting bacteria will then have become established. Pure cultures of the pectose bacteria are made by pasteurising a portion of well-retted flax stems at 90° C. for a short time and developing the surviving spores anaerobically on wort-agar at 35° C. Besides the two active species of *Granulobacter,* two other species, *G. saccharobutyricum* and *G. butylicum* are thus isolated, which have no retting properties. The cells of *G. pectinovorum* have a shape resembling tadpoles; only the swollen ends, which contain the spores, are sharply defined. In malt extract, in absence of air, a powerful evolution of gas is produced without the formation of butyric acid. In other saccharine liquids containing peptone or meat extract, a little butyric acid is produced during fermentation. Only in presence of pectin can ammonium salts be utilised as nitrogenous nutrients. The cells of *G. urocephalum* are more sharply defined and shaped like drum-sticks. This species can utilise ammonium salts as the source of nitrogen for the fermentation of all kinds of carbohydrates.—J. F. B.

Textile Fibres and Dyestuffs ; Relations between ——. H. Behrens. Chem.-Zeit., 1903, **27**, 1252—1254.

Certain Physical and Chemical Properties of Textile Fibres.—Textile fibres are doubly refractive and optically positive, the colours which they exhibit in polarised light extending, in the case of hemp and ramie, to green of the second order, and, in that of wool and silk, to orange of the first order, the least doubly refractive being cotton and wood cellulose. In proportion to the degree in which they possess, in the undyed state, the property of double refraction, vegetable fibres may be rendered dichroic by dyeing: slightly so, for example, with basic dyestuffs, such as Bismarck brown, safranine, and methylene blue, when these are absorbed from neutral solutions; much more so with the benzidine dyestuffs—Congo red, benzoazurin, &c.—applied from baths containing sodium carbonate, and with iodine dissolved in zinc chloride solution or in sulphuric acid. Crystalline dichroism is not the cause of the phenomenon. Wool and silk are not rendered dichroic by dyeing. The distribution of dyestuffs probably takes place regularly throughout the fibre substances in the case of the vegetable fibres, irregularly in that of the animal fibres, the dyeing of the latter being doubtless ascribable to the formation of solid solutions or to chemical combination. Cellulose hexanitrate is not dyed by benzoazurin. The penta- and tetranitrates (collodion cotton) are slightly dyed by the same dyestuff, but without being rendered dichroic. Cellulose dibenzoate (from linen) is also slightly dyed by the same colouring matter, but it is strongly dyed by safranine and malachite green, the dyed fibres not displaying dichroism. By the action of benzene sulphonic chloride on cellulose, esters may be produced which are not dyed in the least degree by benzoazurin, but which, on the other hand, are very strongly dyed by safranine and methylene blue, without becoming, however, dichroic. From these results it would appear that, in the dyeing of cellulose fibres with substantive cotton dyestuffs, the hydroxyl groups of the former, and particularly those two which are most readily attacked in the esterification of the fibre molecule, are acted upon, with the probable formation of sodium salts of cellulose colour-esters.

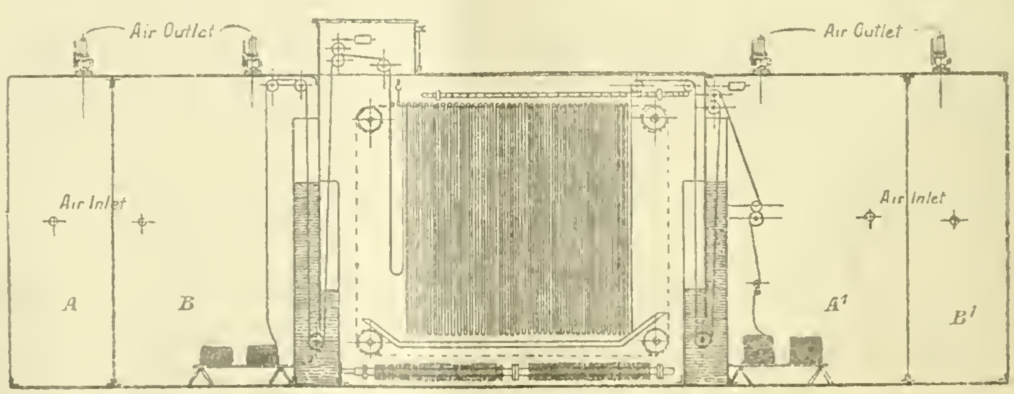
Functions of Alkalis and Alkali Salts in Dyeing.—When linen fibres which have been dyed with benzoazurin are mercerised with caustic soda, their colour changes from blue to red, the soda-lye becoming also coloured red. The combination of the dyestuff and fibre is resolved, the solubility of the dyestuff being increased, and the dyestuff being driven into the walls of the fibre as these thicken. On adding an alkali bicarbonate or a large volume of water to the solution, the red colour of the latter is changed to blue, whilst the dissolved dyestuff is again to some extent absorbed by the fibre. The more thorough penetration of the fibre by the dyestuff, induced by the action of the alkali, is easily perceptible under the microscope in cross sections of the fibre. It is due to the increased osmotic pressure of the solution of the dyestuff in the caustic soda-lye. It is not produced by the addition of common salt or sodium sulphate to the bath when dyeing with Benzoazurin, the deeper shades resulting from such additions corresponding merely with the further deposition of dyestuff on the surface of the fibres. The action of the alkali is, further, seen with linen fibres which have been dyed with indigo in strongly alkaline vats, as compared with fibres which are dyed in nearly neutral vats, the former, under the microscope appearing dyed more deeply and uniformly throughout than the latter.

Behaviour of Wool and Silk in Dyeing.—Silk is dyed by malachite green, methylene blue, and safranine in neutral baths, and by croceine scarlet and eosine in acid baths at the ordinary temperature. To obtain equally intense dyeings on wool, the temperature of the baths must be raised to at least 70° C. In cross sections of dyed wool fibres, the central, medullary part of the fibre cylinders appears less coloured than the surrounding, fibrillary mass, but much more deeply coloured than the external, cuticular scales. Wool fibres which have been strongly pressed in places are dyed by malachite green at the ordinary temperature in the places to which the pressure has been applied. The author thinks that useful application might be made of this observation.—E. B.

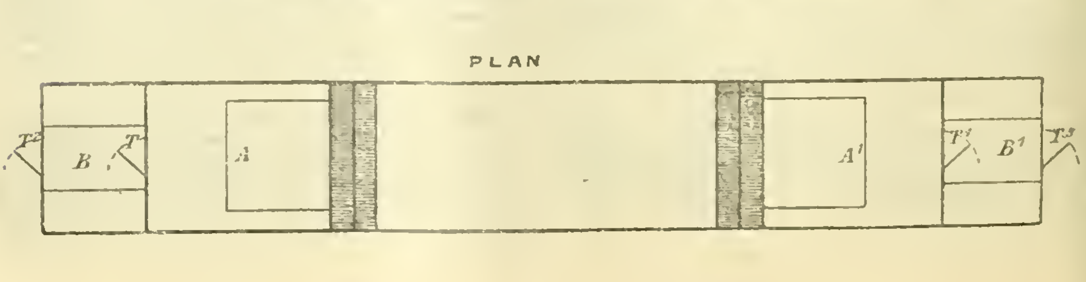
Bleaching Apparatus; The Endler-Welter Continuous ——. W. Elhers. Zeits. f. Farben- u. Textil-Chem., 1904, **3**, 39—41.

Tissues are sewn together end to end, and passed at full width and in a continuous manner through an apparatus consisting of (i) a central steaming chamber (see figures) to which steam is admitted and heated by means of a superheater until it attains a pressure of 2—2½ atmospheres; (ii) two liquor seals, in the first, or both, of which a solution of the scouring agent, *e.g.*, caustic soda, is contained, and through which the tissues successively pass; and (iii) a number of chambers, A, A_1, B, B_1, containing air under a pressure of 1½—2 atmospheres, which serve the purpose of maintaining the height of the liquor in the seals at a convenient level. Access is had to the air chambers through the doors T, T_1, T_2, T_3, which are kept tightly closed when

SECTIONAL ELEVATION



PLAN



the apparatus is in use. The apparatus, it is considered, is likely to be especially serviceable in the bleaching of flannelettes, moleskins, and similar tissues. It is stated that the men in charge can work in the compressed air chambers, provided the pressure in these does not exceed 2 atmospheres, without detriment to their health.—E. B.

Turkey-Red Oil, and the Action of Concentrated Sulphuric Acid on Olive Oil. W. Herbig. Färber-Zeit., 1904, **15**, 38—46.

An examination of the washings of the product resulting from the action of concentrated sulphuric acid on olive oil shows that a portion of the triglyceride has been saponified, the amount of sulphuric acid entering into the reaction being, in general, equivalent to the amount of oleic acid required for the formation of stearosulphonic acid; under certain conditions a larger amount of free oleic acid can result than corresponds to the sulphuric acid used for the sulphonation. The glycerin is found in the washings in the free state, and occasionally as glycerosulphonic acid. In drying the sulphonated oil, and also, under certain conditions, during the treatment with sulphuric acid, decomposition of the sulphonic acid into hydroxystearic acid takes place. This change also occurs during treatment of the fabrics with the oil, since stearinsulphonic acid is converted, by prolonged heating with water, into hydroxystearic acid. An examination of the lake-forming properties of oils sulphonated under various conditions showed that the presence of hydroxystearic acid was necessary, whilst stearosulphonic acid appeared not to assist in the lake formation at all. It also appeared a necessary condition that only a certain percentage of stearosulphonic acid should be present, and also that some unsaponified triglyceride should still exist. The best dyeing results were obtained by using an oil of which 20—25 per cent. was saponified; further saponification (by using more acid, higher temperatures, &c.) gave an oil yielding inferior results.—T. F. B.

English Patents.

Dyeing, Mordanting, or Washing Fibrous Materials; Apparatus for ——. W. Dargue, F. L. Dargue, Halifax, and H. Barker, Bradford. Eng. Pat. 14,125, June 25, 1903.

The machine is used for dyeing, mordanting, or washing fibrous material in hanks. The hanks are passed through the liquor on endless carriers slung from rollers supported above the dye-vessel. Mechanism is provided for rotating the rollers carrying the hanks and for lowering, raising, or traversing the hank roller-lifting frame and also for interlocking the levers controlling these two operations, and for preventing the actuation of the raising or lowering gear except when the sockets, in which the ends of the hank rollers engage, are in the proper position for the rollers to register or to be withdrawn. Mechanism is also provided for automatically throwing out of action the raising and lowering gear and the traversing gear. A new form of hank carrier is also claimed which automatically stretches the hanks of material carried and so prevents "lapping" of the fibres.—E. F.

Glue or Size especially adapted for the Warp Threads of Fabrics; Process for the Manufacture of ——. H. J. Haddan, London. From P. F. Oliva, Barcelona. Eng. Pat. 22,697, Oct. 20, 1903.

See Fr. Pat. 335,506 of 1903; following these.—T. F. B.

United States Patent.

Yarn; Apparatus for Colouring ——. A. Fornander, New York, Assignor to the Carpet Yarn Printing Co., N.Y. U.S. Pat. 750,758, Jan. 26, 1904.

In an apparatus for printing yarns by means of a disc revolving in a trough of colour on a travelling carriage, scrapers are provided for scraping the colour after printing on the yarn, and mechanism is added to automatically remove the scrapers from contact with the yarn drum when the printing of each stripe of colour is completed.
—A. B. S.

French Patents.

Sizing or Dressing suitable for the Warp Threads of Textiles; Process of obtaining ——. P. F. Oliva. Fr. Pat. 335,506, Sept. 14, 1903.

Gluten is subjected to fermentation by suitable substances (*e.g.*, 3 per cent. of carrot juice), and is then treated with substances which prevent any further fermentation (*e.g.*, 1 per cent. of oak-bark). The dressing obtained by this process is applied in the usual manner.—T. F. B.

Dressing [for Textiles] consisting of a Coating of Viscose. Soc. Franc. de la Viscose. Fr. Pat. 335,598, Sept. 28, 1903.

The fabric is passed over rollers successively through water, a solution of cellulose (Fr. Pat. 334,636 of 1903; this J., 1904, 75), a "precipitating" bath (preferably an ammonium chloride solution), a solution of sea-salt (20 per cent.) to remove impurities from the cellulose, and an acid bath, preferably 3 per cent. hydrochloric acid, and is finally washed with water. In this way the fabric is coated with cellulose, and is said to be easily bleached or dyed by any process.—T. F. B.

Bleaching Apparatus; Continuous ——. M. Muntadas y Rovira. Addition, dated Sept. 29, 1903, to Fr. Pat. 327,931, Nov. 10, 1902.

As an improvement on the main patent (see this J., 1903, 948), an arrangement is added to circulate the liquid in the opposite direction to the movement of the cloth.

By a special arrangement the cloth is made to alternately roll and unroll on a series of rollers, whilst all the time moving in the same direction.—A. B. S.

Cotton Dyeing; Apparatus for ——. Wegmann and Co. Fr. Pat. 335,596, Sept. 28, 1903.

In a dye vat are placed a series of connected horizontal pipes, one above the other. These have a number of lateral openings into which are screwed perforated bobbins, which are closed at the other end. The cotton as it comes from the carding machine, is wound around these bobbins, and tightly compressed between two end plates. The dye-liquor is forced by means of a pump through the main pipes, and passes through the cotton by means of the perforations in the bobbins. The liquid is continuously circulated by means of a pump, and by suitable valves water can be circulated for washing, &c. The bobbins bearing the dyed cotton can be easily removed and replaced by fresh ones.—A. B. S.

Finishing Process for Textiles; Continuous ——, *with Arrangement for Drying between each Bath.* F. Bertrand and Co. Addition, dated Sept. 14, 1903, to Fr. Pat. 334,890, Aug. 14, 1903. See this J., 1904, 185.

The cloth passes between two rollers which impregnate it with the finishing material; it then passes over a drying arrangement and is carried round by a series of rollers so as to pass between the same finishing rollers a second time. The same process of alternate impregnation and drying can be repeated as often as required.—A. B. S.

VII.—ACIDS, ALKALIS, AND SALTS.

Nitric Acid; Hydrates of ——. F. W. Küster. Chem.-Zeit., 1904, **28**, 132—135.

The nitric acid of constant boiling-point has long been considered to result from physical causes, and not to be a chemical compound; but Erdmann considers it as a true compound, and that others exist, *e.g.*, an "ortho-" and a "pyro-" nitric acid, H_3NO_4 and $H_4N_2O_7$, corresponding to the two phosphoric acids. Kremann undertook a re-investigation of Erdmann's work. A complete examination of the freezing-points of nitric acids of gradually increasing strengths shows that two maxima exist, corresponding to the hydrates $HNO_3.3H_2O$ and $HNO_3.H_2O$, and three minima indicating cryohydrates. None of the compounds mentioned by Erdmann exist. The two hydrates exist not only in the solid form, but also as liquids, after fusion; the trihydrate is somewhat more stable than the monohydrate. (See also this J., 1903, 1227.)—J. T. D.

Sodium Nitrite; Action of Carbon Dioxide on Solutions of ——. C. Marie and R. Marquis. Comptes rend., 1904, **138**, 367. (See also Moody, this J., 1903, 1352.)

From the following experiments the authors conclude definitely that nitrous acid is liberated from solutions of sodium nitrite by the action of carbon dioxide. (1) If a stream of purified carbon dioxide be passed through a solution of sodium nitrite containing potassium iodide and starch paste, iodine is liberated after a short time. (2) A solution of sodium nitrite mixed with potassium iodide, when shaken with chloroform, imparts no coloration to the latter, but when saturated with carbon dioxide, the chloroform layer becomes coloured owing to the liberation of iodine on shaking. (3) When the purified gas is passed through a solution of sodium nitrite, and then into a solution of potassium iodide and starch paste, the latter becomes slightly but distinctly blue.—J. F. B.

Lead Salts; Basic ——. D. Strombolm. Zeits. anorg. Chem., 1904, **38**, 429—455.

The methods of preparation (only practicable where the substances to be produced are insoluble) were two. (1) Lead hydroxide was prepared by precipitating lead acetate by a very slight excess of sodium hydroxide, thoroughly washing, and draining off the surplus water as far as possible (in all the operations avoiding the introduction of carbon dioxide as far as possible). To the moist hydroxide was added, gradually, N/20 solution of the desired alkali-salt (usually potassium or sodium, but, where these proved inactive, ammonium salt). The completion of the reaction is recognised (*a*) by the alkalinity of the solution, which remains practically constant as long as sodium hydroxide is still being formed in amount proportional to the volume of liquid added, and then begins to diminish; (*b*) by the presence of the acid radicle in solution; or (*c*) by the disappearance from the solution of lead, dissolved as hydroxide in the alkali formed. The salt thus formed is well washed, drained, and dried over soda-lime and sulphuric acid. This method yields the most basic salt of the possible series. (2) To the normal lead salt is gradually added dilute alkali hydroxide till the alkalinity of the solution begins to increase. This method yields the basic salt of the series containing least base (or most acid radicle). The salts prepared by either method are nearly all microcrystalline and very voluminous. The following are the chief results:—

Formula.	Prepared from	Characteristics.
$6PbO.PbCl_2.2H_2O$	$Pb(OH)_2 + KCl$ ..	White crystals, yellow on heating.
$3PbO.PbCl_2.\frac{1}{2}H_2O$	$PbCl_2 + NH_4OH$ ..	Light yellow needles.
$6PbO.PbBr_2.2H_2O$	$Pb(OH)_2 + KBr$ ..	White crystals, bright yellow on heating.
$3PbO.PbBr_2.\frac{1}{2}H_2O$	Next salt + NaOH	Bright yellow needles.
$PbO.PbBr_2.H_2O$.	$PbBr_2 + NH_4OH$.	White, red-yellow while hot.
$6PbO.PbI_2.2H_2O$.	$Pb(OH)_2$ KI....	Light yellow, loses iodine on heating.
$9PbO.2PbI_2.2H_2O$	Last salt + KI....	Bright yellow.
$3PbO.PbI_2.H_2O$ ..	Next salt NaOH	Faint yellow; strong yellow after heating.
$PbO.PbI_2.H_2O$ ..	$PbI_2 + NH_4OH$ ...	Light yellow; golden yellow after heating.

Similar methods yielded one thiocyanate, one bromate, one iodate, two sulphates, one selenate, two chromates, several nitrates, no phosphate, one arsenate, one carbonate ($3PbO.4PbCO_3.2H_2O$), one oxalate, and one picrate. The methods failed with several other salts, often because of the solubility of the basic salt (chlorate, fluoride). The types illustrated by the three bromides, especially the middle one, are the most frequent; 2, 4, 5PbO with PbR_2 are much less common.—J. T. D.

Boric Acid; Determination of ——, *as Phosphate.* F. Mylius and A. Meusser. XXIII., page 269.

Zinc Blende; Roasting of ——, *with Recovery of the Evolved Sulphur Dioxide for the Manufacture of Sulphuric Acid.* F. Kellermann. X., page 255.

English Patents.

Sulphuric Anhydride; Manufacture of ——. W. Garroway, Glasgow. Eng. Pat. 1755, Jan. 24, 1903.

Cooled air under pressure is passed through an ozonising cylinder in which numerous platinum points are oppositely arranged, so adjusted that intermittent electric discharges from a transformer up to 8,000 volts can be maintained. The air thus charged with ozone and nitrogen oxides is conducted to towers to come into contact with gases from a sulphur burner, and form sulphuric anhydride, which is collected by known means. The sulphur fumes, before coming into contact with the ozonised air, are passed through channels containing "brick made of oxide of iron and oxide of manganese."—E. S.

Hydrochloric or Nitric Acid, Regenerated; Treatment of ——, *to Remove Calcium Sulphate.* P. De Wilde, Brussels. Eng. Pat. 25,388, Nov. 20, 1903. Under Internat. Conv., Aug. 3, 1903.

See First Addition to Fr. Pat. 333,344 of 1903; this J., 1904, 116.—E. S.

Glauber Salts, Ferrous Carbonate, Ferrous Hydrate, and Ammonia; Production of —— *from Nitre Cake.* Eng. Pat. 24,639, Nov. 12, 1903.

Solution of nitre cake of sp. gr. 1·250 to 1·275 is brought into contact with a large excess of iron. The ferric sulphate at first formed is reduced to the ferrous state by the nascent hydrogen, and any nitric acid or nitrogen oxides present yield ammonia as ammonium sulphate. To the solution, run off from the iron scrap, a small proportion of acetic acid is added, and then sodium carbonate or hydroxide to precipitate ferrous carbonate or hydroxide; and, after heating, more of the alkali is added to decompose the ammonium sulphate. The ammonia evolved is collected, the ferrous salt is separated, and the sodium sulphate is crystallised out of the solution. Zinc or the like may replace iron in the process.—E. S.

United States Patents.

Phosphoric Acid; Method of Making ——. N. B. Powter, Brooklyn, N.Y.; E. H. Fallows, executor of said Powter, deceased. U.S. Pat. 751,753, Feb. 9, 1904.

"Phosphate rock," aluminic and similar phosphates, are heated in a suitable retort, and the fumes evolved are drawn off by suction, cooled, and passed into water for absorption therein.—E. S.

Sulphuric Anhydride; Process of Making ——. E. Raynaud, Spy, and L. Pierron, Jette St. Pierre, Belgium. U.S. Pat. 751,941, Feb. 9, 1904.

See Eng. Pat. 16,254 of 1900; this J., 1901, 42.—T. F. B.

Hydrated Sulphide of Zinc; Process of Producing ——. V. Bermont, Paris. U.S. Pat. 751,712, Feb. 9, 1904.

See Eng. Pat. 6752 of 1902; this J., 1903, 214.—T. F. B.

French Patents.

Hydrochloric Acid and Sulphuric Acid; Process for the Production and Simultaneous Separation of ——. Consortium für Elektrochem. Ind. Fr. Pat. 335,496, Aug. 21, 1903.

Chlorine, sulphur dioxide, and water are brought into contact in regulated proportions and in a continuous manner, the final products of the reactions being nearly pure hydrochloric acid gas and liquid sulphuric acid. In order to control the proportions of the gases admitted to the reacting chamber, a portion of the mixture is passed continuously into water constantly being renewed, the excess of one gas over the other being measured by the potential which the solution gives to a neutral electrode, in respect to another electrode at a constant potential. The potentials of the oxidation and of the reduction of the two gases are sufficiently wide apart to give precise indications for regulating the process, which regulation may be rendered automatic. An excess of chlorine is used when it is desired to produce hydrochloric acid as free as possible from sulphuric acid.—E. S.

Hydrocyanic Acid; Process of Preparing ——, by Aid of a Mixture of Nitrogen with Hydrocarbons. Deutsche Gold und Silber-Scheide-Anstalt v. Roessler. Fr. Pat. 335,562, Sept. 25, 1903.

A MIXTURE of nitrogen with a hydrocarbon gas, such as lighting gas, is passed into contact with an electric arc of high tension, to produce hydrocyanic acid gas. Compounds of nitrogen, such as ammonia gas, may be substituted for nitrogen. If nitrogen, saturated with benzene vapour, be used, a current of hydrogen may advantageously be passed with the mixture to avert liability to deposition of carbon. —E. S.

Sodium Hydroxide; Manufacture of ——. G. Latham and G. Kinsbourg. Fr. Pat. 335,623, Sept. 10, 1903.

LEAD, or lead monoxide (litharge) is added to fused sodium chloride, and the fluid mass is well agitated until the reaction is complete. If metallic lead be used, it is first rapidly oxidised under the conditions. The product consists of sodium monoxide and lead chloride, from which, by lixiviation, sodium hydroxide solution is obtained. The residue of lead chloride may be utilised to recover lead or litharge. Instead of sodium chloride, sodium sulphate or carbonate may be used in the process.—E. S.

Barium Oxide, Porous; Manufacture of ——. H. Schulze. Fr. Pat. 335,677, Oct. 1, 1903.

A MIXTURE of barium carbonate or sulphate with carbon some combination of alkaline earths, and barium nitrate, or a modification of such a mixture, is formed into a mass about the sides of an electric furnace, heated by radiation from an arc, or from a resistance rod connecting the poles, air being excluded. Barium oxide that has been melted in the process of obtaining it in an electric furnace, may also be rendered porous by mixing it with barium hydroxide and carbide, and heating the mixture as described.—E. S.

Dicalcium Orthophosphate; Manufacture of ——. E. Bergmann. Fr. Pat. 335,790, Sept. 7, 1903.

To a solution of tricalcium phosphate in cold aqueous sulphurous acid; or to the precipitate obtained on heating the same, monocalcium orthophosphate is added, and sulphurous acid is expelled by heat. Instead of adding monocalcium phosphate in the process, this may be produced in the sulphurous solution of the tricalcium salt itself, by addition of an acid, such as hydrochloric, sulphuric, or phosphoric acid, in order to obtain the dicalcium salt, sulphurous acid being expelled as before.—E. S.

Metallic Salts; [Electrolytic] Process of Manufacture of ——, and of Regeneration of Electrolytic Baths. E. A. Campagne. Fr. Pat. 335,972, Oct. 15, 1903. XI. A., page 258.

Oxygen; Extraction of —— [from the Atmosphere, by Magnetism]. L. Benier. Fr. Pat. 335,473, Sept. 22, 1903. XI. A., page 257.

VIII.—GLASS, POTTERY, ENAMELS.

Quartz Glass; Mercury Arc Lamp of ——. M. Bodenstein. II., page 246.

Syrian Asphalt for Printing Plates and Window Transparencies. C. Fleck. XXI., page 268.

English Patent.

Silica Glass; Furnaces for Use in the Manufacture of ——. W. A. Shenstone, Bristol. Eng. Pat. 4031, Feb. 20, 1903.

THE furnace itself is made of silica, preferably in the form of bricks. The silica to be fused is introduced through a number of openings and falls on to a sloping channel, where it is melted by means of electric arcs passing between suitably placed carbon electrodes, the heat from which is supplemented by a number of oxy-hydrogen blow-pipes, introduced through other openings. These blowpipes are made either of iridium or silica, and serve to burn any carbon falling from the electrodes, thus preventing contamination of the silica with silicon or carborundum The melted silica runs down into a central well, from which it may be removed by means of an iridium blow-pipe or by tilting the furnace, or by simply letting it overflow through a suitable opening.—A. G. L.

French Patents.

[Glass] Synthetic Granite; Garchey ——, and Method of Manufacturing the same. L. A. Garchey First Addition of Sept. 18, 1903, to Fr. Pat. 325,475, Sept. 27 1902 (see this J., 1903, 697).

THE melted glass is first run into a cold metallic mould of suitable shape; when sufficiently hardened it is then removed to a heated mould of refractory material and allowed to cool very slowly. The inside of this second mould is sprinkled with hot sand, powdered mica, &c., to make a tight joint between it and the object, which is also covered with a layer of hot powdered refractory material. In certain cases the article may also be compressed in a hydraulic press in which it is allowed to remain until devitrified, after which it may be re-heated and annealed. —A. G. L.

Arsenious Oxide [for Glass Manufacture]; Preparation of Briquettes of Solidified ——. L. Souheur. Fr. Pat. 335,753, Oct. 6, 1903.

ARSENIOUS oxide, whether in powder or in fragments, coloured or otherwise, is subjected to high pressure with or without preliminary or simultaneous heating in suitable apparatus, to form it into briquettes suitable for use in the manufacture of glass.—E. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Road Materials; Testing of ——. L. W. Page and A. S. Cushman. XXIII., page 269.

Lime, Free, [in Portland Cement]; New Method for the Determination of ——; and on so-called "Dead Burnt" Lime. E. H. Keiser and S. W. Forder XXIII., page 272.

English Patents.

Ovens and Kilns [for Pottery and Bricks]. W. H. Owen, Wolstanton. Eng. Pat. 5145, Mar. 5, 1903.

THE air necessary for supporting combustion in the kiln receives a preliminary heating by passing through a heater, consisting of a number of tubes connecting a receiving and distributing head; this heater is placed in the path of the escaping products of combustion. In cases where gaseous fuel is used, a second heater is provided for heating the gas, the waste gases from the kiln being caused to surround the two heaters alternately, so as to heat both the gas and the air.—A. G. L.

[Bricks, &c.] "Gas Lime" and other Spent Lime; Method of and Apparatus for Converting —— into a more Marketable Commodity or Product. J. Lowden, Leeds. Eng. Pat. 7622, April 2, 1903.

THE spent lime is exposed, either alone or mixed with clinker, to the action of hot air from a furnace, which expels a large proportion of the sulphur compounds from the lime and oxidises the remainder to calcium sulphate. The treatment is carried out by allowing the lime to fall down a shaft, at the bottom of which a suitable furnace is placed. In the walls of the shaft there are a number of projections opposite each other, dividing the shaft into a number of chambers, within each of which a horizontal drum revolves; these drums are provided with longitudinal openings, and contain vertical perforated partitions. The material in its passage downwards has to pass through these drums, and is fully exposed to the action of the hot gases. The resulting material is mixed with clinker and coke breeze, or other suitable fuel, and burnt, a current of steam being preferably passed through the kiln during the burning. The mass obtained, consisting of calcium oxide, carbonate, and silicate, and aluminium silicate, is ground and moulded into bricks or slabs, the further hardening of which may be effected by exposure to hot waste gases containing carbon dioxide.—A. G. L.

Tiles or Bricks for use in Regenerative Furnaces. J. C. Moon, Ilford, and F. C. Moon, Scarborough. Eng. Pat. 14,420, June 29, 1903.

In order to afford increased support to the vertical tiles forming the walls of the air- and gas-passages, they are made of rectangular or square shape and may also have a reduced central portion; at the ends of each of the baffle tiles, or at one end when a fire-brick lining is applied to the waste- gas- and air-passages, a reduced portion of rectangular form and of the same width as one of the vertical tiles is provided. The remaining portion of the baffle tiles is made of increasing cross-section, so that this portion constitutes a shoulder running around the whole of the reduced portion. The vertical tiles are made to break joint both vertically and horizontally in the case of the tiles forming the division walls.—A. G. L.

Stone, Artificial; Manufacturing —— suitable for Pavements, Buildings above and below Ground, and for Hydraulic Purposes. J. J. Niessen, Cologne, Germany. Eng. Pat. 25,393, Nov. 21, 1903.

Bauxite, preferably containing a large quantity of ferric oxide, is heated at a high temperature, alone or with fluxes, until "perfectly sintered." The resulting mass is reduced to small pieces, mixed with a binding medium, such as clay, cement, or asphalt, and burned.—A. G. L.

Water-proofing [Building Materials]; Process of Treating Surfaces for —— and Preservative Purposes. E. M. Caffall, Sparkhill, N.Y. Eng. Pat. 27,126, Dec. 15, 1903.

The surface to be treated is heated with hot compressed air. The hot material, *e.g.*, asphalt or paraffin, is then sprayed upon it, after which the surface is again treated with hot compressed air, which forces the material into the pores of the surface. The air may be heated out of contact with the fuel, if desired, by passing it through a pipe placed in a stove.—A. G. L.

Bricks or Blocks; Manufacture of Porous ——. H. Herschbach, Neuwied, Germany. Eng. Pat. 27,626, Dec. 16, 1903.

Three parts by volume of volcanic sand are mixed with 1 of blast-furnace slag; the whole is then moistened with 1 part of water and again mixed, after which it is moulded in iron moulds. The moulded bricks are allowed to dry for two or three weeks, after which they are stacked for several months, a space of about 2 cm. being left around each brick to allow free access of air; in hot, dry weather they should be kept moist by occasionally spraying with water. The resulting brick is claimed to be strong and light.
—A. G. L.

Wood and other Materials; Compositions for the Preservation of —— from the Attacks of, and Destroying, White Ants and other Insects or Growths, and for Preserving such Materials generally. P. Zimmer, Bremen, Germany. Eng. Pat. 28,218, Dec. 23, 1903.

The wood to be preserved is coated once or twice with a composition obtained by adding 1 oz. of "arsenic (powder)," 1 oz. of camphor, 3 oz. of dried chillies (powder) to 400 grms. of wood oil and 700 grms. of "Rangoon oil," boiling for a quarter of an hour, stirring till cold, adding 360 grms. of common kerosene oil and [illegible] oz. of camphor, stirring the whole and filtering.—A. G. L.

Mortar or Cement; Combination of Ingredients for Manufacturing a Water-Resisting ——. W. Staab, Ehrenfeld, Cologne. Eng. Pat. 11,802, May 23, 1903.

See Fr. Pat. 321,171 of 1902; this J., 1903, 556.—T. F. B.

United States Patents.

Bricks or Material; Manufacture of Fireproof ——. F. Krüger, Berlin. U.S. Pat. 751,080, Feb. 2, 1904.

See Eng. Pat. 3483 of 1903; this J., 1903, 867.—T. F. B.

Wood; Process of Preserving ——. G. W. Gordon, Assignor to H. Arzt and J. Sostman, all of Philadelphia, Pa. U.S. Pat. 751,981, Feb. 9, 1904.

The wood to be preserved is soaked in a solution of calcium hydroxide and glycerin, to which sugar may also be added.
—A. G. L.

French Patents.

Wood; Process for Preserving and Fireproofing ——. G. Beaulieu-Marconnay. Fr. Pat. 335,112, Sept. 19, 1903.

The wood is soaked in a solution of polybasic salts, such as ammonium borate or sulphate, dissolved in an excess of ammonia, which renders the impregnation more thorough by saponifying the resins and fatty matter of the wood.
—A. G. L.

Wood; Process for Preserving ——. C. F. Reichel. Fr. Pat. 335,781, Oct. 7, 1903.

The wood to be preserved is painted with a mixture of chalk or slaked lime and tannin.—A. G. L.

Masonry; Composition for Protecting ——, against Weathering, leaving it Permeable to Gases. H. Gärtner and F. Kremen. Fr. Pat. 335,862, Oct. 10, 1903.

The composition consists of a mixture of 200 parts of sodium silicate dissolved in a convenient quantity of boiling water, with 45 to 50 parts of carnauba wax and 15 to 20 parts of olive oil soap. Colouring matter may also be added.—A. G. L.

Paving; Material for ——, and similar Purposes. H. Morin. Fr. Pat. 335,909, Oct. 14, 1903.

Sifted river sand is mixed with raw or boiled linseed oil, to which litharge or other driers may be added. The mixture is then moulded under pressure, and dried at a gentle heat. Part or the whole of the oil may be replaced by caoutchouc, glue, celluloid, rubber surrogates, &c. Sulphur may also be added to the oil, and part of the sand may be replaced by sawdust or other vegetable matter.
—A. G. L.

Cement Mortar; Process for Preserving the Binding Properties of Prepared ——. J. H. Magens. First Addition, of Sept. 12, 1903, to Fr. Pat. 330,393, March 18, 1903 (see this J., 1903, 1089).

Instead of keeping the prepared mortar at 0° C., as described in the original patent, it suffices to bring it to this temperature immediately after mixing, and then keep it cold during storing by simply sprinkling it with cold water, the evaporation of the water lowering the temperature sufficiently to arrest the binding action of the mortar.
—A. G. L.

X.—METALLURGY.

Nickel Steels; Allotropic Transformation of the ——. O. Boudouard. Comptes rend., 1904, **138**, 370—371.

Bars of two series of nickel steels were heated at one end, and curves were plotted showing the temperatures of the bars as abscissæ and the differences of potential between the two extremities of the bars as ordinates. Observations were taken both in heating up and cooling down, and the points at which irregularities in the curves were observed were noted as corresponding to phenomena which tend to modify the thermal state of the bar, *i.e.*, to the molecular transformation of the particular alloy under observation. The following table shows the effect of increasing proportions of nickel on the properties of steels of approximately the same composition otherwise :—

Series I. (*Carbon about* 0·120 *per cent.*)

Composition of Steel.		Critical Points.	
Carbon.	Nickel.	Heating up.	Cooling down.
Per Cent.	Per Cent.	° C.	° C.
0·07	2·23	830. 775. 725	830, 710
0·125	5·23	770, 695	710
0·125	7·13	690, 660	650
0·132	10·10	675, 650	575
0·125	12·07	640, 640	420
0·110	15·17	620	360
0·176	20·40	600	285
0·160	25·85	510	175
0·180	30·0	Regular curve	

Series II. (*Carbon about* 0·800 *per cent.*)

Carbon.	Nickel.	Heating up.	Cooling down.
0·800	2·20	705	695
0·776	4·90	675	625
0·815	7·03	665	560
1·05	9·79	625	Regular curve
0·760	12·27	625	„
0·796	15·04	590	„
0·800	20·01	560	„
0·790	25·06	515	„
0·810	29·96	Regular curve	

—J. F. B.

Vanadium Steels; Constitution and Properties of ——. L. Guillet. Comptes rend., 1904, 138, 367—369.

The author has studied two series of vanadium steels, one containing 0·2 per cent. of carbon and the other 0·8 per cent. In each series the percentage of vanadium was increased from 0 to 10 per cent.

Micrography.—Those steels containing 0·2 per cent. of carbon and less than 0·7 per cent. of vanadium, and those containing 0·8 per cent. of carbon and less than 0·5 per cent. of vanadium, when etched with picric acid, showed a "perlite" structure similar to that of carbon steels, but the "ferrite" structure was rapidly coloured a deep brown by the reagent. Above 0·7 per cent. of vanadium for the one series, and 0·5 per cent. for the other, the "perlite" became interspersed with a number of white grains, which increased with increase in the proportion of vanadium, until, in the steels containing more than 3 per cent. of vanadium, the "perlite" was entirely replaced by these white grains. These grains are a special form of the carbon, consisting of a carbide of vanadium or a double carbide of vanadium and iron. Thus there are three classes of vanadium steels:—(1) Those having the same structure as carbon steel, and containing less than 0·7 per cent. of vanadium. (2) Those having a mixed structure of "perlite" and the special form of carbon. (3) Those containing carbon solely in the form of the special constituent above referred to. The last class is of no industrial importance.

Mechanical Properties.—The steels of the two first groups had breaking strains and elastic limits higher than those of ordinary steels, with the same percentage of carbon. The elongations and mean contractions were normal. These steels are far harder and more brittle than the carbon steels. The steels of the third group had extremely low breaking strains and elastic limits, the elongations and contractions were high, but the steels were very brittle and deficient in hardness. A short annealing at 900° C. softened all the steels slightly. When annealing was sufficiently prolonged at a sufficiently high temperature, carbon was precipitated in the form of graphite. Tempering hardened the steels of the first two groups to a remarkable extent, and softened those of the third group slightly, but it did not affect the structure of the special carbon constituent. In view of the brittleness of the vanadium steels, only those of the first group are capable of industrial application, and these apparently offer little interest except as tool steels.—J. F. B.

Zinc Blende; Roasting of ——, with Recovery of the Evolved Sulphur Dioxide for the Manufacture of Sulphuric Acid. F. Kellermann. Zeits. Berg. u. Huttenw., 51, 606—608. Zeits. angew. Chem., 1904, 17, 179.

The difficulties met with in the roasting of zinc blende are due to the strong tendency of the zinc to form basic zinc sulphate, which on reduction is decomposed into zinc, zinc oxide, and zinc sulphide. The causes of the formation of the basic zinc sulphate in Hungarian reverberatory furnaces are as follows:—(1) High charges of ore on the roasting hearth. (2) Overheating of the ore, especially near the fire-bridge. (3) Direct contact of the fire-gases with the charge. The large amounts of smoke and fire-gases which mix with the evolved sulphur dioxide also hinder the recovery of the latter. In the author's opinion the roasting should be carried on under the following conditions:—(1) An oven with several hearths, one above the other, should be used. (2) The smoke and fire-gases should not be allowed to come into contact with the charge. (3) Each hearth should be furnished with an air-supply to effect the combustion of the sulphur and the oxidation of the blende. (4) The sulphur dioxide should be removed, with the excess of air, through separate outlets. (5) Steam should be supplied to the lowest hearth towards the end of the roasting.—A. S.

Lead-Tin Alloys. I. Chemical Equilibrium between Lead and Tin in Presence of Solutions of their Salts. O. Sackur. Arb. a. d. Kaiserl. Gesundheitsamte, 1903, 20, 512. Chem.-Zeit., 1904, 28, Rep. 33.

As lead and tin stand close together in Volta's contact series, it would be expected that one metal would not completely precipitate the other from its solution. It was found that in acetic acid solution lead is almost completely precipitated by tin, the deposition of lead being more rapid the greater the acidity of the solution. On the other hand, in nitric acid solution, tin is precipitated by lead. In hydrochloric acid solution a state of equilibrium is attained when the salts of the two metals are present in certain concentrations. These concentrations were determined at 18° C. and 25° C. with solutions containing varying amounts of free hydrochloric acid, and it was found that the amount of stannous chloride in solution is a linear function of the amount of lead chloride; this fact is in agreement with Nernst's theory and the law of mass action. The author concludes that the apparently contradictory phenomena observed in the precipitation of lead and tin from different solutions are due to the facts that lead has a greater electrolytic solution pressure than tin, and that stannous chloride and tin acetate are only dissociated to a very small extent, with production of free tin ions.—A. S.

Metals of the Cerium Group. W. Muthmann and L. Weiss. Annalen, 1904, 331, 1—46.

In continuation of their previous work (this J., 1902, 412), the authors have now improved the electrolytic process, and have been able to prepare all five metals of the cerium group in sufficiently large quantities to allow of an investigation of the physical properties of the metals. All the metals are harder than lead and tin; cerium is rather softer than lanthanum, and both are softer than zinc; neodymium and praseodymium are somewhat harder than zinc; samarium is the hardest of the five metals. The metals have the following specific gravities:—Cerium, 7·0424; lanthanum, 6·1545; neodymium, 6·9563; praseodymium, 6·4754; samarium, 7·7—7·8. Melting points:—Cerium, 623° C.; lanthanum, 810° C.; neodymium, 840° C.; praseodymium 940° C. On burning, cerium forms cerium dioxide, with evolution of 1603·2 cals. per grm.; lanthanum gives the sesquioxide and 1602·1 cals.; neodymium, the sesquioxide, and 1506 cals.; and praseodymium, the sesquioxide, and 1466·8 cals. The high heats of combustion indicated that the metals might be used as reducing agents in a manner similar to that wherein aluminium is used in Goldschmidt's thermite process. The alloy of metals of the cerium and yttrium groups obtained directly from the very cheap residue obtained as by-product in the manufacture of thorium nitrate, was found to have a heat of combustion of 1655·5 cals. per grm., and in preliminary experiments with it as a reducing agent, small amounts of pure chromium, tungsten, molybdenum, niobium, vanadium, and tantalum, were prepared.—A. S.

Cerium and Lanthanum ; Some Alloys of ——. W. Muthmann and H. Beck. Annalen, 1904, **331**, 16—57.

The authors describe the preparation and properties of alloys of cerium and lanthanum with aluminium ($CeAl_4$ and $LaAl_4$) and of cerium with magnesium, zinc, and mercury. —A. S.

Gold in the Residues from the Zinc Boxes ; Determination of ——. R. W. Lodge. XXIII., page 272.

Zinc Dust ; Gasometric Assay of ——. A. Wohl. XXIII., page 273.

Tin Ores ; Losses in Vanning ——. R. Pierce. XXIII., page 273.

English Patents.

Iron and Steel Manufacture ; Furnaces for Use in ——. G. Quambusch, Dortmund, Germany. Eng. Pat. 3475, Feb. 13, 1903.

The furnace may have one or more hearths, mounted on wheels, and enclosed in a casing having running channels serving as guides for the hearth trucks, provided with projections packed with sand so that the heated gases have no access to the supporting iron mechanism. The truck ends are also so formed as to close the passage for the gases. Air is admitted through suitable openings to cool the iron work, and the air thus heated is directed into the region of combustion through lateral passages in the longitudinal walls. The heating gases may be directed from either side, or from both sides, or alternately from one or the other, as desired.—E. S.

Steel ; Manufacture of ——. T. J. Tresidder, Sheffield. Eng. Pat. 8298, April 9, 1903.

See Fr. Pat. 333,582 of 1903 ; this J., 1903, 1353.—T. F. B.

Ores ; Smelting of ——. F. H. Schwartz, Chicago. Eng. Pat. 3194, Feb. 10, 1903. Under Internat. Conv., April 9, 1902.

See U.S. Pats. 708,782 and 708,783 of 1902 ; this J., 1902, 1235.—T. F. B.

Ores ; Separation of the Metallic Constituents of —— from Gangue. A. E. Cattermole, London. Eng. Pat. 18,589, Aug. 28, 1903.

The pulped ore is mechanically agitated in a connected series of vessels, with oil and water, and a suitable proportion of an emulsifying agent, which may be either an acid or an alkali, or a soap. The granules of oiled mineral thus formed, which are specifically heavier than the particles of gangue, are classified by methodical treatment with an upward-current of water in separators. When but little mineral is present in the ore, powdered mineral matter from a previous operation, or other matter having an affinity for oil, may be introduced to assist in the formation of granules of metalliferous matter. Compare Eng. Pats. 26,295 and 26,296 of 1902 ; this J., 1904, 118.—E. S.

Tin and Terne Plates ; Means for Reducing the Thickness of the Coating on ——. A. J. Maskrey, Martins Ferry, Ohio. Eng. Pat. 27,425, Dec. 15, 1903.

In a tinning pot, a longitudinal wiper inclined inwards is mounted parallel to the discharge rolls, the tips of the wipers meeting at a point directly below the point of contact of such rolls, whereby the faces of a sheet of metal rising to the rolls are wiped. There is also a longitudinal strip or brush of non-carburising material, mounted parallel to and in contact with each of the rolls, whereby the latter are wiped and cleared of scruff and superfluous molten metal. The brush may be of asbestos strengthened with wire netting, of fine wire or metal strips, or it may be a scraper made of solid graphite.—E. S.

United States Patents.

Ores [Lead-Zinc] ; Method of Treating Refractory ——. E. H. Miller, London. U.S. Pat. 751,401, Feb. 2, 1904.

See Eng. Pat. 20,465 of 1902 ; this J., 1904, 118.—T. F. B

Copper Ores ; Process of Treating ——. N. V. Hybinette, Plainfield, N.J. U.S. Pat. 751,648, Feb. 9, 1904.

The coarsely-divided copper ore is mixed with a salt of an alkali metal, such as sodium sulphate, and is roasted to convert the copper compound, at least in part, into a soluble condition, as into a double salt of copper and an alkali metal. The mass is then heated with a reducing agent, to render the newly-formed copper compound insoluble. Finally, the product is treated with water, and the valuable finely divided material is mechanically separated from the coarse gangue.—E. S.

Uniting Two Metals ; Process of ——. W. H. Wherry, Cleveland, Ohio. U.S. Pat. 750,511, Jan. 26, 1904.

A flux is applied to one of the two metals to be united, that will combine chemically with both metals, and will lower their fusing point and increase their fluidity ; to the other metal, in a molten state, is applied approximately "one-fifth per cent. of phosphorus," and the compound of molten "metal and phosphorus is then poured upon the other treated metal."—E. S.

Flux [for Uniting Metals]. W. H. Wherry, Cleveland, Ohio. U.S. Pat. 750,512, Jan. 26, 1904.

The flux for uniting metals contains phosphorus, or red phosphorus, with an acid, hydrochloric acid being specified as one that may be used.—E. S.

French Patents.*

Aluminium ; Soldering ——. E. H. Moreau. Fr. Pat. 335,413, Sept. 19, 1903.

The solder consists of equal parts, by weight, of pure tin and of pure zinc, melted together.—E. S.

Aluminium ; Process for Tempering ——. C. Sorensen. Fr. Pat. 335,857, Oct. 10, 1903.

See Eng. Pat. 20,758 of 1903 ; this J., 1903, 1353.—T. F. B.

Air for Blast Furnaces ; Extraction of Moisture from the ——. J. Gayley. Fr. Pat. 335,957, Sept. 28, 1903.

See Eng. Pat. 19,933 of 1903 ; this J., 1904, 22.—T.F.B.

Furnace for Roasting Finely Powdered Minerals, Calcining Dolomite, &c. G. O. Petersson. Fr. Pat. 335,977, Oct. 15, 1903. Under Internat. Conv., Jan. 27, 1903.

See Eng. Pat. 22,162 of 1903 ; this J., 1904, 22.—T. F.B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Electrolysis ; Alternating Currents in ——. A. Brochet and J. Petit. Comptes rend., 1904, **138**, 359—361.

The authors have used the public supply of the left bank of the Seine, having a frequency of 42, and transformed down to an E.M.F. of 7 volts. They have assumed that the mean current is 0·9 of the effective current, as measured by a thermal ammeter, and have examined the solution of copper electrodes in a solution of potassium cyanide. The reaction $Cu_2 + 8KCN + 2H_2O = Cu_2(CN)_2 . 6KCN + 2KOH + H_2$ occurs, and proceeds steadily till the solution is saturated with copper, when the rate of yield falls off abruptly. The process is a practicable method of preparing cuprous potassium cyanide. The authors do not agree with Le Blanc and Schick's assumption that the solution of the copper depends on the formation of a complex ion which prevents re-deposition ; for copper can be deposited electrolytically from solution in potassium cyanide, whilst potassium cyanide solution dissolves copper slowly in the cold without the intervention of the electric current. Zinc and nickel behave like copper with the alternating current, yielding $M(CN)_2.2KCN$. Lead, silver, mercury, cadmium, are practically unaffected.—J. T. D.

Alternating Currents: Phenomena of Reduction produced by ——. F. Pearce and C. Couchet. Comptes rend., 1904, **138**, 361—362.

Reducing effects are exhibited, under certain circumstances by alternating currents in electrolytic cells. The effects are, as a rule, produced only with oxidisable electrodes, and depend on the nature of these electrodes, the current density, and the frequency. With feeble current density, solution of the electrodes is all that occurs. Iron alum, for example, is hardly perceptibly reduced when the electrodes are of platinum, much more considerably with aluminium, lead, or cadmium electrodes, and almost quantitatively with iron electrodes. The metal from the attacked electrode usually deposits as oxide in the bath. Alkali nitrates are reduced to nitrites—quantitatively with elec rodes of cadmium or zinc, very slightly with electrodes of ron, copper, or carbon. Cupric and mercuric salts are similarly reduced to the cuprous and mercurous condition; chromates to chromic salts, nitrobenzene to aniline.

—J. T. D.

Nitro-Compounds of the Naphthalene, Anthracene, and Phenanthrene Series; Electro-chemical Reduction of ——. J. Möller. Electrochem. Zeits., **10**, 199—202, 222—226; Chem. Centr., 1904, **1**, 461.

Reduction of 1.5- *and* 1.8-*Dinitronaphthalene.*—The cathode liquid consisted of 2 grms. of the nitro compound dissolved in 270 c.c. of glacial acetic acid and 10 c.c. of concentrated sulphuric acid. the anode liquid consisted of 170 c.c. of water and 6 c.c. of concentrated sulphuric acid; he cathode was a lead cylinder; and the anode was a piece of sheet platinum in a porous cell. Temperature, 80°—90° C.; E.M.F., 4 volts; current, 2 ampères; time, 30 minutes. The products were 1.5- and 1.8-naphthylenediamine melt ng at 189°—190° C. and 66°—67° C. respectively.

Reduction of 2-*Nitrophenanthraquinone.*—E.M.F., 3·8 volts; current 1·6 ampères; time, 20 minutes; other conditions the same as above. The cathode liquid was coloured dark brown. Reduction product, 2-aminophenanthraquinone melting at above 320° C.

Reduction of 2.7-*Dinitrophenanthraquinone.*—Tempera ure. 90°—95° C.: current and time, 65·4 ampère-minutes, Reduction product, 2.7-diaminophenanthraquinone melting at above 315° C.

The experiments show that in general the nitro compounds are reduced directly to amino compounds; in no case could intermediate compounds be isolated. (See also this J., 1901, 1001.)—A. S.

Organic Salts, Fused; Electrolysis of ——. E. Berl. Ber., 1904, **37**, 325.

Lassar-Cohn (Ann. 251, 357) found that fused potassium acetate on electrolysis yields hydrogen and methane at the cathode and carbon dioxide at the anode. The author confirms this, and shows the production of methane to be secondary, since metallic potassium reacts on fused potassium acetate with evolution of methane. The fused potassium salts of nitrobenzoic acids and of benzoic acid (dissolved in excess of free acid) behave analogously.

—W. A. C.

Mercury Arc Lamp of Quartz Glass. M. Bodenstein. II., page 246.

English Patents.

Cell; An Improved Galvanic Dry ——. G. Schauli and D. Löwenstein, London. Eng. Pat. 23,389, Oct. 27, 1902.

The negative pole consists of a zinc vessel coated internally with mercury, and this is surrounded by a sheet-iron containing vessel, an insulating medium being placed between the two vessels so as to leave a circular aperture between the bases. When the inner zinc cylinder is corroded through, the exciting liquid will come into contact with the zinc lining of the outer cylinder and thus prolong the life of the cell. The positive pole consists of a rod of retort carbon of low resistance, surrounded by the following depolarising mixture:—Antimony sulphate, 4 parts; powdered Siberian graphite, 5 parts; granular gas carbon, 20 parts; manganese dioxide, 41 parts, half powdered and half granular; solid zinc chloride, 10 parts; solid ferric chloride, 20 parts. This mixture, slightly moistened with water, is contained in a fabric bag tied round the positive electrode. The exciting electrolyte is prepared by dissolving 1 oz. each of ammonium chloride, ammonium alum, and ammonium sulphate in 400 c.c. of water, cooling slightly in a closed vessel, and then adding 1 oz. of mercury bisulphate, the solution being cooled and allowed to stand for two or three days in a sealed vessel. One part by weight of this solution is mixed with one part by weight of hot rice, previously soaked and cooked to a syrupy consistency, and the paste, when cold, is placed between the inner zinc cylinder and the bag containing the depolariser. The cell is closed with layers of powdered sulphur and pitch.—B. N.

Drying by Hot Air or by the Use of Electric Currents; Methods for —— *Materials which Clog or Matt under Compression, and other Substances.* J. Doall, London. Eng. Pat. 1717, Jan. 23, 1903.

A horizontal cylindrical chamber made of steel or iron, and mounted on hollow trunnions, is fixed inside, but electrically insulated from, another cylinder made of perforated metal or wire netting. To the outer cylinder is secured a copper strip for making electrical contact. The outer cylinder is fitted with beaters or brushes, and radial ribs, to prevent the material from running. The whole is enclosed in an airtight case. The material to be dried is placed in the outer cylinder, both cylinders are rotated, and hot air is forced through the hollow trunnions into the inner one, the material being dried by radiant heat. To accelerate the drying, electric heating may be applied by means of the copper strip and a contact brush. Openings are provided for the collection of the vapours given off.

—L. F. G.

French Patents.

Silica [Quartz] Glass; Furnaces [Electric] for Use in the Manufacture of ——. W. A. Shenstone. Eng. Pat. 4031, Feb. 20, 1903. VIII., page 253.

Gases or Gas Mixtures; [Electrolytic] Method for Producing Powerful Chemical Reactions in ——, *and Apparatus therefor.* F. W. Howorth, London. From S. Eyde and K. Birkeland, Christiania. Eng. Pat. 20,049, Sept. 17, 1903.

See Fr. Pat. 335,692 of 1903; this J., 1904, 193.—T. F. B.

Batteries; Exciting Compound for ——. A. J. Marschall, Littlefalls, N.Y. U.S. Pat. 750,871, Feb. 2, 1904.

The solution consists of about 80 parts of zinc chloride and about 6 parts of ammonium chloride in 100 parts of water.

—B. N.

Purifying Liquids; [Electrical] Apparatus for ——. O. Kartzmark, Brooklyn, N.Y., Assignor to W. Davis, Jersey City. U.S. Pat. 751,986, Feb. 9, 1904.

The liquid is passed upwards in a continuous stream between a series of detachable electrodes, the latter being supported upon stops located above the bottom of the containing vessel; the liquid flows over the edges of the vessel, which is open to the air, into an overflow tank.

—B. N.

Carbonic Acid in Gases; [Electrical] Method of Determining the Quantity of ——. G. Bodländer. U.S. Pat. 761,897, Feb. 9, 1904. XXIII., page 273.

Oxygen; Extraction of ——, *[by Magnetism, from the Atmosphere].* L. Benier. Fr. Pat. 335,473, Sept. 22, 1903.

Advantage is taken of the magnetic property of oxygen to effect its separation from the non-magnetic nitrogen of the atmosphere. A drum of iron or of soft steel, rotating between two electro-magnets in such manner that its peripheral surface is magnetised, is stated to accumulate upon it a thin layer of oxygen from the atmosphere, which oxygen may be continuously detached by a fixed rubbing appliance within a box, applied to any convenient portion of the rim of the drum.—E. S.

Hydrocyanic Acid; [Electrical] Process of Preparing ——, by Aid of a Mixture of Nitrogen with Hydrocarbons. Deutsche Gold und Silber-Scheide-Anstalt. vorm. Roessler. Fr. Pat. 335,562, Sept. 25, 1903. VII., page 253.

Barium Oxide, Porous; [Electrical] Manufacture of ——. H. Schulze. Fr. Pat, 335,677. Oct. 1, 1903. VII., page 253.

Metallic Salts; [Electrolytic] Process of Manufacture of ——, and of Regeneration of Electrolytic Baths. E. A. Campagne. Fr. Pat. 335,972. Oct. 15, 1903.

The metal or alloy to be treated is used as the anode, and sheet iron as the cathode in a half-saturated solution of sodium sulphate. Metallic sulphates and caustic soda are formed, and reacting together, precipitate hydroxides of the metals and regenerate sodium sulphate. Carbon dioxide may be afterwards used to convert the hydroxides into basic carbonates, and, by solution of the latter in suitable acids, salts are formed which may be separated by fractional crystallisation. When an impure metal or alloy is used as the anode for depositing a pure metal on the cathode, the bath becomes impoverished in the salt of the metal, and the salts obtained as above may be added to the bath instead of crystallising fractionally; or if a bath become acid in character, as in the cases where antimony and bismuth alloys are used as the anode, the precipitated hydroxides or basic carbonates may be added to neutralise the acid and thus regenerate the bath.—B. N.

(*B.*)—ELECTRO-METALLURGY.

Iron and Steel; Manufacture of ——, by Electrical Process. A. Neuburger, Zeits. angew. Chem., 1904, **17**, 104—112; 129—140.

For the manufacture of iron and steel by the aid of electricity, the author describes the following processes, which are now being worked on the large scale:—Stassano (Eng. Pats. 11,604 of 1898 and 8288 of 1902; this J., 1898, 1155; 1902, 1284), Héroult and the "Soc. Electrometall. Française" (Eng. Pats. 11,643, 14,486, and 14,576 of 1901, U.S. Pat. 707,776 of 1902, Fr. Pat. 318,638 of 1902, Eng. Pat. 3912 of 1902, U.S. Pat. 721,703 of 1903, and Fr. Pat. 328,350 of 1903; this J., 1902, 915, 917, 1029, 1237, 1459; 1903, 217, 426, 955), Harmet and "Fonderies, Forges et Acières, St. Etienne" (Fr. Pat. 318,283 of 1902 and Additions to same; this J., 1902, 1459; 1903, 501, 658), Keller and "Cie. Electrotherm. Keller, Leleux and Co." (Eng. Pats. 24,234 and 24,235 of 1901, and 15,271 of 1902, Fr. Pat. 329,013 of 1903; this J., 1902, 354, 410; 1903, 371, 1004), Kjellin (see Benedick's Eng. Pat. 18,921 of 1900; this J., 1901, 370), Girod (Fr. Pat. 329,822 of 1903; this J., 1903, 1054), Conley (U.S. Pat. 697,810 of 1902; this J., 1902, 623), Ruthenburg (Eng. Pat. 13,867 of 1901, U.S. Pats. 722,253 and 722,254 of 1903; this J., 1901, 1218; 1903, 127), and Neuburger-Minet. The Neuburger-Minet apparatus is suitable for countries poor in water-power. It is so designed that three sources of heat can be made use of:—(1) Combustible or non-combustible furnace gases; (2) gases from gasworks or gas-producers; (3) electricity, either as a current flowing through the material to be treated, or in the form of an arc. The furnace is shown in vertical section in Fig. 1 and in horizontal section in Fig. 2. The reaction chamber W is separated by the walls D from the combustion chambers S, into which, through the openings O, flow either blast-furnace gas from the passage C, or gas from gasworks or gas-producers from the passage C^{1}. The blast furnace gas is led into the heating chambers R; a portion passes into the passage C through the flap-valve X, and is burnt in the chamber S, air entering from the passage V through openings U. Part of the blast-furnace gas passes through R unaltered and can be used for feeding gas-engines, &c. The position and arrangement of the electrodes, E, E^{1} are varied according to the nature of the material under treatment. It is stated that steel and various kinds of iron and alloys of iron can be produced in this furnace.

Fig. 1.

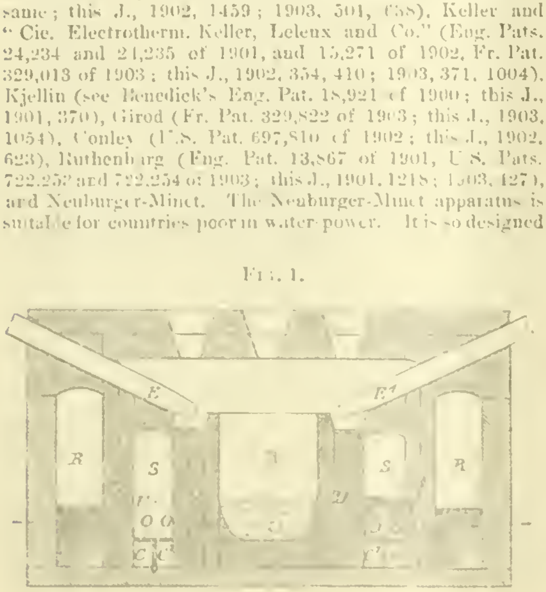
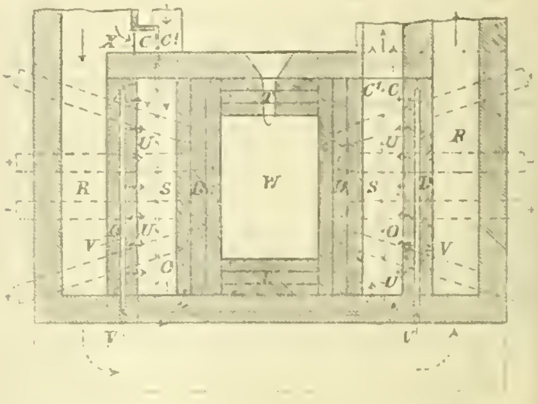


Fig. 2.



L. Simpson has recently described the advantages possessed by the electrical method for the manufacture of steel over the usual processes as follows:—(1) The steel obtained is more compact and more uniform in quality; (2) in the same works different qualities of steel and steel alloys can be manufactured at a minimum cost; (3) the capacity of the works can be easily increased, whilst on the other hand the works can be closed at wish and started again without the furnaces suffering injury; (4) the cost of the electric power is more than balanced by the lesser cost of the furnaces; (5) the work is less liable to interruptions. Repairs can be effected without stopping the work, as the low cost of erection of electric furnaces allows of the building of reserve furnaces, which can readily and rapidly be brought into operation. It seems to be the general opinion that even where the direct electro-metallurgical treatment of iron ores cannot be carried on economically, the production of steel from pig-iron in the electric furnace could be effected with advantage. An ideal works of this kind would be one in which blast-furnaces were used for smelting, the Bessemer plant for the production of the lower qualities of steel, and plant for the production of electric power from the blast-furnace gases, this electric power being used in suitable apparatus for the production of the finer qualities of steel. (See also this J., 1901, 816; 1902, 621, 622, 1048, 1402; 1903, 305, 749, 1198.)—A. S.

Tin Scrap; Electrolytic Treatment of ——. H. Paweck. Oesterr. Zeits. Berg- u. Huttenw., 1903, 341. Proc. Inst. Civil Eng., 1903, **154**, 36.

The tin scrap is held in iron baskets, which form the anode of the apparatus, the cathodes being of sheet iron and the electrolyte a 10 or 12 per cent. solution of caustic soda, heated to 60°—70° C. The material treated contains 7 per cent. of tin, the tension used varying from 1 to 2 volts.

with current density of 100 ampères per square metre of cathode surface. The metal obtained is preferably melted in a reducing furnace, giving a product which contains about 1·5 per cent. of lead. The electrolyte is found to contain 0·9 to 1·2 per cent. of tin in solution as sodium stannate. It is stated that a dynamo giving 6·4 kilowatts will treat from 10—12·5 tons of tin-plate cuttings per week. —T. F. B.

Cyanide Silver Baths; Yield, with Moving Cathodes in ——. W. Pfanhauser. Zeits. f. Elektrochem., 1904, **10**, 101.

The author has experimented with a platinum foil cathode of 100 sq. cm. area, supported between two parallel platinum wires of 0·5 mm. diameter, to which it was welded. Two experiments, of 45 minutes and 2½ hours duration respectively, with a current density of 0·3 ampère per 100 sq. cm., gave, after making allowances for the very small area of electrode (short lengths of the two wires) exposed to the air, 99·721 and 99·879 per cent. respectively of the quantitative yield of silver. The author's contention, therefore, that the yield with a moving cathode is less than that with a fixed cathode only when the former is partially exposed, during its motion, to the air, is upheld.—J. T. D.

English Patent.

Magnetic Ore Separator. F. T. Snyder, Oak Park, Ill., U.S.A. Eng. Pat. 28,399, Dec. 24, 1903.

A magnet pole piece has a flat vertical face applied to one side of a rotating iron cylinder, there being means for directing ore between the pole face and the cylinder. A magnetic pole-piece of opposite polarity is diametrically opposite the first-named pole piece, and has a curved face to embrace a large area of a cylindrical armature, which armature comprises a shaft and toothed circular discs of sheet iron side by side upon the shaft, the teeth forming points of magnetic concentration, rotating between the pole pieces. The more permeable particles of ore are attracted towards the armature, in which a neutral point is established between the two pole pieces, at which point the attracted ore is released. The frame is in horizontal box form, with an opening from top to bottom, the armature being mounted to rotate horizontally between the pole pieces which project inwardly from the sides of the frame, the journals being at substantially neutral points in the sides of the frame, which is made separable for convenience in removing the armature. —E. S.

French Patents.

Metals of the Alkali Group; Process and Apparatus for Producing the ——, *by Electrolysis.* E. A. Ashcroft. Fr. Pat. 335,829, Oct. 8, 1903.

See Eng. Pat. 12,377 of 1903: this J., 1904, 25.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Oil of Rice. Schweiz. Wochenschr. **42**, 66. Pharm. J., 1904, **72**, 216.

The high percentage (from 31·6 to 77·2) of free fatty acids in the oil from Rangoon rice is due to the presence in the bran of a lipase which effects the decomposition of the glycerides, with the formation of free fatty acids.—A. S.

Aspidium spinulosum; Fatty Oil of ——. P. Farup. Archiv der. Pharm., 1904, **242**, 17—24.

The powdered rhizomes of *Aspidium spinulosum* yielded, on extraction with ether, a viscous brownish-green oil, which was decolorised with animal charcoal, and examined by the usual methods. It was found to consist, in the main, of olein, together with glycerides of linolic acid (about 4 per cent. of the total liquid acids), solid fatty acids (not further examined), and probably isolinolenic acid. Phytosterol (m. pt., 126°—129·5° C.) was also isolated, although it was not found by Katz in the fatty oil of *Aspidium filix*. —C. A. M.

Fats; Enzymic Decomposition of ——, *by Vegetable Seeds.* S. Fokin. Chem. Rev. Fett- u. Harz-Ind., 1904, **11**, 30—32.

The author has made experiments to determine the hydrolysing action on fats of oleaginous seeds of different orders and families of Russian plants, and especially of those growing in the central districts. Of the seeds of the various plants tried (of which a list is given) the following were found to effect the decomposition of fats:—(1) *Euphorbia cyparissias*, which liberated 16 per cent. of fatty acids, with 30 per cent. of the seed employed (*i.e.*, 30 grms. of crushed seeds to 100 grms. of oil). (2) *Brunella vulgaris*, liberating 30 per cent. of acids when used in the proportion of 40 per cent. (3) *Cynoglossum*, yielding 30 per cent. of fatty acids (proportion 24 per cent.). (4) *Aquilegia vulgaris*, 11 per cent. of fatty acids (proportion 20 per cent.); and (5) *Aconitum Lycoctonum*, liberating 11 per cent. of fatty acids when used in the proportion of 15 per cent. More active than any of these were the seeds of *Chelidonium majus*, yielding about 95 per cent. of fatty acids from sunflower oil under experimental conditions, of which the following are typical:—Crushed seed, 4 grms. = 27 per cent.; sunflower oil, 15 grms.; sulphuric acid (N/20), 4 c.c.; water, 6 c.c. The reaction was complete in three days. In another experiment in which the proportion of seeds to oil was 5 per cent. 84·93 per cent. of fatty acids were liberated in 3½ days. Since the husks of the seeds were present in each case, and should be taken into account, the author considers that *Chelidonium* seeds have as great (or greater) enzymic activity as castor seeds, though apparently yielding lower results than the latter. (See also this J., 1902, 1541; 1903, 639, 873, 1031, 1137.)—C. A. M.

Stearine from Fatty Acids; Preparation of ——, *by Means of Alcohol.* P. Pastrovitch. Chem. Rev. Fett- u. Harz-Ind., 1904, **11**, 1—3.

Preliminary experiments on a small scale showed that alcohol of sp. gr. 0·872—0·885 at 15° C. was the most suitable for keeping an equal volume of oleic acid in solution whilst dissolving but little stearine. In the experiments on a larger scale, 100 kilos. of the fatty acids were melted and poured into two or three times their volume of alcohol of this strength and allowed to stand for 12 hours. The crystalline magma was then pressed in a filter-press and washed with alcohol of the same strength, the final (colourless) washings being separately collected and used for the treatment of fresh portions of fatty acids. Finally, the

Fatty Acids from	Titre.	Alcohol employed.			Temperature of Mass before Pressing.	Stearine.		Returns.	
		Sp. gr. at 15° C.	For Solution.	For Washing.		Amount.	"Titre."	Amount.	"Titre."
	° C.		Kilos.	Kilos.	° C.	Per Cent.	° C.	Per Cent.	° C.
Tallow	43·95	0·884	150	340	16	44·55	52·40	55·45	28·40
"	43·95	0·887	300	310	16	40·00	54·20	60·00	28·70
"	43·95	0·889	300	250	12·5	43·90	53·40	56·10	..
Pressed tallow (iodine value, 28·53).	47·45	0·882	300	214	15	60·30 (Iodine value, 5·2.)	54·80	39·70	29·75
Bone-fat and palm oil	40·05	0·885	250	580	12	37·70	51·85	62·30	21·00
Tallow and pressed tallow.	45·95	0·883	150	140	17·5	52·75	53·75	47·25	29·10

alcohol was evaporated from the stearine and the distillate condensed, and either rectified or used for the dilution of stronger alcohol. In this way the typical results shown on the previous page were obtained.

Acceleration of the crystallisation effected a slight increase in the yield of stearine. Thus, in two parallel experiments the amounts obtained by stirring the solution during crystallisation and by leaving it alone were 57·25 per cent. ("titre," 51·6° C.) and 45·0 per cent ("titre," 52·75° C.) respectively. In the ordinary methods of preparing stearin by hot expression, the first yield under the most favourable conditions is only about 27 to 30 per cent. ("titre," 44° C.) from tallow fatty acids, or 40 to 45 per cent. ("titre," 54·0° to 57·0° C.) from the fatty acids of pressed tallow, the remainder being in the returns which must be further worked up, thus increasing the cost. In the alcohol method, however, the first yield of stearine amounts to 80 to 95 per cent. of the total amount obtainable. All the stearine had a more or less pronounced reddish tinge, but could be rendered permanently white, it was stated, by being stirred with 2 to 10 per cent. of China clay. The loss of alcohol was 5·35 to 8·59 per cent.
—C. A. M.

Oil and Fats; Relative Inner Friction of Edible ——. M. Pleissner. XXIII. page 273.

Margarine; Micro-organisms in ——. A. Zoffmann. XVIII. A., page 264.

Turkey Red Oil, and the Action of Concentrated Sulphuric Acid on Olive Oil. W. Herbig. V., page 251.

English Patents.

Presses [*for Extracting Oils, &c.*]. W. P. Thompson, Liverpool. From V. D. Anderson, Cleveland. Eng. Pat. 2264, Jan. 30, 1903.

See Fr. Pat. 328,945 of 1903; this J., 1903, 1006.—T. F. B.

Oils; Process of Expressing ——. W. P. Thompson, Liverpool. From V. D. Anderson, Cleveland. Eng. Pat. 2265, Jan. 30, 1903.

See Fr. Pat. 328,946 of 1903; this J., 1903, 1006.—T. F. B.

United States Patent.

Fats or the like; Apparatus for the Recovery of —— [*from Water*]. C. Kremer. Frankfort. U.S. Pat. 751,303, Feb. 2, 1904.

See Eng. Pat. 14,461 of 1903; this J., 1903, 1095.—T. F. B.

French Patents.

Oil-Cakes; Process and Apparatus for Obtaining ——. E. C. Bisbee and C. F. Elmes, U.S.A. Fr. Pat. 335,444, Sept. 22, 1903.

In the ordinary methods the press-cake is not obtained in a perfect form owing to some of the oil exuding and adhering to the plates of the press, whilst this necessitates frequent cleaning. In the apparatus claimed these drawbacks are obviated. The material coming from the kettles is moulded by slight pressure so as to form cakes, which are afterwards pressed between the plates of the press, the cloths being automatically stretched over them.—C. A. M.

Fats and Fatty Acids; Treatment of —— [*for Candle Material*]. O. Hausamann. Fr. Pat. 335,768, Oct. 6, 1903.

The fats or fatty acids are treated with sulphuric acid in the cold, the products distilled in the usual manner, and the cold solidified distillate again treated with sulphuric acid to re-convert into solid products iso-oleic acid, &c., formed during the distillation. In the apparatus claimed for this process, a cylinder, through the interior of which passes a current of water, is made to revolve in the hot distillate. The adherent flakes are removed from the surface of the cylinder by means of a scraper, and fall into a tank below, where they are mechanically mixed with the sulphuric acid.
—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

English Patent.

Lithopone; Manufacture of ——. X. Fischer, Goslar-am-Harz, Germany. Eng. Pat. 17,956, Aug. 19, 1903.

It is found that the slight darkening in colour to which lithopone is subject is due to the presence of traces of chlorine. The compounds used in the manufacture should, therefore, be free from chlorine, and the following process is recommended:—The crude zinc sulphate solution is heated with some oxidising agent (*e.g.*, a manganate or permanganate) and "soda, potash," lime, &c., and filtered; it is then treated with zinc dust, filtered, and precipitated with barium sulphide or a mixture of barium and sodium sulphides in the usual manner.—T. F. B.

United States Patent.

Pigments; Process of Making ——. W. J. Armbroster, St. Louis. U.S. Pat. 751,444, Feb. 9, 1904.

Zinc ores or compounds are dissolved in a suitable acid, and the iron precipitated from the solution by addition of "suitable quantities of a zinc salt." The zinc is then precipitated by means of barium hydroxide, and the filtrate is precipitated by sulphuric acid; the precipitated zinc hydroxide and barium sulphate are washed and mixed together, forming a pigment, whilst the acid solution may be used again for dissolving further quantities of the zinc compound.
—T. F. B.

French Patent.

Arc-Lamp Carbons; Utilisation [*as Pigments*] *of Waste* ——. R. Peters. Fr. Pat. 335,795, Sept. 16, 1903.

The carbon fragments are heated in crucibles to about 2,000°—2,500° C., and plunged whilst still hot, into an oil-bath, where they are left for 12 to 36 hours. By this treatment they are rendered very friable, and can be pulverised and mixed with adhesive material, &c., to form pigments, like Chinese ink, &c.—C. A. M.

(*B.*)—RESINS, VARNISHES.

Turpentine; Examination of ——. H. Herzfeld. XXIII., page 274.

(*C.*)—INDIA-RUBBER.

United States Patent.

India-Rubber; Method of Manufacturing a Substance Resembling ——. D. H. Dupont-Franklin, New York. U.S. Pats. 746,688 and 746,689, Dec. 15, 1903.

A hydrocarbon such as coal-tar or tar of petroleum is mixed with boric, phosphoric, hydriodic, or other acid, dissolved in alcohol; oxygen is passed in, and the mixture is boiled until a green flame appears on igniting the vapours. A product resembling india-rubber is stated to be obtained.
—J. K. B.

XIV.—TANNING; LEATHER, GLUE, SIZE.

Bating and Drenching Light Skins. Leather Trades Rev., 1904, **37**, 98—99.

Goat and calf skins, to be tanned with palmetto and gambier, should be bated with pigeon manure, whilst for combination chrome-tannage, bran-drenching is recommended. For ordinary chrome tanning, goat skins should be puered with dog-dung; sheep, lamb, kangaroo, and calf skins answer well with bran drench and lactic acid, and for the one-bath chrome process with salt and alum, the bran drench gives excellent results.—R. L. J.

French Patent.

Leather or Waste; Process of Detanning ——, *for the Preparation of Gelatin and Glue.* A. R. Weiss. Fr. Pat. 335,996, Oct. 2, 1903.

See U.S. Pat. 738,709 of 1903; this J., 1903, 1096.—T. F. B.

XV.—MANURES, Etc.

French Patent.

Phosphoric and Silicic Acids; Preparation of a very Soluble Compound of ——. Dr. Wolters. Phosphat. Gesellschaft. Fr. Pat. 335,509, Sept. 16, 1903.

Compounds of silicic acid, fused with neutral or basic compounds of phosphoric acid, and suddenly cooled, are stated to yield a product in which the phosphates are soluble n citric acid, &c. Natural phosphates may be mixed with silicates previously prepared, as by the fusion of sand with alkalis, for the described treatment. The best results are obtained by such treatment of a mixture containing 0 to 12 per cent. of alkalis; 25 to 30 per cent. of silica; and 18 to 20 per cent. of phosphorus, the non-alkaline bases being chiefly such as are alkaline-earthy. The phosphates in such a mixture, fused and suddenly cooled, re stated to be wholly soluble in weak solvents; whereas with ordinary cooling only from 25 to 40 per cent. of the phosphates are so soluble. Reference is made to Ger. Pat. 114,482 of 1898. Compare U.S. Pat. 721,489 of 1903; his J., 1903, 429.—E. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Raw Sugar in Store. A. Herzfeld. Zeits. Vereins Deutsch. Zucker-Ind., 1903, **53**, 1201—1277.

The phenolphthaleïn alkalinity of sugars decreases during torage and the diminution proceeds more quickly in propor-on as the alkalinity to litmus is smaller. The cupric reducing ower gradually increases with the decrease of alkalinity, lthough not always quite regularly, acid sugars showing the reatest variations. The cause of loss of alkalinity is to be ttributed to the influence of micro-organisms. The chemical composition—amount of lime or sulphurous acid—does not stand in any exact relation to the reducing power or to he colour. The amount of water appears to be also of no ssential importance in causing fall in alkalinity, but no xceptionally moist sugars were met with. These would aturally not keep well during storage. The fact, already ell known in practice, that sugar keeps better in bags han when accumulated in heaps, is confirmed. Although ost of the sugars alkaline to phenolphthaleïn keep better han acid sugars, there are exceptions. Zettnow found, owever, that moulds were the cause of an alkaline sugar ndergoing alteration. Alkalinity is thus not a direct easure of the keeping quality of a sugar, but is a practical dication which answers generally, but occasionally fails. a convenient method could be found of determining verting moulds, it would be preferable to the determination f alkalinity. It should be clearly noted that it is infection th fungi which alone causes the deterioration in quality uring storage, but only when the fungi are active and creasing in numbers. For under conditions unfavourable development they do the sugar but little harm. Sufficient tention is apparently not given to the keeping of the ores (at least in raw sugar works) in an antiseptic state. Hamburg sugar is found to keep best in corrugated iron eds; wooden sheds come next, and then stone. This pears to be connected with the sensibility of the moulds change of temperature, uniformly heated rooms favouring owth. Care should be taken to cool the sugar as quickly possible, to ventilate the store thoroughly, and to have it parated from the factory.—L. J. de W.

aweed (Fucus), Laminaria, and Carragheen Moss; Products of the Hydrolysis of ——. A. Müther and B. Tollens. XXIV., page 275.

United States Patents.

Sugar] Juices; Process of Electrolytically Purifying ——. A. Kolrepp, Berlin, and A. Wohl, Charlottenburg. U.S. Pat. 751,179, Feb. 2, 1904.

E Fr. Pat. 319,635 of 1902; this J., 1902, 1545.—T. F. B.

Sugar; Process of Making ——. J. McGlashan, Cawnpore, India. U.S. Pat. 751,990, Feb. 9, 1904.

See Eng. Pat. 23,779 of 1902; this J., 1903, 1008.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Raw Starch; Nature of ——. L. Maquenne. Comptes rend., 1904, **138**, 375—377.

Freshly prepared starch paste is completely saccharified by diastase as well as by hydrolysing acids, but paste which has been kept for some time contains insoluble reversion products which are saccharified only with difficulty. Treatment of ungelatinised starch and of starch-paste with malt extract at 55° C. showed the following percentage of soluble matter, calculated on the original starch: Raw starch granules, 2·8; raw starch ruptured by trituration, 94·8; starch paste, 102·2. Thus, mechanical rupture of the granules acts almost as efficiently as gelatinisation, the residue consisting of amylo-cellulose to the extent of 3—4 per cent. of the original starch. From a chemical point of view, the raw starch possesses the same composition as reverted starch paste, and both may be regarded as containing amylo-celluloses in varying stages of condensation. These amylo-celluloses are produced from the soluble granulose in the cold, and are therefore found both in stale starch paste and in the raw starch granule. They are dissolved at high temperatures, and are therefore not apparent in fresh starch paste. In the plant the soluble granulose is probably reverted under the influence of electrolytes or of coagulating enzymes. This coating of reverted starch would modify the osmotic properties of the starch granule and attenuate to a large extent the solvent action of the diastase. Lastly, it is probable that the more or less advanced stage of reversion is one of the factors which differentiate the natural starches and change the composition of their iodides.—J. F. B.

Barley. Guinness Research Lab. Trans., 1903, **1**, 96—141.

The subject is dealt with under the following headings:—(1) Correlation of "mealiness" and density of barley. (2) Microscopical differences between "mealy" and "steely" grains. (3) Artificial production of "mealiness" in "steely" or partly "steely" grains. (4) The air-content of "mealy" grain. (5) Experiments on the density of starch containing varying amounts of moisture. (6) Density of air-free substance of barley containing varying amounts of moisture. (7) Application of the foregoing considerations to a determination of the interspaces of barley by indirect means. (8) A cytological test of physiological maturation. (9) "Coarseness" of barley and its correlation with other qualities.—A. S.

Malt; The Specifications of Contracts for the Purchase of ——. W. Windisch. Woch. f. Brau., 1904, **21**, 91—93.

In "Der Bierbrauer," 1903, 487, Ebrich contends that for contracts for the purchase of malt it is sufficient to specify that the malt shall contain a guaranteed minimum percentage of extract in the air-dry state as delivered, providing for rebates on any deficiency by simple proportion. The author points out that this view is quite erroneous; quantitatively, it does not matter in what state a definite amount of extract is delivered, but qualitatively it is a very serious fault if the malt be delivered in too moist a condition. An excessive proportion of moisture involves great deterioration of the malt during storage This deterioration may have taken place before delivery, or it may occur during storage in the brewery. A guaranteed maximum limit of moisture is, if the malt be well modified, to a certain extent, a guarantee of quality, and if the excess of water be very considerable, the consignment should be rejected. In less serious cases, slight excess of moisture may reasonably be accepted on payment of a fine. The Berlin Research Brewery purchases its malt on the following conditions:—(*a*) and (*b*) For each 1 per cent. of moisture in excess of 0·1 per cent. a deduction of 2 cwt. and a fine of 10s. is made per truck load of 10 tons; (*c*) if a deficiency of extract be due solely to the presence of an excess of moisture, *i.e.*, if the deficiency of extract do not exceed 0·7 per cent. per 1 per cent. excess of moisture, no deduction is made, but any deficiency of extract beyond this amount is to be allowed for by simple proportion. (This clause is equivalent to a guarantee of a certain percentage of extract calculated on the dry malt.) Alternatively, in the case of an objectionable excess of water, the consignment may be refused on that ground.—J. F. B.

"Spring" Mashing Process and its Effect on Top-Fermentation Yeast. R. Lehmann. Woch. f. Brau., 1904, 21, 103—104.

The author has successfully applied the "Spring" mashing process (this J., 1904, 198) to the brewing of top-fermentation dark sweet beers of high palate fulness. The malt used for the production of these beers is not of the first quality; it contains a large proportion of ungerminated and abnormally grown corns; it is kilned for four hours at a temperature of 100° C. The yields from this malt by the old method of mashing were very good, but the worts always ran turbid for the greater part of the time, and in spite of the use of a low attenuating yeast, the beers were always too highly attenuated, and consequently harsh and poor in flavour. The author therefore tried the "spring" mashing process for preparing the mashes of this kind of beer; the grist was mixed with water at a temperature of 45° C., digested for half an hour, then "sprung" into water at 87·5° C., and saccharified at a temperature of 74° C. for 40 minutes. One-half of the mash was pumped back to the tun, and the other half was boiled for 30 minutes, and the whole was struck at a temperature of 75° C. By this treatment the worts ran perfectly clear, and were in every respect normal; the yield was 0·2 per cent. lower. The worts were pitched with plenty of yeast at 15° C., and fermented rapidly and well. The beers showed apparent attenuations 12 per cent. lower than those brewed in the old way, and occasioned general satisfaction owing to their fuller and thicker flavour. But the yield of surface yeast was very small, whilst the bottom yeast had increased to three or four times the amount usually collected. This fact was repeatedly observed when the "spring" mashing process was applied, and it was found impossible to skim off sufficient top-yeast to serve for pitching the next brew. The "spring" mashes contain so little fermentable sugar that the nutrition is not sufficient to enable the yeast to work its way to the surface. In ordinary worts the sedimentary yeast behaved perfectly normally as a top-yeast. The difficulty has been surmounted by a compromise, by "springing" the cool mash into hot mash instead of into hot water, and conducting subsequent saccharification at 75° C.—J. F. B.

Alcoholic Fermentation; Chemical Mechanism of ——. E. Buchner and J. Meissenheimer. Ber., 1904, 37, 417—428.

In cell-free fermentations it is never possible to recover, in the form of alcohol and carbon dioxide, the whole of the sugar consumed; lactic acid and acetic acid are also produced. The formation of these acids takes place under conditions which preclude the activity of bacteria or the presence of air. The authors have determined the quantities of these acids in the cell juice before and after fermentation. When the cell juice was kept without the addition of sugar for four days, the results of the lactic acid determinations were different in different series of experiments. In some cases the whole of the lactic acid originally present disappeared, and when small quantities of lactic acid were added to the juice these also disappeared on standing. On the other hand, in other experiments, especially in the case of very active extracts, there was a production of lactic acid under the same conditions, but the amount of acid freshly produced, decreased in proportion as that originally added to the juice was increased. The production of lactic acid in the experiments in which no sugar was added may be assumed to be at the expense of the glycogen. When cane sugar was added to the juice, the quantity of lactic acid already present either remained the same or increased considerably. The varying results recorded in the above experiments are to be attributed to differences in the physiological condition of the yeast from which the extracts were prepared. From these results the authors are led to conclude that lactic acid (which may be regarded as the carboxylic acid of ethyl alcohol) is an intermediate product in alcoholic fermentation. Glucose may be regarded as breaking up into 2 mols. of lactic acid through a hypothetical α-δ-dihydroxy-γ-ketonic acid as an intermediate stage. The lactic acid is then hydrolysed into carbonic acid (H_2CO_3) and ethyl alcohol. This view is supported by the action of different alkalis upon glucose; under some conditions lactic acid is produced, whilst under other conditions (sunlight) alcohol is formed. Zymase, therefore, may be assumed to consist of two enzymes, one converting the sugar into lactic acid, and the other converting the lactic acid into alcohol and carbon dioxide. The lactic acid bacteria probably secrete only the first of these enzymes, whilst both are present in yeast. In the case of fermentations with yeast cells, both enzymes would be present in excess, owing to continuous secretion, and the final products of fermentation only would be found. In cell juice, where no further secretion of enzymes can take place, one or other might be in excess, according to the condition of the yeast at the time of extraction, hence the variable results recorded above.

Acetic Acid.—In all the experiments a production of acetic acid was observed in the juice on standing for four days; the amount of this acid produced was much greater when sugar was added to the juice than when no sugar was added.—J. F. B.

Attenuation [Beer]; Effect of Different Temperatures and Processes of Mashing upon the Final Degree of ——. C. Bleisch and P. Regensburger. Zeits. ges. Brauw., 1904, 27, 109—114.

The authors have investigated the effect of different temperatures of mashing upon the final degree of attenuation, *i.e.*, the maximum fermentability of the wort, when fermented on the one hand by the feebly attenuating Saaz yeast and on the other with the highly attenuating Frohberg yeast. The mashes were made in the laboratory with both dark and pale malts, the grist being mixed with water, so that the desired temperature of saccharification was established as soon as the mixture was made, and maintained constant until saccharification was complete. In certain cases, where saccharification was unsatisfactory, the mash was boiled up subsequently and again saccharified. Mashes, which were made at 60° C. and at 75° C. respectively, saccharified with extreme slowness, and saccharification was not complete in three hours. Between these limits the mashes saccharified rapidly and well. The fermentations showed that the temperature at which the mashes were made had a very great influence on the final attenuation with both types of yeast, the attenuations being restricted as the mashing temperatures were increased. To those worts which had been fermented with Saaz yeast a similar quantity of Frohberg yeast was subsequently added, with the result that the attenuations were raised to the same points as were attained with Frohberg yeast alone. Worts prepared in the above way, by mashing at definite high temperatures from the first, were compared with worts mashed on the principle of Windisch's "Spring" mashing process (this J., 1904, 198), by pouring cold mash into very hot water in such proportions that the same mashing temperatures were ultimately obtained in both

Dark Malt.

Mashing Temperature.	Time required for Saccharification.	Final Attenuation.	
		Saaz.	Frohberg.
C.		Per Cent.	Per Cent.
65 *a*	1 hour 30 mins.	71·38	84·80
65 *b*	2 hours.	68·20	70·47
70 *a*	1 hour 35 mins.	57·74	70·47
70 *b*	3 hours.	41·51	47·28

Pale Malt.

65 *a*	1 hour 15 mins.	80·98	91·63
65 *b*	1 hour 45 mins.	68·88	83·58
70 *a*	1 hour 10 mins.	68·06	79·08
70 *b*	2 hours 30 mins.	55·94	65·67

a denotes mash mixed at that temperature from beginning.
b denotes mash according to the "Spring" process, temperature reached from above.

cases. In the latter case, however, the diastase would be partially crippled, owing to the principle of reaching the mashing temperature from above instead of establishing it at once. The above table shows the result of fermentation of both types of mash.

The crippling of the diastase by the "Spring" mash process is very clearly shown by the reduced attenuations of the wort prepared in that manner. The principle of mashing at high initial temperatures, comparable with those produced in the laboratory, can be applied in practice by suitable mash tuns and coppers. The principle underlying the "Spring" mashing process has been used in Bavaria for a long time by boiling a large portion of the total mash at once and letting down the residual cool mash into the hot decoction. The main difficulty in applying this principle to the dark Bavarian malts lies in the excessive crippling of the diastase and the consequent danger of imperfect saccharification.

—J. F. B.

Attenuation; Determination of the Maximum Degree of ——. W. Windisch. Woch. f. Brau., 1904, 21, 101.

With the introduction of processes for reducing the fermentability of the wort, the methods for determining this factor become of greater importance. The general procedure for the determination of the maximum degree of attenuation, which a particular yeast is capable of producing n any given wort, consists in fermenting a sample of the wort with a large proportion of yeast under the most favourable conditions. In order to obtain a result in the shortest possible time, the test wort is generally fermented at a temperature as high as 25°—28° C., and fermentation s assisted by frequent agitation to remove the carbon dioxide. But the author points out that under such conditions, with a very rapid and vigorous fermentation at a high temperature, a notable loss of alcohol may occur by volatilisation, especially if the surface of the fermenting wort be relatively large. This loss of alcohol involves an rror in the gravity determination, with the result that the beer on racking may show an apparent attenuation greater han the possible maximum as determined by the test. For his reason it is better to ensure greater accuracy at the xpense of a longer time, and to conduct the test fermentaion more slowly at a temperature of 20° C. only. With a arge proportion of seed yeast and frequent shaking, a result is generally obtainable in three or four days.

—J. F. B.

Beer Filtration and Albuminoid Turbidity ——. W. Windisch. Woch. f. Brau., 1904, 21, 93—95.

The most insidious and puzzling of the turbidities occurring n beer, apart from microbic infection, is the so-called gluten" turbidity. It is caused by the separation of lbuminoid compounds in a state of infinitesimal fineness. A "gluten" turbidity is often present in the beer in the ager cask, but in most cases this is removed by filtration. Unfortunately, however, the beer, which has left the filter bsolutely bright, may again become turbid after a few ays' storage, especially if exposed to low temperatures. Hence it is often said that a beer is sensitive to chill. In esting for this liability to become turbid when chilled, it is ot sufficient in the laboratory merely to cool the sample by means of an ice-bath; the turbidity will frequently fail to ppear by the mere application of cold, but will be found o develop if the samples be placed all night in the open ir exposed to a cold wind. In a series of investigations n the appearance of "chill turbidities" in filtered and nfiltered beer, the author found that only a very few of the amples were inherently—*i.e.*, without filtration—liable to "gluten" turbidities by chilling. Those samples which had been passed through a filter which had not been cleaned for some time were not very liable to this turbidity, but were not so free from it as the unfiltered samples. On the other hand those samples which had been filtered in a filter which had recently been thoroughly cleaned with chemical agents showed a most remarkable tendency to turbidity. This series of experiments shows conclusively that the liability to turbidity is imparted to the beer by the filter, and that it is worst in the case of new or recently cleaned filters. Moreover, the experiments showed, and experience on the large scale has confirmed the fact, that exposure to cold is not an absolutely necessary factor in the production of turbidity after filtration, since these turbidities, although hastened by cold, will develop when the filtered beer is stored at the ordinary temperature. It is now established that the turbidities, often wrongly attributed to chill, are due to the separation of metallic compounds of the albuminoids. The metal which is the chief cause of the trouble is undoubtedly tin, which, either in the pure form or in the form of alloys, is used as a coating on certain of the brewery plant, and especially in the beer-filter. The metal may be present in the beer in such minute traces as to evade detection by chemical tests. In fact, Bergsten has shown that the addition of 0·00025 grm. of tin to a hectolitre of beer is sufficient to bring about a characteristic turbidity after 24 hours. This explains the trouble on the practical scale when a beer, which has been filtered perfectly clear through a new or recently cleaned filter, becomes turbid after standing for a couple of days. The bright, tinned surface of the beer filter must be allowed to become insulated by a thin coating of beer scale. This can be effected at once by allowing beer to remain in the filter all night. When once a deposit has formed, care should be taken to allow it to remain on, consequently all cleansing agents which remove beer scale should be avoided, and the filter should only be cleansed by steeping it in hot water, and brushing the interior gently. The use of filters enamelled internally with glazed enamel, and provided with horse-hair sieves instead of wire gauze, is to be recommended.—J. F. B.

Beer Turbidity caused by Metallic Surfaces. C. F. Woch. f. Brau., 1904, 21, 108.

Referring to the article by Windisch (see preceding abstract) on the production of turbidities in beer through contact with bright metallic surfaces, the writer remarks that a large proportion of the beer, returned by the retailers as turbid and unfit for sale, has been spoilt by contact with the metal pipes leading from the cellar to the bar. The writer has observed that complaints of turbid beer have generally occurred immediately after the innkeeper has given his pipes a thorough cleansing. He therefore concluded that objectionable chemical agents were used for cleaning the pipes, and gave orders that only a weak solution of sodium carbonate in conjunction with lime, or even merely hot water, should be employed for that purpose. This practice proved an almost perfect cure for the trouble.—J. F. B.

Distillery Washes of the Present Season; Analyses of ——. H. Hanow. Zeits. Spiritusind., 1904, 27, 58.

The author has analysed 11 samples of fermented wash from potato mashes in order to check the yield of alcohol and the efficiency of the fermentation. The quantity of fermentable extract still unfermented was determined by evaporation of the alcohol on the water-bath, neutralisation of the acidity down to about 3°, and fermentation of the extract with pure yeast, if necessary, after saccharification with malt extract. The results are shown in the table on page 264. The attenuation and percentage of alcohol in samples 1 and 2 were satisfactory, and the fermentation was pure. Nos. 3 to 5 were also fairly satisfactory. No. 6 is very badly attenuated, and the fermentation had been impure, as is shown by the high acidity, and that the quantity of diastase was insufficient. In Nos. 7 to 11, the attenuation is more or less deficient in spite of the presence of sufficient diastase, but the acidity is not excessive. In such cases it may be assumed that the yeast has ceased to work too early. This

No.	Original Concentration of the Mash. Bg.	Attenuated Wash. Bg.	Alcohol per cent. by Vol.	Degree of Acidity.	Diastase.	Alcohol obtainable from Residual Extract. Vol. per cent.
1	..	0·93	13·0	..	..	..
2	..	1·30	12·5	0·6	sufficient	..
3	22·4	1·71	11·7	0·8	„	0·43
4	19·8	1·82	10·0	0·7	„	0·12
5	21·2	1·95	10·8	0·8	„	0·32
6	21·2	2·21	10·6	1·2	very little	0·61 (with diastase 0·9)
7	22·9	2·72	11·5	0·7	sufficient	0·72
8	24·5	3·05	12·3	0·7	„	0·63
9	24·1	3·54	11·7	0·8	„	0·43
10	25·7	3·70	12·8	0·9	„	1·16
11	23·1	3·81	11·0	0·6	„	0·41

may be due to the faulty preparation of the pitching yeast, or to the temperature in the primary fermentation having risen too high, or to that in the secondary fermentation having fallen too low.—J. F. B.

Citric Acid in Wine; Simple Method for the Detection of ——. A. Devarda. XXIII., page 273.

Turpentine in Denatured Spirit; Determination of ——. U. Chierego. XXIII., page 274.

English Patents.

Wort contained in the Malt of Breweries, Distilleries, and Similar Industries; Rapid Extraction of ——. E. de Meulemeester, Brussels. Eng. Pat. 25,582, Nov. 23, 1903. Under Internat. Conv., Dec. 1, 1902.

The apparatus employed consists of a vertical cylinder containing two sets of concentric perforated walls, and into the space between these latter is introduced the "sacrated malt." The wort drains away through the perforations, and the grains are washed by introducing hot liquor into the annular space between the outer perforated partition and the casing, this liquor then traversing the grains and draining away through the inner perforated partition.
—C. S.

Brewing; Impts. in ——. J. St. P. Macardle, Dundalk. Eng. Pat. 23,456, Oct. 27, 1902.

To supply pure air, in order to prevent wild yeast infection in the brewery, the air is drawn in through a fan and forced through a succession of filters, of large superficial area, whence it is delivered to the various parts of the brewery through pipes. The intrusion of unfiltered air is prevented by providing air-locks at the entrances to the building.
—C. S.

Wines and the like; Apparatus for Use in the Manufacture of ——. G. Driancourt, St. Quentin, France. Eng. Pat. 2986, Feb. 7, 1903. Under Internat. Conv., Feb. 8, 1902.

See Fr. Pat. 318,506 of 1902; this J., 1903, 224. T. F. B.

Filtering Apparatus [Distillers' Slops, &c]; Impts in ——. A. E. Cummer, Cleveland, Ohio. Eng. Pat. 23,230, Oct. 27, 1903.

The apparatus is designed for the filtration of distillers' slops, waste from glucose works, and similar liquids containing starch and the like, which are to be recovered. It consists of an outer casing or cylinder having a series of lengthwise slots, so as to afford free outlet for the filtered liquid. Suitable supports are provided, bearings for a central shaft, and supply tubes. The inside of the casing is lined with a perforated sheet metal plate, which overlies the slots and acts as a filtering material, although a mesh of wire gauze may be added as well. A continuous flow of liquid is sent through the apparatus under pressure, and the separation of the solid particles effected by stirring blades fixed to a central shaft. Over the back end of the shaft is fitted a spiral conveyor, the spirals getting closer together near the exit; this serves to force out the separated solid matter through a terminal opening closed by a cover controlled by a spring. To keep the inside of the filtering plate clean, a cleanser travelling backwards and forwards, is provided, having a scraper edge, and fitted with pipes through which steam or hot water may be admitted.—L. F. G.

Yeast; Preparation of ——, *capable of Fermenting at High and Low Degrees of Density, Acidity, and Attenuation.* G. Jacquemin. Second Addition, dated Sept. 14, 1903, to Fr. Pat. 307,950, Feb. 7, 1901.

In the original specification a means was described for the production of seed yeast for the distillery, possessing any desired special characters, by acclimatising it by aseptic fermentations through a number of vessels to the conditions desired. It is now found that the number of vessels may be reduced, by omitting some of them and replacing those omitted by ordinary fermentation tuns in which the bacteriological purity of the unsterilised worts is ensured by the presence of copper salts or of a mixture of hydrofluosilicic and formic acids. The yeast grown in the laboratory should be taken from a vessel containing a larger proportion of antiseptic than the wort to be fermented by it on the large scale. These antiseptics are also claimed for general use in distillery worts and in the saccharification of grain by the mucedine.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Margarine; Micro-Organisms in ——. A. Zoffmann. Chem. Rev. Fett-u. Harz-Ind., 1904, **11**, 7.

The chief micro-organisms that attack margarine are mould fungi (*penicillium*) and different species of saccharomycetes. In order to protect margarine from mould fungi it should be covered with sound parchment paper taken directly from concentrated brine, and should be packed so that there is no air space between the packages and the interior of the case. The main predisposing cause is the presence of a large amount of casein in the margarine. A product which has been mixed and kneaded with over-soured milk will contain flecks of casein on which the mould fungi will develop on standing. Yeasts develop in margarine chiefly in the autumn, and when present in large quantity may produce so much carbon dioxide as to burst the packages. Hence it is dangerous to add either cane sugar or glucose to margarine. The temperature to which the fats are heated during the manufacture is quite insufficient to sterilise infected materials.
—C. A. M.

Caffeine in Coffee Infusions; Amount of ——. J. Katz. Archiv der Pharm., 1904, **242**, 42—48.

Experiments were made to determine the proportion of caffeine extracted by treating 15 grms. of powdered roasted coffee with 300 c.c. of boiling water in (1) Arndt's percolator; (2) for five minutes in a covered vessel in a boiling water bath; and (3) in an ordinary percolator. In each case the amount of caffeine and total extract was determined, the caffeine by the author's method (this J., 1903, 1300) with the following average results: Proportion of caffeine extracted in (1), 96·5; (2), 85·2; and (3), 60·3 per cent. The amount of total extract in the infusions showed parallel variations. The addition of sodium bicarbonate to the water in the proportion of 1 grm. per litre only increased the amount of caffeine extracted to an insignificant extent.
—C. A. M.

Oils and Fats; Relative Inner Friction of Edible ——. M. Plessner. XXIII., page 273.

Cotton-Seed Oil Industry and the Establishment of Cotton-Seed Mills in India; Note on ——. J. Mollison. Trade Report, page 279.

English Patents.

Emulsifying Apparatus; Impts. in ——. F. W. Howorth, London. From E. Bazzi and Co., Milan. Eng. Pat. 28,022, Dec. 21, 1903.

The apparatus is specially adapted for emulsifying fats in separated milk. It consists of a hollow disc or drum, with a central aperture, through which the two liquids to be emulsified are fed from a hopper or feeding funnel The disc contains one or more radial vanes, and is rapidly rotated, the liquids being forced out centrifugally in an emulsified condition, through circumferential openings.

—L. F. G.

Flavouring Preparations. E. J. Boake, Stratford. Eng. Pat. 28,226, Dec. 23, 1903.

"Natural copra as imported," is pressed and the oil extracted and refined; the harder portion of the oil is then separated by crystallisation, and, on account of its high melting point and lack of odour, is used as a solvent for flavouring or essential principles. For instance, esters or essential oils may be dissolved in it, or it may be added to the warm (undistilled) product of the esterification of alcohols, whereby the ester is dissolved in the fatty substance and can be removed when cold, and washed.

—T. F. B.

Cocoa Paste; Manufacture of ——. F. E. F. Neumann, Wandsbek, Germany. Eng. Pat. 7595, April 1, 1903.

See Fr. Pat. 330,616 of 1903; this J., 1903, 1099.—T. F. B.

United States Patents.

Casein for Food; Preparation of ——. A. A. Dunham, New York. Assignor to the Casein Co. of America. U.S. Pat. 750,832, Feb. 2, 1904.

Casein is dissolved and partly digested by a suitable digestive agent, the peptonising process being interrupted by desiccating the solution, applied as a thin film, on cylinders heated to not less than 212° F. The proteid matter is removed and powdered.—R. L. J.

Albuminous Compounds; Process of Making Water-Soluble ——. A. Busch, Brunswick, Assignor to Bauer and Co., Berlin. U.S. Pats. 750,945 and 751,428, Feb. 2, 1904.

See Fr. Pat. 333,334 of 1903; this J., 1903, 1362.—T. F. B.

Centrifugal Separator [Milk]. P. L. Kimball, Bellows Falls., Vt., Assignor to Vermont Farm Machine Company. U.S. Pat. 751,178, Feb. 2, 1904.

The separator consists of a cylindrical drum, with a conical upper part and a short cylindrical piece attached, through which passes a milk admittance tube reaching nearly to the bottom of the drum. Above the bottom is placed a horizontal perforated plate, and the drum also contains a liner with vertical slots in its walls, for the purpose of directing the milk radially. Outlets are provided for the cream and for the separated milk.—L. F. G.

French Patent.

Casein; Clear Solutions of ——. P. Horn. Fr. Pat. 335,799, Sept. 18, 1903.

A 10—20 per cent. solution of commercial casein is made by using 7—8 per cent. (on the dry proteid) of caustic alkali. Ether (20—40 per cent.) is added, and the mixture is shaken, allowed to stand, and the clear casein solution drawn off.—R. L. J.

(*B.*)—SANITATION; WATER PURIFICATION.

Chloroform as an Antidote to the Injurious Effects of the Inhalation of Nitrous Fumes. Seyfferth. Concordia, Zeits. f. Arbeiter-Wohlfahrtseinrichtungen, **10**, 319. Chem. Centr., 1904, **1**, 472.

The author recommends the proposal of E. Weiskopf to use chloroform in cases of inhalation of nitrous fumes. The chloroform should be administered in doses of 3—5 drops (0·045—0·078 grm.) at intervals of 10 minutes till ·5 grms. have been used.—A. S.

French Patent.

High-Pressure Filters [Water]. W. S. Rawson. Fr. Pat. 335,676, Oct. 1, 1903.

A metal cylinder, fixed to the water-tap by means of the usual caoutchouc cone connection, which is pressed tightly against the tap by the water pressure, contains a block of filtering material, preferably made of calcined magnesia, and this is retained in its place by another caoutchouc cone. Or, the second caoutchouc cone may be attached to another pipe delivering the filtered water, and thus several filters may be mounted in parallel between the supply and delivery pipes. The upper portion of the filtering block may be made star-shaped, to increase the filtering area.—L. F. G.

(*C.*)—DISINFECTANTS.

Ammonium Fluoride for the Disinfection of Rubber Hose. J. Brand. Zeits. ges. Brauw., 1904, **27**, 115—117.

Commercial acid ammonium fluoride, $NH_4F.HF$, is one of the most valuable disinfectants in the brewery, both on account of its power and absence of odour. The chief use to which the salt is put, in solutions containing 0·5— per cent., is for the disinfection of rubber hose pipes. It has recently been suggested, however, that the rubber hose is attacked by the acid and caused to crack and perish. The author has examined specimens of hose which were supposed to have become corroded, and from his experiments it may be concluded that dilute fluoride solutions may safely be used for disinfecting rubber hose pipes, although it is conceivable that badly mixed rubber containing basic mineral loading matter would show a corrosion due to the action of the acid on the loading material. The disinfecting power of the fluoride is doubtless mainly due to the loosely combined hydrofluoric acid. The commercial preparations never correspond exactly to the formula $NH_4F.HF$ and the active hydrofluoric acid varies largely in different samples. The loosely combined acid is best determined by titration in a platinum or silver dish with N/5 baryta solution; using litmus as an indicator, the end point is not very sharp. Most of the commercial samples contain considerable proportions of hydrofluosilicic acid, which, however, is also a valuable disinfectant.

—J. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

Bamboo Pulp. C. D. Ekman. Wochenbl. f. Papierfab., 1904, **35**, 461—462.

The author calls attention to the extreme fitness of the bamboo fibre for mixing with sulphite wood pulp to improve the quality of the paper and to take away its "woody" appearance. In length of fibre, softness, and whiteness, bamboo pulp is equal to the best cotton pulp. The bamboo is obtainable in unlimited quantities in tropical climates, but the cane itself will not bear the cost of transportation to Europe. The pulp would have to be manufactured in the district in which the bamboo is grown. Every species of bamboo is not equally suitable for pulp-making; the pulp is generally difficult to bleach and requires a large proportion of bleaching powder. Some species can be bleached to a good white with 15 per cent. of bleach, whilst others, treated in the same way, give a poor colour with even 25 per cent. of bleach. Only the fully grown canes can be treated economically. There should be a good sale in Europe for the best quality of bamboo pulp for the purpose indicated above.—J. F. B.

Hydrocellulose; So-called ——. A. L. Stern. Proc. Chem. Soc., 1904, **20**, 43.

When cellulose is exposed to the action of dilute acids under certain conditions, the tenacity of the fibre is destroyed, and it falls to a powder which has been called hydrocellulose, and stated to have the empirical formula $C_{12}H_{22}O_{11}$. It is now shown that when the above reaction takes place, instead of a gain in weight, as theory indicates, there is invariably a loss, and that a small amount of soluble matter is formed, a portion of which, in all probability, is *d*-glucose. The elementary composition of the powder is also shown to be identical with that of cellulose, the previous statements bearing on this point being founded on faulty experimental methods. A hydrated cellulose is not formed under these conditions, but a hydrolysis takes place similar to that undergone by other carbohydrates under comparable conditions.

English Patents.

Paper Pulp; Manufacture of —— [from Furze]. G. P. Horteloup, Paris. Eng. Pat. 26,149, Nov. 30, 1903. Under Internat. Conv., Dec. 9, 1902.

See Fr. Pat. 327,136 of 1902; this J., 1903, 879.—T. F. B.

Casein-Cellulose Composition, and Process for Producing Same. J. C. Fell, London. From the Casein Co. of America, New York. Eng. Pat. 23,752, Nov. 2, 1903.

See U.S. Pat. 748,709 of 1904; this J., 1904, 128.—T. F. B.

French Patents.

Waste Paper; Machine for Reducing, Mixing, and Kneading ——. R. Dietrich. Fr. Pat. 335,736, Oct. 3, 1903.

The machine consists of two compartments, a mixing cylinder and a kneading chamber of conical form. The paper is fed in through a funnel attached to the end wall of the mixing cylinder; it is there reduced by rotating toothed wings and passed into the kneading chamber by way of a domed passage, partially open to the air, which discharges the reduced paper directly on to the periphery of the kneading drum.—J. F. B.

Metallic Paper, Impermeable to Air, Water or Grease, and Process of Manufacturing same. Süddeutsche Patent-metallpapier-Fabr., Act.-Ges. Fr. Pat. 335,798, Sept. 18, 1903.

See Eng. Pat. 23,425 of 1902; this J., 1903, 508.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Bismuth; Some Combinations of ——, with Hydroxybenzoic Acids. P. Thibault. Bull. Soc. Chim., 1904, **31**, 36—38.

Bismuth p-hydroxybenzoate, $Bi(C_7H_5O_3)_3$.—This salt is obtained by heating on the water-bath pure anhydrous bismuth oxide, prepared according to the author's method, with an excess of *p*-hydroxybenzoic acid in the presence of water, so that reaction takes place with a saturated aqueous solution of the acid. When microscopical examination shows that the yellow needles of the anhydrous oxide have disappeared, the mixture is evaporated to dryness, and the cold residue washed with absolutely anhydrous ether. The salt consists of minute acicular transparent crystals, which are decomposed by the least trace of moisture. It cannot be obtained by double decomposition, nor by treating hydrated bismuth oxide with the acid.

Bismuth m-hydroxybenzoate is formed in a similar manner, but has not been isolated in a state of purity, since it is decomposed by all solvents, even by anhydrous ether.

Bismuth β-resorcylate, $C_6H_3(OH)_2(CO.O.BiO)[1.3.4]$.—This salt is a white powder comprised of minute transparent needles, insoluble in water and ordinary solvents. It is obtained by heating anhydrous bismuth oxide for several hours with excess of β-resorcylic acid. The insoluble matter is then washed with alcohol or with boiling water, and dried.

Bismuth hydroxysalicylate, $C_6H_3(OH)_2(CO.O.BiO)$ $[1.4.6]$, is obtained in a similar manner by the action of hydroxysalicylic acid on anhydrous bismuth oxide. It occurs in small yellowish-white transparent needles, stable in presence of water.—J. O. B.

Camphor; Synthetic ——. M. O. Forster. Chem. and Druggist, 1904, **64**, 289.

The author points out that the compounds, called "pinyl oxalate" and "pinyl formate," obtained as intermediate products in the manufacture of synthetic camphor (see this J., 1904, 75) are bornyl hydrogen oxalate ($C_{10}H_{17}O.CO.CO_2H$) and bornyl formate ($C_{10}H_{17}O.CH:O$) respectively. The reactions which occur in the conversion of bornyl hydrogen oxalate into camphor and of bornyl formate into borneol, when the mixture of the two compounds is heated with alkalis, are represented by the following equations:—

$$(1)\quad C_{10}H_{17}O.CO.CO_2H = C_{10}H_{16}O + H_2O + 2CO.$$

$$(2)\quad C_{10}H_{17}O\cdot CH:O = C_{10}H_{18}O + CO.$$

—A. S.

Nicotine; Reciprocal Solubility of —— in Water. C. S. Hudson. Zeits. physik. Chem. 1904, **47**, 113—115.

The behaviour of nicotine with water is peculiar, and affords evidence of the existence of combination of the base with water. When equal volumes of nicotine and water are mixed at ordinary temperatures, a marked evolution of heat, and a considerable contraction in volume occur, the resulting mixture having a viscous consistence resembling that of glycerin. On warming, separation occurs, and two layers of liquid are formed, the upper stratum consisting of a saturated solution of nicotine in water, the lower of a saturated solution of water in nicotine. When nicotine is frozen in a mixture of solid carbon dioxide and ether, it solidifies to an amorphous mass which does not crystallise when slowly warmed. Nicotine mixes with water in all proportions at temperatures under 60° F., and above 210° F. Between these temperatures the reciprocal solubilities vary. This was determined by the method of Alexejew, by noting the temperature at which turbidity occurs in mixtures of known weights of the two bodies. The temperatures of separation and re-solution of known quantities of nicotine in water were found to be as follows:—

—	Separates at	Redissolves at
	° F.	° F.
6·8 per cent. of nicotine........	94	95
7·8 " "	89	155
10·0 " "	75	..
14·8 " "	65	200
32·2 " "	61	210
49·0 " "	64	205
66·8 " "	72	190
80·2 " "	87	170
82·0 " "	129	130

The physical properties of the two layers of liquid containing nicotine and water, are of interest. "At about 90° F. a saturated solution of water in nicotine has the same density as a saturated solution of nicotine in water." Above this temperature the density of the nicotine layer is less than that of the water layer; below it, the nicotine layer is the denser. Consequently when a mixture of equal weights of nicotine and water are heated above 210° F. and cooled; at 205° F. it becomes turbid and a layer of nicotine saturated with water separates and floats on the top. When the mixture cools to 90° F. the layers change places, the nicotine layer sinks and the aqueous stratum rises. At 64 the layers mix and the solution becomes homogeneous. The development of heat on mixing nicotine with water is probably due to the formation of a hydrate; the same is borne out by the effect of dilution on the optical rotation and refraction equivalent of nicotine. The formation of this hydrate is the probable cause of the apparent reciprocal solubility of the two substances really insoluble in each other.—J. O. B.

Alkaloids in Conium maculatum; Distribution of the ——. E. H. Farr and R. Wright. Pharm. J., 1904, **72**, 185.

The plant was dried in warm air, extracted with cold 70 per cent. alcohol, and the extract added to water containing a few drops of sulphuric acid; the liquid was then evaporated till free from alcohol. The solution was made alkaline with potassium hydroxide, extracted with chloroform, and the chloroform solution extracted with dilute acid, again made alkaline, extracted with choroform, and the alkaloids taken up in dilute acid, liberated by means of alkali, extracted with chloroform, and converted, by means of fuming hydrochloric acid, into the hydrochlorides, vhich were weighed. The results showed the very apid production of alkaloids as growth proceeds, espeially during the flowering and fruiting stages; in the atter, the increase goes on until the fruit is about three arts grown, after which the percentage of alkaloid liminishes. The table shows the amount of alkaloid hydrochloride found in the various parts of hemlock taken from the same source.

Stage of Development.	Root.	Stems and Stalks.	Leaves.	Flowers.	Green Fruit.
Young plants, 4—6 ins. high	0·047	0·017	0·039	..	..
ft.—3 ft. 6 ins. high, showing incipient inflorescence	0·035 0·052	0·037	0·030	..	..
ft. high, in full flower	0·050	0.064	0·187	0·236	0·905

The amount of alkaloids calculated as hydrochlorides found in the dried hemlock fruit of commerce averaged 0·674 per cent., whilst that found in English fruit gathered by the author averaged 2·13 per cent. (limits, 1·05 and 3·57 per cent.).—T. F. B.

Orange Oil; South American ——. J. C. Umney and C. T. Bennett. Pharm. J., 1904, **72**, 217.

The authors have examined a sample of South American orange oil, which resembled in appearance Paraguay petit grain oil, but had a more delicate odour. The characters of the oil more closely resembled those of orange-leaf oil than of orange-flower oil. A comparison of the oil with some other oils is given in the following table :—

—	South American Orange Oil.	Paraguay Petitgrain Oil.	French Petitgrain Oil.	French Neroli Oil.	Chinese Neroli Oil.
pecific gravity.......................	0·887	0·891	0·885—0·900	0·870—0·880	0·850
ptical rotation	+ 2	+ 0 30	About 2	+ 1 to + 5	+ 35
sters, as linalyl acetate	36·5 per cent.	52·4 per cent.	50—75 per cent.	10—20 per cent.	4·79 per cent.
ree alcohols as geraniol	38·4 ,,	18·9	25—35 ,,	20—35 ,,	21·4 ,,
otal alcohols.	67·1 ,,	60·0 ,,	..	..	25·17 ,,

Owing to its low content of terpenes, the oil is readily oluble in alcohol (*e.g.*, in 2 vols. of 70 per cent. alcohol) Vhen the oil is fractionally distilled under reduced pressure, he optical rotation of the fractions gradually increases and he refractive index decreases with increase of specific gravity and boiling point. In the various fractions the uthors have detected *l*-pinene, dipentene, furfural, geranyl cetate, linalol, and geraniol. The oil also probably ontains terpineol, but, at the most, only traces of methyl nthranilate. For soap-scenting and perfumery purposes he oil appears to compare very favourably, with regard to odour value, with French petitgrain oil.—A. S.

Salicylic Acid [Free] in Bismuth Salicylate; Suggested Test for [Detection of] ——. W. Lyon. XXIII., page 273.

Chloral and Butylchloral; Reaction for Distinguishing between ——. E. Gabutti. XXIII., page 273.

English Patents.

Terpene Alcohols and Artificial Perfumes. J. Wetter, London. From Heine and Co., Leipzig. Eng. Pat. 3543, Feb. 14, 1903.

See Fr. Pat. 329,529 of 1903; this J., 1903, 1063.—T. F. B.

Citrylidene-Acetic Acid, its Nitrile or its Ethers; Manufacture of New Compounds derived from ——. A. Verley, Paris. Eng. Pat. 25,695, Nov. 24, 1903. Under Internat. Conv., Nov. 27, 1902.

See Fr. Pat. 326,771 of 1902; this J., 1903, 819.—T. F. B.

United States Patents.

Rufigallic Acid Ethers; Acidyl Derivatives of ——, *and Process of Making same.* K. Stephan and F. Kaiser, Assignors to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 751,216, Feb. 2, 1904.

By reacting on the alkyl ethers of rufigallic acid with acidylating agents, acidyl derivatives are obtained, which are nsoluble in water, and sparingly soluble in alcohol and ether; they have a yellow or brownish colour, are tasteless, and have a purgative action.—T. F. B.

Dialkyl-Barbituric Acid; Process of Making ——. M. Engelmann, Elberfeld, Assignor to Farbenfabr. vorm. F. Bayer and Co., New York. U.S. Pat. 751,724, Feb. 9, 1904.

See Eng. Pat. 22,967 of 1903; this J., 1904, 76.—T. F. B.

French Patent.

Dihydroxybenzenes, Formaldehyde, and Ammonia; Preparation of Compounds Soluble in Water from ——. Soc. Möller and Linsert. Fr. Pat. 335,725, Oct. 3, 1903.

See Eng. Pat. 20,223 of 1903; this J., 1903, 1306.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Matt Gelatin [Photographic] Paper; Preparation of —— P. Hanneke. Phot. Mitt., 1904, **41**, 49—51.

A suitable unsized paper is provided, on the side to be coated, with a layer of chrome-gelatin (7·5 grms of gelatin, 200 c.c. of distilled water, and 15 c.c. of 2 per cent. chrome-alum solution), which prevents the emulsion from sinking into the paper. This preliminary treatment can be dispensed with by using the matt baryta paper now obtainable commercially. The preparation of the following solutions, which may be effected in ordinary daylight, is next carried out :—I. Emulsion gelatin, 25 grms.; distilled water, 400 c.c.; ammonium chloride, 2 grms. II. Silver nitrate, 14 grms.; water, 100 c.c. III. Citric acid, 3 grms.; water, 50 c.c. These are then brought to 50 C. and mixed by lamplight in the following way: solution II. is run into I., which is kept well stirred, solution III. being then added. The emulsion obtained is filtered through flannel and applied to the paper (by lamplight) as follows :—A portion of the emulsion, heated to 40°—50° C., is poured into a clean flat basin, in which it should have a depth of about 1 cm. A sheet of paper, with the prepared surface downwards, is laid carefully on the emulsion, the corners being raised to see if any air bubbles are present on the paper; these must be removed by means of a glass rod. The paper is left on the emulsion for a minute, after which it is carefully raised by two corners, so that the excess of emulsion may drain off without running on to the back of the paper. The sheets are then hung by wooden clamps in a dark, moderately warm room (near the stove). After two or three hours they become dry, and are then smoothly rolled on to a pasteboard roller. The paper can then be exposed, toned, and fixed as usual. A suitable combined toning and fixing bath is the following :—Water, 1,000 c.c.; sodium thiosulphate, 200 grms.; crystallised sodium acetate 12 grms.; lead acetate, 12 grms.; ammonium thiocyanate (sulphocyanide), 10 grms.; citric acid, 4 grms.; and 1 per cent. gold chloride solution, 60 c.c. The prints must be strongly overprinted and placed direct in the above bath, which gives good purple and violet tones.—T. H. P.

Platinotype Process. L. Ebert. Phot. Corr.; through Phot. Mitt., 1904, 41, 33.

The following sensitising solution is recommended for platinotype papers:—Potassium platinochloride solution (1:6), 12 c.c.; "normal iron solution" (commercial), 7 c.c.; "iron chlorate solution" (commercial), 4 c.c. For cold tones gelatin is used for the film, and arrowroot for warm tones. For use with thin negatives, the "normal iron solution" is omitted, and the chlorate solution is increased to 11 c.c., whilst for hard negatives the chlorate solution is dispensed with, the sensitising bath consisting of platinochloride solution, 12 c.c.; "normal iron solution," 11 c.c. Development is carried out at about 50° R. (62·5° C.) with a solution containing potassium oxalate solution (1:3), 100 c.c.; oxalic acid solution (1:10), 20 c.c.; water, 100 c.c. For sepia tones it is preferable to add 20 c.c. of saturated mercuric chloride solution to the developer. It is stated that a sepia print prepared in this manner has been exposed to the light for 12 years without deteriorating sensibly.

—T. F. B.

Syrian Asphaltum for Printing Plates and Window Transparencies. C. Fleck. Sprechsaal, 37, 111—112.

The asphaltum is purified by mixing the powdered mass to a thick pulp with chloroform or oil of turpentine, and then shaking up several times with fresh ether. Finally, the ethereal mixture is filtered, and 5 parts of the residue are dissolved with 50 of pure chloroform, 75 of 85 per cent. benzol, and 1 part each of chemically pure lavender oil and Soudan brown, this last-named increasing the sensitiveness to light, whilst the lavender oil increases the tenacity of the film and facilitates development. The filtered and clarified solution is used for coating metal plates, and these, when dry, are copied under a negative or transparency, with an exposure of 30—45 minutes in strong daylight. After cooling down, the plates are developed with oil of turpentine, or a negative print can be obtained by developing with alcohol, this solvent taking up the parts of the asphaltum acted on by light and leaving the shaded parts. If the asphaltum solution be mixed with solutions of caoutchouc and sulphur in chloroform and benzene, the resulting film (without gelatin or collodion), will give delicate line prints on glass, suitable for fine etching with hydrofluoric acid. Very delicate screens can be produced on glass or stone with a film composed of Syrian asphaltum, 1 part; virgin wax, 1·2; stearic acid, 1·2; and "gas black," 0·2 part, dissolved in oil of turpentine on the water-bath. An open grain on granulated litho stone can be prepared by traversing the surface with a printing roller charged with a nitrobenzene solution of asphaltum. The gradation of half tones can be increased, and the use of a reversed negative dispensed with, by coating metachromotype paper with asphaltum preparation, transferring the exposed print to the stone, and developing after removing the paper or celluloid film. For coloured prints on marble, the unpolished surface is coated with a mixture of Syrian asphaltum, 5 parts; virgin wax, 1; oil of turpentine, 100; petroleum spirit, 100 parts. After development, all the parts to be left uncoloured are protected by a coating of rubber solution, and the dye is poured on to the stone, into the pores of which it penetrates, and reproduces the design with softened outlines. For window transparencies, the preparation first mentioned is applied to glass plates, previously coated with a 10 per cent. solution of gelatin or 4 per cent. crude collodion.

—C. S.

Photo-Retrogression, or the Disappearance of the Latent Photographic Image. L. Baekeland. Brit. J. Phot., 1904, 51, 146—148.

When exposed photographic plates, films, bromide papers, and, in some cases, chloride papers (of the "velox" class) are not developed for a considerable time after exposure, the latent image will gradually diminish and at length nearly, if not totally, disappear. Dry plates are least subject to this change, while bromide papers and films show rapid "retrogression" under certain conditions. The nature of the developer used has no influence on the extent of this change; that it is a chemical change is shown by the following facts:—Plates kept at a temperature of 0°—4° C. showed no sensible retrogression after two weeks, while those which had been kept at 40°—48° C. showed marked change after three days; plates stored over sulphuric acid showed much less deterioration of the latent image than when kept in a moist atmosphere; if the emulsion has a slight acid reaction, or contains any considerable amount of chromium salts, the retrogression is much more marked than in a neutral or chromium-free emulsion, while if the emulsion be slightly alkaline, the retrogression is reduced to a minimum, even in the presence of chrome alum. An over exposed plate has practically no tendency to this change, under-exposure affording the most favourable circumstances. It thus appears that photo-retrogression will vary with different brands of plate, film, or paper, and with certain kinds of film and paper will be very apparent, even 48 hours after exposure.—T. F. B.

Developers; Constitution of ——, which Develop in Absence of Alkali. A. Lumière and A. Seyewetz. Phot. Mitth., 1904, 41, 51—54.

Substances which have the property of developing the latent image of a photographic plate contain in their molecule an aromatic nucleus possessing either two hydroxyl residues, or two amino groups, or one hydroxyl and one amino group standing in the ortho- or para-position one to the other. It was formerly thought that the only compounds capable of developing without the addition of alkali were such as contain in their molecules two of the above arrangements, but certain developers, such as *o*- and *p*-amino-phenol, *o*- or *p*-phenylenediamine, and *o*-toluylenediamine, which contain only one of these groupings, have the power to develop in the presence only of sodium sulphite: these all contain at least one amino group. This power of developing in absence of alkali is not affected by the introduction of alkyl groups into one or both of the amino groups, but an acid residue diminishes the reducing power considerably. Compounds (like, *e.g.*, hydroquinone) having a double developing function due to hydroxyl groups develop too slowly in absence of alkali to be of practical use; but if amino groups occur simultaneously with the hydroxyl in such a compound, the developing property is considerably enhanced, and this more so as the number of amino groups is multiplied. Certain other substances are able to develop without the addition of alkali. These are formed either: (1) by the combination of an amino developer with a non-developing phenolic compound; all these act too slowly to be of practical use; or (2) by the combination of a phenolic developer with an amino developer; when these are sufficiently soluble in alkali sulphite solutions, they may be practically employed.—T. H. P.

English Patents.

Photographic Films. E. F. Beckwith and T. A. Carten, Ionia, Mich. Eng. Pat. 27,059, Dec. 10, 1903.

Photographic plates, films, papers, &c. are placed vertically in a receptacle into the bottom of which a sensitising liquid is slowly introduced; the plates, &c. are thus more highly sensitised at the bottom than at the top, this being to "compensate for variations in the actinic intensity of light due to differences in altitude."—T. F. B.

Photographic Developer ["Metoquinone"]; Preparation and Employment of a New Substance as a ——. B. J. B. Mills, London. From Soc. Anon. Plaques et Papiers Photographiques. A. Lumière et ses Fils, Lyon-Monplaisir. Eng. Pat. 7163, March 27, 1903.

See Fr. Pat. 325,385 of 1902; this J., 1903, 709.—T. F. B.

French Patent.

Photographic "Developing" Paper with Covering, soluble in Water, to Protect it from "Fog" [Stains]. Chem. Fabr. auf Actien vorm. E. Schering. Fr. Pat. 335,807, Sept. 21, 1903.

The film of gelatino-bromide or similar "developing" papers is protected from mechanical damage, or from contact with foreign substances, by a coating of dextrin or similar soluble inert substance. A 5 per cent. solution of dextrin is suitable for ordinary gelatino-bromide papers. —T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

Explosives; Progress in the Manufacture of ——, since the Development of Organic Chemistry. W. Will. Ber., 1904, **37**, 268—298.

The author describes the developments in the manufacture of explosives from the discovery of gunpowder in the fourteenth century up to the present time.—A. S.

Explosion of Nitroglycerin; Circumstances attending an ——, which occurred in the Final Washing House of the Factory of the Cotton Powder Co., Ltd., at Upleas Marshes, Faversham, on Nov. 9, 1903. By Captain J. H. Thomson, H.M. Chief Inspector of Explosives.

This explosion resulted in the death of one man. There were at the time of the explosion 1,000 lb. of nitroglycerin in the building, the whole being contained in the washing tank. The crater formed was about 30 ft. in diameter and 4 to 5 ft. deep. The possibility of the vibration of an air-pipe or the friction of a rubber shoe as the originating cause of the explosion is dismissed as improbable, and Captain Thomson arrives at the conclusion that it was due to the dropping of a small lead filter on to a tray containing some 3 lb. of nitroglycerin. It is suggested that it would be better "to carry out all such operations as filtering samples in the laboratory on a much smaller scale; but if it is required to do this in the final washing house, the filter should be made of some lighter material, such as ebonite, and should be mounted on a fixed stand."

In connection with the report, Dr. Dupré carried out some experiments as to whether it was possible to produce an explosion of nitroglycerin with a rubber shoe on a lead surface. Drops of nitroglycerin were placed on the lead and were submitted to violent glancing blows from a rubber-shod foot, but without effect. The experiment was repeated with some fine sand sprinkled on the explosive, with the nitroglycerin frozen, and finally with a little powdered sulphur added, the last experiment being to ascertain whether free sulphur in the india-rubber could have produced the effect. In all cases the result was nil. (See also this J., 1903, 650 and 1366.)—G. W. McD.

Explosion of Fulminate-Composition; Circumstances attending an ——, at the Factory of the Blenheim Engineering Co., Ltd., at Tunnel Lane, Greenwich Marshes, on Dec. 18, 1903. By Major A. Cooper-Key, H.M. Inspector of Explosives.

The explosion, which seriously injured a workwoman, took place during the filling of tubes with a composition of potassium chlorate, antimony sulphide, and amorphous phosphorus, and was undoubtedly due to the friction caused by the withdrawal of the wooden rammer which fitted too tightly. The explosion was communicated to some 3 to 4 oz. of composition lying on the table, and this caused the chief damage.—G. W. McD.

United States Patents.

Explosive, and Process of making same. B. D. Pike, San Francisco, Cal. U.S. Pat. 751,751, Feb. 9, 1904.

Metallic salts containing oxygen are reduced to powder which is mixed with "china-nut" oil so as to cover the particles of powder with the oil. Carbon and sulphur are then added and the whole mixed.—A. G. L.

Explosive. H. Poetter, Dortmund. U.S. Pat. 751,807, Feb. 9, 1904.

See Eng. Pat. 21,189 of 1902; this J., 1902, 1471.—T. F. B.

Priming Composition [for Detonators, &c.] M. Bielefeldt, Berlin. U.S. Pat. 751,605, Feb. 9, 1904.

See Fr. Pat. 326,055 of 1902; this J., 1903, 760.—T. F. B.

French Patent.

Explosives; Manufacture of ——. M. Bielefeldt. Fr. Pat., 335,801, Sept. 19, 1903.

An addition of potassium perchlorate to the other ingredients is claimed to increase the safety of the explosive in presence of fire-damp, without decreasing its explosive power.—C. A. M.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUANTITATIVE.

Nitrogen; Determination of ——, by Kjeldahl's Method. Guinness Research Lab. Trans. 1903, **1**, 13—16.

The various modifications of the Kjeldahl method are discussed and the results of a number of test analyses by Gunning's modification are given. In an addendum it is pointed out that when testing natural products like barley, a larger amount of sulphuric acid must be used than when working with pure nitrogenous compounds. The amount of acid should be sufficient to completely oxidise all carbonaceous matter, and to leave an excess in which the potassium sulphate forms a tolerably liquid solution on cooling.—A. S.

Gas Analyses by Combustion; Calculation of ——. A. Wohl. Ber. 1904, **37**, 429—432.

The errors introduced into the calculation of gas-analyses by combustion, through the assumption that the molecular volumes of all gases are alike, are very considerable, compared with the accuracy of modern gasometric methods. The molecular volumes of some common gases according to the latest determinations of density and molecular weight, are as follows, that of oxygen being taken as unit:—Hydrogen, 1·0017; oxygen, 1·0000; carbon monoxide, 1·0000; methane, 1·0020; and carbon dioxide, 0·99393. Hence 100 volumes of carbon monoxide exploded with 50 volumes of oxygen yield 99·4 volumes of carbon dioxide, a contraction of 50·6; and if the carbon monoxide be calculated, as usual, from the contraction, we get for its volume 2 × 50·6 = 101·2, an error of 1·2 per cent. The true molecular volumes should therefore always be used, and the calculations in the commonest cases will take the following forms, where the symbols or formulæ indicate the volumes of the respective gases, and K stands for the contraction:—Hydrogen: $H = 0{\cdot}6670\ K$; $H = 2{\cdot}0034\ O$. Carbon monoxide: $CO = 1{\cdot}9760\ K$; $CO = 1{\cdot}0061\ CO_2$; $CO = 2\ O$. Methane: $CH_4 = 0{\cdot}4990\ K$; $CH_4 = 1{\cdot}0082\ CO_2$; $CH_4 = 0{\cdot}5010\ O$. Other cases can of course be easily worked out.—J. T. D.

Boric Acid; Determination of ——, as Phosphate. F. Mylius and A. Meusser. Ber., 1904, **37**, 397—401.

Boric acid is separated from other substances by forming with methyl alcohol the volatile methyl borate (b. pt., 65° C.) and distilling this off. The authors then recommend the use of phosphoric acid, the aqueous distillate of methyl borate being mixed with phosphoric acid and excess of ammonia, and evaporated till evolution of vapours ceases, and finally heated at 400° C. in a current of steam till the excess of phosphoric acid is completely driven off. Boryl phosphate, BPO_4, is thus left behind, and is then weighed. The method is said to be sufficiently accurate to be useful in technical work.—J. T. D.

Road Materials; Testing of ——. L. W. Page and A. S. Cushman. U.S. Dep. of Agr., Bureau of Chem., Bull., No. 79, 1—46.

The most important physical and mechanical properties of road materials are hardness, defined as the resistance which a material offers to the displacement of its particles by friction; toughness, or the power to resist fracture under impact; and cementing or binding power, or the power possessed by rock-dust to act as a cement on the coarser fragments composing crushed stone or gravel roads. The tests in use at the School of Bridges and Roads in France are as follows:—

The *Deval* test is used for determining the resistance to abrasion, and has been found exceedingly useful. It is carried out by breaking the rock into uniform pieces capable of passing in all positions through a 6-cm. ring; 5 kilos. of these pieces are washed and dried, and then placed in an iron cylinder on which a cover is bolted. These cylinders are 20 cm. in diameter and 34 cm. in depth and are mounted in pairs on a shaft so that the axis of each cylinder is at an angle of 30° with the axis of rotation. The shaft is revolved at the rate of 2,000 revolutions per hour. At the end of 5 hours the machine is stopped, the contents are emptied into a basin, using water to wash out the cylinder, and the washed broken material is separated into three sizes: above 1 cm., between 1 cm. and 0·16 cm., and below 0·16 cm. diameter. The weight of this last portion is ascertained. As it has been found that only the best varieties of rock give less than 100 grms. (2 per cent.) of powder under 0·16 cm., the number 20 was adopted as a standard of excellence, and the "co-efficient of wear" of any rock is calculated from the formula—

$$\text{Co-efficient of wear} = 20 \times \frac{20}{W} = \frac{400}{W},$$

in which W is the weight in grms. of detritus under 0·16 cm. obtained per kilo. of rock used.

The *compression* test is made on at least three 25 mm. cubes of rock with a hydraulic compression machine. The cubes are tested either after desiccation in the open air, or at a temperature of 40° C., or after being saturated with water. The number 20 is again taken as the coefficient of the hardest rocks, the coefficient of any rock being calculated from the formula—

$$\text{Coefficient} = \frac{3000}{20} \times E = 150\ E,$$

where E represents the breaking load in kilos. per sq. cm. To determine the *density* of the rock, the cubes used for this test are measured and weighed.

The test for *hardness* is made with the Dorry machine. At least three specimens of each sample are prepared, 8 cm. high, and 4 cm. by 6 cm. in cross-section. These specimens are placed, two at a time, so that they rest on the upper surface of a circular grinding disc of cast-iron, rotated at the rate of 2,000 revolutions per hour, in a horizontal plane, by a crank. The specimens are held by clamps 26 cm. from the centre of the disc, and weighted so as to press against it with a pressure of 250 grms. per sq. cm. Standard sand, obtained by crushing quartzite rock and screening it, is fed on to the disc from a funnel, four litres of sand being used for each test. The diminution of height and loss in weight of the specimen is ascertained after every 1,000 revolutions; after 2,000 revolutions the specimen is reversed, so as to expose both ends to the grinding action. The loss in height after 4,000 revolutions is taken as the result of the test.

The *impact* test consists in letting two hammers, one weighing 12 kilos., the other 20 kilos., fall from heights of 100 cm. and 80 cm., respectively, on 4 cm. cubes of the materials, at least three cubes of each material being used with each hammer. The number of blows necessary to crack the specimen, as well as that needed for its complete destruction, is noted. The determination of the porosity, of the effect of frost, and of transverse breaking are also occasionally carried out.

For *wood paving blocks*, the resistance to wear when saturated with water is measured by the Dorry machine as above, except that emery is substituted for quartz sand. The *compression* test is made with a hydraulic press upon prismatic specimens with a base 8 cm. square, and a height equal to that of a paving block, the grain of the wood being parallel to the direction of the load. The test specimens are either dried at 30° to 40° C., or saturated with an amount of water, equal to that absorbed in service. The resistance to impact is determined on three dried and three wet specimens, using the 20 kilo. hammer, and a fall of 200 cm. The test piece has a base 6 cm. square, and a height equal to that of the paving block, and is placed in a cast-iron case 7 cm. square, open at top and bottom, the prism being held in place by a resinous cement, and projecting 1 cm. above the case. The number of blows which cause an appreciable breakage, indicated by a smaller rebound of the hammer and a diminution in height of the specimen, is noted. For determining the *thrust* caused by absorption when expansion is partially prevented, whole paving blocks are used. The thoroughly dried block is placed in a watertight receptacle and held between two plates at top and bottom, so that the top face rests against a stationary block of cast-iron, the lower plate being supported on the small lever arm of a cement-testing machine. Water at 30° C. is poured around the paving block; as soon as the lever arm of the machine tends to rise through the expansion of the block a valve is opened through which mercury pours into a vessel supported at the end of the arm till the arm comes back to mid-position, when the valve is closed. The weight of mercury in the vessel is consequently a measure of the force exerted by the test piece, and, as the vessel is supported on a spring balance, can be read at any time.

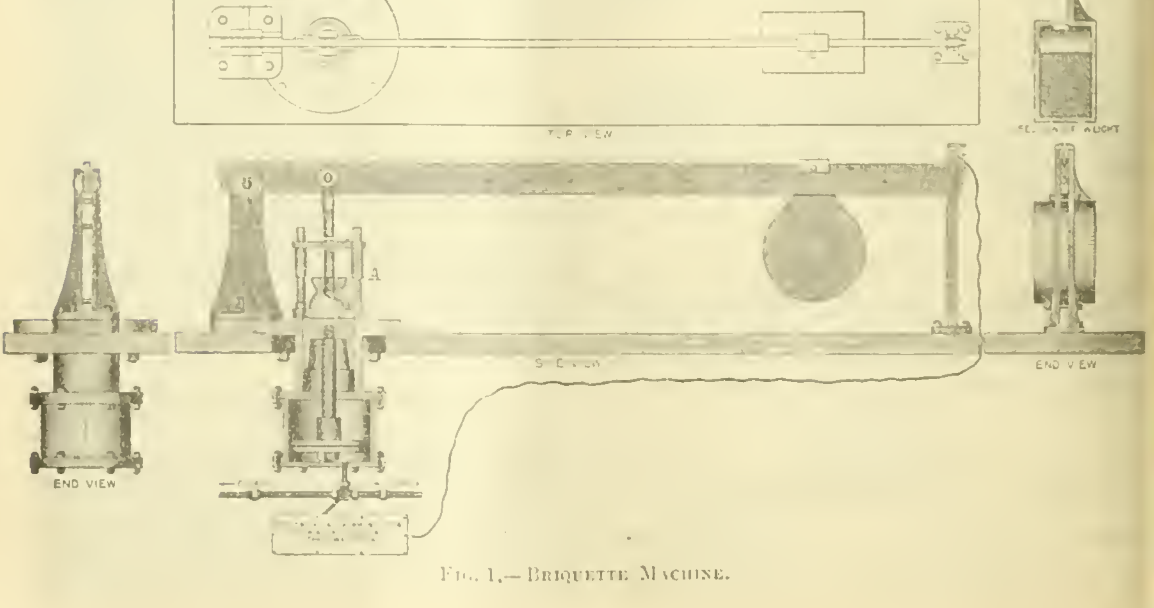


Fig. 1.—Briquette Machine.

bservations are made at first every three hours, then ery 12 hours, and finally every 24 hours until all increase ases.

For asphalts only chemical analyses are made.

In Portugal the Deval test is used, as well as a comession test, carried out on dry and wet 10, 7, and 5 cm. bes, the number of kilos per sq. cm. required to destroy test piece being used for comparison.

The following are the tests used in the road material laboratory in the United States. The *Deval* test is carried out practically as in France, the pieces used being of such a size as to pass through a 6 cm., but not through a 8 cm., ring. They are dried at 100° C. before being put into the machine. Besides the French coefficient, a "Department coefficient" is calculated by subtracting 4,000 grms. from the weight of the remaining fragments over 3 cm. in size, and dividing the difference by 10. If the result be 0, the material is considered unfit for road-making.

For the *cementation* test, 1 kilo. of rock fragments passing through a 6 mm., but not through a 1 mm., screen are ground in a ball-mill for $2\frac{1}{2}$ hours. The mill contains two iron balls weighing 25 lb. each, and makes 2,000 revolutions per hour. The powder obtained, which should pass through a 0·25 mm. mesh, is mixed with water to a stiff dough, and kept in a closed jar for 24 hours. About 25 grms. of this dough are then placed in a cylindrical metal disc, 25 mm. in diameter (A., Fig. 1), and subjected, by means of a closely fitting plug, to a pressure of 100 kilos. per sq. cm. For this purpose the die is placed on a platform supported by a hydraulic piston, below which water is admitted, the whole being so arranged that as soon as the platform is raised $\frac{1}{8}$ in., which requires one minute, an electric circuit is completed which shuts off the water-supply and opens an exhaust, the maximum pressure being only exerted for an instant. If the height of the resulting briquette is not exactly 25 mm., more or less material is taken so as to obtain a briquette of this height. Five such briquettes are then made, dried 12 hours in air, 12 hours in a steam bath, and tested in the machine shown in Fig. 2. It consists of a 1 kilo. hammer (H), guided by two rods (D) and ending in a small cone (L) at the top, which is caught on its lower side by two spring bolts, and lifted by a cross-head (I) joined to a crank shaft above. A vertical rod (P) directly over the cone can be adjusted so as to give a drop to the hammer varying from less than 1 mm. to 10 cm., the standard drop being 1 cm. When the cone of the hammer is brought into a hollow cone at the lower end of (P), the hammer is exactly centred, and is free of the rods (D). As the cross-head (I) rises, the cross-bolts are thrust open by the rod, releasing the hammer, which falls on a flat-end plunger (B) of 1 kilo.

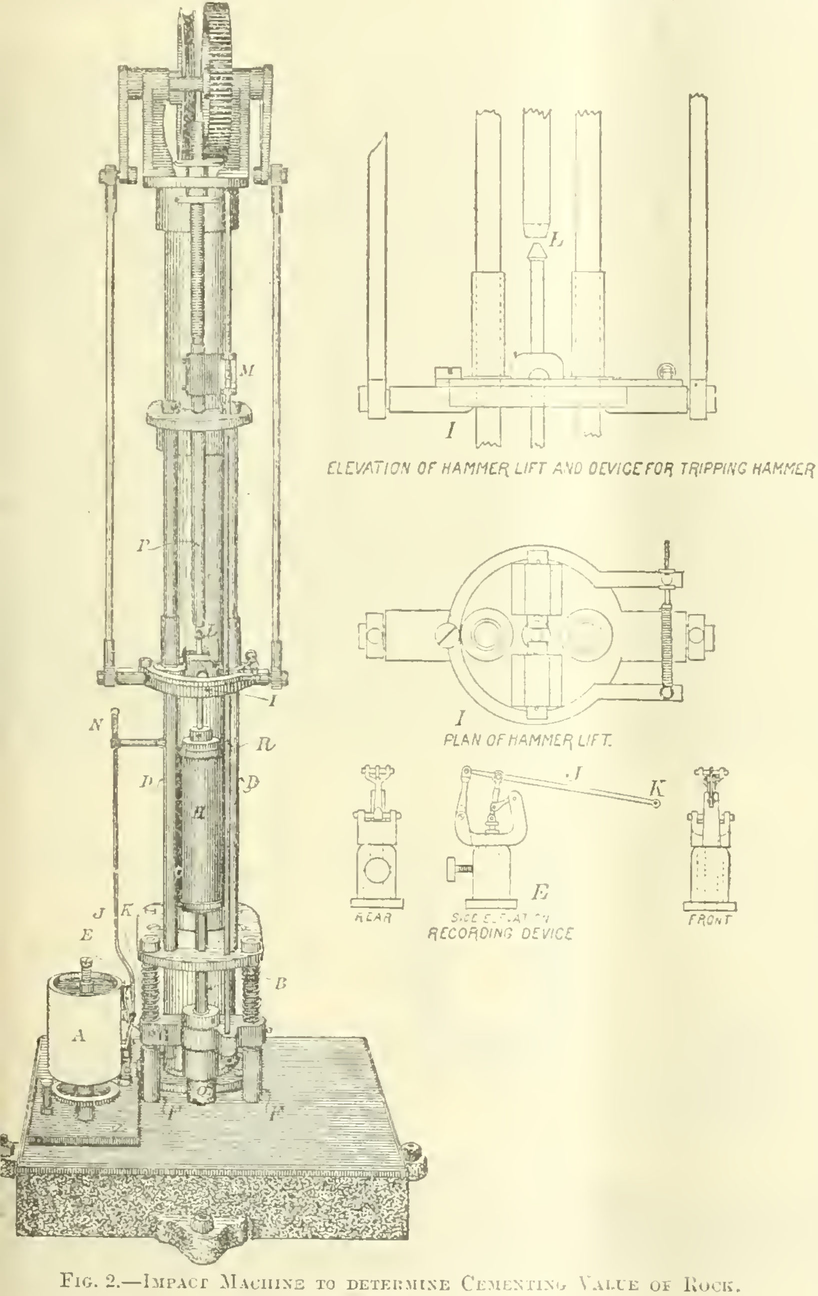


Fig. 2.—Impact Machine to determine Cementing Value of Rock.

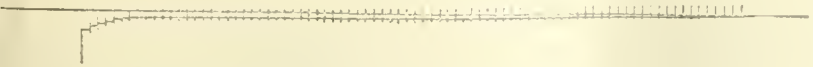


Fig. 3.—Showing Point of Failure in Cementation Test.

weight, pressed on the briquette (O), by two springs surrounding the guide rods (F). This plunger (B) is bolted to a cross-head (G) with which a small lever (J), holding a brass pencil (K), is connected by a link motion, giving the pencil a vertical movement five times as great as the movement of the cross-head. The movement of the pencil is recorded on a slip of silicated paper fastened on a drum (A) which moves through a small angle at each stroke of the hammer. A steel rod (R), passing up through (I), and through a piece of metal attached to the cone rod (P) is fastened to the cross-head (G). By means of this and a vernier scale (M) the fall of the hammer can be regulated, and by lowering the cone rod until it rests on the hammer cone, the height of the briquette can also be measured. The number of blows needed to destroy the bond of cementation of the material is noted, a diagram similar to that in Fig. 3 being obtained. At the last point the material does not recover from the blow, and the plunger stops at the point to which it is driven. The briquette itself is fastened to the bed-plate of the machine by means of a drop of thick shellac. The test is stated to give very useful comparative results.

The test for *toughness* is made on 25 × 25 mm. cylinders cut by means of a spherical core saw. The impact machine used is similar to that employed for the cementation test, except that a plunger with a hemispherical end, 2 cm. in diameter, is used, the idea being to imitate the blows caused by traffic. The hammer used weighs 2 kilos.; it is allowed to fall 1 cm. for the first blow and an additional 1 cm. for every successive blow until the test piece fails.

For the *absorption* test, a smoothly worn stone from the abrasion test, weighing 20 to 60 grms., is used. It is weighed in air (A), immersed in water, immediately reweighed in water (B), and again weighed in water after 96 hours' immersion (C). The number of lb. of water absorbed by 1 cb. ft. of rock will equal $\frac{C-B}{A-B} \times 62 \cdot 5$. The specific gravity and weight per cb. ft. are also determined. The Dorry machine is used for determining hardness. Compression and tensile tests are also carried out occasionally.

For paving bricks the most important is the *rattler test*. The drum is 28 in. in diameter, and 20 in. long, and has 14 cast-steel slats. It is run at a rate of 30 rotations per minute for 1,800 revolutions. A sheet-iron cover prevents the escape of dust, which falls into a pan. The charge consists of 9 paving blocks or 12 dry bricks; 75 lb. of cast-iron shot with slightly rounded ends, $2\frac{1}{2}$ by $4\frac{1}{2}$ in., and weighing $7\frac{1}{2}$ lb. each; and 225 lb. of smaller shot, $1\frac{1}{4}$ in. cubes, weighing about $\frac{1}{2}$ lb. each. The shot are replaced when they have lost about 0·1 of their weight. Since the loss in weight of the bricks in the first 400 or 600 revolutions is due mainly to chipping action, and the loss in the last 600 mainly to abrasive action, both are reported. The total loss in weight after 1,800 revolutions should not exceed 18 per cent. for the best class of paving bricks.

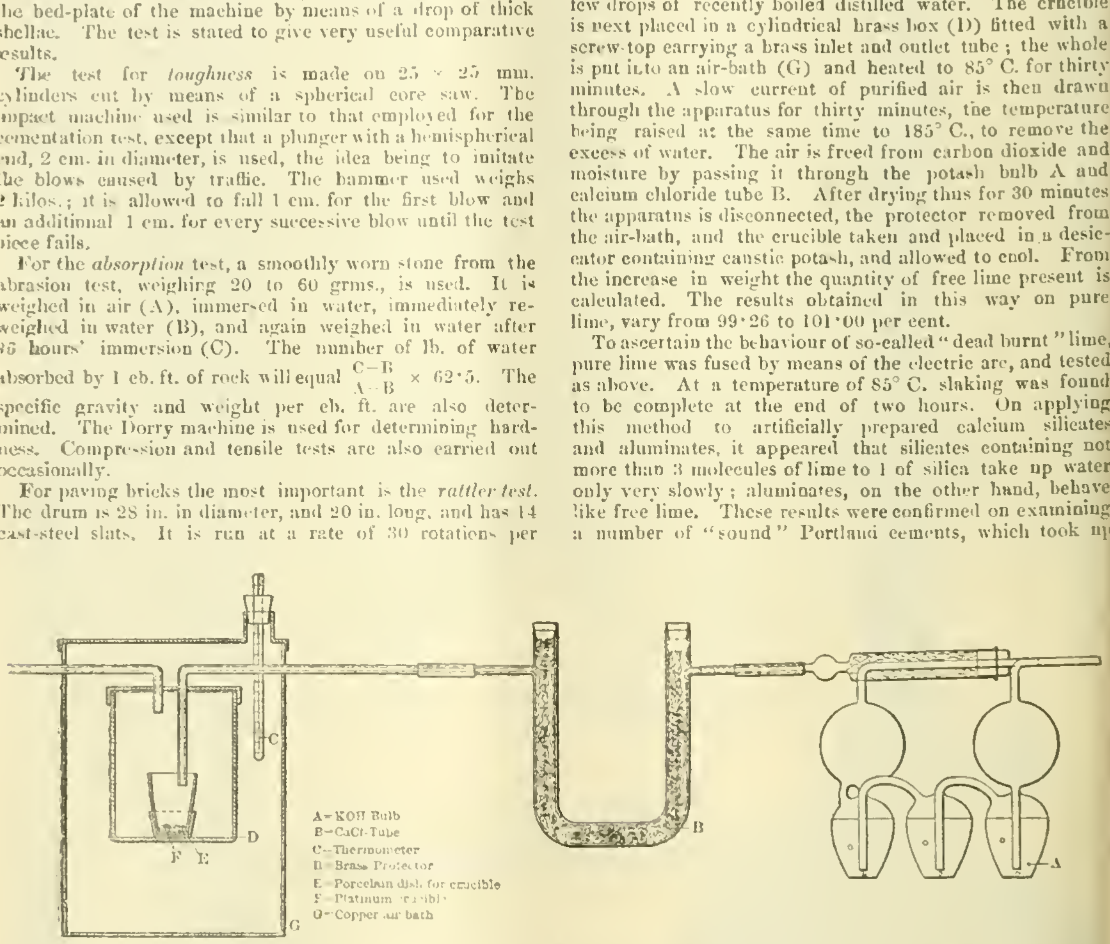
For the *absorption* test, the gain in weight after 96 hours' immersion in water is noted on a brick which has been through the rattler test, and has then been dried. *Cross-breaking* and *compression* tests are also made on cylinders 1 or 2 in. in diameter, but are of less value than the rattler and absorption tests.

For testing cement, the methods of the American Society of Civil Engineers are followed. All rocks are also analysed petrographically and chemically, the methods of analysis used being given.—A. G. L.

Lime, Free [in Portland Cement]; New Method for the Determination of ——, and on so-called "Dead Burnt" Lime. E. H. Keiser and S. W. Forder. Amer. Chem. J., 1904, **31**, 153.

This method for the determination of free lime in Portland cement depends on the fact that free lime combines almost instantly with water, whereas basic calcium silicates are acted upon much more slowly. It is carried out by first heating 0·2 to 0·5 grm. of the substance over the blast lamp for a few minutes in a platinum crucible to expel moisture and carbon dioxide, weighing, and then adding a few drops of recently boiled distilled water. The crucible is next placed in a cylindrical brass box (D) fitted with a screw-top carrying a brass inlet and outlet tube; the whole is put into an air-bath (G) and heated to 85° C. for thirty minutes. A slow current of purified air is then drawn through the apparatus for thirty minutes, the temperature being raised at the same time to 185° C., to remove the excess of water. The air is freed from carbon dioxide and moisture by passing it through the potash bulb A and calcium chloride tube B. After drying thus for 30 minutes the apparatus is disconnected, the protector removed from the air-bath, and the crucible taken and placed in a desiccator containing caustic potash, and allowed to cool. From the increase in weight the quantity of free lime present is calculated. The results obtained in this way on pure lime, vary from 99·26 to 101·00 per cent.

To ascertain the behaviour of so-called "dead burnt" lime, pure lime was fused by means of the electric arc, and tested as above. At a temperature of 85° C. slaking was found to be complete at the end of two hours. On applying this method to artificially prepared calcium silicates and aluminates, it appeared that silicates containing not more than 3 molecules of lime to 1 of silica take up water only very slowly; aluminates, on the other hand, behave like free lime. These results were confirmed on examining a number of "sound" Portland cements, which took up from 1·81 to 3·04 per cent. of water, due to decomposition of the aluminates. All these cements contained less than 10 per cent. of alumina. A sample of cement containing 15 per cent. of alumina, 15 of silica, and 70 of lime took up 4·65 per cent. of water. The authors conclude that if the quantity of water taken up by a Portland cement containing not more than 10 per cent. of alumina, exceeds 3 per cent., the excess is due to the presence of free lime.—A. G. L.



Gold in the Residues from the Zinc Boxes [Cyanide Gold Extraction]; Determination of ——. R. W. Lodge. Amer. Inst. Mining Eng., New York, 1903.

The author has examined the methods which have been proposed for the determination of gold in the residues from the zinc boxes. He found that the cupellation method gives much better results than any of the other methods, but to obtain uniform results, the material must be very finely divided (to pass a 200 mesh sieve), and a large proportion of borax must be used, viz., 3—10 grms. for each 0·1 assay-ton of the sample. Spurting can be prevented by using the muffle at a sufficiently high temperature, and, at the beginning, keeping the door of the muffle closed.—A. S.

Zinc-Dust; Gasometric Assay of ——. A. Wohl. Ber., 1904, **37**, 451.

For accurate analysis, a flask of about 100 c.c. capacity is used, to the neck of which is fused a stopcock. A weighed quantity of zinc-dust having been introduced, the flask is brought to the temperature of the air or of a water-jacket, and evacuated to an accurately measured pressure of about 700 mm. below barometric pressure. The tubulure of the stopcock is now filled with water, and 5 c.c. of hydrochloric acid, sp. gr. 1·1, to which a drop of platinum chloride solution has been added, are sucked into the flask. After reaction, the temperature is re-adjusted, and the pressure measured. Assuming that the flask contains exactly 100 c.c., the temperature is 20° C., and 0·1788 grm. of substance was weighed out, the percentage of metallic zinc is expressed by twice the difference of pressures in mm. of mercury.

—W. A. C.

Tin Ores; Losses in Vanning ——. R. Pearce. Eng. and Mining J., 1904, **77**, 116.

In Cornwall the vanning process is in general use for the determination of the tin oxide in crude tin ores. In order to test the efficacy of this method, the author prepared an artificial mixture from 150 parts of a gangue consisting mainly of quartz, chlorite, and small amounts of pyrite and arsenopyrite, and 5 parts of Bolivian cassiterite, containing 70·38 per cent. of tin. The mixture was pounded in a small mortar until the whole passed through a 30-mesh screen; it was then ground to a pulp, and subjected to the vanning process. The actual percentage of tin oxide in the mixture was 3·225; the percentages found by the vanning process by three independent assayers were 2·970, 2·530, 2·360; mean 2·620. The percentage of tin in the concentrated product was determined in each case, and it was found that the mean percentage of the total tin recovered was 78·447, or a loss of 21·553 per cent. In an ore containing less than 3·225 per cent. of tin oxide, such as is produced in Cornwall at the present time, the loss of tin in vanning would, of course, be proportionately greater. Further, the artificial mixture would give more favourable results on vanning than a natural ore, as the tin oxide would not be contaminated by attached particles of gangue.

—A. S.

United States Patent.

Carbonic Acid in Gases; Method of Determining [Electrically] the Quantity of ——. G. Bodländer, Brunswick, Germany. U.S. Pat. 751,897, Feb. 9, 1904.

The gas is passed through a primary and secondary battery connected together in opposition, the latter battery being adapted to neutralise that part of the electromotive force of the primary battery which owes its existence to the hydrogen or oxygen contained in the gas. This results in an electromotive force, the measure of which may be used for determining the amount of carbonic dioxide in the gas. The primary and secondary batteries each contain an electrode which is not attacked, and a second one of a suitable metal, the electrolytes of the primary consisting of a carbonate and a compound of the last-named metal, while the electrolytes of the secondary consist of a substance acting like an acid, and a salt of the last-named metal.

—B. N.

ORGANIC—QUALITATIVE.

Liebermann's Thiophene Reaction. C. Schwalbe. Ber., 1904, **37**, 324—325.

The author finds that "Pure Benzene" as now supplied to the large colour-factories does not show Liebermann's reaction for thiophene (blue coloration with concentrated sulphuric acid containing nitrous acid), although thiophene is undoubtedly present and can be detected and estimated in other ways. He concludes, therefore, that some other impurity, which prevents Liebermann's reaction, must be present.—E. F.

Citric Acid in Wine; Simple Method for the Detection of ——. A. Devarda. Zeits. landw. Versuchsw. in Oesterr., 1904, **7**, 1; Chem.-Zeit., 1904, **28**, Rep., 38.

Fifty c.c. of the wine are freed from alcohol by boiling, made up to the original volume, shaken for 1 minute with 2 c.c. (4 c.c. in the case of adulterated red wines rich in extract and tannin) of a 10 per cent. solution of malic acid and about 1 grm. (or 1½—2 grms. in the case of adulterated wines) of yellow mercuric oxide, and immediately filtered through a small folded filter. 40 c.c. of the filtrate are treated with 6 c.c. of 95 per cent. (by vol.) alcohol, shaken with 2 c.c. of mercuric nitrate solution (16 grms. of mercuric nitrate and 2 c.c. of glacial acetic acid dissolved in water and made up to 100 c.c.), cooled to 10°—12° C., and the precipitate collected on a washed filter. When the solution has completely drained from the precipitate, the latter is treated on the filter with 15 c.c. of dilute acetic acid (20 c.c. of the glacial acid diluted with water to 300 c.c.), and the acid solution allowed to drain through the filter. 10 c.c. of this solution are treated with 1·5 c.c. of an acetic acid solution of lead acetate (1 vols. of cold saturated solution of lead acetate with 1 vol. of glacial acetic acid), the mixture is heated to boiling, and then rapidly filtered through a small washed filter. The filtrate is slowly cooled, finally to 10°—12° C. In the case of wine free from citric acid, the solution remains clear, or at the most a slight crystalline precipitate of lead tartrate is formed, which soon settles to the bottom; but, in presence of citric acid, a milky turbidity is produced in the solution, and the latter does not become clear unless allowed to stand for a long time.—A. S.

Salicylic Acid [Free] in Bismuth Salicylate; A Suggested Test for [Detection of] ——. W. Lyon. Pharm. J., 1904, **72**, 219.

As a solvent for use in the detection of free salicylic acid in bismuth salicylate, alcohol is unsatisfactory, as it causes decomposition of the salicylate. A better solvent is 90 per cent. benzol, the test being carried out in the following manner:—A small quantity of the bismuth salicylate is placed on a thick filter-paper in a funnel and 90 per cent. benzol poured on. The filtrate is received in a test-tube containing a solution of ferric chloride (1 in 3,000), when, if free salicylic acid be present, a violent ring is produced where the two liquids come in contact.—A. S.

Chloral and Butylchloral; Reaction for Distinguishing between ——. E. Gabutti. Boll. Chim. Farm, **42** 777—778; Chem. Centr., 1904, **1**, 480.

The so-called butylchloral $CCl_3.CH_2.CH_2.CHO$, is frequently adulterated with the cheaper chloral. The latter may be identified by means of its melting point, by the formation of chloroform on treatment with alkalis, and by the following reaction:—A solution of pyrogallol in pure 66 per cent. sulphuric acid gives when gently and carefully warmed, a blue colour with chloral, a ruby colour with butylchloral, and a more or less violet to blue colour with mixtures of the two compounds. On addition of a large quantity of water, the blue colour obtained with the chloral changes to yellowish brown, and the ruby colour obtained with the butylchloral to a more or less deep violet colour, according to the amount of water added.—A. S.

ORGANIC—QUANTITATIVE.

Fats and Fatty Oils; Relative Inner Friction of Edible ——. M. Pleissner. Archiv der Pharm., 1904, 242, 24—31.

The apparatus used by the author was the simple viscosimeter described by Ostwald. The efflux velocity at the given temperature between marks above and below the bulb is measured in seconds, and the relative inner friction calculated by means of the formula $\rho = \frac{s.t}{1}$, where *s* represents the sp. gr. of the oil, t, the time of efflux, and T the efflux velocity of water at 20° C. As the temperature rises, the relative inner friction of an oil decreases, so that at 100° C. the value is only about a tenth of that found at 20° C. Oils differ considerably in their behaviour in this respect, and this is notably the case with castor oil, as is seen in the following table, which gives the co-efficients $\frac{\rho 20}{\rho 100}$

Oil.	20° C.			100° C.			$\frac{\rho 20}{\rho 100}$
	s.	t.	ρ.	s.	t.	ρ.	
Olive	0·915	348	57·9	0·864	34	5·30	10·9
"	0·912	339	56·2	0·868	30	4·73	11·9
Arachis	0·914	310	56·5	0·864	31	5·30	10·7
Linseed	0·927	219	35·9	0·886	29	4·67	7·8
Rape	0·911	421	76·2	0·859	42	6·63	10·6
Cotton-seed	0·922	410	68·7	0·874	33·5	5·32	12·9
Sesamé	0·924	292	49·0	0·866	35·5	5·27	9·2
Castor	0·957	4,273	743·5	0·911	82	13·58	54·7
Bone	0·910	350	57·9	0·863	33	5·19	11·1
Paraffin	0·877	686	101·4	0·805	27·3	3·99	25·4
Vaseline (lubricating).	0·868	178	28·7	0·847	15·5	2·38	12·0

The liberated mixed fatty acids of oils have a much smaller relative inner friction than the original glycerides. Thus the following values for ρ at 100° C. were obtained with the fatty acids of the following oils:—Olive oils, 2·3 and 1·8; arachis oil, 2·75; cotton-seed oil, 1·69; sesamé oil, 2·45; and castor oil, 7·09. The relative inner friction of fatty acids of the type $C_nH_{2n}O_2$ increases with the molecular weight. The method does not give sufficiently distinctive differences to afford a means of detecting arachis oil in olive oil, but may be found of service for the detection of margarine in butter and for the identification of castor oil.—C. A. M.

Turpentine in Denatured Spirit; Determination of ——. U. Chierego. Oesterr. Chem.-Zeit., **6**, 562; Chem. Centr., 1904, **1**, 321.

The method depends upon the determination of the bromine-absorption value. 50 c.c. of the denatured spirit are treated with 25 c.c. of water, 10 c.c. of dilute (1 : 3) sulphuric acid and 10 c.c. of an aqueous solution of dimethyl orange (0·02 grm. per litre). The bromine solution (50 grms of hydrobromic acid and 15 grms. of potassium bromate per litre) is then run in, drop by drop, from a burette, with continuous agitation till the rose coloration disappears. The conditions described must be followed; if the degree of dilution be altered or the bromine solution be allowed to run in too quickly, less reliable results are obtained. For the determination of the bromine-absorption value of turpentine, the latter is titrated in 0·5 per cent. alcoholic solution. A number of samples of turpentine were examined by this method, and it was found that 50 c.c. of the 0·5 per cent. alcoholic solution required 11·7—12·4 c.c. of the bromine solution, corresponding to 1·87—1·98 grms. of bromine for 1 c.c. of turpentine.
—A. S.

Turpentine; Examination of ——. H. Herzfeld. Zeits. öffentl. Chem., 1903, **9**, 454—457; Chem. Centr., 1904, **1**, 548.

In the Zeiss butyro-refractometer, turpentine shows usually a refraction of 68°—72°, rarely as much as 75°. By fractional distillation even small quantities of admixtures can be detected, as, with pure turpentine, the refraction of the different fractions and of the original sample varies only to a small extent.

For the separation of mineral oil from turpentine, the author recommends treatment with sulphuric acid. 10 c.c. of the sample are slowly run, with cooling, into 40 c.c. of concentrated sulphuric acid. After 10—12 hours, 8—9 per cent. by volume of the turpentine separates. The lower dark-brown layer is run off, and the remainder shaken with 3—4 c.c. of fuming sulphuric acid. After standing for several hours 0·1—0·2 c.c. of the turpentine again separates. Mineral oil is scarcely attacked by the acid and is recognised by the increase in the volume of the separated upper layer. If the fuming sulphuric acid dissolve more than 0·9 c.c. of the layer which separates after treatment with concentrated sulphuric acid, this soluble portion in excess of the 0·9 c.c. will correspond to the quantity of benzene present in the turpentine.—A. S.

Mono-amino-acids and their Amides; Determination of ——. Guinness Research Lab. Trans., 1903, **1**, 17—56.

The subject is dealt with under the following headings:—(1) Sketch of the known methods of estimation. (2) Determination of ammonia by Knop's (hypobromite) method. (3) The Sachsse-Knop method applied to the determination of asparagine. (4) Determination of ammonia and asparagine by the Sachsse-Schloesing-Longi method, using oxalic acid and hydrochloric acid as the hydrolysing agents (see this J., 1904, 135). (5) The Sachsse-Kormann (nitrous acid) method for determining amides and amino acids. (6) New apparatus for the Sachsse-Kormann process. (7) The improved Sachsse-Kormann process applied to pure substances (amides and amino-acids). (8) New method for the direct estimation of tyrosine in mixtures of amides and amino-acids. (9) Application of a combination of the foregoing methods to the analysis of mixtures of amides, amino-acids, and ammonium salts. (10) Attempts to estimate asparagine and certain amino-acids by precipitation with mercuric nitrate and subsequent formation of their copper salts.
—A. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Phosphorus Sulphides; Preparation of ——, in the Cold. R. Boulouch. Comptes rend., 1904, **138**, 363—365.

Dervin (see following abstract), by reacting on the sulphide P_4S_3 with sulphur in solution in carbon bisulphide, obtained after some months' exposure to sunlight the sulphide P_3S_6 and another substance possibly of formula P_8S_{11}. The author finds that the reaction is enormously accelerated by the addition to the mixture of a small amount of iodine. After one or two days only, good crystals are obtained, having the composition P_4S_5; a substance of quite constant composition, but probably, like P_8S_{11}, a solid solution, rather than a definite compound. Phosphorus and sulphur, dissolved in carbon bisulphide, will not react, even in sunlight; but on adding a little iodine, reaction occurs and abundant crystals of P_3S_6 are obtained.—J. T. D.

Phosphorus Sesquisulphide and Sulphur in Carbon Bisulphide; Action of Heat and Light on Mixed Solutions of ——. E. Dervin. Comptes rend., 1904, **138**, 365—366.

When a mixture of 110 grms. of phosphorus sesquisulphide P_4S_3 and 16—32 grms. of sulphur, dissolved in 400 c.c. of carbon bisulphide, is subjected to the action of light or of heat, two products are obtained, namely, pale yellow transparent needles of the sulphide P_2S_4 and spherical masses of crystals corresponding to the formula P_8S_{11}, or rather $P_4S_3.2P_2S_4$. The action of light alone requires a period of 1 or 2 months to complete the reaction, whereas at a temperature of 210° C. the same result is produced in 2 hours. The sulphide P_8S_{11} is not identical with the sulphide P_4S_5 obtained by Boulouch from the same materials by the action of light in the presence of traces of iodine (see preceding abstract). When heated at 210° C. with carbon bisulphide, the compound P_8S_{11} is split up into $2P_2S_4$, which crystallises out, and P_4S_3, which remains in solution. The sulphide P_2S_4 when heated at 210° C. with a solution of P_4S_3 in carbon bisulphide reproduces the compound P_8O_{11}.—J. F. B.

Hydrides and Nitrides of Neodymium and Praseodymium. W. Muthmann and H. Beck. Annalen, 1904, **331**, 58—59.

The preparation and properties of neodymium hydride (NdH_2?) and nitride (NdN) and of praseodymium hydride (PrH_3) and nitride (PrN) are described.—A. S.

Intramolecular and Originally Reversible Changes Extending over Prolonged Periods of Time; Observations on Some ——. R. J. Friswell. Proc. Chem. Soc., 1904, **20**, 36.

After long periods of time, changes occurred involving the slow appropriation by aminoazobenzene base from a solution of aniline hydrochloride of sufficient hydrochloric acid to saturate itself; this reaction was shown to occur even in the presence of much free aniline, and the variations due to changes of temperature were described.

Lead Salts; Solutions of ——. *Sensitive to Light.* K. A. Hofmann and V. Wölfl. Ber., 1904, **37**, 249—252.

Mixed and left in the dark or in diffused light, solutions of lead chloride and sodium thiosulphate yield lead sulphide. But when kept ice-cold and in sunlight they form a red crystalline crust on the walls of the vessel, which, to avoid its decomposition, must be washed, in bright light, first with ice-cold water and then with alcohol and with ether. A similar but more stable and much more beautiful scarlet-red iodine compound, looking under the microscope like metallic copper leaflets dendritically arranged, is obtained by adding to the lead chloride and thiosulphate mixture some iodine dissolved in potassium iodide. Since this compound can also be prepared from yellow ammonium sulphide and lead iodide, its constitution will be that of a halo polysulphide. The composition of the chlorine and iodine compounds is expressed by $Pb_4S_6Cl_2$ and $Pb_3S_4I_2$ respectively. —T. H. P.

Cupric Metaborate; Evolution of Oxygen from ——. W. Guertler. Zeits. anorg. Chem., 1904, **38**, 456—460.

Cupric metaborate, CuB_2O_4, is prepared by (1) evaporating to dryness a solution of 1 molecule of copper nitrate and 2 molecules of boric acid, and melting the product. If the temperature has not reached 950° C., fine blue doubly-refracting needles are obtained, of sp. gr. 3·86, unattacked by cold dilute acids, even hydrofluoric, or by sodium hydroxide or sulphide solution, but slowly dissolved by hot concentrated hydrochloric acid. When carefully melted and cooled, the product yields a deep green, almost black, glass of sp. gr. 3·61, extremely hard, but much more readily attacked by reagents than the blue crystals. (2) By fusing copper nitrate with excess of boric anhydride; the fusion separates into two layers, the upper containing practically nothing but boric anhydride, the lower cupric metaborate. When heated, cupric metaborate begins to give off oxygen at a temperature below its melting-point (about 970° C.), and at 1,000° C. the evolution is rapid and even violent. Determination of the amount of oxygen evolved and analysis of the residue show that the reaction is $6CuB_2O_4 = 3Cu_2O.2B_2O_3 + 3O + 4B_2O_3$. The cuprous borate so obtained cannot be prepared directly from cuprous oxide and boric anhydride.—J. T. D.

Iso-rhodeose, the second Methylpentose from Convolvulin. E. Votoček. Zeits. f. Zuckerind. Bohmen, 1904, **28**, 209—212. See this J., 1902, 1353.

The author obtains confirmation of his assumption that *iso*-rhodeose is a methylpentose by converting it into methylfurfural and estimating as phloroglucide, by direct determination of the rotation in a 1·44 per cent. solution, from which $[a]_D = + 20·3$, and by the analysis of the phenylosazone. Convolvulin is thus found to give a syrup consisting of one molecule of glucose ($[a]_D = + 52·5$), one of rhodeose, + 75·2, and two molecules of *iso*-rhodeose + 20·3.—L. J. de W.

Seaweed (Fucus), Laminaria and Carragheen Moss; Products of the Hydrolysis of ——. A. Müther and B. Tollens. Ber., 1904, **37**, 298—305.

Seaweed (Fucus species) from Heligoland was extracted with cold 2 per cent. sulphuric acid for 24 hours. From the extract, in addition to inorganic salts, crystals of mannitol were obtained. The residue was hydrolysed by heating with 5 per cent. sulphuric acid at the temperature of the boiling water-bath for eight hours. The hydrolysed extract yielded fucose, galactose, and small quantities of arabinose. *Laminaria digitata* from Heligoland also yielded mannitol. The products of hydrolysis included fucose and a sugar yielding a glucosazone m.pt. 204° C. Carragheen moss probably contains fructose groups in the form of a lævulan. Besides the decomposition products of fructose, galactose was isolated from the hydrolysed solution, and the presence of glucose groups was indicated by the production of saccharic acid on oxidation.—J. F. B.

Leucine and Tyrosine; Note on the Purification of ——, *by E. Fischer's Method of Esterisation.* H. T. Brown. Trans. of the Guinness Research Lab., 1903, **1**, 57—60.

The article is subdivided as follows:—(1) Esterification of leucine. (2) Saponification of the ester with production of pure leucine. (3) Properties of the pure leucine. (4) Esterification of tyrosine. (5) Properties of the pure tyrosine. (6) Examination of a tyrosine from another source.—A. S.

Oxido-reducing Enzyme in Plants; Existence of an ——. J. E. Abelous and J. Aloy. Comptes rend., 1904, **138**, 382—384.

The authors have shown that the animal organism contains an enzyme capable of oxidising certain substances (*e.g.*, salicylic aldehyde), not like oxydases of the laccase type by utilising free or dissolved oxygen, but at the expense of certain highly oxidised constituents of the organism which are thereby reduced. The enzyme is therefore simultaneously an oxidising enzyme towards one substance and a reducing enzyme towards others. A similar enzyme has now been observed in the expressed juice of potato pulp. Potato juice alone, whether in presence or absence of oxygen, has no sensible oxidising action upon salicylic aldehyde; but if a small quantity of a highly oxidised compound like potassium chlorate be added, considerable oxidation of the aldehyde takes place. If, instead of the chlorate, potassium nitrate be added, oxidation takes place, but to a much smaller extent than in the case of the chlorate. Potato juice alone does not oxidise salicylic aldehyde at the expense of the more highly oxidised constituents of the juice, probably because the dissociated oxygenated constituents have already been rendered stable by the action, in presence of air, of the oxydases of the laccase type also contained in the juice.—J. F. B.

New Books.

Traité d'Analyse des Substances Minérales. Par Adolphe Carnot, Directeur de l'École Supérieure des Mines, &c. Tome Second. Métalloïdes. Vve. Ch. Dunod, éditeur, 49, Quai des Grands Augustins, Paris. 1904. Price 25 francs.

The first volume of this work was devoted to the subject of "General Methods of Analysis, Qualitative and Quantitative." The present volume (on the Metalloïds) is an 8vo volume, containing 808 pages of subject-matter, with 81 illustrations, a table of contents, and the alphabetical index. The text is subdivided as follows:—I. Hydrogen II. Oxygen. III. Nitrogen. IV. Argon. V. Neon, Krypton, and Xenon. VI. Helium. VII. Carbon. Combustible Minerals. VIII. Cyanogen. IX. Chlorine. X. Bromine. XI. Iodine. XII. Fluorine. XIII. Sulphur. XV. Selenium. XVI. Tellurium. XVII. Germanium. XVIII. Phosphorus. XIX. Arsenic. XX. Boron. XXI Silicon. XXII. Titanium. XXIII. Tantalum. XXIV Niobium. XXV. Tungsten. XXVI. Molybdenum. XXVII Vanadium. The method of dealing with each of the elements above classified is fairly uniform, and may be illustrated by the example of one of them:—(i) Natural state. (ii) Analytical methods of determination. (iii) Volumetric methods. (iv) Minerals and mineral products. (v) Analysis of the latter.

THE ELECTROLYSIS OF WATER: PROCESSES AND APPLICATIONS. By VICTOR ENGELHARDT, Chief Engineer and Chemist of the Siemens and Halske Co., Ltd., Vienna. Translated by J. W. RICHARDS, M.A., Ph.D. Chemical Publishing Co., Easton, Pa. 1904. Price: Paper, 1 dol.; cloth, 1 dol. 25 cents.

8vo volume containing 131 pages of subject-matter with 90 illustrations, and followed by 15 tables. The work closes with an alphabetical index of authors. The table of contents at the beginning serves as index. The subject is treated under the following heads:—I. Historical Review. II. Constants of the Electrolytic Decomposition of Water. III. Review of the Processes. A. Processes and Apparatus for the Separate Production of Oxygen and Hydrogen. (*a*) With Porous Diaphragms of Non-conducting Material. (*b*) With Complete Non-conducting Partitions. (*c*) With Complete or Perforated Conducting Partitions. B. Processes and Apparatus for the Electrolysis of Water without Separation of the Gas (Production of Detonating Gas). (*a*) For Purposes of Instruction and Laboratory Work (Voltameter). (*b*) For Technical Purposes. C. Processes for the Simple Evolution of Oxygen. (*a*) Through Depolarisation at the Cathode. (*b*) By the Precipitation of Metal at the Cathode. Chronological Review. IV. Applications. (1) Electro-chemical Processes. (2) Physical Processes. (3) Chemical. Compression. Special Applications. (1) Detonating Gas. (*a*) High Temperature. (*b*) Lighting. (*c*) Blasting. (2) Hydrogen. (*a*) Ballooning. (*b*) Soldering. (*c*) Lighting. (*d*) Motoring. (3) Oxygen.

DIE ELEKTROMETALLURGIE DER ALKALIMETALLE. Von H. BECKER. Wilhelm Knapp's Verlag, Halle a/S. 1903. Price M. 6.

8vo volume, containing 133 pages of subject-matter with 83 illustrations and 3 tables. There is an index of names at the end, and a table of contents at the beginning. The method of treatment of the subject is as follows:—I. Chemical Methods for preparing the Alkali Metals. II. The Electro-chemical Methods for preparing the Alkali Metals. A. Processes and Apparatus for the Electrolytic preparation of Sodium and Sodium Chloride. B. Process and Apparatus for the Electrolytic preparation of Sodium from Caustic Soda. C. For the Electrolytic preparation of Sodium from Sodium Carbonate or from a Mixture of Carbonate and Caustic. D. For that of Sodium from Sodium Nitrate. E. For that of Sodium Alloys. Potassium. Lithium. III. The Electrothermic Process. IV. Experiments and Apparatus for Laboratories.

DIE TROCKENPLATTE: Ihre Eigenschaften und ihre Behandlung in der photographischen Praxis. Von Dr. LÜPPO-CRAMER. Gustav Schmidt's Verlag, Berlin. 1903. Price M. 2.50.

SMALL 8vo volume containing 99 pages of subject-matter, with 7 illustrations. The subjects treated of under the chief title are as follows:—I. Properties of the Dry Plate, generally. Composition of the film, &c. II. Measuring the Rapidity of the Dry Plate. III. The Latent Image. IV. Gradation. V. Solarisation. VI. Dark Room Illumination. VII. Development. VIII. Fixing. IX. Washing. X. Drying. XI. Intensification and Reduction. XII. Plates sensitive to Colours, &c. Diapositive Plates.

LEHRBUCH DER MIKROPHOTOGRAPHIE; nebst Bemerkungen über Vergrosserung und Projektion. Von Dr. CARL KAISERLING. Gustav Schmidt's Verlag, Berlin. 1903. Price M. 4.

SMALL 8vo volume containing 171 pages of subject-matter, with 54 illustrations. There is an alphabetical index of subjects and names at the end, and a table of contents at the beginning of the treatise, which is divided into three sections:—I. The Subject Treated Generally. II. The Special Section; and III. The Photographic-Technical Section.

AN ATTEMPT TOWARDS A CHEMICAL CONCEPTION OF THE ETHER. By Prof. D. MENDELÉEFF. Translated from the Russian by GEORGE KAMENSKY. Longmans, Green, and Co., 39, Paternoster Row, London; New York and Bombay. 1904. Price 2*s*. nett.

8vo volume containing 51 pages of subject-matter. The author shows that if the ether be conceived as a peculiar all-permeating gas, the lightest, most mobile, and chemically inactive, certain difficulties in the explanation of phenomena of recent observation, are greatly reduced if not fully removed.

Trade Report.

I.—GENERAL.

BRITISH INDIA; VALUATION TARIFF OF ——.

Bd. of Trade J., Feb. 1904.

A Customs Circular (No. 1 of 1904) issued by the Finance and Commerce Department of the Government of India, on the 23rd of December, 1903, revises from 1st January, 1904, the "Tariff Valuations" fixed for various classes of goods imported into British India.

Schedule IV.—Import Tariff: General Duties.

No.	Names of Articles.		Tariff Valuation.	Duty.
			R. a.	
5	Mineral and aerated waters, and all unfermented and non-alcoholic beverages	..	*ad val.*	5 %
8	Sugar—			
	China, candy	Cwt.	15 0	„ *
	Loaf	„	14 0	„ *
	Crystallised, beet	„	9 12	„ *
	„ and soft (other than beet) refined in the United Kingdom	„	9 12	„ *
	„ and soft from China	„	10 0	„ *
	„ and soft from Egypt	„	9 12	„ *
	„ and soft white from Java	„	9 8	„ *
	„ and soft from Mauritius	„	9 4	„ *
	All other sorts, including saccharine produce of all kinds and confectionery	..	*ad val.*	„ *
	CHEMICALS, DRUGS, MEDICINES, AND NARCOTICS, AND DYEING AND TANNING MATERIALS.			
10	Chemical products and preparations—			
	Acid, sulphuric	Lb.	0 1½	5 %
	Alkali, Indian (sajji-khar)	Cwt.	2 4	„
	Alum	„	4 10	„
	Arsenic	„	23 0	„
	„ (China mansil)	„	19 0	„
	Bicarbonate of soda	„	6 4	„
	Copperas, green	..	*ad val.*	2½ %
	Explosives, namely, blasting gelatin, dynamite, roburite, tonite, and all other descriptions, including detonators and blasting fuse	..	„	%
	Sal ammoniac	Cwt.	30 0	„
	Sulphate of copper	„	16 8	„
	Sulphur (brimstone), flour	„	7 0	„
	„ („), roll	„	5 8	„
	„ („), rough		5 0	„
	All other sorts of chemical products and preparations, including saltpetre and borax	..	*ad val.*	„
11	Drugs, medicines, and narcotics—			
	Aloes, black	Cwt.	22 0	„
	„ Socotra	„	16 0	„
	Aloe-wood	Lb.	6 0	„
	Asafœtida (hing)	Cwt.	75 0	„
	„ coarse (hingra)	„	19 0	„
	Atáry, Persian	„	15 0	„
	Banslochan (bamboo camphor)	Lb.	0 4	„
	Brimstone (amalsara)	Cwt.	25 0	.
	Calumba root	„	5 0	„

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* Exclusive of the *additional* and *special* duties imposed upon bounty-fed sugar.

Schedule IV.—Import Tariff: General Duties—cont.

No.	Names of Articles.		Tariff Valuation.	Duty.
			R. a.	
11	Drugs, medicines, and narcotics:—*cont.*			
	Camphor, refined, cake	Lb.	1 9	5 %
	„ partially refined, cake, in blocks of about 13 lb.	„	1 3	„
	Camphor, crude, in powder	„	1 1	„
	Cassia lignea	Cwt.	28 0	„
	China root (chobchini), rough	„	8 0	„
	„ „ („), scraped	„	16 0	„
	Cubebs	„	20 0	„
	Galangal, China	„	7 0	„
	Pellitory (akalkára)	„	35 0	„
	Peppermint crystals	..	*ad val.*	„
	Quinine and other alkaloids of cinchona	..	..	Free.
	Salep	Cwt.	100 0	5 %
	Senna leaves	„	5 0	„
	Storax, liquid (rose melloes or salaras)	„	36 0	„
	Tobacco, unmanufactured	..	..	Free.
	„ manufactured	..	*ad val.*	5 %
	All other sorts of drugs, medicines, and narcotics, except opium*	..	„	„
12	Dyeing and tanning materials—			
	Alizarin dye, dry, 40 per cent.	Lb.	1 4¼	5
	„ „ „ 50 „	„	1 8½	„
	„ „ „ 60 „	„	1 12	„
	„ „ „ 70 „	„	2 0¼	„
	„ „ „ 80 „	„	2 4¼	„
	„ „ „ 100 „	„	2 12	„
	„ „ moist, 10 „	„	0 4¼	„
	„ „ „ 16 „	„	0 7	„
	„ „ „ 20 „	„	0 8	„
	Aniline „ „ (indigo blue)	„	0 6¼	„
	„ „ dry	„	1 0	„
	„ salts	..	*ad val.*	„
	Avar bark	Cwt.	4 0	„
	Buzgand (gulpista)	„	40 0	„
	Cochineal	Lb.	1 3	„
	Gallnuts (myrabolams)	..	*ad val.*	„
	„ Persian	Cwt.	36 0	„
	Madder or manjit	„	8 8	„
	Orchilla weed	„	5 4	„
	Sappan wood and root	..	*ad val.*	„
	Turmeric	..	„	„
	All other sorts of dyeing and tanning materials	..	„	„
	OILS.			
16	Petroleum, including also naphtha and the liquids commonly known by the names of rock-oil, Rangoon oil, burma oil, kerosene, paraffin oil, mineral oil, petroline, gasoline, benzol, benzoline, benzine, and any inflammable liquid which is made from petroleum, coal, schist, shale, peat, or any other bituminous substance, or from any product of petroleum	Imp. gall.	..	1 anna.
	Petroleum, which has its flash point at or above 200° F., and is proved to the satisfaction of the Customs collector to be intended for use exclusively for the batching of jute or other fibre or for lubricating purposes	..	*ad val.*	5
	Petroleum which has its flash point at or above 150° F., and is proved to the satisfaction of the Customs collector to be intended for use exclusively as fuel	..	„	„
	All other sorts of oil, animal or vegetable (including otto of all kinds) and mineral (including paraffin wax)	..	„	„
31	Earth, common clay, and sand	..	..	Free
32	Earthenware (except earthenware piping, china, china clay, porcelain, and imitation or false coral	..	*ad val.*	5 %
34	Fireworks, all sorts, including fulminating powder	..	„	„
37	Gums, gum-resins, and articles made of gum or gum resin—			
	Copal	Cwt.	70 0	„
	Cutch and gambier	„	23 0	„
	Gamboge	Lb.	1 12	„
	Gum ammoniac	Cwt.	10 0	„
	„ Arabic	„	14 0	„
	„ bdellium	..	*ad val.*	„
	„ Benjamin, ras	Cwt.	25 0	„
	„ „ cowrie	„	70 0	„

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* The duty on opium, under Schedule III., is fixed at Rs. 24 per ser of 80 tolas.

Schedule IV.—Import Tariff: General Duties.—cont.

No.	Names of Articles.		Tariff Valuation.	Duty.
			R. a.	
46	Manures of all kinds, including animal bones	..	..	Free
47	Oilcake, also bran, fodder, and cattle food of all kinds	..	..	„
48	Oil-cloth and floor-cloth, including lincrusta, linoleum, and tarpaulins	..	*ad val.*	5 %
49	Paints, colours, painters' materials, and compositions for application to leather, wood, and metals—			
	Lead, red, dry	Cwt.	13 0	„
	„ white, dry	„	17 0	„
	Ochre, other than European, all colours	„	1 8	„
	Paints, composition	..	*ad val.*	„
	„ patent driers	..	„	„
	Turpentine	Imp. gall.	3 0	„
	Verdigris	..	*ad val.*	„
	Vermilion, Canton	Box of 90 bundles.	115 0	„
	Zinc white, dry	..	*ad val.*	„
	All other sorts, including glue and putty	..	„	„
50	Paper, pasteboard, millboard, and cardboard of all kinds	..	*ad val.*	5 %
	Paper, articles made of paper, and papier-maché	..	„	„
51	Perfumery—			
	Gowla, husked and unhusked	Cwt.	40 0	„
	Kapurkachri (zedoary)	„	12 8	„
	Patch leaves (patchouli)	„	28 0	„
	Rose-flowers, dried	„	13 0	„
	Rose-water	Imp. gall.	2 0	„
	All other sorts, except perfumed spirit (for which see Schedule III.)*	..	*ad val.*	5 %
52	Pitch, tar and dammar—			
	Bitumen	..	..	
	Dammar	Cwt.	5 0	„
	Pitch, American and European	..	*ad val.*	„
	„ coal	Cwt.	4 0	„
	Tar, American and European	„	6 8	„
	„ coal	„	4 0	„
	„ mineral	..	*ad val.*	„
55	Pulp of wood, straw, rags, paper, and other materials	..	..	Free
60	Seeds—			
	Castor	Cwt.	4 0	5 %
	Cummin	„	13 0	„
	„ black	..	*ad val.*	„
	Linseed	Cwt.	5 8	„
	Methi	„	4 8	„
	Mustard, rape or sarson	„	6 8	„
	Poppy	„	6 0	„
	Quince bihidána	„	60 0	„
	Til or jinjili	„	6 0	„
	All other sorts	..	*ad val.*	„
64	Soap	..	„	„
66	Tallow and grease, including stearin	..	„	„

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* The duty on perfumed spirits, under Schedule III., is fixed at Rs. 8 per imp. gall. or 6 quart bottles.

NATAL; TRADE OF ——, IN 1903.

Bd. of Trade J., Feb. 25, 1904.

The following information relating to the value of the trade of Natal for the year ended 31st December, 1903, as compared with 1902, is based on statistics published in a supplement to the *Natal Government Gazette* for 26th January last:—

The following table shows the value of some imports into Natal (by sea) in 1902 and 1903:—

Articles.	1902.	1903.
	£	£
Metals and manufactures of (includes agricultural implements, bicycles, hardware, ironmongery, machinery, sewing machines, &c.)	[illegible]	[illegible]
Leather and manufactures (includes saddlery)	533,000	[illegible]
Beverages (includes ale, spirits, wine, and aerated waters)	[illegible]	[illegible]
Oilman's stores (includes oils and paints)	[illegible]	[illegible]
Drugs and chemicals	169,000	[illegible]
Soap and candles	145,000	[illegible]
Earthen, china, and stone ware, &c.	52,000	[illegible]
Cement	49,000	[illegible]
Cocoa, chocolate, and confectionery	107,000	[illegible]

Included in the exports from Natal are the following :—

Articles.	1902.	1903.
	£	£
Sugar	163,000	162,000
Bark	75,000	71,000
Hides and skins	36,000	23,000
Beer	9,000	2,000

II.—FUEL, GAS, AND LIGHT.

COAL TAR ; PROPOSED REDUCTION OF DUTY ON ——, IN RUSSIA.

Foreign Office Annual Series, No. 3115.

The British Vice-Consul at Marinpol reports that, with the view of developing the manufacture of briquettes from the large amount of small coal to be found at all the mines in the Donetz basin, the existing high Customs duty (2*l.* per ton) on coal tar will be greatly reduced, if not altogether abolished.

III.—TAR PRODUCTS, PETROLEUM, Etc.

ASPHALT MINES IN COLOMBIA (S. AMERICA).

Foreign Office Annual Series, No. 3114, *Jan.* 1904.

Asphalt mines have been recently discovered, and are now being worked under the direction of the Home Land and Mining Company of New York.

At the present time the Company has one mine or deposit working near Chaparral, Tolima, from which about 2,000 tons are shipped per year ; of this a little more than one-half goes to the United States, the balance to Germany. The asphalt is of the hard variety, and it is almost impossible to tell the difference between it and Egyptian, which contains 99·75 per cent. of bitumen, compared with 99·65 (Crane) and 99·45 (Guzman) in that mined by the Home Land and Mining Company.

This asphalt is used entirely for the body of paints and the making of fine varnish. It is shipped from the mines in sacks, and sells f.o.b. New York for 65 dols. (13*l.*) the short ton. The Chaparral mines are some 1,000 yds. from the Saldaña river, which empties into the Magdalena a few miles above Girardot. The asphalt is sent down to Honda in rafts, where it is embarked in steamers for the coast. The markets for this grade of asphalt are the United States, the United Kingdom, Germany, France, and Austria-Hungary. This Company owns all the asphalt deposits of this grade known in Colombia. The ocean freights on this kind of asphaltare about 5 dols. 50 cent. (1*l.* 2*s.*) per ton.

NAPHTHA NEAR THE BAGDAD RAILWAY (ASIA MINOR).

Dr. P. Rohrbach. Bd. of Trade J., Feb. 25, 1904.

A broad zone, lying between the Persian frontier mountains in the region of the Lower Sab, and stretching in a south-westerly direction over the Tigris and Euphrates into the Arabian Desert, including Kerkuk, Tekrit (on the Tigris) and Hit (on the Euphrates), appears to be full of bitumen, naphtha, and carburetted hydrogen gases. The inflammable exuding gases near Baba Gurgur, and the naphtha springs at Kerkuk are more abundant than those in Russian Transcaucasia, on the Apsheron Peninsula, before borings were commenced. The importance of this fact is evident when the Bagdad railway passes through this district close to rich petroleum wells.

This naphtha supply will be all the more important for the Bagdad railway, seeing that the supply of coal along the line, as far as yet explored, appears to be inconsiderable. The largest coal supply is in the neighbourhood of Eregeli, north-west of the Alican Taurus on the River Chabur, which joins the Tigris above Mosul.

VII.—ACIDS, ALKALIS, Etc.

TARTAR MATERIALS ; EXPORT OF ——, FROM ITALY.

Foreign Office Annual Series, No. 3118.

The appended table shows the exports of various tartaric materials from Italy during the 12 months ended Sept. 30, 1903, the figures for the previous 12 months being added for comparison :—

Article.	1901 2.		1902 3.	
	Tons.	£	Tons.	£
Half-refined tartar	960·5	50,500	632	38,500
Vinaccia argols	2,180	103,500	2,801	153,500
Crude argols	2,918·5	122,500	3,826	192,900
Wine lees	2,433	34,000	3,386	84,300
Totals	8,492	310,500	10,645	469,200

—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

BUILDING MATERIALS ; TRANSVAAL PRODUCTION OF ——.

Bd. of Trade J., Feb. 18, 1904.

The following figures show the value of the output of the various industrial concerns in the Transvaal during the year ended June last, with comparisons for the preceding year :—

——	1901-2.	1902 3.
	£	£
Machine-made bricks (building)	7,113	59,741
" " " (fire)	5,126	7,961
Cement	17,639	9,880
Lime (blue)	9,606	41,129
" (white)	2,923	12,727

CEMENT IMPORTS OF U.S.A.

Eng. and Mining J., Feb. 4, 1904.

Imports of cement into the United States in 1903 were 463,590 short tons, against 399,098 tons in 1902, an increase of 64,492 tons. Of the imports last year 275,483 tons were from Germany, 147,515 tons from Belgium, 29,399 tons from Great Britain, and 8,456 tons from other European countries.

X.—METALLURGY.

TIN PRODUCTION OF BOLIVIA IN 1903.

J. B. Minchin. Eng. and Mining J., Feb. 11, 1904.

The production of metallic tin from the mines in the neighbourhood of Oruro in 1903 was 3,838,520 lb., from 2,855 short tons of concentrates, or an average of 67·2 per cent The Avicaya mine showed the largest output, *viz.*, 1,001 tons of concentrates, and also the highest yield of tin, 71 per cent. ; the other important mines are at Huanuni, Chuncho, and Uncia, all producing over 500 tons of concentrates, with a yield of not less than 60 per cent. Other important deposits of tin appear also to exist, but they have not yet been worked.—T. F. B.

PIG-IRON ; U.S. PRODUCTION OF ——, IN 1903.

Bd. of Trade J., Feb. 25, 1904.

The American Iron and Steel Association has received from the manufacturers statistics of the production of all kinds of pig-iron in the United States in 1903.

According to the *Bulletin* of the Association for the 25th January, the total production was 18,009,252 tons against 17,821,307 tons in 1902, 15,878,354 tons in 1901, and 13,789,242 tons in 1900. The following table gives in half yearly periods the production of pig-iron in the last four years :—

Periods.	1900.	1901.	1902.	1903.
	Tons.	Tons.	Tons.	Tons.
First half	7,642,569	7,674,613	8,808,574	9,707,367
Second half	6,146,673	8,203,741	9,012,733	8,301,885
Total	13,789,242	15,878,354	17,821,307	18,009,252

The chief pig-iron producing States in 1902 were Pennsylvania, 8,211,500 tons; Ohio, 3,287,434; Illinois, 1,692,375; and Alabama, 1,561,398 tons.

Of the total iron produced last year 504,757 tons only were made with charcoal as fuel; 927 tons with mixed charcoal and coke; 1,911,347 with coke and anthracite coal, and 15,592,221 tons with bituminous coal.

The division according to classes of iron made in 1902 and 1903 was as follows.—

—	1902.	1903.
	Tons.	Tons.
Foundry and forge iron	5,176,568	5,785,257
Bessemer pig	10,393,168	9,989,908
Basic pig	2,038,590	2,040,726
Spiegeleisen and ferromanganese	212,981	192,661
Total	17,821,307	18,009,252

The stocks of pig-iron which were unsold in the hands of manufacturers or which were under their control at the close of 1903, and were not intended for their own consumption, amounted to 591,438 tons, against 49,951 tons at the close of 1902, and 70,647 tons at the close of 1901.

The whole number of furnaces in blast on 31st December, 1903, was 182 against 307 on 31st December, 1902, and 266 on 31st December, 1901.

Pig-Iron Production of Germany in 1903.

Bd. of Trade J., Feb. 25, 1904.

The output of pig-iron in Germany during each of the last five years was as follows, in metric tons:—1899, 8,143,132; 1900, 8,520,540; 1901, 7,880,081; 1902, 8,442,660; 1903, 10,085,634.

Mercury Production in Europe.

Eng. and Mining J., Feb. 11, 1904.

A recent communication from Vincent Spirek, of Santa Fiora, Italy, gives the production of mercury in 1903 as follows, in metric tons:—Spain, 930; Austria, 520; Italy, 270; total, 1,720 tons. The output of the Spanish mines shows a marked falling off from the production in 1902, while the output of Austria and Italy increased slightly.

Mercury in Russia.

Eng. and Mining J., Feb. 25, 1904.

According to a special report furnished by Mr. W. A. Abegg, of Warsaw, the production of mercury by Russian mines in 1903 was 22,110 poods, equivalent to 362 metric tons. The output in 1902 was 416 tons.

XII.—FATS, FATTY OILS, Etc.

Cotton Seed Oil Industry, and the Establishment of Cotton-Seed Mills in India.

J. Mollison. Agric. Ledger, 1903, 215—232.

The average percentages of oil and of crude fibre in 64 samples of Indian cotton-seed were as follows:—

Seed from	Oil.	Crude Fibre.
	Per Cent.	Per Cent.
Madras (26 samples)	17·41	17·41
Bombay (18 samples)	17·66	17·04
Central Provinces (15 samples)	19·65	16·90
United Provinces (5 samples)	19·89	16·89

The present export of Indian cotton-seed consists mainly of the Jari variety from the Central Provinces and the Varadi variety from Bombay; these seeds contain, on the average, about 20 per cent. of oil and 17 per cent. of crude fibre. The seeds of exotic varieties of cotton acclimatised in India diminish in size, and contain, on the average, less oil and more crude fibre than indigenous varieties. F. G. Sly considers that Indian cotton-seed would give a yield of 13 per cent. of oil under treatment by proper machinery, and it is proposed to test this conclusion by having specimens of Indian cotton-seed treated in American and English machines.

In the following table is shown the result of a comparison of Egyptian and Bombay cotton-seed cakes, and an analysis of Indian cotton-seed, by S. H. Collins, together with analyses of English-made samples of undecorticated Indian cotton-seed cakes, by J. W. Leather.

—	Egyptian Cotton-Seed Cake.	Bombay Cotton-Seed Cake.	Indian Cotton-Seed.	Undecorticated Indian Cotton-Seed Cakes.		
				1.	2.	3.
Moisture	14·13	12·41	10·5	10·41	10·90	10·75
Oil	5·17	5·35	14·7	4·77	4·76	4·94
Albuminoids	24·19	21·19	16·6	17·87	17·50	17·44
Carbohydrates	32·10	35·19	29·7	39·41	43·35	42·60
Woody fibre	19·31	18·65	23·3	20·55	17·27	18·75
Mineral matter	5·10	5·91	5·2	6·99	6·22	5·54
Nitrogen	3·87	3·39	2·66	3·07	3·06	3·05
Sand	0·05	1·24	1·10	1·98	1·29	0·95

With regard to chemical composition, the difference between Egyptian and Bombay cotton-seed cakes is not important, but the fibre of the latter is of an objectionable woolly character, and having regard also to the rather large amount of sand in the Bombay cake, this must be regarded as slightly, but certainly, inferior to the Egyptian cake as a cattle-food.—A. S.

XVII.—BREWING, WINES, SPIRITS, Etc.

Alcohol Trade of Italy.

Foreign Office Annual Series, No. 3118, *Feb.* 1904.

The export of alcohol from Italy in 1902 was 1,506,166 galls., as compared with 310,407 galls. in 1901, and in fact the figures for the last 10 years show a steady increase. This industry is largely beneficial to agriculture, and therefore highly important to this district. The distilleries are divided into three categories, of which the first is concerned with the distillation of saccharine residuum—beetroot and cane. In this are 17 establishments, which used up 37,237 tons of material, and produced 2,771,323 galls. of spirit. The second deals with wine refuse, stalks, skins, &c., and with wine itself. This is divided into three classes, all using the same materials. The first class consumed 157,147 tons of material and produced 1,236,543 galls. of spirit. The second class is of small stills, which work under special conditions, and produced 124,950 galls. The production by agricultural co-operative societies is also encouraged by special enactments, and amounted to 28,590 galls.

No reason has been assigned for the extraordinary boom in the trade in 1902.

The spirit is largely utilised in the country for making essences, preserving fruit and kindred purposes, as well as for fortifying wine for export, as is shown by the following table:—

Articles.	Quantity Exported.	Added Spirit.
	Hectolitres.	Hectolitres.
Marsala	25,462	1,6[illegible]
„ (red)	36	1·2
Vermouth	39,488	2,0[illegible]
Liqueurs	11,699	5,5[illegible]
Pure spirit	1,455	81[illegible]
Cognac	129	69
Common wines	180,521	4,02[illegible]
	Tons.	Tons.
Fruit	135	41[illegible]

The net taxation on the above reached 86,900*l*. From this table it appears that exported wine is fortified to the extent of 2·16 per cent. From the port of Naples alone 14,420 hectolitres were exported, to which 64,894 litres of spirit were added, which is equal to 4·5 per cent. The increase in the export of Italian Cognac has not realised the expectations of manufacturers.

Vinegar makers consumed 4,500 hectolitres of spirit to produce 46.226 hectolitres of their wares, but there is no increase on preceding years.

The importation of spirit in 1902 amounted to 68,431 hectolitres. This comes almost entirely from Austria-Hungary and Germany, and shows a very large increase over the preceding quadrennial average. The duty on foreign alcohol being 30 lire per hectolitre, besides the octroi dues of the various towns where it is used, the sum realised by the State by this sudden increase of importation has been remarkable.

SPIRIT; EXPORT OF ——, FROM THE GERMAN CUSTOMS UNION IN 1903.

M. Student. Zeits. Spiritusind., 1904, **27**, 48.

The exports of spirit in casks amounted to 232,797 German centners in 1903, as against 313.502 centners in 1902, and 155,672 centners in 1901. Of these amounts the re-export of imported spirit after refining was only 1 centner in 1903, as against 54 in 1902, and 7,297 in 1901. The exports of actual German spirit for the past 10 years is shown in the following table:—

Year.	Amount in Centners.	Year.	Amount in Centners.
1894	76,987	1899	159,662
1895	167,652	1900	154,322
1896	182,108	1901	148,375
1897	28,201	1902	313,448
1898	60,250	1903	232,796

The spirit exported, including the small amounts re-exported after refining, went chiefly to the countries mentioned in the following table:—

——	1903.	1902.	1901.
	Centners.	Centners.	Centners.
Great Britain	55,713	92,106	57,803
Switzerland	51,012	29,555	35,424
Holland	22,412	15,754	8,219
Italy	15,134	14,845	2,741
Austria-Hungary	14,323	16 217	2,819
Hamburg (free port)	11,395	2,510	3,133
Turkey in Europe	9,053	17,198	6
„ Asia	8,602	9,780	1,099
British West Africa	5,006	7.252	7,503

The import of spirit in casks into the German customs union amounted to 8095 centners in 1903, as against 3415 centners in 1902, and 9980 in 1901. Of these amounts, 7813 centners were destined for re-export after refining, in 1903, 3238 in 1902, and 9685 in 1901, and thus the amounts imported for consumption in Germany were 282 centners in 1903, 177 in 1902, and 295 in 1901.—A. S.

SHERRY IN SPAIN; PRODUCTION OF ——.

U.S. Cons. Rep., No. 1875, *Feb.* 12, 1904.

The production of sherry is confined to the district of Jeres. Since 1890 the vintage has decreased so enormously that unless the new vineyards planted with American vines in the last few years prove a success, the existence of this great industry is near its end. In 1890, there were produced 6,000,000 gallons in the district of Jeres. The vintage has fallen off from year to year, until the product of 1903 only amounted to 145,848 galls.

XVIII. A.—FOODS.

FOODS AND DRUGS; U.S. "STANDARD DEFINITIONS" OF PURE ——.

Bd. of Trade J., Feb. 25, 1904.

A Bill, now before the United States Senate, fixes "standard definitions" of pure foods and drugs, and defines what are to be considered adulterations or misbrandings of the same. A copy of the Bill may be seen at the Commercial Intelligence Branch of the Board of Trade, 50, Parliament Street, S.W.

XIX.—PAPER, PASTEBOARD, Etc.

WOOD PULP; EXPORT DUTIES ON ——, IN SWEDEN.

Bd. of Trade J., Feb. 25, 1904.

By a Law passed by the Swedish Parliament during the Session of 1903, export duties were imposed on wood pulp at the following rates:—

——	Rates of Duty.	English Equivalent.
Wood pulp—	Öre.	*s.* *d.*
Dry—		
Chemically prepared, per ton	50	0 6¾
Mechanically „ „	30	0 4
Wet, per ton	Half the rates imposed on dry.	Half the rates imposed on dry.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.], "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 3795. Imray (Meister, Lucius und Brüning). Extraction of water or other liquid from mineral, vegetable, or animal substances. Feb. 15.

„ 3807. Aktiebolaget Separator. Centrifugal separating apparatus. [Swedish Appl., Feb. 16, 1903.]* Feb. 15.

„ 3859. von Ritterhausen. Filters. Feb. 16.

„ 4139. Stanton. Apparatus for use in heating substances in retorts.* Feb. 18.

„ 4231. James and Richardson. Method and apparatus for the production of power and liquefaction of gases. Feb. 19.

„ 4567. Northcott. Machinery for compressing gaseous fluids. Feb. 24.

„ 4575. Ellis (Maschinenfabr. Grevenbroich). Filtering apparatus.* Feb. 24.

„ 4602. Thompson (Hanrahan). Drying kilns.* Feb. 24.

„ 4618. Woolford. Crucibles and other refractory vessels. Feb. 25.

„ 4687. Perrier. Distilling apparatus. [Belgian Appl., Feb. 25, 1903.]* Feb. 25.

[A.] 4694. Von Orth. Method of and apparatus for preventing the freezing of liquid gases on the discharge thereof from storage vessels.* Feb. 25.

[C.S.] 3938 (1903). Smith. Filters. Feb. 24.

„ 5770 (1903). Waché and Locoge. Apparatus for concentrating liquids. Feb. 24.

„ 8500 (1903). Cristadoro. Kneading and mixing machines. Feb. 24.

„ 11,450 (1903). Schofield and Cole. Apparatus for the production of liquid extracts. March 2.

„ 26,712 (1903). Grimwade. Continuous muffle furnaces or kilns. March 2.

„ 27,621 (1903). Gordon (Licardie). Evaporators for distilling or concentrating liquids, or for generating steam or gas. March 2.

II.—FUEL, GAS, AND LIGHT.

[A.] 3721. Clapham. Condensers for use in the manufacture of illuminating and other gases. Feb. 15.

„ 3781. Marks (Internat. Fuel Co.). Artificial or composite fuels.* Feb. 15.

„ 3821 Mackenzie and Mackenzie. Mantle for incandescent lighting. Feb. 15.

„ 3901. Thompson (Hoberecht). Means to economise fuel.* Feb. 16.

„ 3938. Hills. Manufacturing gas from carbonaceous material. Feb. 17.

„ 3994. Levis (Gen. Electric Co.). Electrodes for arc lamps. Feb. 17.

„ 3997. Levis (Gen. Electric Co.). Electrodes for arc lamps. Feb. 17.

„ 3999. Levis (Gen. Electric Co.). Electrodes for arc lamps. Feb. 17.

„ 4000. Levis (Gen. Electric Co.). Electrodes for arc lamps. Feb. 17.

„ 4001. Levis (Gen. Electric Co.). Electrodes for arc lamps. Feb. 17.

„ 4002. Levis (Gen. Electric Co.). Electrodes for arc lamps. Feb. 17.

„ 4003. Levis (Gen. Electric Co.). Electrodes for arc lamps. Feb. 17.

„ 4004. Levis (Gen. Electric Co.). Electrodes for arc lamps. Feb. 17.

„ 4099. Bamford. Gas-burning furnaces. Feb. 18.

„ 4133. Levis (Gen. Electric Co.). Arc lamps and electrodes therefor. Feb. 18.

„ 4134. Levis (Gen. Electric Co.). Arc lamp electrodes. Feb. 18.

„ 4230. Pfeifer and Wolz. Complete combustion of solid fuel. Feb. 19.

„ 4355. Vernon. Gas-producers. Feb. 22.

„ 4506. Leinss. *See under* VII.

„ 4625 Singer. Manufacturing mantles for incandescent gas lights. Feb. 25.

„ 4708. Settle and Padfield. Mode of making coke, and apparatus to be used therefor. Feb. 26.

[C.S.] 3331 (1903). Westphal. Retort furnace and method of charging the retort. Feb. 24.

„ 3852 (1903). Brooks (Stettiner, Chammotte, Fabr., vorm. Didier). Gas generator furnaces with inclined retorts. Feb. 24.

[C.S.] 8135 (1903). Angus and McPherson. Gas retorts. March 2.

„ 9733 (1903). Bousfield (Gerdes). Gas washers. Feb. 24.

„ 11,442 (1903). Vogel. Arc light electrodes. March 2.

„ 26,712 (1903). Grimwade. *See under* I.

„ 27,613 (1903). Ritz. Furnaces. Feb. 24.

„ 769 (1904). Stevens and Timmerman. Furnaces. Feb. 24.

„ 770 (1904). Stevens and Timmerman Furnaces. Feb. 24.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 4377. Newton (Bayer and Co.). Manufacture and production of anthraquinone derivatives. Feb. 22.

[C.S.] 7396 (1903). Johnson (Badische Anilin und Soda Fabrik). Manufacture of monazo colouring matter. Feb. 24.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 4596. Détré. Tubes for holding yarns or threads during dyeing, bleaching, mordanting, and like operations. [Fr. Appl., July 10, 1903.]* Feb. 24.

„ 4610. Willard. Apparatus for dyeing raw stock, wool, and like materials. [U.S. Appl., May 21, 1903.]* Feb. 24.

„ 4787. Détré. Apparatus for the dyeing, mordanting, bleaching, or other treatment of textile materials in bobbin or like form. Feb. 26.

[C.S.] 5867 (1903). Imray (Meister, Lucius und Brüning). *See under* VII.

„ 21,961 (1903). Sucker. Beaming and dressing warp yarns. Feb. 24.

„ 24,641 (1903). Roberts and Crossley. Carbonising or destroying cotton or silk in woollen or worsted rags. Feb. 24.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 3776. Boult (Soc. Romana Sofati). Process for the simultaneous preparation and purification of aluminium hydrate. Feb. 15.

„ 4130. Ahrendts. *See under* IX.

„ 4217. Abel (Siemens and Co.). Manufacture of barium oxide. Feb. 19.

„ 4295. Martier. Manufacture of sulphide of zinc. Feb. 20.

„ 4372. Corbin. *See under* XI

„ 4409. Feely. Treatment of lime. [U.S. Appl., March 5, 1903.]* Feb. 22.

„ 4462. Gutensohn. Means for the recovery of metallic bases or compounds from their acid solutions. Feb. 23.

„ 4487. Granier. *See under* XI.

„ 4506. Leinss. Preparation of calcium carbide. Feb. 23.

„ 4796. Stanley. Extraction or preparation of nitrates or similar salts. Feb. 26.

[C.S.] 4513 (1903). Grossmann's Cyanide Patents Syndicate, Ltd., and Grossmann. Manufacture of cyanides and recovery of by-products. March 2.

„ 5867 (1903). Imray (Meister, Lucius und Bruning). Manufacture of new hydrosulphite compounds and methods of dyeing and printing with their aid. March 2.

„ 6458 (1903). Spence and Peter Spence and Sons, Ltd. Manufacture of aluminium sulphate. Feb. 24.

„ 23,918 (1903). Keogh and Broughton. Processes of making alumina and by-products. March 2.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 3760. Perkiewicz. Coating bricks, and apparatus therefor.* Feb. 15.

„ 3769. Howorth (Jurschina). Manufacture of artificial stone.* Feb. 15.

„ 4130. Ahrendts. Manufacture of artificial stones or bricks in which the waste from the Leblanc or ammonia soda process is used. [German Appl., May 5, 1903.]* Feb. 18.

„ 4249. Gostling. Vertical kiln for burning cement or lime by the aid of furnaces and a blast.* Feb. 20.

„ 4275. Nelson (McNeill and Co.) *See under* X.

„ 4433. Williams and Tomkins. Products of silica as a refractory material. Feb. 23.

„ 4478. Bach. Manufacture of refractory articles. Feb. 23.

„ 4557. Twynham. Utilisation of blast furnace slag and similar materials. Feb. 24.

„ 4606. Liebold. Process for manufacturing cement.* Feb. 24.

„ 4618. Woolford. *See under* I.

„ 4674. Ford. Manufacture of artificial stone or sand-lime bricks. Feb. 25.

„ 4898. Wouldham Cement Co. and Fennel. Manufacture of refractory material suitable for lining rotary and other kilns, &c. Feb. 27.

[C.S.] 4048 (1903). Mills (Seigle). Artificial building materials. March 2.

„ 4907 (1903). Briggs. Bituminous cement. March 2.

„ 26,751 (1903). Morris. Brick kilns. March 2.

„ 1279 (1904). Johnson (Brown and Tredway). Manufacture of pipes, conduits, &c., for use underground, or in other places where they are subject to electrical or corrosive action. Feb. 24.

X.—METALLURGY.

[A.] 3735. Alzugaray. Manufacture of metallic alloys. Feb. 15.

„ 3736. Alzugaray. Soldering and welding metals. Feb. 15.

„ 3962. Evans. Method of and means for the treatment of gold-bearing slimes. Feb. 17.

„ 3998. Levis (General Electric Co.). Methods of producing metals from a compound containing silicon. Feb. 17.

A.] 4008. Tresidder. Manufacture of steel. Feb. 17.

„ 4058. Simm, Simm, Storey and Sellers. Process for treating zinc blende and other substances containing zinc, and apparatus therefor. Feb. 18.

„ 4275. Nelson (McNeill and Co.). Manufacture of slag wool, silicate cotton, or mineral wool. Feb. 20.

„ 4343. Mollard. Means of producing metal or metals or the like. Feb. 22.

„ 4358. Moseley. Furnaces for smelting iron and making steel. Feb. 22.

„ 4462. Gutensohn. *See under* VII.

„ 4706. Cunnington. Extraction and purification of zinc. Feb. 25.

„ 4793. Wolf. Separation of metals from their ores. [U.S. Appl., May 22, 1903.]* Feb. 26.

[C.S.] 4891 (1903). Jones. Puddling and similar melting and re-heating furnaces. Feb. 24.

„ 9064 (1903). Lauer. Production of bronze and the like metallic powder. March 2.

„ 15,420 (1903). Kaiser. *See under* XI.

„ 23,821 (1903). Hunt. Process of perfecting cast steel ingots. March 2.

„ 1842 (1904). Engels. Process for treating steel and armour plates. March 2.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 3790. Keller. Electric furnaces.* Feb. 15.

„ 4059. Simm, Simm, Storey and Sellers. Electric furnaces. Feb. 18.

„ 4188. Blackman. Electric accumulators. Feb. 19.

„ 4372. Corbin. Electrolytic manufacture of chlorates and perchlorates. [Fr. Appl., Dec. 31, 1903.]* Feb. 22.

„ 4487. Granier. Process and apparatus for the manufacture of sulphate of copper and caustic alkalies by the electrolysis of alkaline chlorides. [Fr. Appl., April 6, 1903.]* Feb. 23.

„ 4512. Nehmer. Generating electricity by the use of moist chemicals which are mechanically pressed upon zinc. Feb. 23.

[C.S.] 6954 (1903). Diamant. Forming lead peroxide on plates of electric accumulators. March 2.

„ 8676 (1903). Cance. Plates for electric accumulators. March 2.

„ 15,420 (1903). Kaiser. Electrolytic production of zinc. Feb. 24.

„ 28,057 (1903). Wheatley (Atwood Electric Co.). Solutions for use in the cells of galvanic batteries. March 2.

„ 1599 (1904). Ryffel. Galvanic batteries. March 2.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 4415. Castle. Manufacture of soap washing compounds and the like. Feb. 22.

„ 4488. Garle and Lougsdon. Bleaching fats, oils, waxes, &c., and apparatus therefor. Feb. 23.

[A.] 4532. Bolton. Soap for domestic and manufacturing purposes. Feb. 24.

„ 4867. Hearson (Frank and Ziegler). Process for the extraction of fat or wax-like substances from hydrous materials.* Feb. 27.

[C.S.] 4420 (1903). Turner and Turner. Process of treating refuse soap-suds. March 2.

„ 5687 (1903). Pfestroff and Gillon. Compound for use as a substitute for linseed oil. Feb. 24.

„ 6590 (1903). Knox. Soap. March 2.

„ 27,449 (1903). Cronholm. *See under* XVIII. A.

III.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A*.)—Pigments, Paints.

[A.] 4491. Mitchell. Manufacture of paint. Feb. 23.

XIV.—TANNING; LEATHER, GLUE, SIZE, Etc.

[A.] 3981. Boult (Trenckmann). Manufacture of leather. Feb. 17.

„ 4246. Moore and Kirk. Glue or cement. Feb. 20.

XV.—MANURES, Etc.

C.S.] 10,581 (1903). Wardle. Utilisation of brewers' and distillers' yeast in the manufacture of artificial manures. March 2.

XVI.—SUGAR, STARCH, GUM, Etc.

[A.] 4112. Shaw. Treatment or preparation of sugar, and machinery for use therein. Feb. 18.

„ 4792. Reynaud. Manufacture of achroo-dextrin. Feb. 26.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 4011. Von Szathmáry. Condensing apparatus for preventing losses in distilleries through the escape of alcohol vapour.* Feb. 17.

„ 4271. Oppenheimer and Kent. Spirituous fluid or compound, and process for obtaining same. Feb. 20.

„ 4294. Krueger. Malting apparatus. Feb. 20.

„ 4560. Leaker. Brewing, distilling, and like processes, and apparatus therefor. Feb. 24.

„ 4651. Alliott. Apparatus for treating brewer's wort for cooling and other purposes. Feb. 25.

C.S.] 9477 (1903). Lapp. Closed grain-steeping vats for manufacturing malt and similar substances. March 2.

„ 10,581 (1903). Wardle. *See under* XV.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A*.)—Foods.

[A.] 3954. Moss. Preparation of cocoa. Feb. 17.

[A.] 4232. Parker. Manufacture of a bleaching agent and its application for bleaching, ageing, or conditioning flour and the like. Feb. 19.

„ 4287. Best. Bleaching grain and products thereof. Feb. 20.

„ 4589. Binder. Process of making milk extract similar to meat extract. [Fr. Appl., Feb. 25, 1903.]* Feb. 24.

[C.S.] 4150 (1903). Bromhead. Food products. Feb. 24.

„ 10,845 (1903). Howorth (Bauer and Co.). Manufacture of albuminous compounds soluble in water. Feb. 24.

„ 27,449 (1903). Cronholm. Edible fats and process of making the same. March 2.

(*C*.)—India-Rubber.

[A.] 4540. Kitching and Shirley. Disinfectants. Feb. 24.

XIX.—PAPER, PASTEBOARD, Etc.

[C.S.] 4378 (1903). Dietrich. Means for regulating the supply of pulp water to pulp catchers or savers, &c., used in the manufacture of paper. March 2.

„ 7058 (1903). Atkins. *See under* XXII.

„ 7269 (1903). Nathan, Thomson, and Thomson. *See under* XXII.

„ 7346 (1903). Newton (Bayer and Co.). Manufacture of cellulose acetate. Feb. 24.

„ 28,186 (1903). Meixell and Holt. Process of making paper. March 2.

„ 307 (1904). Ingersoll and Lenhart. Cork compositions. Feb. 24.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 3706. Ewan and Young. Manufacture of guanidine salts. Feb. 15.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 3794. Abel (Act.-Ges. f. Anilinfabr.). Flash lights for photography. Feb. 15.

„ 3855. Hoffsümmer. Process of preparing photographic tissues.* Feb. 16.

„ 4668. Cleaver and Marcussen. Process for producing photographs in colours. Feb. 25.

[C.S.] 7924 (1903). Gurtner. Production of coloured photographs and photo-mechanical prints. Feb. 24.

„ 14,073 (1903). Nusch (Franklin Tarsulat). Preparation of durable collodion emulsions for all colour rays of the spectrum, suitable for the production of negatives for half-tone in natural colours. Feb. 24.

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[A.] 4028. Hargreaves, and Curtis's and Harvey, Ltd. Blasting compounds. Feb. 17.

„ 4090. Bichel. Manufacture of explosives. Feb. 18.

„ 4699. Haddan (Führer). Process for the manufacture of explosives of the nitrate of ammonia group. Feb. 25.

„ 4742. The Miners' Safety Explosive Co., Ltd., and Levett. Safety explosives. Feb. 26.

[C.S.] 6409 (1903). Selwig. Manufacture of guncotton. Feb. 24.

[C.S.] 7058 (1903). Atkins. Manufacture of nitrated cellulose. Feb. 24.

„ 7269 (1903). Nathan, Thomson and Thomson. Manufacture of nitro-cellulose. Feb. 24.

„ 8898 (1903). Wetter (Westfälisch-Anhalt. Sprengstoff A.-G.). Explosives. Feb. 24.

„ 116 (1904). Schmidt. Manufacture of a nitro-cellulose gunpowder. Feb. 24.

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[A.] 4088. Briggs. Apparatus for measuring the percentage of explosive gases in the air. Feb. 18.

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Notices.

JUBILEE OF Dr. H. CARO.

On February 13th a celebration took place at Mannheim in honour of the 70th birthday of Dr. H. Caro, one of the original members of this Society. On that date the President and Dr. Messel, acting on behalf of the Council, sent to him a telegram of congratulation, of which the following s a copy :—

"Dr. H. Caro, Mannheim.

"The Society of Chemical Industry, proud of the grand achievements of its member, sends its sincerest congratulaions on your 70th birthday, and hopes that you may long be spared to your family and to your admiring friends.

(Signed) Ramsay, President.
Messel, Vice-President."

To this Dr. H. Caro has sent the following reply :—

'Dear Sir William, Mannheim, 1 March 1904.

"I never feel more my inability to make words meet with my feelings than at the present moment, when I am bout to undertake the task of expressing to you, as the President of the time-honoured Society of Chemical ndustry, and to Dr. Messel, as the Vice-President thereof, my heartfelt thanks for the great honour and distinction which your Society has bestowed upon me by its congratuations to my 70th birthday, framed in words honouring he generous sender not less than the deeply thankful eceiver. May I then be allowed, dear Sir William, to ask ou, kindly, to complete your noble mission and to convey he expression of my sincerest and never-dying gratitude o the Society of Chemical Industry. I have never forgotten he happy time of my younger days when I became aprenticed to English manufacturing chemistry, when I earned to make my first steps in chemical investigation, nd when, above all, I was led to love and appreciate the true greatness of your noble country and your generous-hearted ountrymen. To be honoured by my British fellowhemists in the manner done by you, dear Sir William, by Dr. Messel, and the Society of Chemical Industry, is to my mind the crowning of my entire life, and the most recious gift presented to my 70th birthday.

Believe me, dear Sir William,
Yours ever faithfully,
(Signed) Dr. H. Caro.

To Sir William Ramsay, K.C.B., Ph.D., F.R.S.,
President of the Society of Chemical Industry,
London."

THE MEDAL.

At a meeting of the Council of the Society held on March 23rd last, it was unanimously resolved to present he Society's medal for 1904 to Prof. Ira Remsen, President f the Johns Hopkins University, Baltimore, Md., U.S.A., r conspicuous services rendered by him to Applied hemistry.

NNUAL GENERAL MEETING, NEW YORK, 1904.

The Annual General Meeting will be held in New York ity on Thursday, Sept. 8th, and following days. Members ho contemplate attending are requested to communicate ith the General Secretary as soon as possible, in order hat suitable travelling arrangements may be made. A vised programme appears in this issue of the Journal.

ST. LOUIS EXHIBITION, 1904.

The St. Louis Chemical Society has established a Bureau Information for the benefit of members of foreign hemical societies who may visit the World's Fair. Any embers of such societies who desire information in regard the Exhibition are invited to write to the Secretary, rof. E. H. Keiser, Washington University, St. Louis, Mo.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

List of Members Elected

23rd MARCH 1904.

Appleby, Joseph, 35, Pembroke Road, Bootle, Liverpool, Flour Miller.

Bayly, Harold G., 65, Fulham Park Gardens, London, S.W., Analytical Chemist.

Bleakley, Wm., Phœnix House, Swinton, Lancashire, Cotton Mill Manager.

Brown, Frederick W., 470, Lenox Avenue, New York City, U.S.A., Chemist.

Buchanan, J. L., 27, Birch Road, Lower Bebington, Cheshire, Analytical Chemist.

Burton, Thos. R., c/o Scott, Greenwood, and Co., 19, Ludgate Hill, London, E.C., Technical Journalist.

Chubb, H. M., Wharfedale Villas, Tadcaster, Yorks. Brewery Chemist.

Clark, Ernest, Royal Technical Institute, Salford, Assistant Lecturer in Chemistry.

Cooke, W. Ternent, Chem. Dept., University College, Gower Street, London, W.C., Research Student in Chemistry.

Dixon, Fred. J., 5, Prospect Terrace, Harrogate, Yorks., Civil Engineer.

Elliott, Philip, c/o Lanosoap, Ltd., Marion Street Works, Bradford, Yorks., Works Chemist.

Everitt, Walter, 83, The Grove, Ealing, W., Analyst.

Garnar, G. Lestor, Monticello, Sullivan Co., N.Y., U.S.A., Superintendent (Leather Works).

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Muckenfuss, Anthony Moultrie, State University, Fayetteville, Arkansas, U.S.A., Professor of Chemistry.

Newgass, Solomon, 257, W. 132nd Street, New York City, U.S.A., Student (Columbia School of Mines).

Payne, Allen G. C., 89, Rokeby Street, West Ham, E., Assistant Works Chemist.

Peyser, Horace F., 68, West 47th Street, New York City, U.S.A., Chemist.

Pollitt, George P., Ferndale Villa, Rectory Road, Stanford-le-Hope, Essex, Chemist.

Reinherz, Otto, 9, Heaton Grove, Bradford, Yorks., Chemist.

Richards, Adelbert H., c/o General Metals Co., Colorado Springs, Colo., U.S.A., Chemist.

Schoeller, Walter R., 169–170, Shoreditch High Street, London, E.C., Analytical Chemist.

Stanffacher, W., 64, Oberwilerstrasse, Basle, Switzerland, Manager (Chemical Works).

Strange, Edward Halford, 7, Staple Inn, Holborn, London, Technical Research Chemist.

Swindells, Seth, Craiglea Villa, Kidsgrove, Stoke-on-Trent, Chemist.

Thornley, Thomas, Cross Chemical Co., Ltd., Camelon, Falkirk, N.B., Chemical Manufacturer.

Zimmermann, Henry D., c/o American Ether Co., Richmond, Va., U.S.A., Chemist.

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When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

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Williams, Jno. T., l/o Stamford, Conn.; Lord's Court Building, 27, William Street, New York City, U.S.A.

Liverpool Section.

Meeting held at the University, Liverpool, on Wednesday, January 27th, 1904.

MR. FRANK TATE IN THE CHAIR.

DESTRUCTIVE BACTERIA IN MANUFACTURING OPERATIONS.

BY H. B. STOCKS, F.I.C.

To those engaged in the manufacture of organic products from animal and vegetable sources the study of bacteria is of the utmost importance. Our rapidly increasing knowledge of this subject, though of recent date, has shown that many of our largest industries depend either entirely or partly upon bacterial action, and that in others these minute organisms are responsible for many changes, either beneficial or otherwise, which occur at various stages of manufacturing processes. The changes directly due to bacteria come within the scope of the chemist, and it may be a part of his duty to deal with them.

There are stages in many manufactures where bacteria do a considerable amount of damage, and there are few stages where the conditions are so unfavourable that bacteria cannot increase or at least exist if they find an entry. There exist several species of bacteria whose spores can withstand a temperature of boiling water for several hours and afterwards develop under favourable conditions: there are many bacteria which flourish at moderately high temperatures, and others which may be frozen and yet multiply. Some can withstand moderately strong alkalis or acids, and there exist quite a number that are not checked at all by the usual antiseptic methods of treatment such as weak solutions of phenol or mercuric chloride.

The sources of infection are the materials used, the air or the water used; and bacteria may also be introduced by careless or uncleanly methods of working. If the conditions are at all favourable bacteria will multiply at an enormous rate, and pass from one stage of the process to another, finally appearing in the more or less damaged finished product. Especially is this the case in intermittent work, when the plant is only in use for a portion of each day; the material left in the apparatus then becomes a breeding ground for germs, and the vats, filter presses, pipes, and pumps containing it have to be thoroughly cleansed before they can be used again.

The first precaution to be observed is thorough cleanliness. All apparatus should be cleansed or disinfected i such a manner that it may be used without any fear o contamination to the material that may be in process o manufacture.

It was shown in 1878 by Downs and Blunt (Proc. Roy Soc., **26**, 188) that the development of bacteria and othe putrefactive organisms is arrested under the influence o sunlight and oxygen. Most bacteria shun the light putrefactive bacteria flourish under anærobic conditions Efficient ventilation is therefore absolutely necessary in factory.

Waste water should be treated in some way, or run directly into the sewer. Other waste materials should be sterilised, destroyed, or carried right away while they are quite fresh.

It should always be remembered that bacteria require water for their growth, so that a waste product should be brought into a dry condition, if possible.

Other methods of treatment will depend upon the nature of the material operated upon. In dealing with food products, sterilisation by heat is largely practised, and, if the material will bear a high temperature, it is heated to 100° C. or slightly above, as in the preservation of meat, meat extracts, &c.

The preservation of substances not intended for food is usually insured by the addition of preservatives or antiseptics, which may be added during the manufacture or to the finished product, but it is essential for proper working to get them in as soon as possible to prevent, if possible, even incipient signs of decomposition.

The preservatives mostly used are phenol, cresols, thymol, salicylic acid, formaldehyde, formic acid, lactic acid, zinc chloride, borax, boric acid, sulphurous acid, sodium and calcium sulphites and bisulphites, hydrofluoric acid and alkali fluorides and silicofluorides.

The application of some of these to foods is also to a certain extent practised, but this should be severely dealt with; though of great benefit to the manufacture, it is far from beneficial to the consumer, and no doubt leads to the working-up of a lot of material that would otherwise have to be destroyed or converted to some meaner use.

In the brewing of beer, in the distillery, and in wine manufacture, a considerable amount of trouble is caused by bacterial action. In bread making, the general surroundings of a bakery ought to be carefully looked into, and any source of infection quickly put a stop to. A new Act came into force in January, which deals with the question, and no new bakehouses will be allowed below ground. In the manufacture of sugar and starch destructive bacteria are especially numerous, and cause a great amount of trouble. The leather industries are dependent upon the action of bacteria; the various soaks used contain immense numbers of bacteria which act upon the skins in such a way as to better fit them for the subsequent tanning operation; these bacteria may, however, become destructive, and cause a loss of weight or strength in the finished material.

In the manufacture of gum tragasol from the locust beans as carried out at the Gum Tragasol Works, we noticed, during the extraction of the gum from the milled beans, soon after the commencement of operations, isolated black patches disseminated through the gum. On examining these with the microscope, it was found that they contained a large number of spores, and, though the temperature was very high, *i.e.* about 88° C., they were evidently developing. These black patches were eventually traced to the mill. The machines for grinding include two sets of small millstones enclosed in cast-iron casings. During the grinding of the beans considerable friction is experienced, and heat is generated in the mills which drives out the moisture contained in the beans; this collects upon the inside of the iron covers, and is quickly coated with fine dust produced during the grinding, which also passes into this space; the water and dust together form a soft pulp, which accumulates until it touches the revolving stones, and forms a layer half an inch or more in thickness. During the period of grinding there is a current of air passing down through the feed opening in the upper stone, between the stones, and out through the delivery spout, this air being heated to a temperature of about 35° C. while it is passing through. The spores contained in the volume of air passing through these mills must be considerable, and many of them are held back by the coating of dust and water lying upon the iron plates; the temperature being very suitable, and the necessary organic matter plentiful, they develop, the bacteria multiply very rapidly, and soon the pulp is swarming with them.

The bacteria thus introduced generate acids which attack the iron casings, while the iron thus dissolved combines with the tannin of the dust from the husk forming a black lake or ink, and imparts to the material a black colour. The acidity of the moist material equals 0·46 per cent., calculated as acetic acid. After a time this black material dries up and breaks away from the iron casings; it falls into the grading machines along with the beans, and any pieces which may have broken up to about the same size as the beans pass with them through the remainder of the grinding machines, becoming rounded, hardened, and polished in the process. About half an ounce or less of this material may be found in 100 lb. of beans, but the number of spores in this quantity must be so great that its absolute weight gives no idea of the destruction these spores may do when they develop. In the manufacture of the gum the black particles very rapidly swell and liberate the spores into the gum, and if allowed to develop these cause a considerable amount of trouble. Attempts were made to cultivate these bacteria by inoculation into agar-agar, but they did not develop; they will, however, grow readily by simply warming these black particles with water and allowing them to remain for a few days in a warm place. The organisms which appear to be most common, are a short rod-shaped bacterium, with well-developed spore at one end; in very sour material this becomes about twice as long; and a short bacterium, under favourable conditions developing into a very long chain, and a diplococcus. Some of these bacteria act upon the gum in such a way as to render it quite fluid, and this action becomes so powerful that a very small quantity of the fluid gum added to a large quantity of fresh gum will cause it to become fluid in about half an hour; this action is no doubt due to enzymes excreted by these bacteria, as the organisms alone could not, in so short a time, destroy so much material. This emphasises what I said in my opening remarks, that all old material should be removed, as it is often very destructive.

In the preparation of flour for sizing purposes two methods are pursued; either the material is used in its fresh state after the addition of a preservative, or it is allowed to ferment for several weeks. In conjunction with Mr. Graham White I have studied the changes which take place when flour ferments, and as they are of a destructive character they may be of interest here. When flour and water are mixed together and allowed to stand, a fermentation commences in about three days and continues for a long period. This fermentation may be due entirely to bacteria, or partly to bacteria and wild yeasts, or partly also to the ordinary forms of moulds according to which organisms get the upper hand; but the changes appear to be of a similar character in different fermentations. The figures given in the table refer to a fermentation carried out on a fairly large scale, the atmospheric temperature varying between 64° and 72° F. Samples for analysis were taken from the bulk at 2, 4, 6, and 8 weeks, and corrections made accordingly:—

Fermentation of Flour at 64° to 72° F.

Samples taken from Bulk.

——	Fresh.	Fermented 2 weeks.	Fermented 4 weeks.	Fermented 6 weeks.	Fermented 8 weeks.
Albuminoids:					
Soluble in water	3·96	9·76	9·25	7·27	7·29
Insoluble in water ..	7·68	1·43	1·62	2·50	2·50
Total.........	11·64	11·19	10·87	9·77	9·79
Sugars................	3·62	0·54	..	..	..
Acidity in parts NaHO per 100 of flour	0·35	2·25	2·59	4·85	5·90
Ammonia.............	0·018	0·102	0·120	0·250	0·234
Nitrogen:					
In soluble albuminoids	0·632	1·516	1·481	1·164	1·167
In insoluble „	1·233	0·275	0·260	0·406	0·400
As ammonia	0·015	0·084	0·099	0·206	0·193
Total	1·880	1·875	1·840	1·770	1·760
Soluble albuminoids ppt. by tannin and sodium chloride:					
In acid solution...	..	..	..	..	4·03
In neutral „ ...	..	..	..	..	4·74

If we compare the figures obtained after two weeks' fermentation with those obtained when the flour was fresh we find that a great change has taken place: most of the albuminoids have become soluble, nearly all the sugar has been removed, the acidity has considerably increased, and some ammonia has been produced. The changes after the second week are of a similar character but much slower, and it is evident that the greater part of the work is done at an early period. There is a gradual loss of nitrogen, and a large increase in acidity, and also a slight increase in insoluble albuminoids owing to the large increase in bacteria and yeasts which are themselves nitrogenous. The acids generated appear to be to a certain extent preservative, for putrefactive fermentation does not set in for a long period, an unusual occurrence in presence of such a quantity of albuminous matter. The amount of soluble albuminoids and peptones at the eighth week is shown to be fairly large by the precipitate obtained with tannic and sodium chloride. The time at my disposal will not allow of a full account of the work done. The following are the most interesting points:—After the eighth week ethyl alcohol was found to be present in the liquid to the extent of 0·6 per cent.; volatile acids, principally acetic acid, were also found equal to 0·313 per cent.; and non-volatile lactic acid 0·504 per cent., besides other products. When the necessary corrections were made and the weights of these constituents calculated on 100 grms. of the original flour, the amounts were as follows: —

	Grms.		Grms.
Alcohol	6·13	containing carbon	3·20
Acetic acid	3·20	„	1·28
Lactic acid	5·15	„	2·06
		Carbon.........	6·54

The sugar in the original flour amounting only to 3·62 per cent., and containing 1·44 per cent. of carbon, it is evident that a portion of the other carbohydrates dextrin and starch must have been destroyed, and this is borne out by the fact that the starch granules are much shrunk and eroded. There is no doubt a good deal of starch lost in this process.

It appeared to be of interest from a sizer's point of view to determine whether the albuminoids or gluten could be brought into solution without the long and wasteful process of fermentation, and for this pupose three experiments were tried:—

By acting upon flour with—

(1) 10 times its weight of cold water.

(2) „ „ ½ per cent. acetic acid.

(3) „ „ ½ per cent. of lactic acid.

On analysis these mixtures gave the following results:—

—	Soluble.	Insoluble.	Total.
	Albuminoids.	Albuminoids.	
1	2·50	7·81	10·31
2	7·69	2·62	10·31
3	8·56	1·75	10·31

proving that the albuminoids of flour are very largely soluble in these weak acids.

With regard to the pollution of water supply a good deal might be said, but the following example, which has come under my own notice, will suffice.

The Gum Tragasol Co. derive the water for boiler purposes partly from pits or ponds in an adjacent field and partly from the mains; in one of the pits, which is nearest the works, changes have been going on of a rather unusual kind. The pond water is derived from rain, drainage from fields, more or less waste effluent draining through the soil, and water blown through the boilers; in consequence of the latter the temperature of the water in this pond is 5 or 6° higher than that of other ponds in the neighbourhood. I have had this pond under observation for a considerable time, and the following is an outline of these observations:—In January 1902 the water was quite clear, and a well-defined gray layer could be seen about a foot from the edge toning off into yellow as it neared the shallower water, this was found to consist largely of diatoms: beyond this layer the mud was black. Early in April the water became quite turbid, and of a creamy white colour, and a loose flocculent material was gathered thickly upon the water weeds, the lower part of the weeds and the mud being black: sulphuretted hydrogen was evolved when the latter was stirred.

On April 7th a portion of the black mud was dried in a current of coal gas, and the following determinations made:—

	Per Cent.
Matter soluble in hot benzene	3·09
Containing free sulphur	0·37
Iron.... } in combination as FeS.............	3·28
Sulphur } in combination as FeS.............	1·87
Iron as Fe_2O_3	1·33

A microscopical examination of the black mud revealed besides the presence of the black ferrous sulphide and other mineral matter, many active monas, and reddish brown cells in shape and size resembling protococcus, many species of infusoria, and greyish flocculent matter made up very largely of bacteria.

On April 28th, when the water appeared to be very turbid, 2¼ litres of it were warmed and filtered. The weight of the precipitate was only about 0·1 grm., but it contained 0·0055 grm. of free sulphur, or 0·22 part per 100,000 of the water. At this period the water had exactly the same appearance as sulphuretted hydrogen water which has been exposed to the air for a time and in which an incipient precipitation of sulphur has taken place; it also evolved sulphuretted hydrogen on warming, and there appears to be no doubt that a great part of the turbidity is due to the separation of finely-divided sulphur formed by the oxidation of dissolved sulphuretted hydrogen produced from the mud. The formation of sulphides, sulphuretted hydrogen and free sulphur in this water are due to the same changes that occur in sewage and wherever sulphates and decaying organic matter are exposed together (Quart. Journ. Geol. Soc., Vol. LVIII., 1902 pp. 46—58; this J., Vol. XXI., p. 52) that is, under anaerobic conditions the following changes take place:—

$$CaSO_4 + 2C = 2CO_2 + CaS.$$

$$CaS + CO_2 + H_2O = CaCO_3 + H_2S.$$

$$Fe_2(OH)_6 + 3H_2S = 2FeS + 6H_2O + S.$$

and under limited aerobic conditions:—

$$H_2S + O = H_2O + S.$$

The bacteria producing these changes are readily cultivated in a solution containing meat extract peptone, $Ca\,SO_4$, and $Fe_2(OH)_6$, and in three or four days the same reaction is perceived by the blackening of the latter, if after inoculation, the liquid is sterilized by heat there is no change whatever, showing conclusively that bacteria are necessary to bring about these reactions.

Besides the sulphide organisms there are also present in the mud numerous active spirillæ, Fig. 5, which cultivated in a solution of citrate of iron and ammonia precipitate the whole of the iron as hydrate in a short time, no doubt absorbing the organic acid and probably the ammonia; these organisms are present in peat and peaty waters, and they may be the cause of similar troubles to the other iron organisms, *e.g.* Crenotherix and Cladothrix.

Reverting to the pond water again: during the whole time of the observations bacteria were swarming, but a very large kind seemed to become prominent when the water was turbid, it was in the form of long rods or of filaments and contained refractive granules which may be sulphur; whether this organism helps in the oxidation of the sulphuretted hydrogen and absorbs the sulphur in the same way as Beggiatoa alba does I should not like to affirm, but that they were prominent at this time was evident.

On 29th April a thick yellowish-white greasy scum appeared upon the surface of the pond. On examining this the following results were obtained:—

	Per Cent.	
Oil	28·61	Soluble in benzene.
Free sulphur	12·14	
Insoluble in HCl	19·42	
Fe_2O_3	8·53	
CaO	4·10	
MgO	0·76	

The lime and magnesia were probably present as carbonates; organic matter, water, and carbonic acid make up the remainder; the most interesting point about this scum was the presence of over 12 per cent. of free sulphur.

On June 13th the pond evolved a strong odour of sulphuretted hydrogen, and the air over the water blackened paper moistened with lead acetate; the water itself gave a black precipitate with lead acetate solution and a white flocculent precipitate with hydrochloric acid.

The sulphur present as hydrogen sulphide equalled 1·81 parts per 100,000, and the sulphur precipitated by hydrochloric acid 0·6 part per 100,000.

A few of the constituents were determined as follows:—

CaO	18·00	parts per 100,000
MgO	8·24	„
SO_3	10·09	„
Total solids	88·20	„

The water changed from a black tint (when hydrogen sulphide was evolved) to a turbid white colour (in which state there was no free hydrogen sulphide) several times, the changes evidently being due to alternate periods of reduction and oxidation.

The alkalinity of the water was determined several times with Methyl Orange and standard hydrochloric acid, and attempts were made to estimate the carbon dioxide present in the free state and as bicarbonate by means of baryta water and hydrochloric acid, but these last were not successful, as it was found that a carbonate of an alkali was also present.

On May 7th the alkalinity calculated as $CaCO_3$ was 42·0 parts per 100,000, and the apparent CO_2 only 0·176 part.

On June 13th the alkalinity equalled 45·5 parts $CaCO_3$ per 100,000, and the apparent CO_2 only 2·68 parts per 100,000.

On July 2nd the alkalinity equalled 50·2 parts $CaCO_3$ per 100,000. And on this day there was apparently no free CO_2, the water, after addition of baryta was more alkaline than the blank test, in fact the water both before and after boiling gave a pink colour with phenolphthalein showing unmistakably the presence of an alkali carbonate.

On July 2nd 500 c.c. of the water was boiled and the precipitate filtered off, dissolved in N/2 HCl, and titrated back with NaOH; this equalled 36·25 parts $CaCO_3$ per 100,000 (some MgO would be present in this). The filtrate was titrated with N/10 HCl and Methyl Orange, and the alkalinity was found to be equal to 12·72 parts Na_2CO_3 per 100,000.

If the Na_2CO_3 be calculated as $CaCO_3$, we get the following results:—

Temporary alkalinity as $CaCO_3$	36·25
Permanent alkalinity due to Na_2CO_3 calculated as $CaCO_3$	12·00
Total alkalinity calculated as $CaCO_3$	48·25

which is approximately the same as the total alkalinity directly determined. The water was evidently in a state of unstable equilibrium, as there was not enough carbonic acid present to form bicarbonates both of soda and lime. The sodium carbonate present in this water must have been produced from sodium sulphate by the same reactions as are given for calcium carbonate, for no sodium carbonate was present in any of the waters draining into the pond. The steam from this water had given a good deal of trouble when used in open coils for boiling purposes owing to the odour it imparted, but finally the water boiled with it contained an appreciable quantity of sulphuretted hydrogen, and for this reason the supply was cut off.

I am indebted to the directors of the Gum Tragasol Co., Ltd., for permission to give the results of the work which I have described in this paper.

ERRATA.

THE MANUFACTURE OF SULPHURIC ACID FROM ARSENICAL PYRITES.

BY W. ROSCOE HARDWICK.

Discussion (this Journal, 1904, 220—221).

Page 220, col. 2, line 8 from bottom, for "included in the precipitate a sulphide," read "occluded in the precipitate some nitric peroxide."

Line 5 from bottom, before "If vitriol, &c.," insert "In such a case."

London Section.

Meeting held at Burlington House, on Monday, March 7th, 1904.

MR. WALTER F. REID IN THE CHAIR.

PRESENTATION TO MR. A. R. LING.

The CHAIRMAN said that their late Secretary, Mr. Ling, after working for them for some years had been obliged by pressure of business to resign the office of Honorary Secretary and many of them wished to give him some testimonial of their appreciation of his services. He then read the following letter from their late Chairman, Mr. Otto Hehner:—

Dear Mr. Chairman,

As I am unfortunately prevented from attending the meeting to-night, I must do by letter what I wished to have done personally, namely, to say that I have been in almost daily communication with our late secretary, Mr. Ling, while I presided over the section and know, therefore, better than most other members how much he has done for the section, how with an utter disregard of his personal interests, he thought and slaved for us, yet always kept himself modestly in the background.

We cannot repay him for his services; his repayment must consist in his own knowledge that he has done well and that each member of the section thinks of him as a friend. But we want him to have a visible token of our affection and gratitude, and of our good wishes for his health and prosperity.

Sincerely yours,
OTTO HEHNER.

The way in which the sentiments expressed by Mr. Hehner had been echoed by the meeting, showed how entirely they all agreed with him, and he was quite sure they all regretted that Mr. Ling had found it necessary to resign his post, but in order that he might retain some tangible mark of their appreciation they had in the first instance had an illuminated testimonial prepared bearing the following inscription:—

"Presented to A. R. Ling as a token of recognition of his untiring energy and zeal as Honorary Secretary and Treasurer of the London Section of the Society of Chemical Industry during the years 1898—1903.

"Signed on behalf of the Members and Committee:

BOVERTON REDWOOD, Chairman, 1898—1900.
OTTO HEHNER, Chairman, 1900—1902.
WALTER F. REID, Chairman, 1902—1904.
JULIAN L. BAKER, Hon. Local Sec.

March 7th, 1904."

Those words expressed the obligations which Mr. Ling had conferred upon them, and they were glad to know that he would still remain an active member not only of the London Section but of the Committee. He felt sure that the services he had rendered in the past were not the only ones he would render to the section. The Committee entrusted with the selection of this testimonial had chosen a silver tea service which they trusted would meet with the approval of Mr. Ling and of his family.

In addition to that there was a cigar case for Mr. Ling himself. He hoped that however their ways might diverge in future he would always think as kindly of his old friends in the Society of Chemical Industry as they would of him.

Mr. **Ling**, in reply, said he was much touched by the kind words of the Chairman. His feelings of gratitude were mingled with a certain amount of regret at leaving the Secretarial Office. It was, in fact, most reluctantly, and only after mature consideration, that he asked the Committee to accept his resignation. The secretaryship involved a certain amount of work, and it had always been a great pleasure to him to carry it out; in fact, he took it as a privilege to have been able to further in any way the ends of that great Society of Chemical Industry. He hoped to be associated with the work of the London Section and with the Society as a whole for many years. Turning to the beautiful illuminated address, on which were inscribed the signatures of the Chairmen he had served under—Dr. Boverton Redwood, Mr. Otto Hehner, and Mr. Reid—he could only say that it had been an honour to be associated with any one of them. With regard to this as well as to the very handsome plate he might say on behalf of his wife as well as himself that they could not have selected a more acceptable token of their appreciation of his services.

OBSERVATIONS ON COTTON AND NITRATED COTTON.

BY H. DE MOSENTHAL, F.I.C.

The effect of solvents on cellulose and nitrocellulose, and their so-called *gelatinisation*, has found so many applications in the arts, that anything which adds to our knowledge of this subject must be of interest. I have for some years endeavoured to ascertain the structural changes which celluloses and nitrocelluloses undergo when acted upon by solvents, and in this connection I have also studied starches and nitrostarches. Mr. Lindsay Johnson, F.R.C.S., has kindly placed his great manipulative skill at my disposal, and assisted me in the preparation of microscopic specimens both with and without the microtome, and in obtaining microphotographs for illustration.

On this occasion, my remarks will be limited to cotton and nitrocotton, for in the manufacture of articles based on gelatinised cellulose, cotton is generally used, and supplies the cellulose which, when nitrated, is used for explosives and artificial silk, as well as for most celluloids. An investigation into the solubility of cotton or nitrocotton required, in my opinion, a knowledge of—

1. *The Minute Structure of the Cotton Fibre.*—The most recent work on cotton is that of Heinrich Kuhn.[*] As regards the structure, however, he relies on the work of O'Neill, Crum, and Bowman. In fact, the book published by the latter in 1881,[†] in which Crum's work is fully referred to, seems to be the source from which subsequent writers have chiefly taken their data as to the histology of the cotton fibre. Hugh Monie, jun.'s, book, published in 1890,[‡] deals mainly with the differences between cottons of different origin, although a good deal of useful information regarding the structure of the fibre in general can be gathered from it.

The cotton fibre is usually described as a single elongated cell, the mature fibre having the form of a hollow tube twisted many times throughout its length, the outer surface being striated or corrugated. The fibre or tube consists of an outside membrane or outer cuticle, and an inner membrane or inner cuticle between which lies the intercuticular substance. The cuticles are harder than the intercuticular substance which constitutes 85 per cent. to 90 per cent. of the fibre. Hugh Monie says that the inner cuticle is harder than the outer. I have not succeeded in differentiating them.

The statement that the intercuticular substance constitutes 85 per cent. to 90 per cent. of the fibre, rests on experiments made with cuprammonium (Schweitzer's reagent), which dissolves the intercuticular substance before it attacks the cuticles. I have tried to repeat the experiments, but could not make sure that the minute supernatant cuticles were all collected and free of intercuticular substance and copper. I, therefore, think that the percentage estimation must be regarded as approximate, and 10 per cent. as a maximum for the cuticles. That the intercuticular substance dissolves in cuprammonium more readily than the cuticles, points to the celluloses being different. Hugh Monie terms the cellulose of the intercuticular substance the real cellulose; he means, no doubt, to draw a distinction between the cuticular and intercuticular cellulose, similar to that which is made between the amidose and granulose in starches.

The intercuticular substance, which, as remarked, constitutes the bulk of the fibre, consists, according to my observations, of minute spherical granules of nearly uniform size (about 1 μ). I attempted to see them *in situ* by obtaining longitudinal sections of the cotton fibre. The difficulty of obtaining such sections was very great, due to the resistance of the cotton, which was liable to be struck by the knife and dragged through the substance in which it was embedded. I have, however, succeeded in obtaining longitudinally cut fragments, some of which had one of the cuticles removed revealing the intercuticular substance (see Fig. 4). The intercuticular granules lie closely packed, kept in position by the cuticles, and it is only when the tension of these is sufficiently relaxed that the granules can escape.

The well known fact that cotton depolarises and shows, when examined by polarised light, brilliant colouring, seems due to differences in the relative tension or strain of the layers. Longitudinal sections through the cotton fibre still show depolarisation, except where the knife has torn off fragments of either of the cuticles. In fact as long as the two cuticles remain in position the full effect of depolarisation is visible. Precipitates of cotton and nitrated cotton from filtered solutions do not depolarise. The differences of appearance in polarised light observed when the cotton fibre is treated in various ways, including nitration, must no doubt be ascribed primarily to a change in the relative tension or strain of the layers. I mean a similar condition to that which causes annealed glass to depolarise and show differences of colour according to the strain.[*] The optical properties of cotton and nitrated cotton, the appearances in polarised light, their rotatory power, and the refractive index, form a subject so large that it cannot be discussed within the limits of this paper.

It is to osmotic action of the cuticles in conjunction with the capillary action of the tube, that the penetration of dyestuffs into the fibre is ascribed. This theory, which seems to be generally accepted, was originated by Walter Crum, F.R.S. He points out, however, that the most powerful microscopes did not reveal any pores in the cotton fibre (J. Chem. Soc., Vol. I., p. 409). He seems to have seen a difficulty in admitting that the mordants and dyes penetrated the intercuticular substance passing through a non-porous membrane. Now I find that the cuticle is extremely porous. It has pores in addition to what appear to be minute stomata, which latter are frequently seen in oblique rows as if they led into oblique lateral channels.

Many of the corrugations, striations, and indentations which the microscope reveals in the cotton fibre, can, with proper preparation of the slides and with high magnification be resolved into pores and oblique rows of stomata. (See Figs. 1, 2, 3.) Once observed with high magnification, the pores and stomata can be seen with somewhat lower powers as is often the case in microscopy: the knowledge of that which can be seen assisting the eye. The pores and stomata can be seen with more or less distinctness in any

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[*] "Die Baumwolle, ihre Cultur, Structur und Verbreitung." Leipzig. 1892.

[†] "The Structure of the Cotton Fibre in its Relations to Technical Application." Manchester. 1881.

[‡] "The Cotton Fibre: its Structure, &c." London. 1890.

[*] See H. Prelat: "Polarisation et Optique Cristaline." Paris 1898. Chap. VI. "Polarisation Chromatique."

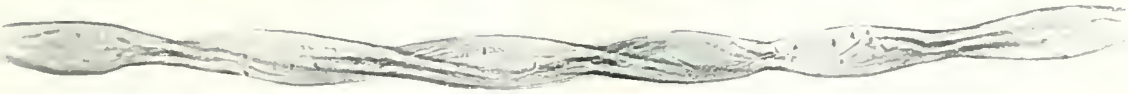


Fig. 1. Natural Cotton Fibre × 300.

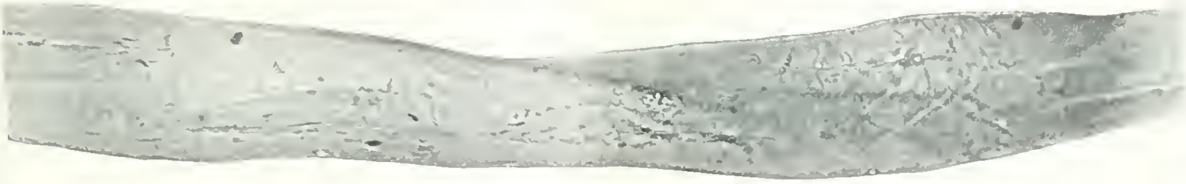
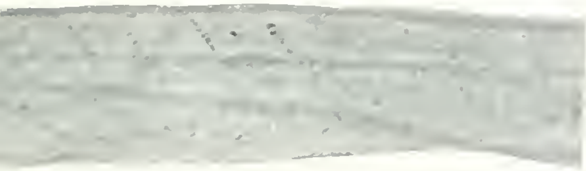


Fig. 2. Portion of same Fibre × [illegible]



ig. 3. Portion of Fig. 2 focussed to show stomata × 1100.

Fig. 4. Longitudinal section of a Cotton Fibre × 1000.

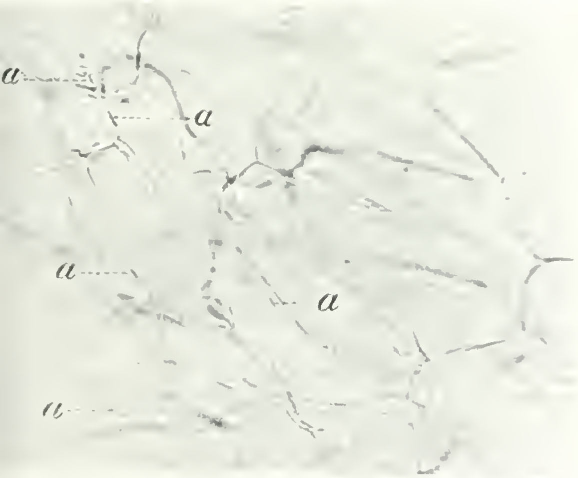


Fig. 5. Portion of a fragment of Cotton Cuticle from a
Solution in Cuprammonium × 1100.
a... indicates the stomata.

Fig. 6. Granules from a ½ % Solution of Nitrated
Cotton × 1500.

Fig. 7. Portion of a Nitrated Cotton Fibre × 300.

cotton fibre—every fibre varying somewhat in this respect—with a homogeneous oil immersion objective and a × 6 ocular. They are more distinctly seen if the fibre is stretched or strained on the slide, staining or dyeing does not seem to render them more prominent; the only method by which I have been able to bring them out more distinctly is by treatment with nitrate of silver.

Fibres digested with pepsin and tripsin did not show the pores and stomata more plainly, nor did treatment with hydrofluoric acid materially assist me. In mercerised cotton the pores and stomata are somewhat more distinct, and digestion with alum or tannic acid seems to enlarge the former to some extent. When the fibre is nitrated the pores frequently become larger. In fragments of cuticle obtained from solutions in cuprammonium, as explained later, the pores and stomata can be seen (see Fig. 5, in which the stomata are marked *a*).

It may here be stated—as I have not seen it recorded—that according to my observation single isolated cotton fibres have no capillary action; several fibres must be in contact before the liquid will rise. The liquid seems to rise between the fibres and then to enter the fibre through its pores. I have experimented with various aniline dyes and also with vanadic chloride, potassium bichromate, and permanganate.

2. *The Minute Structure of the Nitrated Cotton Fibre.*—Nitration produces in the cotton fibre but little apparent structural change. The tube collapses and the corkscrew twists flatten down to such an extent as to be unrecognisable, so that the nitrated fibre presents, as a rule, a tape-like appearance with rugosities there where the twists occurred. The outer cuticle appears still more wrinkled (see Fig. 5). The intercuticular substance remains practically unchanged, unless it be that the granules are somewhat larger. It is extremely difficult to verify this, as I have not been able to measure the granules of either cotton or nitrated cotton *in situ*, but only when precipitated from solutions.

That the relative tension of the layers decreases materially is seen in the marked difference in the appearance in polarised light, the nitrated fibre appearing dull as compared with the brilliant colours shown by the natural cotton fibre. Cotton and nitrated cotton which has been pulped, shows, when examined by the microscope in ordinary light, that the pulping partially opens the fibre. This is especially the case with the nitrated fibre, the granules frequently becoming visible at the ends.

A. *Solutions of Cotton.*—Before considering the question of solubility, it may be permissible to refer to the question of cotton considered as a seed-hair. A considerable amount of study has been devoted to ascertaining the changes which cotton undergoes during growth, reference to which will be found in the above-mentioned books, but no satisfactory explanation seems so far to be given to the change which the proteid contents of the cells undergo in order to become cellulose. Evidently the granular intercuticular substance s a modification of the granular contents of the cell which Mann* has referred to as *cytoplasm* and Heidenhain has termed *microsomes*; they probably correspond to that which Dippel terms the *intercellular substance* of the fibre cells.†

Text books on botany contain but few references to seed hairs, beyond stating generally that their object is to waf he seed, and enable it to be carried by the wind until it finds a suitable resting place. My attention has been drawn to the part which the hygroscepicity of cellulose may play in the utility of the seed hairs, and the suggestion has been made that when the weather is moist the seed hairs become limp and prevent the seed from being blown away and deposited on the wet soil, because it is essential hat the seed should settle on dry ground and enter the earth without exposure to the damaging action of moisture.

Cross and Bevan, in their classical work on Cellulose,‡ state that cellulose is insoluble in all simple solvents; in he presence of certain metallic compounds, however, it combines rapidly with water, forming gelatinous hydrates which finally disappear in solution. There are three such solvents for cellulose—(1) zinc chloride in concentrated aqueous solution which requires heating; (2) zinc chloride and hydrochloric acid which dissolves cellulose in the cold; and (3) ammoniacal cupric oxide, or Schweitzer's reagent. The process of dissolution of cellulose is ascribed by these authors to the presence in the cellulose molecule of OH groups of opposite functions, basic and acid, the compounds formed with the solvents being, according to them, of the nature of double salts.

A distinction should, I think, be made between solutions in zinc chloride with or without the addition of hydrochloric acid and those in cuprammonium. With the former a clear solution cannot be obtained from which the cotton can be regained quantitatively, whilst with the latter it can. I have found a distinct difference between cotton regained from solutions in zinc chloride or zinc chloride and hydrochloric acid as compared with that from solutions in cuprammonium. Zinc chloride both with and without the addition of hydrochloric acid destroys the structure, and neither the granules of the intercuticular substance nor fragments of the cuticle can be found in the restored cellulose. In the cotton regained from a cuprammonium solution the granules are preserved and the fragments of cuticle are present.

Dr. Lottermoser, in a recent publication on colloids,* after mentioning the hydrosols obtained by Graham with sugar and metallic hydroxides, and the colloids obtained by Grumaux (Comptes rend., **98**, 1485), by means of organic compounds containing hydroxydes and alkaline solutions of metallic hydroxydes, refer specially to Grumaux's (Comptes rend., **98**, 1540), investigations on cuprammonium as follows:—

"In dialysing Schweitzer's reagent the excess ammonia together with a considerable amount of blue salts passes into the water. After six or seven days no copper can be found in the latter. The dialyser contains a blue fluid which will not pass through the membrane, and from this copper hydrate can be precipitated by adding water freely, and it gelatinises on the addition of acids and a number of salts, with the exception of sodium chloride and sodium nitrate. The fluid which remains in the dialyser is really the solvent for cellulose. If cellulose is dissolved in Schweitzer's reagent and dialysed, blue salts likewise go over with the ammonia, and the colloid remaining in the dialyser is much lighter in colour and contains all the cellulose. The cellulose is precipitated by the addition of water, but enters into solution again on the addition of a few drops of ammonia."

I have repeated Grumaux's experiment and examined the dialysed cotton, after freeing it from copper by means of acetic acid. I find that I can distinguish the granules and fragments of the cuticles. I also find the granules and fragments of cuticle in precipitates from cuprammonium solutions of cotton. When hydrochloric acid is used to neutralise the cuprammonium and remove the copper, the granules are frequently seen embedded in a white transparent stellate or nodular crystalline mass, which I have identified micro-chemically as cuprous chloride. It may be that this led Gibson† (Chem. Centralbl., 1893) to state that cellulose may be crystallised from its solution in cuprammonium. He used hydrochloric acid.

If acetic acid is used to precipitate the cotton and to remove the copper, the precipitate, when washed, shows the granules and cuticles without any crystalline nodules, acetic acid removing the copper more thoroughly than hydrochloric acid. This is no doubt why Pauly in his patent (Eng. Pat. 28,631 of 1897) indicates the use of acetic acid in the manufacture of artificial silk by means of a cuprammonium solution of cotton. The slightest trace of copper would adversely affect the dyeing of the yarn. In order to wash the very flocculent precipitate I found it easiest to allow it to settle, and to decant the supernatant liquid, adding water and acid; repeating this until all the copper

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* "Physiological Histology." Oxford. 1902.

† "Anwendung des Mikroscopes auf die Hystologie der Gewächse." Braunschweig. 1898.

Cellulose." London. 1895.

* "Ueber Anorganische Colloide." Von Dr. Alfred Lottermoser. Stuttgart. 1901.

† See Cross and Bevan: "Cellulose." p. 12.

was removed. A centrifuge expedites the operation. It is very difficult to distinguish the granules and cuticle fragments in the dried precipitate. I leave the precipitate in suspension, draw off the water with the suspended particles by means of a pipette, and allow a few drops to dry slowly on the slide.

If cotton fibres in course of dissolution in cuprammonium are freed from copper and washed, it will be seen on microscopic examination that the granules gradually become freed and washed out as the cuticles yield to the swelling of the fibre. The fibre swells and bursts, thus liberating the granules, and it takes some time before the cuticles themselves break up into minute fragments and enter into solution.

All my solutions were filtered through glass-wool, as particles of spun glass are easily recognisable in the microscopic preparation, which would not be the case if a fibrous substance were used, as, for instance, asbestos. Moreover, most of the filtering media which suggest themselves have the disadvantage of depolarising, vitiating results when polarised light is used.

B. *Solutions of Nitrated Cotton.*—Acetone seems to be the only solvent for all nitrated cottons without distinction. It has been referred to as the *universal* solvent in contradistinction to the *selective* solvents which dissolve only certain nitrated cottons. I have watched the patent literature carefully for years and obtained a list of solvents, which I have been able to extend through the courtesy of Mr. Oscar Guttmann, who has placed a list of his own at my disposal. It will be found appended to this paper.

The effect of some of the solvents mentioned seems very doubtful, and there is moreover in many cases a distinct difference between the pure and the commercial material. I have tested but few and have no evidence of the efficiency of the majority beyond that they are mentioned in a patent. The manner in which cotton has to be nitrated in order to be soluble in a given solvent has in each case to be closely investigated. In consequence of the very large number of selective solvents, and the different varieties of nitro-cellulose on which they act, it is quite impossible to establish any general rule as to the method to be followed in order to obtain suitable nitrated cotton. Moreover the solubility in any given solvent is no index of the solubility in another. We can, however, say with certainty to-day that the solubility is not a function of the degree of nitration. Cotton can, within certain limits, be nitrated to the same degree of nitrogen contents to be either soluble or insoluble in a given solvent.

The terms soluble and insoluble require qualification, as the nitrated cotton is as a rule neither entirely soluble nor entirely insoluble. A specification for nitrated cotton should give the percentage of nitrogen desired and the degree of solubility required, and should indicate the solvent. The viscosity should also be stated, as it varies materially with the method of nitration, being independent of the degree of nitration.

The classification of nitrated cottons according to their solubility in ether-alcohol is fallacious, as cottons can be nitrated to the same percentage of nitrogen to be either soluble or insoluble in ether-alcohol.[*]

There is a prevailing idea that the gradual changes in the conditions of nitration cause immediate transitions in the degree of nitration, thus justifying the distinction between di-, tri-, tetra-, &c., nitrocellulose, and attempts have been made to isolate such entities. But this discontinuity has now been proved to be non-existent.[†]

My experiments have been carried out with acetone, but I have, for comparison, made observations on solutions of suitably nitrated cottons in ether-alcohol, amyl-acetate, and acetic-ether.

If a solution of nitrated cotton, carefully filtered through glass-wool, is allowed to evaporate on glass, the resulting film appears granular under the microscope. I have prepared solutions ranging from 1 in 10,000 to 5 in 100, and found that the ½ per cent. solution (0·5 grm. of nitrated cotton in 100 grms. acetone) showed the granules most distinctly. They are arranged in strings or clusters which tend to mat together, and occasionally some isolated granules are seen. Focussing down, I can distinguish fragments of the cuticles, which, therefore, evidently settle first being, no doubt, heavier. Fig. 7 represents the appearance of the granules obtained by the evaporation of ½ per cent. solution. If the solution is more dilute the granules are more straggling and isolated, and many preparations have to be examined before cuticle fragments can be found. If the solution is more concentrated the clusters of granules lie so closely fused together as to make it difficult to identify them. In solutions of over 2 per cent. it is not possible to obtain a single layer.

With a little practice the dissolution of nitrated cotton can be watched with the microscope. I prefer an 8 mm. objective and a × 12 ocular on account of the longer working distance. I use a small open cell into which I place a little nitrated cotton, so as to fill the cell to about one-quarter of its capacity, and squirt a few drops of acetone into the cell by means of a fine long pipette fitted with a rubber ball. I must then rapidly focus upwards. If this is done, it will be seen that the acetone, so to say, washes the granules out of the fibre, and these granules float about in the fluid at a very great rate, seemingly attracting and repelling each other, turning round on their axes, and ultimately settling in strings and clusters. The movements of these granules are analogous to Brownian movements, for even when the stage of the microscope is considerably inclined, they travel upwards as well as downwards and laterally. The manner in which the granules settle varies with the nature of the solvent, and is dependent on the rate of evaporation. The stratification of the granules and cuticles, therefore, varies with the solvent. This may account for the great difference between smokeless nitrocellulose powders in the manufacture of which different solvents have been used.

Whenever a solution of nitrated cotton is filtered through a dense medium, the remnant which remains in the filter and will not pass is of greater viscosity than the original solution. A 1 per cent. to ½ per cent. solution, according to the nature of the nitrated cotton as regards viscosity, can to a considerable extent (about 80 per cent.) be drawn through a Pasteur filter. When then is done the filtrate will be found to contain granules only; all the cuticle fragments, as well as a portion of the granules, remaining in the more viscous remnant. Considering that the granules in the filtrate measure very nearly 1 μ, it is difficult to see how they can pass through a Pasteur filter. It was suggested to me at the Pasteur Institute in Paris that this was only possible on the assumption that the granules, yielding to pressure, elongate, and pass through with a considerably reduced diameter.

It is well known that water precipitates nitrated cotton out of solutions, and that the resultant precipitate frequently assumes so fibrous an appearance that, to the unaided eye, the cotton fibre seems to have been restored to its original form. I have carefully examined these precipitates microscopically, and find that they show a felting of the cuticle fragments to which the granules adhere. Remarkable to say, the precipitates obtained from solutions of unpulped nitrated cotton in water seem more fibrous and much more like the original cotton to the naked eye than those obtained from nitrated cotton which has been pulped. The microscope shows differences in the size of the cuticle fragments. Precipitates from solutions of 2 per cent. or under of cotton nitrated at high temperatures scarcely coalesce or felt at all; they are flocculent or are thrown down as a fine powder. The reason for this is evidently that the acids having disintegrated the fibre to a much greater extent, the cuticles break up in the solution into much more minute fragments than is the case with cottons which have been nitrated at lower temperatures. When solutions which have passed through a Pasteur filter, and which, as we have seen, contain granules only, are thrown into water, the precipitate comes down as a fine powder.

When dried, all felted precipitates cake and harden, and are then so friable that it is difficult to examine them microscopically with transmitted light. They must, there-

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[*] See Dr. Dupré's remarks on p. 22 of H.M. Inspectors of Explosives Report. 1898.

[†] Dr. Will: "Der Fortschritt der Sprengtechnik," Ber., 37. 1904.

fore, be teased out while wet, preferably in glycerin. Precipitates obtained by means of water from solutions of suitably nitrated cottons in ether-alcohol and acetic-ether do not differ materially from those obtained from acetone, except in the rate at which they coalesce. When the solvent is not miscible with water, as in the case of amyl acetate or nitrobenzene, for instance, the precipitate coalesces with great difficulty.

It would seem as if this felting of nitrated cotton from solutions is one of the reasons why it has been found more suitable for certain industrial purposes than other celluloses. This felting appears to be a function of the cuticles. Cotton partially dissolved in cuprammonium will felt like paper. The fact that the original condition of the nitrated cotton influences the final product, and that unpulped nitrated cotton shows more fibrous felting than pulped, may account for the fact that unpulped nitrated cotton is used in the manufacture of artificial silk to ensure greater tensile strength.

A great deal of work has recently been done on hydrosols, both organic and inorganic. Graham and others have studied colloids of inorganic substances in organic menstrua, but I cannot find any investigations on a colloid in which both the solute and the solvent are organic, as in the case of solutions of nitrated cotton, all the solvents for which are organic.

The difficulties of the present investigation are increased by the fact that we are dealing with a substance the structure of which is apparently partially retained in solution. The solid solution of nitrated cotton in camphor still further adds to these difficulties. I have so far been unable to detect any structure in nitrated cotton extracted from celluloid.

Are we to regard these solutions as colloids, as suspensions of finely-divided particles? The microscopic examination of films and precipitates certainly points in that direction. That no particles can be seen in the solutions does not, I think, militate against that view. It is true that according to Lottermoser particles must be smaller than 0·5 μ to be microscopically invisible in solution and our particles are much larger. But surely the detection of minute particles in a liquid does not only depend upon their size, but also on the relative refractive indices of the suspended matter and the liquid. In our case, the liquid soaking into the particles of nitro-cellulose influences the relative refractive indices, decreasing the likelihood of visibility. Moreover, even in a ½ per cent. solution of nitrated cotton which has been filtered by a Pasteur filter, a slight turbidity can be seen with proper illumination and a sufficient thickness of layer, as, for instance, in the 20 cm. tube of the polarimeter.

On the other hand, we must not forget that the solutions can be filtered through dense media, but I have not yet attempted dialysis. It was Tyndall who first pointed out that a ray of light, concentrated by means of a lens, if allowed to pass through a colloid, and examined with a single Nicol prism, will be found to be polarised. A test for colloids has been based on this fact, but there are some exceptions. I find that solutions of nitrated cotton in acetone, ether-alcohol, or acetic-ether do not polarise the ray.

I may further mention that no separation occurs when solutions of nitrated cotton are placed in a centrifuge of the milk separator type, neither does this occur with a solution of cotton in cuprammonium. Evidently the question cannot be decided without further research.

Solvents for Nitrocellulose mentioned in Patents.

Nitric acid at 80° C.

Sulphuric acid.

Methyl, ethyl, propyl, butyl, isobutyl, and amyl alcohols.

Methylal, acetal, isovaleric aldehyde, and its derivatives, and other aldehydes; acetone, diethyl ketone, propione, dibutyl, dipentyl, methyl-ethyl, methyl-propyl, methyl-butyl, methyl-amyl, ethyl-butyl ketones.

Ethyl ether at low temperatures (−100°, below freezing point of 95° alcohol), amylidene-dimethyl, and amylidene-diethyl ethers. Methyl-amyl ether.

Glacial acetic acid, butyric acid.

Alkyl sulphuric acid, hydrochloric and nitric esters, amyl nitrate, nitrates of methyl and amyl.

Nitroglycerin, nitromannite.

The methyl, ethyl, propyl, butyl, and amyl esters of the following acids:—Formic, acetic, butyric, valerianic, lactic, oxalic, succinic, sebacic, tartaric, citric, and their nitro, chloro, bromo, chloronitro and bromonitro, acetyl and benzoyl derivatives.

Alkyl esters of acids acting on fats and oils, and their soaps.

Alkyl esters of adipic, pimelic, suberic, azelaic, and glyceric acids.

Acetine, chloracetate of chloramyl.

Glycerides of acetic and hydrochloric acids, such as acetodichlorhydrin, and diacetochlorhydrin.

Ammonia dissolved in ethyl ether.

Methyl, ethyl, propyl, butyl, isobutyl, and amyl alcohols mixed with any of the following:—

(*a*) Methylic, ethylic, propylic, butylic, amylic ether.
(*b*) Aldehydes, such as acetaldehyde, and their compounds with alcohol, such as methylal, acetal, &c.
(*c*) Acetic, lactic, levulinic, oxalic, tartaric, citric acids.
(*d*) The esters of the acids mentioned under (*c*).
(*e*) The salts of the acids mentioned under (*c*), also the salts of hydrochloric or alkylsulphuric acid, with ammonium, sodium, potassium, magnesium, calcium, strontium, barium, aluminium, and zinc, provided the salt is soluble in alcohol.

Polyhydric alcohols, such as glycol and glycerol, mixed with the esters of acetic, lactic, levulinic, oxalic, tartaric, and citric acids.

Palmitone and stearone in alcoholic solution.

Impregnation with alcohol, then dissolving in caustic alkalis, or sulphides of sodium, potassium, or ammonium.

Benzine.

Wood naphtha, distilled over calcium, zinc, or manganese chloride.

Ozonised methyl alcohol, fusel oil, acetone, acetal, ethyl amyl ether.

Methyl alcohol, amyl alcohol, benzine and acetic acid, distilled together.

Benzol, aniline, pyridine.

The nitro, chloro, bromo, chloronitro, and bromonitro derivatives of aromatic hydrocarbons.

Acetylated and benzoylated secondary aromatic amines.

Solid ketones (methylnaphthylketone, dinaphthylketone, and the corresponding derivatives of naphthol, or the ethers of these ketones).

Benzylidene acetone.

Paranitrobenzaldehyde.

Phthalic and phthalonic acids and their anhydrides.

Coumarin.

Benzicine.

Phenol and naphthol esters of inorganic acids.

Methyl, ethyl, propyl, butyl, and amyl esters of:—Benzoic, toluic, mesitylenic, hippuric, and phthalic acids, and the nitro, chloro, bromo, chloronitro, and bromonitro derivatives thereof, and their acetyl and benzoyl derivatives.

Esters of the nitrophenols.

Phenolic esters and derivatives of mono- and poly-valent aliphatic acids, such as carbonic, formic, propionic, tartaric, and citric acids. (Diphenylcarbonic ester, naphtholpropionic ester, dinaphthylcarbonic ester, diacetyl resorcinol, acetylnaphthol, acetylchloronaphthol, acetylnitronaphthol are mentioned.)

Phosphoric acid esters of halogen or similar derivatives of the phenols, cresols, and naphthols. Thiophosphoric acid esters of the phenols, cresols, naphthols, and their substitution products. (Triphenyl and trinaphthylphosphate, monochlortricresylphosphate, tetranitrotrinaphthylphosphate, tricresylthiophosphate, dichlorodiphenylthiophosphate, dinitrotrinaphthylthiophosphate are mentioned.)

Esters of phthalic and phthalonic acids.

Glycerides of benzoic and hippuric acids.

Anilides and their homologues (formanilide, acetanilide, acetotoluidide, acetoxylidide).

Acidyl derivatives of secondary amines, containing only aromatic radicles. (Formyldiphenylamine, acetyldiphenylamine, acetylphenyltolylamine, acetylphenylnaphthylamine are mentioned.)

Alpha and beta naphthol, and anthraquinone in alcoholic solution.

Creosote.

Camphor.

Nitro, chloro, bromo, chloronitro, and bromonitro derivatives of camphor.

Thujone.

Pulegone (oil of pennyroyal).

Oil of camphor.

Ozonised oil of turpentine, oil of camphor, and oil of caraway seed.

Artificial camphor (terpenes in alcohol).

Nitrated resin oils and resins.

Camphor dissolved in sulphurous acid, carbon bisulphide, carbon tetrachloride, hydrocarbons, alcohol, and ether.

Methyl, ethyl, propyl, butyl, isobutyl, and amyl alcohols mixed with—

(*a*) Aldehydes, such as benzaldehyde, and their alcohol derivatives.
(*b*) Nitrophenols, aminophenols, and hydroxybenzoic acids.
(*c*) Nitroderivatives of aromatic hydrocarbons which are soluble in alcohol.
(*d*) Pyridine, quinone, and their homologues.

Acetone oils mixed with benzaldehyde.

Mixed esters and anilides of phosphoric acid from alcohol, or anilide radicles and phenol, cresol, or naphthol.

Note.—Since reading the paper I have succeeded in dialysing a 5 per cent. solution of nitrated cotton. After 24 hours a sufficient quantity had passed through the parchment diaphragm into the external acetone to show a film on glass and give a water precipitate.—H. de Mosenthal.

Discussion.

Sir William Ramsay said the phenomenon of Brownian motion always took place with excessively small particles, but they might conceivably be too small to be visible, and yet be revealed by the polarisation of light. But, going a stage further, it was possible to imagine particles still smaller and not able to polarise light, owing to their minuteness, but still giving rise to very rapid Brownian motions. The question of the passage of such a solution through the Pasteur filter was a very curious one indeed. Messrs. Linder and Picton, in their laboratory, had made a number of experiments on the passage of various dyes through a Pasteur filter. A blue dye of very high molecular weight would not pass through the filter, the molecules being too large; a kind of separation was made of substances according to their molecular weights, some of which would pass and others would not. In this case, evidently, the cotton must have a sufficiently small molecule—curious as it might appear—to pass through the filter; or else, conceivably, the particles must deform themselves and glide through as worms, reverting to the shape of balls on the other side, which did not seem likely. Another possible means of investigation would be by measuring the osmotic pressure. Of course there was no possibility of measuring it by means of lowering the freezing point of the solvent, but it could be measured directly; the difficulty would be to keep the temperature perfectly constant, for the instrument acted as a thermometer. Still, *faute de mieux*, some method of this kind might perhaps be useful in further experimenting.

Dr. Robertson said he could confirm the statement made by the author, namely, that great differences in viscosity could be obtained with nitrocottons of the same nitrogen content and the same solubility, according to the method of nitration employed. Using a viscosimeter differing from the one with which the author had worked, and in which the dilute solution in acetone was passed through a very fine aperture in a pipette, and measuring the time of discharge, he observed that nitrocotton containing 13·2 per cent. of nitrogen and having a solubility of 3 or 4 per cent. made by two different processes varied in viscosity to as great a degree as 1 to 6.

Dr. Silberrad said that he could not agree with the author in his view that nitrocellulose was not a mixture of *definite compounds*. In support of his view the author referred to the fact that the viscosity constants of various samples of nitrocellulose, prepared under different conditions, differed even though the percentage of nitrogen were the same in both samples; he also referred to the property of selective solvents, as ether-alcohol, pointing out that they would dissolve one sample but not another, even though both had the same nitrogen content. Both facts were equally well explained on the assumption that the nitrocellulose was a mixture of definite compounds. In the case of the sample soluble in ether-alcohol they were all of approximately the same degree of nitration. From experiments he had recently carried out on heating nitrocellulose under such conditions that the active mass and the volatile catalysers were maintained at a minimum, he had found that the inherent velocity of decomposition at a high temperature for a sample of medium nitration soluble in ether-alcohol was peculiar to itself, whereas the results obtained with the insoluble sample coincided very closely with those obtained from a sample of the same nitrogen content made by mixing together samples of very low nitration and very high nitration, both of which were insoluble in ether-alcohol. Thus he deduced that the sample soluble in ether-alcohol was a mixture of nitrocelluloses of nearly the same degree of nitration, whilst the sample insoluble in the selective solvent consisted of a mixture of high and low nitrated cottons.

Prof. Hodgkinson did not consider that they were quite in a position to discuss the nitration problem at present. He did not know really whether he believed that there were definite stages of nitration (that is, definite nitrates), or whether this went on, as Prof. Will said, gradually, so that any intermediate stage or degree of nitration could be arrived at. As the result of some recent experiments he was rather inclined to Will's idea.

Mr. Oscar Guttmann pointed out that there was no definite stage of nitration, but a gradual merging of the percentage of nitrogen from low to high. This statement was made first by himself in the Chem.-Zeit. of 1901, and Prof. Will referred to it in a footnote. It had, however, been disputed by Dr. Silberrad. He would only say that there was quite as much evidence, and in fact far more, the other way, namely, that the nitrates of cotton were not mixtures. The fact mentioned by Mr. de Mosenthal that there could be nitrocelluloses of the same percentage of nitrogen, one completely soluble and the other completely insoluble, pointed distinctly to the impossibility of their being a mixture. With regard to the dissolving action of a certain number of solvents, he was in the same position as Mr. de Mosenthal. He had not tried nearly a quarter of those mentioned, and he had to take them on trust. But the facts mentioned with regard to the different solubilities of pulped and unpulped cotton and the use of the latter for making artificial silks had been strikingly illustrated to those who had had the opportunity of seeing that manufacture. When they saw how the fibrous nitrocellulose was dissolved by merely tumbling it about in the solvent, and that, in spite of the solution being fairly clear, there could be filtered out through special filters a large quantity of material which would otherwise obstruct the very fine apertures of the so-called silkworm, namely, the glass tube which served for spinning, they would find that the solution, however carefully made, and however powerful the solvent might be, was never quite a perfect one. In fact, he doubted whether in filtering through a Pasteur filter a 2 per cent. or even a ½ per cent. solution it would not be possible by repeated filtering to still retain further fibres. When it was considered that solutions made for the purpose of artificial silk were much stronger, so strong, indeed, that considerable pressure had to be applied to drive them through the filter, it could be seen that this became a very intricate problem.

Mr. Cross said that cellulose was a substance which combined in a very definite way with negative groups, giving, *e.g.*, the tetracetate, trinitrate, and dibenzoate; not only very wide chemical variations from the original sub stance, but each was convertible into a regular solid of controlled dimensions, threads, and films, the physical constants of which could be definitely measured. Such comparisons constituted a scientific basis of investigation of the first order. He might mention one fact. Bronnert (Rev. Gen. Màt. Col., 1900) took a skein of cotton of certain dimensions and measured its breaking strain. After being fully nitrated the gross breaking strain had scarcely altered. In other words, the cellulose had combined with 70 or 80 per cent. of a highly negative residue, such as the NO_2 group, and still had not sensibly altered its visible structure, nor, in a sense, the fundamental structure and properties of the substance itself. This was true also of the acetate. Cellulose could be combined with 80 or 90 per cent. of acetyl, and the resulting acetate retained the properties of the original cellulose. Similarly, the water soluble forms of cellulose, for example, the xanthate, were convertible into regular solids. The instance of a substance like cellulose, combining with 80 per cent. of nitric acid, without fundamental structural change, might be contrasted with the case presented by an inorganic basic hydroxide of colloidal character, where the immediate result of combination with nitric acid was an entire structural change and an alteration of the whole internal constitution. On the other hand, the cellulose, under similar conditions, retaining all its structural properties unchanged, would appear to show that they were independent of hydroxyl groups, and depended on some aggregate, which was probably a high aggregate of the carbon atoms of the cellulose, and that was retained or persisted, throughout cycles of chemical actions of severity, such as in the production and decomposition of the xanthate. The author had dealt with the subject from his point of view in an extremely practical and suggestive way, and he only hoped that he would extend his work on the lines that he had laid down with regard to nitrates, to the acetates, benzoates, and other derivatives, and would associate himself with those who were endeavouring to bring this very important scientific problem within the range of modern methods.

Dr. GOLDSMITH said all workers in nitrocellulose would be indebted to the author for this paper. It would be impossible to pass in review the large number of solvents he had compiled, but they differed greatly in their solvent power. For instance, camphor dissolved in carbon bisulphide was not a solvent for nitrocellulose. With regard to the viscosities of colloid solutions, Prof. Quincke had been determining this property, and found it varied in the first few hours after the solution was prepared, before it obtained a constant value. The colloid solutions he was referring to, gelatin and water, and also albumin and water, behaved really as though there were two solutions with mutual surface tensions against each other, and also as if there were threads of a thick solution swimming in a thinner one. He referred also to the fact, which seemed to be universal with colloids, that at the beginning of solution there were two solutions actually visible; the more concentrated solution containing perhaps 90 per cent. of the solid colloid and 10 per cent. of the solvent, and a thin solution containing 10 per cent. of the solid colloid and 90 per cent. of the solvent. In the celluloid industry there were experiments recorded where the nitrated cotton fibre had entirely disappeared for months and then reappeared again. The nitrated cotton might have been dissolved and passed into a perfectly transparent sheet, but under the conditions of these experiments, one saw after some months ghosts of nitrated cotton fibres, which gradually materialised more and more, and finally the sheet became quite opaque from intersecting fibres of precipitated nitrated cotton. A subsequent examination showed that there was a great alteration in their properties. For instance, this precipitated nitrated cotton did not depolarise. With regard to examining the solutions of nitrated cotton in different solvents, an apparatus might be found very useful which was exhibited at the Deutsche Naturforscher-Versammlung last year by Zgismondy, and described as "an apparatus to render ultra-microscopic particles visible."

Dr. JOHNSON said he had had a very small share in assisting his friend Mr. de Mosenthal in his work, and it was rather in self-defence he should like to make a few remarks. The chemist was apt to regard the cotton fibre as an agglomeration or collection of molecules of cellulose which were more or less structureless and which became fused together to form the cotton fibre, but from a physiologist's point of view the case was very different. No doubt they recognised in the illustrations that a certain number of small apertures to which they had given the name stomata were to be seen, but some people might be inclined to challenge the assertion that they were stomata, and ask what evidence there was that they were holes at all and not minute specks of dirt on the specimen. That remark might have had great force a great many years ago at the time when Schleiden and Van Baer discovered the cell, and that all organic bodies, vegetable or animal, consisted of a great accumulation or agglomeration of cells. About 1874 it was discovered that the cell—so far from being what physiologists had previously thought, a simple collection of inorganic particles, a mere mass of protoplasm or cellulose or albumin—was an extremely complex body, and it was on these lines that Mr. de Mosenthal thought that with extreme care and by examination with the microscope he could find some differentiation in the cotton cell. In fact they were both quite prepared to find such stomata, or at any rate to find some differentiation of structure in the fibre, and from having seen these stomata in wood fibres, in every case they naturally concluded it might be quite possible to find them in the cotton fibre, and were not at all surprised when they saw them in many specimens. He did not think they had ever been seen before, but they had both of them seen them in so many specimens that there could be no doubt that cotton fibre did contain a very large number of stomata. He should not be at all surprised if Mr. de Mosenthal were to find that the fibre revealed even other things quite as interesting as the stomata.

Dr. DIVERS said with regard to the question of the nitration of cellulose not consisting in the formation of definite compounds, he could not see the force of the arguments brought in favour of its being a continuous process. No doubt, as Mr. Cross pointed out, cellulose was such a remarkable substance, and of such very great interest to chemists and others from its nature, that it was very dangerous to generalise about it; but still the facts brought forward by the author, and confirmed by others, that there could be obtained by different kinds of treatment the same cotton nitrated to the same extent, and yet quite different in its chemical behaviour with regard to solvents, &c., were almost decisive proof that both nitro-cottons were mixtures of differently nitrated cellulose, one being a mixture of highly nitrated with very low nitrated cellulose, and the other being a mixture of nitrocelluloses that more nearly approached each other. He did not see how otherwise there could be an explanation of that fact. He gathered that Sir William Ramsay hardly believed in the possibility of these microscopic granules of cellulose passing through the pores of a Pasteur filter by elongating themselves. But it seemed to him the most natural thing that under pressure they would thus elongate and pass through. Many of them knew that the leucocytes of the blood did pass in that way through the membrane of the capillaries without there being any visible pore by which they did so. It was possible to see them pass by that system of elongation under the microscope, and he thought that was almost the only explanation of the passage of these cellulose granules through the Pasteur filter. He asked whether the author really believed that his cellulose structures did enter into solution in the zinc or copper solvents. According to Mr. de Mosenthal, what had once been cuticle became dissolved, ceased to have any structure, and then was precipitated as cuticle. That seemed to him utterly impossible. He thought the particles must only have become transparent and invisible, owing to the refrangibility of the solvent, and the substance being practically identical. All the solutions exhibited were quite distinctly opalescent, in spite of their wonderful clearness, considering what solutions they were, and he thought the experiments and the photographs which had been shown only served to support the position for which he contended, that the cellulose did not enter into a true solution.

Mr. ARTHUR MARSHALL pointed out that the experiments in which cellulose was precipitated from solution in a fibrous state could be repeated with other colloids, which originally possessed no fibrous structure. For instance, if gutta-percha was dissolved in chloroform or benzene, and the solution poured into alcohol, the gutta-percha would be precipitated in a fibrous state, which might not be exactly the same as that of the cellulose exhibited by Mr. de Mosenthal, but certainly was not very dissimilar. No doubt the same result could be obtained with other colloids, showing that these substances have a tendency to form strings or fibres under these conditions. The interesting phenomenon that guncotton, which had been subjected to different physical treatment, gave solutions of different viscosities, also had its parallel with other colloids. If indiarubber were worked too much upon the rolls, many of its valuable properties were destroyed, although its chemical composition remained the same, as far as could be judged. It was evident then that these were properties of colloids in general rather than of cellulose in particular.

Prof. Mills said that when experimenting a number of years ago (1881): "On the Ascent of Hollow Glass Bulbs in Liquids," he had observed that the state of ascent was inverse to the diameter of the cylinder used for the experiment. In his own case the rule ceased to apply at a diameter of four inches. Tubes of one inch in diameter, like those used by the author, would give results much too high for the very viscous liquids he used, and were probably five inches too small, though they might not be without a certain value comparatively. As bearing on the question of viscosity itself, he might mention that castor oil did not immediately regain its viscosity after heating, but, in his experience, took about 24 hours to recover it. It was also a known fact that when guncotton was dissolved in ether-alcohol for the purpose of making collodion, months were required before the substance dissolved became properly associated with the solvent. Differences in viscosity would depend on variations in the method of preparation, on the antecedent temperature, and on the time given to a solution to "ripen."

The Chairman congratulated Mr. de Mosenthal on his success in finding the stomata which had so long been overlooked by the many who had investigated nitrocellulose. He should much like to know how the photographs were obtained, for it was by no means an easy matter to observe a translucent substance such as cotton fibre; but perhaps it was dyed. With regard to the function of cellulose in nature, that went rather beyond their subject, but it was a very interesting one. He was rather inclined to think that instead of cellulose being nature's first material it was one of nature's final or waste products, and came as the derivative of many others. He thought they were wrong from the very beginning in treating it as a chemical entity as had been done in that room the whole evening. He never considered it one, but believed it was a compound substance of complicated structure. They had not determined the chemical constitution of cellulose, and until they did so they would not be able to explain the compounds produced from it. In certain circumstances they got, as Mr. Cross had shown, compositions of certain regularity; but on the other hand they had this remarkable fact, as had been ably pointed out, that they could get nitrocellulose not only of almost any stage of nitration between the limit terms, but in those stages varying degrees of viscosity could be obtained, showing that the substances dealt with were totally different, although the total nitrogen might be the same. They also knew that cellulose from various sources, although considered to be pure cellulose, still behaved very differently indeed when nitrated. The interesting disappearance of the twist in the fibre when nitrated was, he thought, due to the action of the acid and not to the nitration. There would be an important paper in a forthcoming number of the Journal by Professor Pope and Mr. Hübner, in which they showed that after mercerisation the natural twist of the fibre was lost and a straight fibre resulted when the concentration of the acid or alkali went beyond a certain percentage. He asked Mr. de Mosenthal why he did not use as a test of viscosity the rate of flow of the solution from an orifice. For many years he had used that method and always found it satisfactory; if dealing with an extremely thick liquid it was a different matter, but there were very few solutions that could not be diluted.

Mr. de Mosenthal remarked that many members had spoken about cellulose, while he had spoken about cotton; it was impossible in one paper to deal with the various forms of cellulose. He had made experiments with wood cellulose, hemp, and various other celluloses, and he thought it would be possible to show that there was a certain number which behaved in a very different way when acted upon by solvents. He considered from the first that he was dealing with a suspended substance so finely divided that it looked like a clear solution. But there were a number of points, as for instance the fact that the ray of light was not polarised, which led him to ask himself whether he was dealing with a real solution or with a pseudo solution. The question could no doubt be settled by dialysis and osmotic pressure, and he was obliged to Sir William Ramsay for indicating the manner in which this could be carried out. His difficulty, however, was to determine the osmotic pressure at a constant temperature when he was dealing with volatile solvents. He had tried to construct an apparatus, but had not so far succeeded, and he should be very grateful for any suggestion. The question of nitration, which had been mentioned by so many speakers—namely, whether these were mixtures or not—he was not prepared to go into at present. With regard to viscosity, he might observe that this again raised difficult problems, because after all it was believed that viscosity was directly connected with the size of the molecule. If they considered that by mechanical as well as chemical differences in the manufacture the viscosity was affected the question of the constitution of the molecule would arise. An investigator on this subject had recently said to him "We are much further away from the constitution formula of cellulose than we are from that of albumin."

THE PRODUCTS AND RELATIVE TEMPERATURE OF COMBUSTION OF SOME SMOKELESS POWDERS.

BY W. MACNAB, F.I.C., AND A. E. LEIGHTON.

Having had occasion to examine a number of smokeless powders, chiefly sporting, it is hoped that a short statement of the results obtained may be of interest to members of this society.

The sporting powders were purchased from a well known firm of gun makers. All the samples were analysed. The calorimetric determinations were made in a Berthelot bomb,

nd the products of combustion, measured and analysed s described in a paper published in the Proc. Roy. Soc., 6, 8 (see this J., 1894, 973). In all cases when deteriining the calories and products of combustion, 4 grms. of ach explosive were fired in the exhausted bomb, the apacity of which was 488 c.c. When the explosive ontained inorganic compounds the solid products of ombustion were not analysed. The relative temperature eached during combustion was determined by means of ie method described in the Proc. Roy. Soc., 65, 221 (see iis J., 1900, 466).

Briefly described, this method is a modified application f the thermo-electric pyrometer developed by the late ir W. C. Roberts-Austen, and consists in exposing a hodium-platinum couple in the interior of the bomb aring the combustion of the explosive, and by means of galvanometer, to which the couple is connected, ieasuring the deflection of a spot of light on a falling photographic plate. The deflection is directly proportional to the temperature to which the couple is heated. Although it is not claimed that the actual temperature developed during the explosion can be determined, yet a reliable comparison of the temperatures produced by the combustion of different explosives can in most cases be obtained. Before firing, the spot stands at the base line *a*; immediately after firing, the spot is deflected till the maximum is reached at *b*, when it slowly returns to its original position. The measure of the temperature is the distance *a b* from the base line to the highest point of the curve. The curve is the result of the combined movement of the spot of light and the falling photographic plate.

In the temperature experiments, 4 grms. of each explosive were fired in the bomb full of air, the same couple, 0·028 in. diameter, being used in each case. The following table gives the composition of the different explosives examined.

—	Imperial Schultze.	Amberite.	S.S.	E.C.	Schultze.	Kynoch's Smokeless.	Cannonite.	Shotgun Rifleite.	Walsrode.	Cordite, M.D.	Cordite.	Sporting Ballistite.
itroglycerin	..	..	..	..	..	..	..	..	..	29·2	57·3	37·6
itrocotton	..	71·0	59·2	79·0	..	52·1	86·4	94·0	98·6	64·9	37·7	62·3
itrolignin	80·1	..	..	..	62·1	..	..	..	..	..	..	..
initrotoluene	..	..	15·7	..	..	19·5	..	3·5	..	..	..	..
otassium nitrate	..	1·2	1·3	4·5	1·8	1·4	..	..	..	..	..	..
arium nitrate	10·2	18·6	17·0	7·5	26·1	22·2	5·7	..	..	..	..	..
amphor	..	..	..	4·1	..	..	..	..	..	..	..	..
'oodmeal	..	1·4	5·2	3·8	..	2·7	..	..	..	..	..	..
aselin	7·9	5·8	..	..	4·9	..	2·9	..	..	5·3	4·8	..
arch	..	..	..	..	3·5	..	..	..	..	..	..	..
amp-black	..	..	..	..	..	..	1·3	..	..	..	..	..
otassium ferricyanide	..	..	..	..	..	..	2·4	..	..	..	..	..
lcium carbonate	..	..	0·6	..	..	..	..	..	..	..	..	..
sh	..	..	..	..	..	0·9	..	0·9	..	..	..	..
olatile matter	1·8	2·0	1·0	1·1	1·6	1·2	1·3	1·6	1·4	0·6	0·2	0·1

In regard to the sporting powders, they may be broadly ivided into two classes—those containing and those ithout metallic nitrates. The chief constituent of those owders is nitrocellulose, either in the form of nitrocotton : nitrolignin, and in the case of the first five on the table considerable quantity of metallic nitrates is present; nnonite contains a much higher percentage of nitrootton with a small amount of nitrate, shotgun rifleite is early pure nitrocotton with a small quantity of dinitrotoluene, walsrode is a pure nitrocotton powder, and sporting ballistite is composed of nitrocotton and nitroglycerin. The sample marked "Cordite" has the composition originally employed by the Government, while that marked "Cordite, M.D.," has the composition recently adopted in which the proportions of nitrocotton and nitroglycerin are practically reversed. The following table gives the calories, the quantity, and composition of the gases evolved :—

Name.	Calories per grm.	Permanent Gas c.c. per grm.	Aqueous Vapour c.c. per grm.	Total Volume of Gas calculated at 0 and 760 mm.	Percentage composition of Permanent Gas.				
					Carbon Dioxide.	Carbon Monoxide.	Methane.	Hydrogen.	Nitrogen.
nperial Schultze	742	763	152	915	8·9	52·7	1·0	27·0	10·4
mberite	745	635	156	791	12·0	50·0	0·4	25·5	12·1
.S.	755	695	131	816	11·8	51·3	0·8	23·7	12·4
.C.	762	718	158	876	11·9	52·1	0·5	23·9	11·6
chultze	786	576	160	735	15·5	46·7	0·8	23·0	14·0
ynoch's smokeless	807	600	126	726	14·8	49·5	0·7	18·8	16·2
annonite	845	725	146	871	14·6	49·9	0·6	22·2	12·7
hotgun rifleite	896	705	169	874	19·0	45·3	0·8	21·5	13·4
'alsrode	1,014	669	206	875	21·3	48·2	0·4	10·1	14·8
ordite, M.D.	1,031	726	215	941	16·3	50·4	0·0	19·7	13·6
ordite	1,253	647	235	882	24·9	40·3	0·7	14·8	19·3
porting ballistite	1,286	591	234	825	32·2	37·1	0·4	10·1	20·2

The powders have been arranged in the order of the mount of heat evolved, and it is worthy of note how omparatively similar are the results of the first six. As ie amount of nitrocotton increases the heat evolved also icreases, and a large increase takes place when nitrolycerin is present. In the case of the cordites the effect f the nitroglycerin from the point of view of the heat volved is greatly reduced by the introduction of vaselin. t will be noticed that as the heat increases the quantity of arbon dioxide also increases and the carbon monoxide nd hydrogen decrease, and a larger quantity of aqueous apour is formed. The table on next page shows the powders rranged in the order of the temperature developed. The ieasurements are in millimetres.

It will be seen from the table that the order of the powders according to the temperatures is, broadly speaking, the same as when they are arranged according to the calories. It was observed in these and other experiments that when the powder left no residue, either carbonaceous or mineral, the results were more uniform (see Walsrode, the Cordites and Sporting Ballistite), whereas in the case of shotgun rifleite there was a large carbonaceous, and in the other cases a considerable mineral residue, and as is seen the results are much less uniform; but in these experiments the order is practically the same whether the maximum or the mean figures are taken.

In the temperature experiments, the sporting powders were fired in the form of grain as supplied, but the two cordites were ground and sieved to the size as prescribed for the heat test, which gave grains of about the same size as the other powders.

—	Three Experiments.	Millimetres.	
		Mean.	Maximum.
Imperial Schultze	108 112 97	106	112
E.C.	117 124 127	123	127
S.S.	131 143 130	135	143
Cannonite	142 128 138	136	142
Schultze	123 149 140	137	149
Amberite	138 147 132	139	147
Kynoch's smokeless	162 151 136	150	162
Shotgun rifleite	151 170 159	160	170
Walsrode	159 162 163	161	163
Cordite, M.D.	163 172 169	168	172
Cordite	198 191 186	191	198
Sporting ballistite	198 207 207	204	207

A series of experiments, to study the effect of size of grain or form of the explosive on the temperature measurements, is in progress, and some interesting results have been already obtained, which it is hoped will form the basis of a future communication.

In conclusion we desire to express our thanks to Mr. T. P. Middleton for valuable assistance in carrying out these experiments.

Discussion.

Prof. **Hodgkinson** said the diagrams showed the quantity of carbon dioxide, carbon monoxide, nitrogen, and hydrogen, but he did not see any mention of oxides of nitrogen. Was any oxide of nitrogen noticed in these experiments?

Mr. **Guttmann** said it was remarkable that sporting ballistite should show a higher percentage of nitrogen than cordite, seeing that the former contained less nitroglycerin.

Dr. **Silberrad** said that the importance of estimating the pyrometric value of propellants with accuracy could scarcely be over-estimated, as undoubtedly their erosive properties depended to a very large extent thereon. Consequently as the method described by Mr. Macnab gave a ready way of comparing powders, it was of great value. It must, however, not be lost sight of that the method was purely empirical and measured the product of the temperature of the flame by the time of burning of the explosive under the conditions of the experiment, since the explosion was never of sufficient duration to raise the thermo-junction up to the temperature of the flame. Hence, it was necessary that the conditions of the experiment, the quantity of explosive, and its time of burning, should always be kept constant in order to obtain truly comparative results. He had carried out a large number of experiments on the pyrometric values of powders of all sizes, from small arms powders up to those used in 12-in. guns, and could not agree with Mr. Macnab on this point; he found that the effect of the size of grain had very little influence on the absolute pyrometric value. The products of combustion were the same and the maximum time taken for combustion was less than $\frac{1}{50}$th of a second for the largest size ammunition used in the largest guns fired under gun pressures. Then the question of pressure raised another point. His experiments, which had been carried out at pressures from 10—30 tons to the sq. in. (1,500—7,500 atmospheres), had indicated that pressure had a very marked influence, both on the nature of the gases produced on explosion and also on the pyrometric value of the powder; hence, to obtain really useful results pyrometric values should be determined at gun pressures. The practical value of this method, however, was doubtless far greater than one which necessitated very long and elaborate experiments, even if thereby one ultimately obtained absolute results.

Dr. **Robertson** asked if Mr. Macnab found any relation between his results and the absolute values, and if the latter were in accordance with the values deduced by using the most recent determinations of Mallard and Le Chatelier for the variation of the specific heat of gases at high temperatures, based on Sarrau's figures. He had recently worked with a bomb of much stronger material than that Mr. Macnab used, namely of gun steel $1\frac{1}{4}$ in. in thickness. He obtained very similar figures as regards the number of calories from cordite and cordite, M.D.; for example, at $\Delta = 0{\cdot}1$, 1,249 cal., for cordite, Mark I., and for cordite, M.D., 1,020 cal. By means of the figures of Mallard and Le Chatelier certain absolute pyrometric values could be deduced. One would like to get a confirmation of such values by some method on the basis of Mr. Macnab's elegant apparatus, if only it could be made absolute.

The **Chairman** asked if the vaselin had been identified in the composition of the powders in every case; he understood that in some of these powders the substance was not altogether vaselin, but other things were added. With regard to the method in general, they did get practical results with it no doubt, and they were extremely valuable and could be compared one with another; but, as Dr. Silberrad had pointed out, there were some difficulties when the results were compared with those obtained in practice; in the barrel of a gun or ordnance there was a gradually increasing space, whereas with the calorimetric bomb there was not. Again, with regard to the explosion, when air was present in the bomb a different result must be obtained than in a vacuum. Had Mr. Macnab compared the two conditions to see what the actual difference of temperature might be? In one case air was compressed by the gases produced, and in the other only the gases themselves were compressed.

Mr. **Macnab**, in reply, said that under the conditions in which the experiments were carried out they never found any trace of oxides of nitrogen, all the nitrogen appearing in the free state. Mr. Guttmann asked about the nitrogen in sporting ballistite being higher than in cordite. That came from the large amount of carbon monoxide and dioxide, due to the vaselin which diluted the gas. What Dr. Silberrad said about pressure was perfectly true. One knew the results obtained in the comparatively low pressure under which they worked in the Berthelot bomb were considerably modified when the explosive was fired under heavy pressure. Vieille had made a number of experiments showing how the amount of carbon dioxide in the total volume of gas increased and that of carbon monoxide decreased when fired under greater pressure, and there was no doubt that the temperature would be very much higher as measured by the pyrometer. With regard to the size of the grain, Dr. Silberrad said it did not seem to affect the pyrometric result. In certain conditions he found it had a very great effect, but he could not say more on that point at present. Dr. Robertson spoke about the absolute temperature. That of course was the object with which he was trying to work, but a great many unforeseen difficulties had arisen. All he could say was that he believed he was getting nearer to a solution of the problem, so that one would be able to say with some show of accuracy that the temperature was so many thousand degrees. It was certainly much to be desired that one could have some definite statement to make, but one could only work away and hope to get accurate results. With regard to the vaselin, they got a body which had all the appearance of vaselin, and one could safely call it a mineral jelly. The presumption was so strong it was vaselin that it was put down as such.

New York Section.

Meeting held at Chemists' Club, on Feb. 19th, 1904.

DR. VIRGIL COBLENTZ IN THE CHAIR.

GRAPHITIC ACID OR OXIDE.

BY FREDERIC S. HYDE.

The preparation of the yellow insoluble substance termed "graphitic acid," which has been described by Brodie, Berthelot, Staudenmaier, and others, and to which the ormula $C_{11}H_4O_5$ has been given (Mendeleeff's Principles of Chemistry), is, perhaps, one of the best illustrations of the derivation of an organic compound directly from elementary carbon—a link, as it were, between the organic and inorganic worlds. It is not only a characteristic derivative of graphite in distinction from other forms of carbon, but it is also noted for its peculiar instability, or power of deflagrating when subjected to a temperature just below a red heat, leaving a black, buoyant, sooty residue known as "pyrographitic acid," $C_{22}H_2O_4$ (Tidy's Handbook of Modern Chemistry).

Notwithstanding the somewhat indiscriminate use of the erms "acid" and "oxide," the expression "graphitic oxide" is usually applied to the grass-green substance obtained as an intermediate product during the transformaion of the graphite to the yellow acid. This "green oxide" likewise possesses the power to deflagrate when dry. It also represents a critical step in the transormation, its colour being indicative of the presence of graphite.

Staudenmaier's method of preparation evidently depends on he use of "puffed up" or expanded graphite (aufgeblähten Graphit); otherwise the operation might be prolonged for days, or even weeks. According to Staudenmaier, graphitic acid may be prepared in quantity in a short time, 24—48 hours (Chem. Centr., 1896, **69**, 258, and Ber., **31**, 1481—1487), without danger of explosion from chlorine dioxide, by mixing in a shallow porcelain dish at the ordinary emperature 1 litre of crude concentrated sulphuric acid and $\frac{1}{2}$ litre nitric acid (sp. gr. 1·4), and stirring into this mixture 25 grms. "puffed up" or expanded graphite ollowed at intervals by portions of dry potassium chlorate, 450 grms. in all. After testing with permanganate and acid to obtain a bright yellow colour, the whole is poured nto an excess of water, allowed to settle, and decanted. The green residue is thoroughly washed and heated with a solution of 7 grms. potassium permanganate in 120 c.c. water, o which, after cooling, 90 c.c. of dilute sulphuric acid (1:5) s added. The product, no longer green, is transferred to a porcelain dish and heated on the water-bath until the red coloration disappears, and then treated with hydrogen peroxide, stirring the mass occasionally, and allowing to stand awhile. The graphitic acid is washed with dilute nitric acid (1·28 sp. gr.), then with alcohol and ether, and dried. For small quantities it is suggested that 30 grms. of potassium chlorate be stirred into a mixture of 40 c.c. sulphuric acid and 20 c.c. nitric acid at a temperature of 20° C., and when nearly dissolved 1 grm. of graphite added and thoroughly stirred. It is stated that in five minutes it becomes bluish and greenish, and in about an hour it is sufficiently transformed to become yellow immediately with permanganate.

On trying this method the writer found that direct treatment of Ceylon graphite (200 mesh fine and 90 per cent. pure) failed to give satisfactory results, until the graphite itself had been subjected to a preliminary treatment to obtain the "puffed up" or Brodie's form; and even then it required 10—12 hours to become dark greenish, and (after renewing the chlorate mixture) two days before it was sufficiently transformed to yield the yellow product with permanganate and acid.

It is recommended not to oxidise more than 20—25 grms. graphite in the same dish at the same time, at a temperature above 20° C., especially in summer—simply a precaution against local overheating and collection of explosive gases in bulky solutions.

For rapid oxidation, Staudenmaier suggests a preliminary treatment of the graphite, using 300 c.c. crude concentrated sulphuric acid, 100 c.c. concentrated nitric acid (1·4 sp. gr.), 50 grms. pulverised Ceylon graphite, stirring in at intervals 100 grms. potassium chlorate, and allowing to stand several hours at the ordinary temperature. After thorough washing with water, the graphite so treated is heated to a glow in a large metal dish, so that it expands or "puffs up." When cool, the "puffed up" mass is stirred in water, and the floating portions taken for further oxidation. The writer found this treatment quite satisfactory, and far preferable to Brodie's dangerous method, in which sulphuric acid and chlorate alone are employed.

The general method adopted by Staudenmaier for preparing graphitic acid deserves consideration because of the substitution of potassium permanganate, sulphuric acid, and hydrogen peroxide to complete the oxidation. His method is, however, somewhat tedious and uncertain, and is also characterised by the excessive amounts of potassium chlorate required to produce the green oxide—nearly a pound of chlorate to every ounce of graphite oxidised. The fumes evolved on stirring the acid mixture are copious and very disagreeable, and even in small quantities seem to exert a depressing effect in spite of precautions for ventilation.

Staudenmaier's objection to Moissan's method consists mainly in the difficulty of preparing anhydrous nitric acid (monohydrate) in sufficient quantity to yield large amounts of graphitic acid. But it is quite evident that anhydrous nitric acid, once obtained, fully repays the pains taken in its preparation, even if necessary to conduct several separate distillations at once to obtain the requisite quantity.

Brodie, who is credited with being the first to discover that graphite could be oxidised to graphitic acid, and Berthelot, who investigated methods for distinguishing various forms of carbon, evidently depended on the use of strong nitric acid and chlorate of potash at low temperatures. Berthelot states that with a mixture of potassium chlorate and red fuming nitric acid graphite is oxidised to graphitic acid (Chem. Centr., 1896, **67**, 466). This may be true with certain amorphous graphites, but as a rule the ordinary fuming nitric acid, as obtained from the dealer, is not concentrated enough for the reaction.

Probably, one of the most simple and satisfactory methods (a combination of Berthelot's and Staudenmaier's) is that described by Fitzgerald (this J., 1901, 443—445).

Instead of heating over the ordinary water bath, as in Fitzgerald's case, the writer prefers a beaker containing water at 60° C., in which the test tube is inclined, the temperature being maintained by placing the beaker on top of a radiator or hot air bath. Above 70° C., explosions varying in intensity from the "toot" of a small whistle to the noise of a fire cracker are liable to occur, rendering close observation hazardous. Excessive amounts of potassium chlorate are unnecessary. The acid used should be especially prepared by distilling a mixture of equal parts C.P. concentrated sulphuric and nitric acids, so as to obtain one-third its bulk of distillate.

After obtaining the grass-green oxide, it should be washed with water, and heated on the water bath with about 150 c.c. N/50 permanganate solution to which dilute sulphuric acid has been added. The substance should assume a yellow colour, and the permanganate show signs of reduction. Hydrogen peroxide is then added to destroy the permanganate and "clear up" the solution. The yellow crystalline product may be washed by decantation successively by dilute nitric acid, alcohol, and ether; but generally two or three washings with absolute alcohol on a filter will suffice, after which it should be dried at the odinary temperature.

Ceylon graphite of 90 per cent. or more purity seems to produce the best results. The green oxide is formed more readily from Ceylon graphite than from artificial graphite; and not at all from ordinary coke, or charcoal, or carbon black. As a rule, ordinary carbon or carbonaceous matter simply passes into solution, imparting a dark brown colour to the oxidising mixture, such solubility forming a basis of separation from graphite. Charcoal dust may he almost completely dissolved in twenty-four hours, yielding the usual coffee-coloured solution and a whitish residue which dissolves on dilution, imparting a yellowish-brown coloration. This is not necessarily true, however, with gas retort carbon, which is more or less inert, and may give an unmistakable green solution, as if it were partially graphitised and required only a strong electric current to complete the graphitisation.

Some of the low grade amorphous graphites respond readily to the test, while others, like Bohemian and Mexican, are uncertain. With the American flake variety, the action is slower than with Ceylon, yielding a darker shade of "green oxide." Occasionally, the writer has obtained the final product as a dark brown powder, which deflagrated more readily than the yellow form. Very often the yellow acid seems to retain the flaky structure of the original graphite.

That graphitic "oxide" may be produced more readily from natural than from artificial graphite is no criterion of the refractory powers of the latter, since, gram for gram, the best Ceylon lump, after proper milling, resists oxidation by fire much longer than artificial graphite of the same carbon content and degree of fineness and under same conditions. Apparently the more perfect the graphitisation, the more readily is the graphitic oxide formed, although a hard crystalline structure in itself might retard the reaction.

Whether or not natural graphite is the result of the decomposition of plant life; or the destructive distillation of hydrocarbon gases; or the metamorphosis of charred residues from prehistoric forest fires, it is, nevertheless, quite evident that differences in physical structure are usually accompanied by differences in behaviour with oxidising agents. Ceylon plumbago, occurring in massive form and yielding an ash more or less granular, should not be classed with the American flake varieties having a micaceous structure, nor with the amorphous compact forms containing argillaceous matter.

The use of the chlorate oxidising mixture to distinguish graphite from other forms of carbon through production of insoluble graphitic acid and soluble humic acids has claimed more or less attention from time to time (Berthelot, Comptes rend. 1869, **68**). The Staudenmaier mixture has already been recommended by Fitzgerald for testing carbon electrodes to determine whether they are composed entirely of amorphous carbon or partially of graphite (Electrochemical Industry, Oct. 1902, page 68). Of course, graphite itself may exist in the amorphous state and produce the usual grass green oxide.

While approximate separations may be made with simple mixtures of graphite and charcoal dust or ordinary coke, the results are hardly satisfactory with hard gas retort carbon for reasons previously stated.

THE IODINE ABSORPTION OF SPIRITS OF TURPENTINE.

BY R. A. WORSTALL.

Little has been published concerning the analysis of turpentine and the detection of adulterants, which have consisted chiefly of petroleum distillates, rosin spirits, and rosin oil. Burton (Amer. Chem. J., **12**, 102) detected petroleum products by oxidising the sample with fuming nitric acid, pouring into water, and extracting the unchanged paraffins with ether. Armstrong (this J., 1882, 478) detected heavy petroleum products by distilling the sample in steam, only the heavy paraffins remaining behind. Naphtha and gasoline he determined by first polymerising the terpenes with sulphuric acid, and then distilling in steam, the distillate containing only the volatile paraffins. Hinsdale (Chem. News, **63**, 161) claimed to be able to detect petroleum fractions by evaporating ten drops of the sample in a watch glass at 77 C. In seven minutes all was evaporated save the petroleum. This is evidently a crude method. Aignan (Comptes rend., **109**, 944) detected rosin oil by the decrease it caused in the rotation. Baudin (J. prakt. Chem., **23**, 279) tested for petroleum by the grease that it left when the sample was evaporated spontaneously on filter paper. Zune (Monatsh. f. Chem., **2**, 794), employed the increased index of refraction to denote rosin oil. Evers (Zeits. öffentl. Chem., **4**, 211) stated that equal volumes of spirits of turpentine and fuming hydrochloric acid (1·19) when shaken together gave a definite rise in temperature, and used a qualitative test with bromine to distinguish between genuine and imitation spirits of turpentine. Schreiber and Zetzsche (Chem.-Zeit., **23**, 68) have also made use of the latter test.

The preceding, while not a complete bibliography of the subject, comprises most that has been published concerning the detection of adulteration in spirits of turpentine. Usually the determination of specific gravity, which should be 0·865; the flash point, which should be 92—94 F.; and the distillation test—pure spirits should begin to distil at 150 C., and 90 per cent. should pass over before 165—are sufficient to denote any considerable adulteration with petroleum products or rosin spirits. But since the development of the yellow pine distillation industry and the appearance on the market of various grades of "wood turpentine," from straw colour to water white, the problem has become more difficult. "Wood turpentine," as might be expected from its method of production, possesses characteristics both of spirits of turpentine and of wood alcohol, and seems to consist both of terpenes and of alcoholic bodies. In its general properties it closely resembles true spirits of turpentine, and its strong odour can be largely removed by refining. It is not equal to genuine "spirits" in any way, however, and hence must be classed as an adulterant.

Some two years ago, feeling that the methods in use for the analysis of spirits of turpentine were both slow and unsatisfactory, the author determined to try to substitute for them some method at once quicker and more reliable. The specific gravity test, the distillation test, and the flash test, while easily carried out require time, and are not absolutely sure indications of purity. Upon looking into the literature upon the subject, it was found that R. H. Davies (Pharm. J. and Trans., 1889, 821) had determined the iodine absorption of a large number of essential oils, using the Hübl method, and that with the exception of two or three rare and costly essential oils, none gave nearly as high figures as did spirits of turpentine, whose absorption he found to be 377 per cent. After a few preliminary tests the following method was adopted for carrying out the determination, and is still in use. About 0·1 grm. of the sample is weighed out from a dropping bottle into a glass stoppered bottle, 10 c.c. of Hübl's solution added, and the tightly stoppered bottle set away over night. The excess of iodine is then titrated back as usual. For more than two years this method has been the chief test employed in this laboratory for spirits of turpentine, and the results have been most satisfactory.

The average iodine absorption of 55 samples of spirits of turpentine of undoubted purity, examined during the first six months of 1903, had been 384 per cent. As a rule, three times the total quantity of iodine necessary for complete saturation had been added, and 18 hours had usually been allowed. $C_{10}H_{16}$ would be converted into $C_{10}H_{16}I_4$ by complete addition, and this would require theoretically 373 per cent. iodine.

The first point investigated was the rapidity of the reaction. The spirits of turpentine, of undoubted purity, was weighed from a dropping bottle into glass stoppered bottles, a definite volume of Hübl's solution added, and the tightly stoppered bottles placed in the dark for definite periods of time, when the excess of iodine was titrated back in the usual way with thiosulphate. The following table shows the results :—

Time.	Absorption.	Time.	Absorption.
Hours.	Per Cent.	Hours.	Per Cent.
½	314	5	378
1	335	6	379
2	348	7	380
3	365	18	380
4	374	24	389

It would appear from these figures that absorption is complete in from four to six hours, given a large excess of iodine, and that if the time be greatly prolonged, substitution or other secondary reactions ensue. The influence of a large excess of iodine, and the proper amount of the same necessary to ensure complete saturation, was next studied, with the following results :—

Time.	Excess of Iodine.	Absorption.
Hours.		Per Cent.
18	0·0456	316
18	0·0881	332
18	0·1428	357
18	0·2098	366
18	0·3583	378
18	0·5749	392
18	1·0123	402

It would follow from these results that if 18 hours be allowed for the reaction, twice as much iodine must be added as is necessary for complete reaction; and if 12 hours be allowed, three times the quantity of iodine should be added; also that a very great excess of iodine or unduly prolonged time for the absorption each result in secondary reaction, which increase the apparent absorption.

The most common adulterants of spirits of turpentine, and in fact about the only possible and profitable ones are kerosene, 63° naphtha, or other petroleum distillates; rosin spirits or rosin oil, and wood turpentine. The iodine absorption of each of these was determined from samples on hand:—Rosin spirits, 185; rosin oil, 97; kerosene, 0; naphtha, 0; refined wood turpentine, 212; water white, 328 per cent. Evidently any adulteration, even in very small proportions, with petroleum distillates should be easily detected by the consequent decrease in the iodine absorption. Mixtures of pure turpentine and kerosene were made, and the iodine number determined, with the following results:—

	Absorption after 18 hours. Per Cent.
Pure turpentine	391
5 per cent. kerosene	360
10 ,, ,,	350
20 ,, ,,	313
40 ,, ,,	238
100 ,, ,,	0

Another test was made with resinous mixtures containing refined wood turpentine as the adulterant, with the ollowing results:—

	Absorption after 12 hours. Per Cent.
Pure turpentine	375
5 per cent. wood-turpentine	360
10 ,, ,, ,,	355
20 ,, ,, ,,	313
50 ,, ,, ,,	278
100 ,, ,, ,,	212

It would, no doubt, be more difficult to detect the addition f 5 per cent. of such a wood-turpentine as the sample hich gave an iodine value of 328 per cent., but no such dulteration is likely to be encountered. The cost of such an xtra-refined article is so little below that of genuine pirits of turpentine that if used as an adulterant for the tter it would have to be in the proportion of 25 to 0 per cent. to be profitable, and such adulteration would asily be shown by the decreased iodine number. In the econd place, it is extremely doubtful if the addition of 0 per cent. of this water-white wood-turpentine would be t all detrimental. It has been so well refined that nearly ure terpenes are left.

The author believes that the iodine absorption can thus e applied to spirits of turpentine as a positive and reliable est of purity. Kerosene and wood-turpentine were taken s the extremes—in iodine absorption—of possible adulerants, and what is true of them applies equally well to esin spirits, resin oil, naphtha, or any other adulterant. rovided the test be carried out with the proper precautions s to time and excess of iodine, any sample which shows n iodine absorption of less than 370 per cent. can certainly e condemned; and, given the fact that its iodine absorption too low, the nature of the adulterant can be determined y any of the methods now in use.

A METHOD FOR THE DETERMINATION OF CERTAIN ALDEHYDES AND KETONES IN ESSENTIAL OILS.

BY SAML. S. SADTLER.

In a paper read before the Chemical Section of the Franklin nstitute in Philadelphia, on October 15th, 1903, I described a general way a method for the quantitative estimation aldehydes of both the aliphatic and aromatic series, based upon the assumed fact that, when neutral sulphites react with aldehydes, caustic alkali is separated. I have since that time experimented on several applications of the method, and read a short paper before the Philadelphia Section of the American Chemical Society on January 21st, 1904, on the determination of formaldehyde. Very recently, however, I received word from Dr. Clemens Kleber to the effect that he had been working along the same lines, and had sent a paper on the subject of formaldehyde assay to one of the journals for publication. In view of that fact I have left that field to Dr. Kleber, and have devoted what time I could to experimenting upon some essential oils. I wish to acknowledge my indebtedness for the receipt of most of the samples used in this work to Dr. F. D. Dodge and Messrs. Fritzsche Bros.

The subject of this reaction has been treated upon at considerable length by the late Prof. Tiemann (Ber., **31**) Dodge (Amer. Chem. J., 1890, 55), and Heusler (Ber., **24**). Tiemann and Dodge used the reaction to obtain citral from lemon-grass oil, and Heusler used it in connection with cinnamic aldehyde. Tiemann says that many organic compounds containing double linkings add the elements of sulphurous acid, forming sulphonic acids. He pointed out that the reaction occurred readily with unsaturated aldehydes, such as acrolein, croton aldehyde, &c. Heusler pointed out the reaction with cinnamic aldehyde, as follows:—

$$C_6H_5.CH:CH:COH + Na_2SO_3 + H_2O =$$
$$C_6H_5.CH.(SO_3Na).CH_2.COH + NaOH,$$

but said, however, that the resulting alkali, in a certain concentration, exercises a decomposing action upon the sulphonate formed, and has to be neutralised by acids.

Prof. Tiemann has shown in the case of citral that, besides the bisulphite compound, three hydrosulphonic acid compounds exist. The normal bisulphite compound is obtained by the action of sodium bisulphite, preferably containing a little free sulphurous acid. It is completely decomposed by soda, regenerating citral. When this compound is steam-distilled from water, half of the citral contained passes over and the other half is converted into the sodium salt of the so-called "stable" citral dihydrodisulphonic acid; thus:—

$$2C_9H_{15}CH(OH)SO_3Na = C_9H_{15}COH, C_9H_{17}(SO_3Na)_2COH.$$

This compound is readily soluble in water, without being reconverted into citral, by means of sodium carbonate or hydrate. He shows that the aldehydic group is still intact.

The second compound is the so-called "labile" citral dihydrodisulphonic acid, and results when citral is agitated with an aqueous solution of neutral sulphite, the formula, unless written stereo-chemically, being the same. The reaction is—

$$C_9H_{15}COH + 2Na_2SO_3 + 2H_2O$$
$$C_9H_{17}(SO_3Na)_2COH + 2NaOH.$$

He stated that this compound was quantitatively decomposed by the action of sodium hydroxide, forming citral and neutral sodium sulphite. In other words, the reaction is reversible, and the laws of mass action should apply

A third compound is the mono-hydro-sulphonate Tiemann further points out that the decomposition of this "labile" compound may be prevented by the addition of an acid salt, such as acid sulphite, bicarbonate of soda, or a weak acid, such as acetic acid.

I came to the conclusion that if the alkali formed were neutralised with measured quantities of standard acid the reaction should complete itself, and the measure of the amount of the reacting substances be determined at the same time; and, as in experiments with acidified solutions, I got low results, which tend to show that if the sulphite solution is acidified the bisulphite addition compound is likely to form.

With regard to the applicability of the reaction, Tiemann seemed to hold that it only related to unsaturated compounds, such as acrolein, crotonic aldehyde, cinnamic aldehyde, and citral. This does not seem to me to be the case, as it reacts apparently quantitatively, with the formation of two molecules of alkali hydroxide, with formaldehyde. It seems also to react with acet aldehyde; to a certain limited, yet definite extent with condensed aldehydes, like para-formaldehyde and paraldehyde; and in the aromatic series, besides unsaturated aldehydes, it seems to react with benzaldehyde and vanillin, and even in the class of ketones I have found it to react, carvone, as will be seen later, reacting quantitatively. A strong qualitative test was also obtained with purified acetone and some constituent of honey, possibly laevulose. It seems to me, therefore, that the reaction must be considered either, as Tiemann has pointed out, as taking place with unsaturated aldehydes according to our reaction, and reacting in a different way, almost certainly affecting the aldehydic group itself, in the other cases mentioned; or, as seems more reasonable, as a purely aldehydic reaction, primarily affecting the oxygen atom of the $-CHO$ group, with a molecular rearrangement in certain cases, such as citral and cinnamic aldehyde. I believe double bondings and other groupings affect the reaction, as the position and character of substitution groups affect the activity of groups in the aromatic series. For example, carvone reacts, while its isomer, Japan camphor ($C_{10}H_{16}O$), does not react, with neutral sulphite.

Although my method of citral assay, outlined in the advance sheets of the Journal of the Franklin Institute, seems to be fairly clear, inasmuch as Kremens and Brandel, in a very recent publication, entitled "The Citral Assay of Volatile Oils," obtained very concordant results, and state that the figures obtained show "that, even without experience, fairly good results may be obtained by this method;" still I would like to add some precautions and discuss results to some extent, and will here give the method with such revision as I believe desirable. The method is apparently applicable to oils containing aldehydes or ketones which are found to react. The only differences in procedure that I have found are in the amounts of different oils taken. The use of bicarbonate and acetic acid to take up the caustic soda as formed, I have not found beneficial in any case which I have investigated. Either phenolphthalein or rosolic acid may be used as an indicator; I have generally used the latter, as it is less affected by sulphurous acid, and, although the end point is not as deep in colour, it does not fade, which is an advantage, as it is well to let the flasks stand all night to see if any additional alkali forms, indicating incompleteness of reaction. I have used normal and semi-normal hydrochloric acid for titrating, but have also tried weaker acids, such as oxalic, acetic, and sulphurous acids, to prevent any decomposition of sulphite, but, as I do not add the acid after the red or pink colour of the indicator has been discharged, I found no advantage in the change.

With oils of lemon, 10 grms. are weighed into an Erlenmeyer flask, 10 c.c. of water and four drops of rosolic acid (or phenolphthalein) indicator solution added, and N/10 potassium hydroxide solution added until just alkaline, to remove free acid which, to a greater or less extent, is present in all essential oils. Then 25 c.c. of a 20 per cent. sodium sulphite solution is added, measuring out an equal amount for a blank test. On agitation, a pink colour forms, and this is discharged by adding N/2 hydrochloric acid from a burette. The agitation (effected by inserting a well-fitting cork in the neck of the flask and shaking violently) and neutralising are carried out repeatedly, being careful not to let the solution become strongly alkaline at any time. When no more alkali is liberated, the flask is heated on the water bath, the shaking and neutralising being still carried out successively. Several tests may be made at once, a separate burette with the standard acid being reserved for each test. When the pink colour no longer forms, the flask is allowed to cool; the pink colour, if any, in the blank test is also discharged with N/2 hydrochloric acid, and both are then titrated with N/2 sodium hydroxide until the pink colour begins to form. The algebraic sum of the c.c. of acid and alkali of the blank experiment (those of sodium hydroxide being minus) are subtracted from those of the test, and the c.c. of N/2 hydrochloric acid are calculated into citral by considering one molecule of citral as equivalent to two molecules of hydrochloric acid; this, divided by the weight of oil taken, gives the percentage of citral. The following results were obtained by this method:—

Lemon Oils.

	Per Cent.
Sanderson's oil of lemon.	4·49 and 4·31
Dodge and Olcott sample	4·13 „ 4·31
Expressed oil of lemon	3·08, 3·09 „ 3·20
Oleo resin of lemon (California)	5·24 „ 5·29

Lemon-grass Oil (using about 1 *grain of Sample and* 10 *c.c. of Kerosene as a Diluent).*

	Per Cent.
Oil of lemon-grass, I.	75·13 and 76·04
„ „ II. (71 per cent.)	71·24 „ 72·74
Sample of citral	93·43

A polymerisation effect appeared to have taken place to a certain extent with citral, as a residue neutral to this reaction was noticed. Probably more water should have been used, and the alkali neutralised more promptly. But the result is close enough to show the correctness of the general reaction.

Before leaving the subject of citral, I would again refer to the paper of Kremers and Brandel, and call attention to the results which they obtained with mixtures of citral and limonene.

These results were as follows:—Calculated, 5 per cent. Found, 5·2, 5·04, 5·5, 5·2, by one experimenter; 4·7, 4·9, 5·0, by a second experimenter; 5·1, 5·09, by a third. They were very satisfactory. It is, however, in the determinations with cinnamic aldehyde where my results differ from those of Tiemann.

Oils of Cinnamon and Cassia (same amount used and Kerosene added as with Oil of Lemon-grass).

	Per Cent.
Oil of Cinnamon, I.	70·11 and 70·94
„ „ II. (64 per cent.)	62·37 „ 62·59
„ cassia (82 per cent.)	84·35, 79·7 „ 76·2
Pure cinnamic aldehyde	93·2 „ 94·5

(In the case of the Cassia the samples probably stood too long with the free alkali.)

Oil of Carraway (1 grm. and used Kerosin).

	Per Cent.
Oil of carraway (50-60 per cent.)	55·10
Carvone (97 per cent.)	91·3

Benzaldehyde and oils of bitter almonds were tried and gave results varying about one-third of the theoretical. They showed, however, that other than unsaturated aldehydes react with neutral sulphites. It is possible that acids salts or acids might control this reaction satisfactorily, but I have not as yet had success with the use of bicarbonate or acetic acid, as I tried the samples of citral, carvone, and cinnamic aldehyde, using an excess of N/2 acetic acid, but obtained the following results respectively, 88·31, 87·1, and 86·5. It seems likely to me that some bisulphite compound formed as well as the dihydro-disulphonate, as these results are lower than those obtained in neutral solutions.

Oil of citronella gave a small amount of free alkali, which would correspond to a few per cent. of citral.

Oil of fennel was tried in order to see whether fenchone reacted as well as carvone.

The applicability of this reaction is at least twofold. To serve as a convenient assay method of several constituents of essential oils, notably citral, cinnamic aldehyde, and carvone, and to be a means of learning more about the constitution of substances, especially aldehydes and ketones, of doubtful composition.

The close agreement in most cases shown here between this and other methods seems to show very clearly that with the aldehydes investigated two molecules of sulphurous acid are attached not only to aldehydes containing two double bonds like citral, but the same number were found to be taken up by cinnamic aldehyde, which has but one double bond, and furthermore two molecules were found to be taken up by aldehydes with no double bonding, such as formaldehyde, benzaldehyde, and vanillin, and also by a ketone, a body of distinctly different composition.

I would, therefore, provisionally write the general reaction for aldehydes, thus—

$$\mathrm{R.CHO + 2Na_2SO_3 + 2H_2O = R.CH:(NaSO_3)_2 + 2NaOH + H_2O.}$$

and for ketones—

$$\mathrm{R'.CO.R' + 2Na_2SO_3 + 2H_2O = R'_2:C:(Na_2SO_3)_2 + 2NaOH + H_2O.}$$

Meeting held at Chemists' Club, on March 25th, 1904.

DR. VIRGIL COBLENTZ IN THE CHAIR.

ACETIC ACID IN ACETATE OF LIME.

BY ALBERT G. STILLWELL.

The estimation of acetic acid by means of the distillation method is of growing importance, and it seems to the writer that a uniform method of analysis should be adopted.

A large amount of acetate of lime is manufactured each year, in factories scattered throughout the United States, a large amount of which is exported, while the rest finds a ready market at home.

A short description of the method in use in this laboratory should prove of interest to manufacturer and consumer alike. The following method has been in use for some time, with very satisfactory results.

Method.—The sample is drawn from bags as shipped, by means of tryers 14 ins. long, having a bevelled edge, mouth $1\frac{1}{2}$ ins. inside diameter, and expanding to 2 ins. at the handle end. The sample should be kept in tight cans or glass jars, as acetate of lime absorbs moisture very rapidly in wet weather, and loses it just as rapidly in dry. On reaching the laboratory the sample is rapidly passed through a $\frac{1}{4}$ in. sieve. The moisture in this sample is determined, and constitutes the original moisture. An average sample (about 6 oz.) is now passed through a 14-mesh sieve. This is the working sample, and the moisture in this should also be determined. From this fine sample 2 grms. are weighed out on balanced aluminium foils, and very carefully brushed into a round bottomed flask of 300 c.c. capacity, and having a neck 4 ins. long, great care being taken not to lose any of the fine dust. 15 c.c. of syrupy phosphoric acid are now added, and all drops carefully washed down from the neck with about 25 c.c. of water. 30 c.c. of standard soda solution are measured out by means of a pipette and run into a 12-oz. Erlenmeyer flask, and the flask placed under the delivery tube of the apparatus.

The flame is now lighted, and distillation carried on for $1\frac{1}{4}$ hours; the Erlenmeyer is now removed and a small beaker substituted; the distillate in the Erlenmeyer is neutralised by standard soda, drawn from a burette (10 c.c. capacity, and measuring about 12 ins. long, divided into tenths).

The distillation is carried on for 15 minutes longer, and the distillate in the beaker added to that in the Erlenmeyer; if the colour is discharged more soda is added and the distillation carried on 15 minutes longer. Usually the distillation is completed in $1\frac{1}{2}$ hours.

Soda.	Acetic Acid.	Acetate of Lime.	Soda.	Acetic Acid.	Acetate of Lime.
c.c.			c.c.		
30·00	52·50	69·13	34·05	59·59	78·45
30·05	52·59	69·25	34·10	59·68	78·57
30·10	52·67	69·36	34·15	59·77	78·69
30·15	52·76	69·48	34·20	59·85	78·80
30·20	52·85	69·59	34·25	59·94	78·92
30·25	52·94	69·71	34·30	60·03	79·03
30·30	53·03	69·82	34·35	60·12	79·15
30·35	53·12	69·94	34·40	60·20	79·26
30·40	53·21	70·06	34·45	60·29	79·38
30·45	53·30	70·18	34·50	60·38	79·49
30·50	53·38	70·28	34·55	60·47	79·60
30·55	53·47	70·40	34·60	60·55	79·72
30·60	53;55	70·51	34·65	60·64	79·83
30·65	53·64	70·63	34·70	60·73	79·95
30·70	53·73	70·74	34·75	60·82	80·07
30·75	53·82	70·86	34·80	60·90	80·19
30·80	53·90	70·97	34·85	60·99	80·30
30·85	53·99	71·09	34·90	61·08	80·42
30·90	54·08	71·20	34·95	61·17	80·54
30·95	54·17	71·32	35·00	61·25	80·65
31·00	54·25	71·43	35·05	61·34	80·77
31·05	54·34	71·55	35·10	61·43	80·88
31·10	54·43	71·67	35·15	61·52	81·00
31·15	54·52	71·79	35·20	61·60	81·11
31·20	54·60	71·89	35·25	61·69	81·23
31·25	54·69	72·01	35·30	61·78	81·35
31·30	54·78	72·12	35·35	61·87	81·47
31·35	54·87	72·24	35·40	61·95	81·57
31·40	54·96	72·36	35·45	62·04	81·69
31·45	55·05	72·48	35·50	62·13	81·80
31·50	55·13	72·58	35·55	62·22	81·92
31·55	55·22	72·70	35·60	62·31	82·03
31·60	55·31	72·81	35·65	62·40	82·15
31·65	55·40	72·93	35·70	62·48	82·27
31·70	55·48	73·04	35·75	62·57	82·39
31·75	55·57	73·16	35·80	62·65	82·50
31·80	55·66	73·28	35·85	62·74	82·62
31·85	55·74	73·39	35·90	62·83	82·73
31·90	55·83	73·50	35·95	62·92	82·85
31·95	55·92	73·62	36·00	63·00	82·95
32·00	56·00	73·73	36·05	63·09	83·07
32·05	56·09	73·85	36·10	63·18	83·19
32·10	56·18	73·96	36·15	63·27	83·30
32·15	56·27	74·08	36·20	63·35	83·41
32·20	56·35	74·19	36·25	63·44	83·52
32·25	56·44	74·31	36·30	63·53	83·64
32·30	56·53	74·42	36·35	63·62	83·75
32·35	56·62	74·54	36·40	63·70	83·87
32·40	56·70	74·65	36·45	63·79	83·98
32·45	56·79	74·77	36·50	63·87	84·10
32·50	56·87	74·89	36·55	63·96	84·21
32·55	56·96	75·00	36·60	64·05	84·32
32·60	57·05	75·11	36·65	64·14	84·43
32·65	57·14	75·23	36·70	64·23	84·56
32·70	57·23	75·35	36·75	64·32	84·67
32·75	57·32	75·46	36·80	64·40	84·79
32·80	57·41	75·58	36·85	64·49	84·90
32·85	57·50	75·69	36·90	64·58	85·01
32·90	57·59	75·81	36·95	64·67	85·12
32·95	57·68	75·93	37·00	64·76	85·25
33·00	57·75	76·04	37·05	64·85	85·36
33·05	57·84	76·16	37·10	64·94	85·47
33·10	57·93	76·27	37·15	65·03	85·58
33·15	58·02	76·39	37·20	65·10	85·71
33·20	58·11	76·50	37·25	65·19	85·82
33·25	58·20	76·62	37·30	65·28	85·94
35·30	58·29	76·73	37·35	65·37	86·05
33·35	58·37	76·85	37·40	65·45	86·17
33·40	58·46	76·97	37·45	65·34	86·29
33·45	58·55	77·09	37·50	65·63	86·40
33·50	58·64	77·20	37·55	65·72	86·52
33·55	58·73	77·31	37·60	65·81	86·63
33·60	58·80	77·42	37·65	65·90	86·75
33.65	58·89	77·54	37·70	65·98	86·86
33·70	58·98	77·65	37·75	66·07	86·97
33·75	59·07	77·77	37·80	66·16	87·09
33·80	59·16	77·89	37·85	66·25	87·20
33·85	59·25	78·00	37·90	66·33	87·32
33·90	59·34	78·11	37·95	66·42	87·43
33·95	59·43	78·23	38·00	66·50	87·55
34·00	59·50	78·34			

During the distillation the volume of liquid in the flask is kept as near 40 c.c. as possible, by means of the inlet or water controlled by screw as per cut.

The standard soda employed is of such a strength that 1 c.c. equals 0·0175 grm. of acetic acid when 2 grms. of sample are used.

When the acetic acid in the working sample is found, a simple calculation back to the original moisure will give the amount in the original sample.

It is perhaps superfluous to say that in standardising the soda phenolphthalein should be used as indicator, as well as in the final distillation.

If the water supply at hand contains much carbonate, distilled water should be used, as the carbon dioxide liberated by the phosphoric acid during the distillation will (by use of phenolphthalein) be reckoned as acetic acid.

In order to save calculation, the table given on the preceding page is used, the figures reading per cent. when 2 grms. of sample are taken.

Apparatus.—The condensing tank is of copper with glass tubes running through it as shown.

The water supply for the flasks is drawn from a small brass pipe by means of rubber tubes, and flow controlled with screw clamps.

The flasks are supported on a galvanised strip with holes cut in it, these holes being just a little smaller than the bottom of the flask.

Nottingham Section.

Meeting held at Nottingham, on Wednesday, February 24th, 1904.

MR. J. T. WOOD IN THE CHAIR.

NOTE ON THE DETERMINATION OF THE IODINE VALUE BY IODO-BROMIDE.

BY L. ARCHBUTT, F.I.C.

In the Hanus method of determining iodine values, a solution of iodine monobromide in acetic acid is used, which is somewhat more easily and cheaply made than the Wijs solution, and for this reason it has been adopted by some analysts. Results which have been published in this J. by Hunt (1902, p. 455) and by Harvey (1902, p. 1439) have shown that iodine values determined by means of the Hanus solution are lower than those obtained by the Wijs solution, the difference being greater the higher the iodine value, and these observations are confirmed by the following values which have been obtained in my laboratory. The difference in the case of turpentine oil is very marked. Duplicate tests by the Hanus solution do not agree so closely as duplicates obtained by the Wijs method, and it seems a pity that the latter process, which is so excellent, should be discarded in favour of a less perfect process.

Iodine Values by Wijs and Hanus Methods.

Description of Oil.	Time of Contact.	Wijs Values.			Hanus Values.		
		1.	2.	Mean.	1.	2.	Mean.
	Minutes.						
Olive (1)	15	84·7	..	84·7	84·8	..	84·8
„ (2)	15	82·8	82·9	82·85	82·6	82·5	82·55
Rape (1)	30	106·4	..	106·4	103·7	..	103·7
„ (2)	30	104·7	104·9	104·8	103·5	103·3	103·4
Linseed (1)	60	182·8	183·4	183·1	176·8	..	176·8
„ (2)	60	178·5	178·5	178·5	174·6	174·1	174·4
Turpentine oil (American)	24*	320·9	320·9	320·9	272·9	{269·1 269·0}	270·4

* See this J., 1902, p. 1439.

DISCUSSION.

Mr. HARVEY said he could thoroughly support Mr. Archbutt's opinion as to the superiority of the Wijs method, over that of Hanus and others. Dr. Wijs had shown that theoretical results were obtained with pure unsaturated fatty acids, and that the reaction was practically instantaneous, earth-nut oil absorbing in one minute 99 per cent. of the total halogen finally absorbed, and linseed oil 98 per cent.

The CHAIRMAN said Mr. Archbutt's figures seemed to confirm what Mr. Harvey had said about this method. He asked Mr. Archbutt if he had any comparative figures for cod liver oil.

Mr. ARCHBUTT replied in the negative, but expressed the opinion that the results would be similar to those obtained with linseed oil.

Scottish Section.

Meeting held at Edinburgh, on Tuesday, Jan. 19th, 1904.

DR. L. DOBBIN IN THE CHAIR.

THE CHEMICAL AND MECHANICAL TESTING OF PORTLAND CEMENT.

BY G. H. GEMMELL, F.I.C., F.C.S.

The Cement Trade Section of the London Chamber of Commerce, in a report issued in 1897, defined Portland cement to be a mixture of two or more suitable materials, intimately and artificially mixed in the requisite proportions, and afterwards properly calcined and ground, to which nothing has been added during or after calcination, excepting that an addition not exceeding 2 per cent. of gypsum is permissible for the purpose of regulating the setting. That if any material whatever, excepting an amount not exceeding 2 per cent. of Gypsum, be added to the Portland cement clinker, during or after calcination the article so produced shall not be sold as Portland cement but under some other distinctive name. This definition is practically the same as that adopted by the German and Austrian Association of Portland cement makers. Made in the manner described, however, Portland cement is not a substance of definite chemical composition. According to Le Chatelier, the essential and valuable ingredients are tricalcium silicate and tricalcium aluminate, but associated with these compounds of definite chemical composition there are various impurities and the ultimate composition of samples of cement varies within the following limits :—

	Per Cent.
Lime, CaO	60 to 65
Iron and alumina oxides	7 to 14
Alkalis	Traces to 3
Sulphuric anhydride, SO_3	Traces to 3
Silica	20 to 26
Magnesia	1 to 3
Loss on ignition	3 to 5

A mixture of the pure tricalcium silicate and tricalcium aluminate, $3CaO.SiO_2$, $3CaO.Al_2O_3$, would have the percentage composition :—

	Per Cent.
Lime, CaO	67·4
Silica, SiO_2	12·1
Alumina, Al_2O_3	20·5

Messrs. Newberry, of America, after a very careful investigation, arrived at conclusions somewhat different from Le Chatelier (see this J., 1897, page 1035). They prepared from pure materials the tricalcium silicate, and agreed with Le Chatelier that to this ingredient is due the hardening properties of cement, though it sets very slowly. A cement containing $2\frac{1}{2}$ molecules of lime to one of alumina was not sound, but one containing 2 of lime to 1 of alumina set quickly, showed constant volume and soundness, and good hardening properties. A mixture of pure tricalcium silicate and dicalcium aluminate, $3CaOSiO_2$ $2CaOSiO_2$, would have the per-centage composition :—

	Per Cent.
Lime, CaO	63·4
Silica, SiO_2	13·5
Alumina, Al_2O_3	23·1

A chemical analysis indicates whether a cement has a proportion of ingredients within these limits, but in other espects fails to give much information of its true value.

A report of a sub-committee of the New York Section of our Society was published in this Journal in 1902, on "Uniformity in Analysis of Materials for the Portland Cement ndustry." Admirable and full of details as that report is, t appears to me that the results obtained were not of such value as to warrant the expenditure of so much time and rouble. Further, some of the more important determinaions, and those in which there is doubt as to the most suitable method, were omitted altogether. I refer more especially to the determination of insoluble silica and clay, free lime, blast urnace slag, and other adulterants.

I fail to appreciate the necessity of drawing up a uniform cheme for the chemical analysis of cement, and the stimation of silica, lime, magnesia, &c.; but when we conider the mechanical and physical tests to which Portland ement should be submitted, I am strongly of opinion that a efinite and uniform method of procedure should be adopted. These tests are purely of an arbitrary and empirical character.

There is general agreement that in addition to a chemical nalysis the specific gravity, fineness, time of set, tensile trength and soundness, is required to enable a reliable udgment to be passed on a cement but it is in the method f carrying out these tests that chaos reigns. The determination of the specific gravity is simple.

Fineness.—This test is one of great importance and is ncluded in most specifications.

Though coarse particles have a certain value, fine grinding argely increases the adhesive power of cement, because of s greater covering power and the possibility of using a elatively larger proportion of sand. In finely ground ement, water attacks the free lime more readily and there less liability to unsoundness. The cement is also made uicker setting, but more thorough aeration will counteract his. There is no general agreement as to the sieves to be sed in testing for fineness. The American Society of Civil ngineers recommend three sieves 50 by 50 (2500), 76 by 6 (5776), and 100 by 100 (10,000), and while many ngineers are satisfied with a residue of not more than per cent. on a 76 by 76 some makers guarantee no residue o a sieve of this mesh and 15 per cent. on a 180 by 180. ttention has frequently been drawn to the gauge of the ire used in making the sieve but as yet no general greement has been arrived at. On the continent and in merica, the standard agreed upon is that the diameter of he wire should be half the width of the meshes. Thus a eve having 76 holes to the inch should be made with ire, one-third of a seventy-sixth of an inch, or 0·0044 in. = No. 41 standard wire gauge, and the holes should be qual to 0·0088 in.

Tables have been prepared showing the number of holes er linear or square inch, No. of British standard wire auge, size of wire, and size of hole. As there is no trouble n obtaining reliable sieves made according to this standard here is no reason why this method should not be universally dopted.

Soundness.—The tendency in cement to "blow" is attriuted to the presence of uncombined lime, and no reliable method has yet been devised of distinguishing the free from he uncombined. Fresenius attempted to measure it by an estimation of the alkalinity of water after being shaken with the cement, but the limits prescribed were abandoned after some years trial by the Association of German manufacturers as valueless.

Cement is entirely decomposed by repeated shakings with large quantities of water and ultimately the greater proportion of the lime can be dissolved in this way. In looking into this matter some time ago with a view to devising, if possible, a method for estimating free lime, a series of trials were made with glycerin. This liquid has a slight solvent action on calcium oxide and can be obtained free from water. An objection to its use is its great viscosity and the difficulty of filtering. The method of procedure adopted was as follows: 0·5 grm. of finely ground cement was dried and placed in a dry wide mouth stoppered bottle. To this 50 c.c. of glycerin was added and the bottle and contents heated to 40° C. for seven days shaking twice a day, on the seventh day 50 c.c. of 90 per cent. alcohol was added and the solution filtered, using a hot water jacketed funnel. The residue was washed with 90 per cent. alcohol, dried and weighed. The solution was diluted with water, a few drops of ammonia added, and the lime precipitated by ammonium oxalate in the usual way.

The results do not give much promise that the method is a satisfactory one by which to estimate free lime with any degree of accuracy, and it is, I fear, much too long and troublesome to be of general use.

Another of the methods of attempting to measure the free lime indirectly is by the rise of temperature on addition of water, but this rise is due to the crystallisation and setting of the mass, and the higher the proportion of lime, up to the limit of 63·5 per cent., which is in chemical combination with silica and alumina the more rapidly this will proceed, and the higher the temperature will rise—but this does not necessarily mean that the cement is a dangerous one to use. Experiments have shown that the rise of temperature varies also with the degree of fineness. A fine, quick-setting cement will show a marked rise of temperature in a very short time, due to rapid crystallisation, while a slow setting cement will only show a slight rise over a period of time, though the heat evolved may possibly be equal in both cases. In fact, at the present time there are no satisfactory chemical tests for free lime, and indication of its presence from rise of temperature is quite unreliable, so that we must have recourse to one of the methods in use for soundness to determine this factor. Here again the number of tests recommended are bewildering in their variety. In my opinion the boiling test is unduly severe. A cement which passes it—and there are many—can certainly be relied upon, but on the other hand it has been known to condemn cements which in after practice have proved entirely satisfactory.

By the Faija test a cement is put to a very severe trial and for all purposes is sufficient. It has been practised for more than 20 years, and is probably held in higher esteem now than ever.

The Deval test is probably worthy of more extended use in this country. After a long series of experiments he concluded that cold tests were no criterion of soundness, but that good cement briquettes with one to three of sand and immersed at 80° C. for two and seven days should be equal in strength to similar briquettes kept at the ordinary temperature for seven and 28 days. A cement containing any appreciable quantity of free lime would not stand this test. It is claimed that the temperature used in the Faija apparatus at 115° to 120° F., imparts an artificial age to briquettes, and it would be interesting and suggestive to know the results of tests of sand briquettes made with various cements kept at 120° F., for two and seven days with those tested in the usual way.

Tensile Strength.—While it is true that cement is used where resistance to compression is more important than resistance to tension, still the tensile strength is the test most in favour. This probably arises from the fact that such tests are much more easily carried out by simple and inexpensive machines, and that the resistance to compression is approximately ten times that of the tensile strength. Of all the methods in use to ascertain the value of cement, the manner in which this is carried out is most unsatisfactory. Considerable latitude is permissible as to the percentage of water, and the manner in which the briquettes are made, and two individuals using the same cement will often get greatly varying results, while a set of six briquettes made together by the same person will vary 100 lb. in 500.

To eliminate all question of the personal element, I am strongly in favour of the Arnold system of making briquettes, and that standard rules be prescribed as to the method of carrying it out. Every cement and every briquette is then tested under precisely the same conditions.

The method of using this process is as follows:—135 grms. of cement are weighed and placed in the mould on a tray; with the handle of a palate knife press down the cement and expel the air, level it off, gently tap it on the table to consolidate the mass, place the die in the mould, and submit to pressure till the top of the die is on a level with the top of the mould; this is usually done in a screw press. This manner of compressing the briquette is the least satisfactory feature of this method; by it, cements of low sp. gr. get a greater pressure than those of higher gravity, and are tested under more favourable conditions. It has been suggested to me that by means of a weighted lever all briquettes could be subjected to the same pressure and this would entirely do away with the difficulty. The section of the briquette would vary slightly, but, before breaking, this can be accurately measured and allowed for by calculation. After making the briquette, water at 60° F. is filled into the tray containing the mould. In 20 to 30 minutes the briquette is set and may be removed, but I have always allowed it to remain one hour in water. Under these conditions the cement will take up the exact quantity of water it requires, and no more. After the removal of the briquette from the mould it is weighed, and the percentage of water absorbed calculated The briquette is then placed in a moist atmosphere for 24 hours, and in water for six days or longer. I have always made it a rule to make three briquettes by this method of each cement sent to me, in addition, to hand-gauged briquettes. The results are more uniform, though usually lower than when hand-gauged and rammed, but not lower than when thumb-pressed. Briquettes made in this way undoubtedly "blow" more readily than when hand-gauged, and, with unsound cements, give less favourable results. As an example of the plan of working, I give an extract taken from the laboratory note-book:—

Number of Mould.	1.	2.	3.
Weight of cement taken in grms. pressed and kept in mould one hour	135	135	135
Weight when taken from mould ...	156·7	156·7	156·7
Water absorbed per cent.	16·07	16·07	16·07
Weight when taken from water ...	159·2	159·3	159·4
Water absorbed per cent.	17·9	18·0	18·1
Tensile strain in lbs., seventh day..	487	487	470

Briquettes made with the same cement gauged with 20 per cent. of water, broke at 381 lb.; gauged with 18 per cent. of water, the average of three broke at 487 lb.; gauged with 17 per cent. of water, which was the correct quantity, broke at 552 lb.

With another quick-setting cement, three briquettes each were made as follows:—Briquettes made by hand-gauging and rammed with the handle of the trowel, with 22 per cent. of water, average result, 387 lb.

Briquettes pressed in with thumbs, gauged with 22 per cent. of water, average 249 lb.

Briquettes made by Arnold method: water absorbed, 17·6 per cent., 460, 459¼, 452; average, 454.

A third cement: briquettes made by ramming gave an average test of 1,110 lb., but thumb-pressed only 905 lb.

Where such discrepancies are possible, and no indication is given in the specification as to how the briquettes are to be made, a uniform system of testing is much to be desired. In Germany, the sand test is always specified, and is much to be preferred to the neat test, which gives the cohesive power of the cement only, whereas the sand test indicates its adhesive or cementing value, and also the presence of adulterants.

There is, undoubtedly, a strong suspicion abroad that much cement adulterated with slag is sold, and that considerable quantities are put on the market with a large percentage of ragstone.

The use of ragstone is defended by certain manufacturers, who maintain that such addition increases the tensile strength; but it has been conclusively shown by the researches of Messrs. Stanger and Blount (this J., 1897, p. 853), that ragstone is not a cementitious substance, and a sound cement is weakened by its addition, though unsound cement may be temporarily improved by its addition. Most users of cement accept this view and are desirous of some means whereby the presence of an adulterant can be detected. Side by side with an analysis of cement is here placed the composition of the commoner adulterants:—

—	Portland Cement.	Ragstone.	Hassock.	Blast Furnace Slag.
Silica	20 to 26	4 to 10	62·6	30 to 35
Iron and alumina oxides	7 ,, 14	1·5 ,, 3	1·4	30 ,, 35
Lime	60 ,, 65	45 ,, 50	16·3	24 ,, 30
Water and carbon dioxide	1 ,, 3	36 ,, 40	11·7	..
Magnesia	1 ,, 3	0·5 ,, 1	0·5	..
Specific gravity	3·1 ,, 3·2	2·5 ,, 2·7	2·36	2·85

Experiments have shown that admixture with such an adulterant materially reduces the strength of the sand briquettes, but here also it is not possible to state absolutely whether any admixture is the cause, and, if so, to what extent. It was thought that if some rapid and fairly accurate method for the separation and estimation of ragstone could be devised it would prove useful to the trade. The most successful method of detecting adulteration with ragstone has been by a microscopic examination, but during an investigation into this matter it occurred to me that a method based upon the difference of the sp. gr. of ragstone and cement might possibly be devised. It is well known that a very complete separation of the various mineral constituents of rocks can be made by agitating the finely-ground material with a fluid of a less gravity than the heavier constituent, and a greater gravity than the lighter ones. The sp. gr. of a Portland cement should not be less that 3·1, while that of ragstone is 2·6 to 2·7. If then a mixture of these two substances be agitated in a fluid of a density intermediate between these figures a separation should be effected. It was not only necessary that the liquid be of suitable gravity but that it would not dissolve or react on the cement, and after consideration the fluid selected was bromoform, sp. gr., 2·853. This was tried, but on agitating violently in a test tube, it was found that no satisfactory separation took place, much of the material remaining suspended in the fluid even after long standing. It was thought that this might be owing to the presence of moisture, so the experiment was repeated with perfectly dry material, but with no better result.

With a view to assist the separation it was thought that "whirling" in a centrifugal might be of use. Small quantities of known mixtures of finely-powdered ragstone and cement were placed in a sediment tube with a measured volume of bromoform, and, after thorough agitation, whirled for a short time; as this appeared to give promise of satisfactory separation, systematic experiments on these lines were instituted. Samples of mixtures of known proportions of three ragstones marked, respectively, R., G., and B. were then made with a cement.

Each were carefully ground together, passed through a 90 by 90 sieve, again ground and dried. They were then shaken up with bromoform and whirled for three minutes. The mixture separated quite readily, at the bottom of the tube was a compact layer of cement, then a nearly clear layer of bromoform, and finally the ragstone floating on the surface. This was decanted on to a small filter, the bromoform after filtration being ready for use again. The filter paper and contents were dried over a low argand flame, the paper burned off, and the ragstone weighed. The first series of results were all too low, some of the ragstone being apparently carried down by the heavy cement, it was therefore decided to try the effect of whirling three times, decanting off the ragstone after each whirling, shaking up with clear bromoform, and whirling again. The following were some of the results obtained per cent. :—

Cement.	Ragstone.	Ragstone recovered.
80	R. 20	19·4
90	10	11·9
80	G. 20	19·1
75	25	25·1
70	30	30·0
95	5	6·5

With mixtures of 10 per cent. or less of ragstone there appeared to be a proportion of cement carried up with it. It was thought advisable, therefore, to try a number of experiments with cements of guaranteed purity, and this was done with the following results :—

Cement 1.	Per cent. of floating matter	3·4
„ 2	„ „	2·2
„ 3	„ „	2·2
„ 4	„ „	3·1
„ 5	„ „	5·3
„ 6	„ „	5·0
		per Cent.
Ragstone		94·9
		94·4

Many other trials were made, all cements showed a small quantity of floating matter, but ragstones and hassock floated entirely. These losses are apparently due to particles of the ragstone adhering to the side of the tube, and probably a slight loss on ignition. A sample of cement said to be adulterated was tried with the following results :—Floating matter per cent., 16·9, 15·4, 16·5. This floating matter was tested and found to contain 16 per cent. of carbon dioxide. As this was too low for ragstone it appears probable that the separated material contained an admixture of cement.

To determine whether this was so or not a number of the tests were repeated with known proportions of cement and ragstone, and a partial analysis made of the floating matter. The following is a typical result :—

—	Cement.	Ragstone.	Floating Matter.
	80 parts.	20 parts.	22·5 parts.
Silica	22·80	6·35	11·5
Iron and alumina oxides	11·70	1·40	3·3
Lime	61·40	49·50	51·2
Loss on ignition	0·44	40·20	31·8

The results confirm those previously made, and the general conclusions to which I have arrived are that all cements contain a proportion of inert matter which may readily be estimated in this way, but which should not exceed 5 per cent.

By it an approximate estimation or separation can also be made of added substances such as ragstone, and the adulterent can be collected, weighed, and submitted to partial analysis to ascertain the composition. So far experiments have been made with only one liquid, bromoform, but I propose to continue them with liquids of greater density, 3·0 to 3·05, and, if possible, make a more complete analysis of the separated products.

Yorkshire Section.

Meeting held at the Midland Hotel, Bradford, on January 25th, 1904.

MR. JAS. E. BEDFORD IN THE CHAIR.

ESTIMATION OF CANE SUGAR, LACTOSE, &c., IN MILKS, &c.

BY F. W. RICHARDSON AND ADOLF JAFFÉ.

The disaccharide or biose known as lactose or milk-sugar, manifests some very peculiar properties when its solutions are examined in the polarimeter. When freshly dissolved in water at 20° C. the lactose anhydride gives a rotation of +88° to the polarised ray ; in 24 hours the rotation sinks gradually to the normal degree +52·53°. A, B, and γ forms give respectively +88°, +25·3°, and +36·2°. The very abnormal "γ" modification can be made by quickly evaporating a 20 per cent. to 30 per cent. solution of the ordinary "A" form, and drying the residue at 98° C., till quite free from water of crystallisation. The analyst finds it very necessary to make himself acquainted with these multirotative properties of lactose. The ordinary, or "B" form, is the stable variety with which the chemist has to deal, and may be produced by mere boiling of the solutions of milk sugars, or by allowing them to remain at the ordinary temperature for 24 hours.

Nine eminent observers have given as many different values for the rotatory power of lactose. As extremes we may mention Hoppe-Seyler's 51·18°, and Pogginle's 54·20°. The average figure of the nine is 52·65°. Schmoeger seems to us to have given the correct degree, +52·52° for lactose hydrate, $C_{12}H_{22}O_{11}. + OH_2$, as we obtain an average of 52·5° for the purest crystalline lactose we can procure.

A remarkable, and to the analyst a very satisfactory feature of lactose is the scarcely perceptible change its polarimetric powers undergo when its concentrated solutions are diluted. Strength of solution is a most important factor with carbohydrates generally, and with nearly all bodies which exercise a rotative influence upon polarised light. We confirm Schmoeger that the $[\alpha]_D$ of lactose at 20° C. is 52·5 for solutions of 2·5 to 12·5 per cent. concentration. As we employ 86° C. in the method to be described we have determined the $[\alpha]_D$ of lactose at this degree and find it to be 49·0—a result in harmony with Landolt's temperature formula —

$$A_T = A_{20} \times \frac{1020 - T}{1000}$$

(Landolt's "Das Optische Drehungsvermögen," &c., 1898, p. 533), which gives 49·04.

In general our conclusions as to copper methods are :—

(1) Despite all its defects no other metallic solution gives results at all as comparably good as Fehling's.

(2) Ost's copper solutions are altogether too unsatisfactory.

(3) Glycerine may replace Rochelle Salt in Fehling's solution with some very slight advantage.

(4) Wein's mode of applying Fehling's copper solution, *i.e.*, short boiling in porcelain dishes, gives better results than Brown, Morris, and Millar's process of heating in covered beakers in the water bath for 12 minutes.

(5) Collection of the cuprous oxide on asbestos, and reduction by hydrogen in tubes is open to several objections, and at the best gives no better results than our own modified method of receiving the oxide on double Swedish filters washing well and then using 25 c.c. of a one-tenth per cent. solution of tartaric acid, finally incinerating directly and weighing the cupric oxide.

(6) Pavy-Fehling's solution is altogether too weak, 1 c.c. being equivalent to only half a milligram of dextrose, and gives too erractic results with lactose and inverted sucrose solutions ; Messrs. Stokes and Bodmer (Analyst, 1885, p. 82, &c.) notwithstanding. With as much as 100 c.c. of

Pavy-Fehling solution should 25 c.c. of the sugar solution be required for reduction, and less should not be used if reasonable accuracy is required, one would have to use only a one fifth per cent. solution of the reducing sugar.

Apart from the question of excessive dilution, Pavy-Fehling's copper solution mostly gives an end reaction not easily discernible and often misleading.

(7) Fehling's copper solution gives very unreliable results when applied *volumetrically*, even when the colour of the solution does not interfere with the application altogether.

(8) Fehling's copper solution applied gravimetrically never gives data sufficiently accurate to meet with the requirements of theory, and mostly supplies only roughly approximate approximate results.

The reasons for these obliquities are not far to seek, and we may summarise them in brief :—

(*a*) Unstable equilibrium of organic solutions in alkaline copper solution.

(*b*) Powerful action of caustic alkalies, particularly in boiling solutions, upon carbohydrates, producing saccharic and mucic acids and other oxidation products.

(*c*) Necessity of using a known strength of the reducing sugar solution. Wein's and other chemists tables show how concentration affects copper reducing power.

(*d*) Disturbing influence of non-reducing organic substances, *e.g.*, sucrose, upon the copper reducing power of a sugar. (Wein's tables for mixture of sucrose and invert in varying proportions prove this).

(*e*) Influence of temperature; time required to heat to 212° F., and for boiling the mixture.

(*f*) Great variations due to the use of differing amounts of copper.

For our experiments we used Merck's purest dextrose and lactose which were found to be 92 per cent. and 98½ per cent. pure respectively by combined polarimetric and copper-reducing methods, associated with the results of fermentation. With these sugars our own experiments show :—

Ratio of CuO precipitated to CuO added as "Fehling."	Dextrose actually present.	Dextrose found.
	Per Cent.	Per Cent.
1 : 5·15	92·0	104·00
1 : 2·93	92·0	92·10
1 : 1·56	92·0	89·10
	Lactose actually present.	Lactose found.
1 : 6·60	98·5	104·24
1 : 3·34	98·5	94·70
1 : 1·75	98·5	92·30

For the estimation of lactose and sucrose in the presence of each other, one is advised to get the copper reducing value before and after inverting with 2 per cent. of citric acid, boiling for 10 minutes.

Unfortunately lactose and invert sugar when present in mixtures do not react in the aggregate towards alkaline copper as one might assume from the sum of the sugars present. Doubtless one might work out the value of any particular mixture and construct some sort of a table; but the need of such a procedure proves the unsatisfactory character of the general method.

It may be necessary to estimate starch sugar in condensed milk; one must be therefore prepared to determine dextrose in the presence of lactose. We have made mixtures of these sugars and have compared the results with those obtained under the same conditions with the same strength and same volume of lactose and dextrose solutions taken separately, using similar amounts of Fehling's copper solution.

Our results prove that the mixtures do not give the same weights of CuO as the sum represented by the reducing powers of the constituents would occasion us to assume. The differences appear small, but they are really large enough to vitiate the accuracy of the analysis to a very marked extent. When sucrose was added the weight of copper oxide obtained was large enough to render the data quite useless.

We wish to protest strongly against the arbitrary fixation of copper reducing powers for sugar. If we turn to standard works on chemistry and analysis we find the copper oxide value of lactose given as 1·736 per grm., while 2·20 has been fixed for dextrose.

Wein's tables show us that the copper oxide values may vary from 1·632 to 1·746 for lactose, and from 2·06 to 2·460 for dextrose. It would not be difficult to show the utter absurdity of relying upon any such fixed factors for calculating the composition of a mixture of reducing sugars.

Having failed to find a really reliable chemical method we turn to polarimetry to help us out of our difficulty. To our Schmidt-Haensch instrument we have added a water-jacketed 2-dcm. observation tube; by means of this and a vessel of water and a thermo regulator, we can readily ascertain the rotatory power of our carbohydrate solutions at any degree from 0° C. to 100° C.

When sucrose, *i.e.*, saccharose (pure cane or beet sugar), is heated at 70° C. in solution with an addition of 10 per cent. of the volume of pure hydrochloric acid for seven minutes, complete inversion is effected. We have often confirmed this method of Herzfeld—

$$\underset{\text{Saccharose.}}{C_{12}H_{22}O_{11}} + OH_2 = \underset{\text{Lævulose.}}{C_6H_{12}O_6} + \underset{\text{Dextrose.}}{C_6H_{12}O_6}$$

average of—

$$\frac{-92{\cdot}9 + 52{\cdot}5}{2} = 20{\cdot}2$$

for "invert sugar" in this manner 1 part of sucrose furnishes 1·0528 grms. of a mixture of equal parts of lævulose and dextrose with a rotatory power of − 20·2, under specified conditions of temperature and concentration of solution. If the temperature be raised from 20° C. to 86° C., the polarimetric reading of invert solution becomes nil. For every elevation of one degree centrigrade lævulose loses about seven-tenths of a degree of rotatory power and at 86° C. the minus reading sinks until it is equal to the plus reading of the dextrose. For the analysis of a pure solution of sucrose and invert sugar, we have, therefore, a twofold polarimetric method based upon the following determinations :—Reading of the original solution at 20° C. and at 86° C., and reading of the inverted solution at 20° C. We find that at 86° C. the $[\alpha]_D$ of sucrose is 63·05 instead of 66·5 at 20° C. Therefore any *plus* reading of the original solution at 86° C., divided by 0·6365, at once gives the amount of sucrose. We find that in 10 per cent. solutions at 20° C., the rotatory power of invert sugar is uniformly − 20, a convenient figure to work with and remember.

One grm. of pure sucrose furnishes 1·053 grms. of invert with a reading therefore of − 0·20 × 1·053 = − 0·2106. The 1 grm. of sucrose has disappeared, and with it a plus reading of 0·665: therefore, every grm. of sucrose on inversion occasions a reduction in rotatory power of − 0·2106 + − 0·665 = − 0·8756.

Any diminution of the plus reading affected by Herzfeld's inversion process is divided by 0·8756 to obtain the percentage of sucrose. Knowing this and the rotatory value of the original solution it is easy to calculate the percentage of sucrose and invert.

The following are a few results obtained by us from the use of the latter method :—

—	Present.	Found.
Sucrose	3·41 3·96 4·92	3·27 3·81 4·96
Invert	12·69 12·60 3·32	12·32 12·60 3·19

Working at a temperature of 86° C. the process gave even more satisfactory results, and it will be admitted that these percentages are as accurate as we have any reason to desire, *i.e.*, in commercial or industrial analysis.

Having obtained such good results with mixtures of invert and sucrose at 86° C., we applied the same process to solutions containing sucrose and lactose. As an example of the method and the calculation we submit the following: 25 c.c. + 0·5 c.c. of strong hydrochloric acid heated to 187° F. gave 20·0° in a 2-dem. tube.

$$\frac{25 \cdot 5}{25 \cdot 0} \times 20 = 20 \cdot 4$$

for the original solution, or 10·2° in 1-dem. tube. 10·2° × 0·3466 = 3·537 $[\alpha]$. 3·537 $[\alpha]$ ÷ 0·49 (factor for lactose hydrate at 187° F., as above stated) = 7·22 per cent. lactose. Reading of the original solution in 2-dem. tube at 20° C. = 62·5 = 31·25 in 1 dem. = 10·84 $[\alpha]$.

$[\alpha]$ of original solution at 20° C.	10·84
$[\alpha]$ of lactose found, 7·22 × 0·525 at 20° C...	3·79
$[\alpha]$ of sucrose in original solution at 20° C.	7·05

7·05° ÷ 0·665 = 10·6 per cent.

——	Present.	Found.	Error.
Sucrose......................	10·58	10·60	+ 0·02
Lactose......................	7·10	7·22	+ 0·12
	17·68	17·82	+ 0·14

These results leave little to be desired.

How to apply the process to milks and condensed milks was the next question. Milk albumin in various solvents has a lævo-rotatory power of −76 to −91. It is therefore essential that these albumens should all be removed before taking the polarimetry of the serum. Wiley has tried several albuminoid precipitants and coagulating substances, but has decided in favour of a solution of mercury in nitric acid. Basic-lead acetate in excess causes a decrease of the rotatory power. Wiley found, as we are also surprised to find, that excess of the acid mercury nitrate solution has not the slightest effect on the readings.

Wiley uses an ingenious double-dilution method to dispose of the volume of the mercury precipitate. If the same weight of milk, after precipitation with mercury nitrate, is made up to 100 c.c. and 200 c.c. respectively, the rotatory powers of the filtrates should furnish the necessary data for the calculation of the volume of the mercurial precipitate, on the basis of $(200 - X):(100 - X)::a:b$. Where X = volume of precipitate, and a = reading of the single dilution, and b = reading of the double dilution. The correct reading according to Wiley = $\frac{ab}{a-b}$.

H. D. Richmond and L. K. Boseley have severely criticised Wiley's formula. Certainly numerous results of our own throw considerable doubt upon the correctness of $\frac{ab}{a-b}$.

Dr. P. Vieth assumes that the proteids in milks rarely ever vary more than from 3·5 to 4·0 per cent., and finds that for these the volume of the mercury precipitate is approximately 3 c.c.

Richmond and Boseley use Vieth's estimate and determine the percentage of fat (which may be calculated with sufficient accuracy from the gravity and total solids): an operation easily affected by one of the many modifications of Babcock's centrifugal process. Every per cent. of fat gives 1·11 c.c. volume of precipitate plus 3 c.c. for the proteids; therefore to every 100 c.c. one should add 3 c.c. of mercury nitrate solution and 4½ c.c. of water. The filtrate should give a reading reasonably representative of that of the milk itself.

We find that the acid mercury nitrate solution completely inverts sucrose when the solution is heated to 86° C.; it is therefore only necessary to place some of the filtrate in the 2-dem. jacketed tube and get readings at 20° C. and 86° C. to enable one to estimate the lactose and sucrose. If to a solution of sucrose one adds 2 per cent. of citric acid and heats to boiling for 10 minutes (as recommended by Stokes and Bodmer) or heats in a boiling water bath for 30 minutes (as advised by E. W. T. Jones) complete inversion results. Under the same conditions lactose remains quite unaffected. We have abundantly proved the accuracy of these statements.

Our method is simpler, as one has only to take the readings at 20° C. and 86° C. in the water-jacketed tube.

Lactose, Sucrose, and Glucose (Dextrose) in Milks, &c.—As starch-sugar is now so extensively used and is such a cheap commodity it is quite probable that it may be found in condensed milks; we should then have to deal with a mixture of three sugars and possibly some dextrins; we say "possibly" because we have met with starch-sugars quite free from dextrins, as proved by the alcohol test. Unfortunately the osazone process is not of much service; for although lactosazone is more soluble than glucosazone, the difference is not sufficiently great to allow of a quantitative separation.

We have shown that with mixtures of lactose and glucose in the presence of sucrose the copper methods are quite unreliable. The process we are perfecting is based upon the very different changes which the three sugars exhibit when heated in solutions containing 10 per cent. of the volume of hydrochloric acid. After three hours at 100° C. the glucose has suffered a little change, owing to the formation of mannose and other substances. The reading has increased for the lactose solution as the molecule has split up into galactose and dextrose. With $[\alpha]$ 80·21 for galactose and 52·9 for dextrose we obtain an average of $[\alpha]$ 66·55 for the mixed sugars; as 1 grm. of lactose produces 1·0528 grms. of these carbohydrates on hydrolysis it should produce an equivalent $[\alpha]$ of 1·0528 × 66·55 = 70·0. We find only 64·0, as similar changes to those occurring in the case of glucose have no doubt occurred.

Sucrose solutions when boiled with 10 per cent. hydrochloric acid first produce invert sugar, of which the levulose portion soon commences to carbonise. With sufficient boiling all the levulose disappears and only glucose remains; indeed, after three hours, we find this change has taken place. Unfortunately the results so far have been wide of what theory would assume For the sucrose used + 15·1 $[\alpha]_D$ was found instead of + 26·45 $[\alpha]$ the figure expected. We are trying to obtain constants for the three sugars; even should these not be in harmony with theory; with such constants we could readily calculate the composition of the solution containing the three sugars. Other workers may possibly offer elucidation of this subject.

Our best thanks are due to Mr. Donald Levy and also to Mr. Walter Mann for conducting a number of the experiments upon which our conclusions are based.

Discussion.

The Chairman referred to the practical importance of the paper, in which the question was attacked by both chemical and optical methods, of which the optical method appeared to have the great advantages of rapidity and cleanliness. The purity of certain foods and especially of the different varieties of condensed milks, were dependent on researches such as those of Mr. Richardson and his colleagues.

Mr. Fairley referred to the great advantage a physical method possessed when only a small quantity of the substance was available for analysis, as in many cases no destruction of the material took place.

A member suggested that the "blueing" of the filter paper was brought about by the paper becoming mercerised with strong caustic soda, then taking up and combining with a portion of the copper, and that the washing with tartaric acid according to Mr. Richardson's method decomposed any compound thus formed, and enabled the paper to be more thoroughly washed.

Mr. Richardson said that ordinary filter papers were practically pure cellulose and a fine texture was necessary to obtain a clear filtrate. To carry out the process a large excess of copper was necessary, and he had not found any filter paper which did not turn blue.

Meeting held at Leeds, on February 22nd, 1904.

MR. JAMES E. BEDFORD IN THE CHAIR.

THE TREATMENT OF SEWAGE BY BACTERIA.

BY W. J. DIBDIN, F.I.C., F.C.S., ETC.

In responding to the invitation of the Yorkshire Section of the Society of Chemical Industry to introduce a discussion on the present position of the important question of the disposal of sewage by bacterial agency, I do so with much pleasure, especially as in no other district has the question been more ably or enthusiastically taken up with the view to ascertain the most economical and reliable means of applying this now generally recognised method of sewage purification.

From the work which has been done in the past it is perfectly clear that there is no difficulty in obtaining effluents of excellent quality by the final treatment of the partially purified sewage on either bacteria or "contact" beds, or on trickling filters on which the liquid is distributed by one of the various forms of rotating sprinklers. By either method or by various modifications of these the final work may be equally well accomplished. The great desideratum is an equally effective and simple method of primary treatment of the raw sewage in such a manner as will effectually and economically meet the sludge difficulty. In the following observations I propose to confine myself to this point.

When the original bacterial installation on working lines was started at the Northern Outfall Works of the London County Council under my direction in 1892 the sludge was first removed from the sewage by preliminary treatment with lime and iron in the proportions of about 4 grs. of lime to 1 gr. of ferrous sulphate per gallon of sewage, followed by settlement in tanks.

When I introduced the coarse-bed treatment at Sutton as a preliminary to the second or fine bed, it was with the object of ascertaining how far the bacterial agency was capable of disposing of the suspended organic matters and thereby avoiding the necessity of chemical treatment. The result was that the organic matters were so far destroyed or altered in character that they no longer formed the foul abomination denominated sludge, and that the resulting effluent was in many cases sufficiently pure for direct treatment either on land or for discharge into streams having a sufficient flow, while, if passed through the second or fine bed the effluents were sufficiently pure to be passed direct into any inland brook.

The difficulty experienced with the ordinary coarse, or "first contact" bed, in those cases where the crude sewage was turned direct on to it, was that the interstices between the particles of coke or clinker, &c., became filled with the finely divided matter in the sewage and the carbonaceous residuum from the bacterial action on the organic matters.

I have always felt that notwithstanding the expense entailed in turning over the material in the coarse bed from time to time and occasionally changing it for a standbye quantity which had been weathering, the coarse bed system does indeed go further to solve the problem of the inoffensive disposal of the sludge than any other known method.

Take a case in point, at Alton, Hants, where about 33 per cent. of the dry weather flow is brewery refuse. The filling material in the coarse beds had to be changed after three years' work. The cost of labour was 1*s.* 2*d.* per sq. yd. or, say, 5*d.* per yard per annum. The fine beds, equal to 830 sq. yds., had treated 160,000 gallons daily plus subsoil water. This quantity is equal to over 200,000 gallons per yard, so that five yards would have treated one million gallons, the cost for which for renewing the material in the beds from a reserve supply would be 5*s.* 10*d.*

The adoption of a grit or detritus tank for the purpose of intercepting the mineral matters and those of a more resistant organic character has been very successful in prolonging the life of the coarse bed, while the septic tank, introduced by Mr. Cameron at Exeter, is undoubtedly effective in this connection.

Unfortunately, however, both these contrivances still leave a quantity of sewage sludge to be disposed of. The septic tank especially, whilst the effluent from this tank does undoubtedly give rise to objectionable emanations, and no little evidence is forthcoming to the effect that it is better to prevent, if possible, the sewage undergoing putrefactive decomposition before passing it on to the grass land, or on sprinkling filters. These experiences entirely support the view that I have always held, and do still hold most strongly, viz., that the sewage should never be allowed to undergo putrefaction, but should be collected and treated in as fresh a condition as possible. I admit at once that the tank methods are convenient at first sight as they may save a little trouble. Let there be a grit or detritus tank to prevent the mineral matters going on the beds, but I submit that the moment putrefaction starts in this tank it should be cleaned out.

The question next arises as to what can be done to either prevent the putrefactive action in the tank whether "septic" or "grit," or to increase the efficiency of the coarse or first contact bed. On turning to the two admirable reports by the Corporations of Manchester and Leeds we find the question as to causes of loss of capacity of contact beds fully discussed. Summarising these, it is found that the chief causes of loss of capacity are the following:—

(*a*) Settling together of the material.
(*b*) Growth of organisms.
(*c*) Impaired drainage.
(*d*) Insoluble matter entering bed.
(*e*) Breaking down of material.
(*f*) More organic solids entering the bed than it can can digest.
(*g*) Soluble matters being rendered insoluble by the action of the beds, as for instance, iron salts.

After reviewing these points the Leeds report continues: "If, therefore, contact beds are to be used for Leeds sewage in future the problem will be—

"1. To find a material of perfectly even size not liable to degradation.

"2. To reduce as far as possible the solid matters put on to the rough bed.

"3. To exclude and treat separately the iron liquors. Another point suggests itself, whether it would be possible to construct a bed in such a way that the undigested or indigestable solids shall be expelled from the beds with the effluents."

We have here the question fully set out. With a view of suggesting how the various points may be successfully met and inviting discussion thereon, I submit the following considerations:—In the case of a coarse bed filled with coke or clinker, &c., we have a number of solid particles presenting only an outer surface, the interior of the particle occupying space to no purpose. On consideration it occurred to me that this interior space could be utilised by employing a material of hollow form so that it would present an interior as well as an exterior surface on which the bacteria could grow, whilst the interior space would largely increase the water content, or working capacity of the bed. These considerations induced me to think of agricultural drain pipes as suitable, but the cleansing of the interior of the pipes presented a difficulty. Then the obvious question followed, What is a pipe but a bent plate? Cut your pipe down its length and the thing is done. At once we have the interior and exterior surface, facilities for cleansing, and the working content of the bed increased as desired. With this view I requested Mr. Hamblet, of West Bromwich, to make me some trial tiles having ridges on their under surface so as to separate them from each other. According to the depth of these ridges, so will be the water capacity of the bed. Thus, if they were 1 inch deep and the thickness of the tile half an inch, the water capacity will obviously be two-thirds or 66 per cent. In the case of a new coarse coke bed the initial water capacity will be about 50 per cent., which soon becomes reduced to about 33 per cent., by one or more of the causes mentioned above, particularly to the breaking down and settling of the material together, inducing impaired drainage, which would be entirely avoided by the use of suitable flat plates supported at intervals.

As an alternative to the use of tiles I may instance an experimental installation at Devizes in which waste slate *débris* is used under the sanction of the Local Government Board. The slates vary in size from about 1 ft. to 3 ft. super., and average about $\frac{1}{4}$ inch thick. They are supported about 1 in. apart by small slate blocks. This arrangement gives no less than 80 per cent. of water capacity to the beds, thereby doubling their effective working capacity as compared with coke, &c. In fact the bed at Devizes is exactly one-half the size of the fine bed into which it discharges, with the result that the cost of construction of an installation is reduced 50 per cent. The slate *débris* from the hard slate refuse at Blaenau Festiniog, in North Wales, is obtainable in practically unlimited quantity and a great variety of sizes. By the use of such tiles or slates or other similar material the chief causes of loss of capacity are overcome. To take these seriatim as before—

(*a*) The material will not settle together.

(*b*) The growth of organisms will take place on both surfaces of the slates or tiles and will not choke the spaces between as in the case of coke, &c.

(*c*) The drainage cannot be impaired.

(*d*) The insoluble matter (grit, &c.) can be kept off the bed by the use of a grit tank, or, if it gains access, can be removed from such surfaces by flushing, &c.

(*e*) The material will not break down.

The accompanying diagrammatic plan and section shows the arrangement proposed for the disposition of the slates or tiles. The top layer should be laid overlapping in such a manner that it forms an automatic screen by the junction of the edges through which the finer divided matters can pass to the under layers. The fibrous and coarser matters being retained on the top layer of slates, may from time to time be swept to the further end of the bed, which is raised above the water level, where they may thoroughly drain before removal. The wide channel receiving the sewage will act as a grit chamber as in the Carlisle installation which I designed in 1899. The sewage will flow over the weir-lip of this channel on to the slates and thereby become aerated.

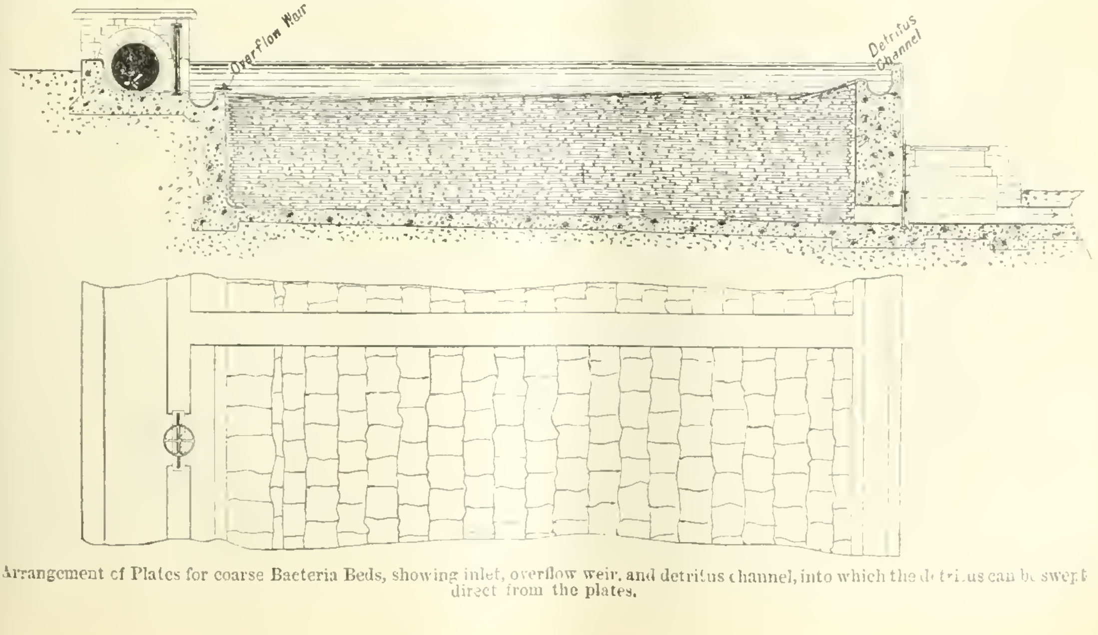
Another point is that as the sewage gradually fills the bed films of air will be retained on the under surface of each plate. If this film is only one-fiftieth of an inch thick and the intervals between the plates 1 in., the quantity of oxygen so retained will be sufficient to thoroughly aerate the sewage, for instance, each gallon of sewage will dissolve about 2 cb. in. of oxygen, which will be contained in 10 cb. ins. of air. Two cubic feet of bed capacity of 50 per cent. will contain $6\frac{1}{4}$ galls., which will accordingly have to be supplied with $62\frac{1}{2}$ cub. ins. of air. The plates in 2 cub. ft. of such a bed will present a total underneath area of 144 × 24 = 3,456 ins. super. If the film of air retained under this surface be only of an average depth of one-fiftieth of an inch the total film of air so retained will be equal to 69 cb. ins. This quantity is in addition to that which will be already dissolved in the sewage and mechanically held in suspension as the water flows over the weir on to the plates.

The following analyses of samples of sewage put on to a slate bed in which the layers of slate are about 2 ins. apart, and of effluents obtained therefrom, will serve to indicate the nature of the work accomplished :—

Slate Bed with Layers 2 ins. apart.

No. of Filling.	Sewage. Alb. NH_3.	Effluent. Alb. NH_3.	Percentage Purification effected.	Suspended Matters in Effluent.
	Grains per Gallon.	Grains per Gallon.		
2	0·804	0·668	17	None.
4	0·675	0·546	19	,,
5	0·910	0·740	19	,,
6	1·160	1·020	12	,,
7	0·945	0·840	11	,,
8	0·803	0·735	8	,,
10	1·400	1·310	6	,,
24	0·791	0·472	40	,,
26	0·402	0·360	10	,,
30	0·889	0·427	52	,,
32	0·486	0·206	57	,,
33	1·085	0·504	53	,
42	0·787	0·381	51	
43	1·015	0·525	48	
44	0·980	0·490	50	,,
45	0·891	0·460	48	,,
46	1·295	0·402	69	,,

From these results it will be seen that as the deposit of sewage matters became more thoroughly charged with bacteria, the efficiency of the bed increased until it was fully equal to that of a coke bed in regard to the effect on the nitrogenous matters of the sewage, whilst the capacity of the bed was equal to double that of a coke bed of similar size.



Arrangement of Plates for coarse Bacteria Beds, showing inlet, overflow weir, and detritus channel, into which the detritus can be swept direct from the plates.

Discussion.

The Chairman said he considered that the principle of the process a good one, because it found use for slate which would otherwise be wasted. The area occupied by these beds was only one-half of that required for the usual installations, and this was another important point which favoured the method described. The whole subject of sewage purification was of great importance, especially to a town situated as Leeds was, with a river flowing through it containing unpurified sewage from towns higher up the stream. Authorities ought to be compelled to remove objectionable matter from sewage before allowing it to pass into a stream.

Mr. Jones (Yorkshire Fisheries Board) mentioned a case of contamination which was going on through the circulation of unpurified sewage. It was only one instance of many similar cases, and he was sorry that his board had not been able to deal with the responsible authorities in a proper manner.

Dr. H. Maclean Wilson (West Riding Rivers Board) said that it was now recognised that any kind of sewage could be purified by one or other of the several bacterial methods which were in use. He agreed with the author of the paper that there was no need to allow putrefaction to take place in the sewage before its application to the bacteria beds. Although the bacteriological treatment of sewage was first looked upon with some reserve, it was now admitted to be one of the best methods of purification. At the Knostrop Sewage Works they were able to produce a pure effluent 20 minutes after the sewage arrived at the works, thus showing the rapidity of the purification by bacteria. An ideal contact bed is one that offers the largest amount of surface of material with the largest water capacity. The beds described by Mr. Dibdin possessed this advantage, and this commended them to him. He thought it necessary to have detritus tanks, although the lecturer did not use them.

Dr. Cheetham (M.O.H., North Riding of Yorkshire) thought that some inexpensive method of treatment would be appreciated by authorities which were unable to expend large sums of money on sewage works. Mr. Dibdin's method had the advantage of being more economical than other processes.

Dr. Evans (M.O.H., Bradford) asked what kind of sewage had been used in the experiments at Devizes.

Mr Oscar J. Kirkby supported the use of septic tanks. When the sewage putrefies, one half of the work of purification is done.

Mr. E. W. Dixon (Harrogate) thought that although the water capacity in a bed made of slate slabs was greater than in one of honeycomb slag, yet the surface available for oxidising was greater in the latter case. He asked whether the sediment which deposited on the slabs of slate interfered with the action of the bacteria on that surface. He also inquired what was the relative superficial area of a slate bed compared with a coke bed.

Dr. J. Spottiswoode Cameron (Medical Officer of Health, Leeds) said if the slate bed got rid of the difficulties of the present coarse bed on the contact system and the septic tank could be got rid of altogether, he thought that it would be an advantage. He asked the lecturer if the slate bed could be used with a sprinkler. He congratulated Mr. Dibdin upon the improved prospect of his contact beds. This matter was, however, rather an engineering one. He had hoped to have heard something more upon the chemistry of the effluent. He was anxious to know what became of the bacterial products in the effluent. It was an interesting inquiry whether products of an alkaloidal nature, allied to the ptomaines which they were accustomed to in the body, were not generated by the bacteria in the tanks, and whether they did not pass away in the effluent. Some of them might naturally be of a poisonous character, and he rather hoped that this matter would have been dealt with. Even typhoid germs themselves might pass through bacterial beds with comparatively little change. He congratulated the Society upon having secured a paper from Mr. Dibdin, who, although a chemist, had like another distinguished chemist (M. Pasteur), largely discarded chemistry for biology. The success of the bacterial process of sewage treatment was largely due to Mr. Dibdin.

Mr. T. Fairley pointed out one great advantage of this method of treatment which previous speakers had overlooked. This was the easy way in which a slate bed could be cleaned when necessary and restored to its original condition, the only expenditure incurred being the cost of labour to carry out the cleansing. This would be the only cost for the maintenance of the bed.

Mr. W. J. Dibdin, in replying, said that he did not wish to deny the value of septic tanks where they were found to be useful, but personally he did not approve of them. One great disadvantage was the production of objectionable odours. He could not say that ptomaines were produced during the putrefaction of the organic matter; this, however was avoided by using aerobic bacteria beds. He did not wish to say that the use of detritus tanks was unnecessary. The channels around the beds described acted as such, so long as the rate at which the sewage was flowing was not too great. The kind of sewage with which he had experimented varied very considerably, at times absorbing 10 and even 13 grains of oxygen per gallon, but at other times it could be considered normal for a residential district. A coke bed was liable to break down, so that, although the area of surface in a new bed might at first be slightly greater than in a slate bed, it diminished considerably, whereas the area of a slate bed was practically constant. The question was not as to relative area in regard to mechanical contact, but to relative bacterial efficiency and working capacity.

In answer to the question regarding a deposit of sewage on the upper surface of the slate, bacterial action went on at the surface of the deposit on the slate just the same as underneath a slate. The film of bacteria was the active agent, and so long as this was present, purification must go on. There were two methods of cleaning the beds: (1) By taking up each slate separately, cleaning it, and relaying the bed. (2) When laying the bed in the first place it could be so arranged that, by the removal of the slates down the centre of the bed, a hose pipe might be introduced to wash away the deposit on the slates on either side of the opening.

Replying to Dr. Cameron, he had not yet tried a slate bed with a sprinkler, but hoped to try it on a new bed which he was about to put down. If any typhoid germs were present in the sewage before treatment, they were practically all destroyed by the action of the bacteria in the beds and the effluent. The effluents from these beds retained and maintained over 50 per cent. of dissolved oxygen, and would not undergo putrefaction, and fish were able to live in the effluents. These he considered sufficient tests for the purity of the water, but he agreed that the standards proposed by the Mersey and Irwell Joint Committee and the West Riding of Yorkshire Rivers Board were good standards.

Obituary.

VLADIMIR MARKOWNIKOFF.

Professor of Chemistry in the University of Moscow.

Vladimir Markownikoff was born in 1839. He entered the University of Kazan in 1856 and studied under Professor Ketara, at a later date becoming the assistant of Prof. Butlerow. He shortly afterwards obtained his degree, and then the Chair of Chemistry in the University of Kazan. Here Markownikoff continued his work until about 1872, when he was elected to the Chair of Chemistry in Moscow University, with which institution he was connected with so much distinction up to the time of his death, which took place on Feb. 11th. Markownikoff's researches were especially directed to the inquiry into the nature of the hydrocarbons of Caucasian petroleum. It is now nearly twenty-five years since Mr. Ragosine approached him with regard to the investigation of

Baku petroleum, in the utilisation of the hydrocarbons and other products of which the former was greatly interested, extensive works having been erected by him at Konstantinoff and Balakhany. Markownikoff's investigation of this subject, in conjunction with Ogloblin, appeared in the Journal of the Russian Phys. and Chem. Soc. in 1883 (see this J., 1883, 166). He discovered the naphthenes, and later on practically confirmed the views of Beilstein and Kurbatow, to the effect that the hydrocarbons of Caucasian petroleum, of the general formula C_nH_{2n}, are hydrogen addition products of aromatic hydrocarbons, and are not identical with the hydrocarbons of American petroleum of the same general formula, which occur along with those of the C_nH_{2n+2} series. His remarkable work on the naphthenes and terpenes, published in 1893, and on the so-called petroleum acids, is sketched in this J., 1893, 32—33. There is not the least doubt that the researches of Markownikoff have furnished the means whereby the most important improvements have been introduced in the refining of Russian petroleum. In conjunction with Reformatsky, in 1894, he investigated the Bulgarian oil of roses (this J., 1894, 272).

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.—PLANT, APPARATUS, AND MACHINERY.

English Patents.

Air and other Gaseous Fluids; Apparatus for Liquefying ——. H. Knudsen, London. Eng. Pat. 23,646, Oct. 29, 1902.

The air, under a pressure of about 2,000 lb. per sq. in. nd sufficiently cooled, passes into a separator consisting of a comparatively small inlet pipe leading to near the bottom of a comparatively large surrounding pipe, in which moisture and other impurities, *e.g.*, oil, are deposited. The air then passes through an after-cooler consisting of coils of pipe, in which any remaining moisture is frozen out. A spare after-cooler is provided so that the coils can be leaned without interrupting the process. The compressed ir passes from the after-cooler to the liquefier, in which t is cooled sufficiently to cause liquefaction of any arbon dioxide present. It then enters the top of the entral tube of the liquefier, which is provided with xternal and internal baffles, and from the bottom of he central tube passes to the nozzles of a turbine having a "Pelton" wheel. The cold compressed air impinges upon the buckets of the Pelton wheel, expands, and is partially liquefied, the liquid portion being tapped off from the motor casing. The unliquefied portion is led back first to the spaces surrounding the tubes in the liquefier, then to the after-cooler, thereby cooling the incoming compressed air, and is finally returned to the air-compressor.—A. S.

Retort Furnace, and method of Charging the Retort. C. Westphal, Berlin. Eng. Pat. 3331, Feb. 12, 1903.

See Fr. Pat. 329,008 of 1903; this J., 1903, 990.—T. F. B.

Drying Apparatus; Impts. in ——. H. Diedrich, Paris. Eng. Pat. 4173, Feb. 21, 1903.

A horizontal cylinder, mounted on rollers, is provided with blades shaped to lift up the material and deposit it slightly further on, to be taken up by the following blade, and thus pass it through the cylinder. The cylinder is heated by passing the furnace gases round it. The drying is effected by passing air through winged or corrugated tubes in which it is heated by the furnace gases and then through the cylinder in the opposite direction to the material. Part of the air, after passing through the cylinder and a dust-depositing chamber, is returned to the furnace to support combustion.—W. H. C.

Drying Apparatus; Impts. in ——. H. J. Haddan, London. From The Edison Reduction Machinery Co., Cleveland, Ohio, U.S.A. Eng. Pat. 25,060, Nov. 17, 1903.

The drying chamber surrounds a central shaft furnished with radial stirring arms. It consists of two end-pieces, between which are a number of cast-iron annular cylindrical sections, provided with projecting flanges, by means of which they are bolted together. The sections can be adjusted circumferentially, and are provided with ports by which the annular space between the inner and outer walls of one section communicates with the corresponding space between the walls of the next section. Steam, enters through a port in one of the end-pieces of the chamber and passes successively through the spaces between the walls of the different sections, condensed water being drained off. One or more of the cylindrical sections are provided with pipe connections for the introduction and discharge of the material to be dried, all vapour escaping through the feed-opening.—A. S.

Centrifugal Separating Apparatus; Impts. in ——. J. M. Adam, Glasgow. Eng. Pat. 4612, March 2, 1903.

The improvements consist in arranging the centrifugal dust separator described in Eng. Pat. 14,302 of 1897, in an outer casing, which acts as a balance chamber to equalise any intermittent suction. Also a trap is provided for the inlet to the separator, fitted with a perforated screen to intercept any bulky matter.—W. H. C.

Centrifugal Machines; Impts. in ——. A. R. Robertson, Glasgow. Eng. Pat. 8114, April 8, 1903.

The strainer or lining of the revolving basket of a centrifugal machine is arranged as an annular piece or ring made of a material, preferably "Liebermann gauze," either itself elastic and perforated, or porous, or it is made of parts capable of expanding, and thus of bearing against the inner surface of the basket when the machine is in operation.—A. S.

Concentrating Liquids; Apparatus for ——. A. J. J. Waché, Paris, and E. F. G. E. Locoge, Douai. Eng. Pat. 5770, March 12, 1903.

See addition of Dec. 24, 1902, to Fr. Pat. 283,758 of 1898; this J., 1903, 899.—T. F. B.

Moulding or Briquetting; Process and Apparatus for preparing Pulverulent Materials for ——. B. J. B. Mills, London. From The Zwoyer Fuel Co., New York. Eng. Pat. 541, Jan. 8, 1904.

The material is fed in at one end of a horizontal chamber mounted on a longitudinal shaft, which is provided with blades and driven at a high speed. The binding material is blown in at the other end, by an atomiser, either as spray or powder. Means are provided for passing hot gases through the chamber. The mixture passes from the chamber to the briquetting or moulding machine. A vertical arrangement is also claimed for letting the material fall through the chamber whilst the binding material is being sprayed upwards from the side and hot gases passed up.—W. H. C.

United States Patent.

Muffle. J. Carter and A. G. Carter, Malden, Mass. U.S. Pat. 752,438, Feb. 16, 1904.

The claim is for a cylindrical muffle having a central vertical cylindrical flue, as well as a surrounding external flue. The dome covering the muffle has a central opening opposite this flue, provided with an adjustable cover, which can be operated from without, by means of a chain and pulley, or other mechanism.—W. H. C.

French Patent.

Extraction Apparatus. E. Bataille. Fr. Pat. 328,185, Dec. 24, 1902.

The apparatus consists of an extraction chamber superposed on an evaporation chamber and connected with a condenser. The filtering medium in the extraction chamber surrounds the material to be extracted, upward or downward extraction being employed. There is also direct communication with the evaporator, which can be controlled from without by means of a valve and rod. The evaporator is heated by a water bath, and steam from the latter for blowing out the solvent, is conveyed to the evaporator and delivered by means of silent heaters. The water-bath can be heated by direct fire. The condenser coil is in two parts, with a separator between, so that the hot solvent can be directly applied. The condenser communicates with a receiver placed below and from which a reflux condenser, cooled by the incoming water to the main condenser, serves to complete the condensation of the solvent.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Cyanogen; Extraction of —— from Coal-Gas. W. Feld. J. f. Gasbeleuchtung, 1904, **47**, 132—136, 157—159, 179—184.

The author has investigated Bueb's process of cyanogen-extraction (this J., 1900, 999; 1903, 204, 356; 1904, 111), in which the ammonia of the gas is utilised as the alkali required, along with a solution of ferrous sulphate. Instead of all the cyanogen being arrested as insoluble ammonium-ferrous ferrocyanide, he finds that the cyanide mud contains only one fourth of it in that form, one half existing as soluble ammonium ferrocyanide, and the remaining fourth as insoluble iron cyanide. According to the amount of oxygen present in the gas, there is a loss of cyanide through formation of sulphocyanide (thiocyanate); hence the process cannot be applied to coke-oven gases. The working up of the cyanide mud is a difficult matter, unsuitable for gas-works practice; and, as the recovery of the ammonia is also troublesome, the profit from the process is less than in the case of other wet methods of extraction. (See this J., 1903, 16.) Where this process is employed it is preferable to work with a weaker (14—18 per cent.) solution of ferrous sulphate than that recommended by Bueb: in this way the absorptive power of the iron salt is fully utilisable, and the cyanogen is retained almost wholly as soluble ammonium ferrocyanide. From such a liquor the ammonia and cyanogen can be readily recovered.—H. B.

Luminous Arcs in Metal [Mercury, &c.] Vapours. E. Weintraub. XI. A., page 326.

English Patents.

Peat; [Electrical] Process and Apparatus for removing Water from ——. B. Kittler. Eng. Pat. 126, Jan. 2, 1904. XI. A., page 326.

Carbon Monoxide; Producing ——. R. Pearson, London. Eng. Pat. 3347, Feb. 12, 1903.

Gases from a lime kiln are passed over incandescent coke. —E. S.

Gas-Generator Furnaces with Inclined Retorts. A. G. Brookes, London. From Stettiner Chamotte-Fabrik A.-G. vormals Didier, Stettin. Eng. Pat. 3852, Feb. 18, 1903.

In gas generator furnaces with inclined retorts, to facilitate the production of a uniform temperature in the retorts, the combustion chamber of the furnace is divided by means of vertical partitions into a number of separate compartments, each communicating with the generator through apertures controlled by dampers. The air supply to the combustion chamber is heated by flowing through zig-zag passages in the furnace pillars.—H. B.

Gas Generating Apparatus or Gas-Producers; Impts. in ——. W. P. Thompson, London. From Schweizerische Lokomotiv- und Maschinen Fabrik, Winterthur. Eng. Pat. 5798, March 12, 1903.

A gas-generator, worked by suction, is provided at the upper end of the furnace with a hollow, annular water-vaporiser, which is connected to a water reservoir. A diaphragm within the latter is attached to the outlet valve and acts automatically by admitting to the vaporiser, at each suction stroke, the required quantity of water. The air supply for the generator is drawn through the vaporiser, and the mixture of air and steam is led to the grate of the furnace down a pipe round which the hot generator gases circulate. The apparatus is provided with charging devices, a scrubber, and a fan for starting the furnace.—H. B.

Gas Furnaces ; Impts. in Regenerative ——. F. Siemens, London. Eng. Pat. 5866, March 13, 1903.

The claim is for an improved type of Siemens' regenerative furnace, in which the gas-regenerative flues (constructed of checker brickwork) expand towards the furnace, and are heated by radiant heat from it. The flues are built so as to have no direct communication with the chimney, and may be surrounded wholly or in part by air-passages between the furnace and air-regenerators. Before the final combustion of the gases takes place in the furnace, they may be mixed in a chamber interposed between the gas- and air-flues and the furnace, and in order to enrich poor gas, oil may be admitted into the mixing chamber. The waste heat of the products of combustion may be utilised by passing them through a heating flue in a boiler.—L. F. G.

Gas ; Manufacture of ——. A. J. Boult, London. From J. E. Goldschmid, Frankfort-on-the-Maine. Eng. Pat. 7770, April 3, 1903.

Coal is first partially coked in a lighting-gas retort, through which a current of water-gas is passed, and is then treated in a water-gas generator for the production of the water-gas. If the gas produced is too rich for the purpose in view, it may be diluted by mixing with the water-gas the carbon dioxide generated during the blast period.
—H. B.

Oil-Gas of High Combustible Value ; Process for Making an ——. H. Blau, Augsburg, Germany. Eng. Pat. 10,527, May 8, 1903.

See Fr. Pat. 322,115 of 1903 ; this J., 1903, 1190.—T. F. B.

Generators for Power Gases ; Impts. in ——. E. Catier, Boussois, France. Eng. Pat. 19,929, Sept. 16, 1903.

The invention relates to improvements in various details of construction of a suction-generator for use with a gas-engine.—H. B.

Water-Gas ; Manufacture of ——. A. J. Boult, London From W. A. Köneman, Chicago. Eng. Pat. 28,761, Dec. 31, 1903.

See U.S. Pat. 749,302 of 1904 ; this J., 1904, 247.—T. F. B.

Carburetting or Enriching Coal Gas ; Apparatus for ——, *and for like purposes.* The Gas Economising and Improved Light Syndicate, Ltd., London, and J. McColl, Barking. Eng. Pat. 622, Jan. 9, 1904.

Improvements are described in Eng. Pats. 14,111 of 1886, 14,031 of 1889, and 18,082 of 1891 (this J., 1892, 898), these comprising an arrangement of valves for controlling the flow of gas to the chamber, means for preventing the deposition of naphthalene round the valves by the preliminary introduction of oil, and devices for bringing the gas more completely into contact with the carburetting liquid.—H. B.

Gas Washers. J. E. Bousfield, London. From H. Gerdes, Berlin. Eng. Pat. 9733, April 29, 1903.

The washer is built up of a number of superimposed horizontal circular chambers, having a central vertical shaft which carries, within each chamber, a centrifugal device for atomising the washing liquor. The liquor flows down through the apparatus, entering each chamber through the top, near the circumference, and leaving it through a central orifice in the bottom, while the gas flows in the reverse direction.—H. B.

French Patents.

Peat Briquettes ; Process and Apparatus for Making ——. F. White and G. A. Griffin. Fr. Pat. 336,151, Aug. 14, 1903.

See Eng. Pat. 17,514 of 1903 ; this J., 1903, 1237.—T. F. B.

Aluminium Alloys ; Manufacture of ——, *with a view to the production of Hydrogen more or less Carburetted, and Pure Hydrogen.* N. A. Hélouis, L. Mauclaire, and E. Meyer. Fr. Pat. 335,954, Sept. 25, 1903. X., page 325.

Air-Gas ; Apparatus for Making ——. E. Pichegru. Fr. Pat. 336,036, Oct. 17, 1903.

Compressed air is admitted from a reservoir, by way of a reducing valve, into a carburetter consisting of a chamber containing a number of superimposed trays, charged with gasoline. The air is caused to pursue a tortuous course in its passage up between the trays, to the outlet.—H. B.

Generator for Poor Gas, free from Tar. L. Boutillier. Third Addition, Oct. 30, 1903, to Fr. Pat. 331,014, April 7, 1903.

Various modifications are described of the apparatus mentioned in the principal patent, in which the gases from the freshly charged fuel are freed from tarry matters by passage through a body of fuel free from tar.—H. B.

Gas ; Continuous Process for Manufacturing ——. F. Clauss. Fr. Pat. 336,397, Nov. 2, 1903.

See Eng. Pats. 1090 and 1091 of 1903 ; this J., 1903, 1342
—T. F. B.

Electrodes for Arc Lamps ; Mineralised ——. Soc Française d'Incandescence par le Gaz (Système Auer). Fr. Pat. 328,180, Dec. 20, 1902.

The addition of borate or fluoride of barium, magnesium, aluminium or strontium, with or without alkali borates, to carbons containing calcium compounds is claimed (see Blondel's Fr. Pat. 323,924 ; this J., 1903, 487).—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM AND MINERAL WAXES.

Ammonia [Recovery from Coal Gas] ; Notes on ——. F. E. Sheriff. J. Gas Lighting, 1904, **85**, 2130.

The author advocates the use of rotary scrubbers instead of towers, both for absorbing ammonia from the coal-gas and for the final production of liquor ammoniæ, claiming as advantages the use of a smaller quantity of water the removal of a greater amount of impurities from the gas, and the production of a much stronger crude liquor. It is stated that by the use of rotary scrubbers for washing the gas, 47 per cent. of the carbon dioxide, 33 per cent. of the sulphuretted hydrogen, and 99·8 per cent. of the ammonia can be removed from the gas ; and that crude liquor containing 6 per cent. of ammonia can be produced.
—A. S.

Petroleum ; Neutral Sulphuric Ester in Commercial ——. F. Heusler and M. Dennstedt. Zeits. angew. Chem., 1904, **17**, 264—265.

Several years back the authors discovered in commercial petroleum sold in Bonn, the presence of a sulphuric ester resembling that formed during the acid refining of lignite tar (see this J., 1895, 558), and a series of tests since performed has revealed the same (neutral) compound in all the oil in the storage tanks at Hamburg. The presence of the aforesaid ester is said to increase the tendency of the burning oil to carbonise the lamp wick.—C. S.

Aniline ; Direct Hydrogenation of ——. *Syntheses of Cyclohexylamine and of two other New Amines.* P. Sabatier and J. B. Senderens. XXIV., page 341.

English Patent.

Gas Liquor; Treatment of ——. C. G. Moor, London. Eng. Pat. 4988, March 4, 1903.

The gas liquor of small works, not having plant for sulphate making, is mixed with acid sodium sulphate, and after separation of the precipitate formed, is evaporated. Ferrous sulphate may be added during the concentration to prevent the evolution of hydrogen sulphide. The product may be used as a manure, or as a source of ammonia.—E. S.

United States Patent.

Organic Acids [from Petroleum]; Process of making ——. N. Zelinsky, Moscow. U.S. Pat. 752,744, Feb. 23, 1904.

See Fr. Pat. 326,665 of 1902; this J., 1903, 807.—T. F. B.

French Patent.

Asphalt; Process of making Artificial ——. Aktieselskabet Venezuela-Asfalt Komp. Fr. Pat. 336,020, Oct. 6. 1903.

See Eng. Pat. 21,799 of 1903; this J., 1903, 1343.—T. F. B.

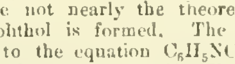
IV.—COLOURING MATTERS AND DYESTUFFS.

Diazotisation of Nitrobenzene. E. Bamberger and A. Wetter. Ber., 1904, **37**, 629—630.

If a paste of sodamide with light petroleum spirit be added to nitrobenzene in a freezing-mixture, traces of normal benzene-sodium diazotate are formed and can be detected by means of an alkaline α-naphthol solution. Finally some iso-diazotate is also formed. The formation of the normal diazotate probably takes place according to the equation $C_6H_5.NO_2+H_2N.Na = C_6H_5(N_2ONa)+H_2O$. If the mixture be warmed iso-diazotate alone is formed, but only in small traces. In presence of β-naphthol the yield of diazo-compound is considerably improved, though even in this case not nearly the theoretical amount of benzene-azo-β-naphthol is formed. The reaction takes place according to the equation $C_6H_5NO_2 + Na.NH_2 + C_{10}H_7OH = C_6H_5.N_2.C_{10}H_6.OH + NaOH + H_2O$. Aniline, sodium nitrite, β-naphthol, and nitrobenzene, when mixed together in absence of moisture form no benzene-azo-β-naphthol, even in a week, and therefore the dyestuff formation in the above experiment cannot be due to the formation of aniline and sodium nitrite from sodamide and nitrobenzene.—E. F.

α-Naphthylmagnesiumbromide. S. F. Acree. Ber., 1904, **37**, 625—628.

α-Bromonaphthalene reacts almost quantitatively with magnesium to form α-naphthylmagnesium bromide. This compound reacts readily on carbon dioxide, ketones, benzoyl chloride, and other substances. With ketones it forms carbinols according to the equation—$R_2:CO + C_{10}H_7.MgBr = R_2:C(OMgBr)(C_{10}H_7)$. The products form the corresponding carbinols on pouring into dilute sulphuric acid. On adding small quantities of diphenyl-α-naphthyl-, methylphenyl-α-naphthyl-, or phenyl-α-naphthyl-carbinol to concentrated acids, the solutions show intense coloration, which disappears on dilation with water, the carbinol being then precipitated unchanged. The corresponding methanes do not show this reaction. The author considers it to be probably due to the formation of quinonoid salts of the type—



$$C_6H_4\left\langle\begin{array}{l}CH(SO_4H).CH\\ \qquad\qquad\quad\;\; \ddot{}\\ C(CR_2) — CH\end{array}\right.$$

which would be hydrolysed by water and would then at once revert to the ordinary carbinol form. α-Naphthoic acid may be prepared by acting on α-naphthylmagnesium bromide with dry carbon dioxide in ethereal solution, and pouring the product into dilute sulphuric acid. The yield is almost quantitative.—E. F.

Anthraquinone-α-monosulphonic Acid. C. Liebermann and B. Pleus. Ber., 1904, **37**, 646—648.

The presence of the α-sulphonic acid in commercial anthraquinone monosulphonic acid was established by Liebermann and Bischof in 1880. They obtained from anthraquinonemonosulphonic acid, an anthracene sulphonic acid, which when distilled with potassium ferrocyanide and hydrolysed gave a mixture of two isomeric carboxylic acids which were separated by means of the different solubilities of their barium salts. The acid from the soluble barium salt was found to be identical with the α-carboxylic acid previously obtained by Liebermann and v. Rath, whilst the acid from the insoluble salt formed the greater portion of the mixture. Liebermann and Bischof demonstrated from the results of their investigations, that the carboxyl group in the new anthracene-carboxylic acid occupies the same position as the hydroxyl in hydroxyanthraquinone. That the formation of the acid from the soluble barium salt is due to the presence of alpha acid in commercial anthraquinone-monosulphonic acid, is now proved by the production of anthracene-carboxylic acid from the sodium salt of anthraquinone-α-monosulphonic acid.—D. B.

Dibenzalacetone and Triphenylmethane. A. Baeyer and V. Villiger. Ber., 1904, **37**, 597—612.

In a former communication the authors described an anhydride, containing no oxygen, of p-aminotriphenylcarbinol. They now find that this anhydride is bimolecular, and that the compound $(C_6H_5)_2:C:C_6H_4:NH$, which may be supposed to be first formed, polymerises. They have also prepared the anhydride of p-phenylaminotriphenyl carbinol, and find it to be monomolecular. It was obtained by converting the chloride of diphenyl-p-anisyl carbinol into the corresponding anilide, and heating this with benzoic acid, acetic acid, or other organic acids, the reaction proceeding according to the equation:—

$$(C_6H_5)_2(CH_3O.C_6H_4).C.NH.C_6H_5 = C_6H_5.N:C_6H_4:C:(C_6H_5)_2 + CH_3OH.$$

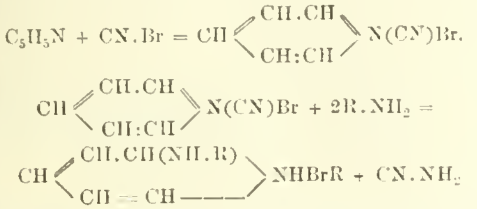
The product is purified by converting it successively into the picrate and the sulphate, treating with dilute aqueous ammonia solution, and shaking out with ether. It forms red crystals and readily combines with alcohols, aniline, and water to form colourless addition products of the carbinol type. With acids it forms deeply coloured quinonoid salts.—E. F.

Diphenyl- and Triphenylmethane Dyestuffs; Basic ——. J. v. Braun. Ber., 1904, **37**, 633—646.

Malachite Green does not react smoothly with cyanogen bromide, but on acting on leuco-Malachite Green with the same compound, s-dimethyldicyanodiaminotriphenylmethane, $[(CN)(CH_3)N.C_6H_4]_2:CH.C_6H_5$, was obtained. This was oxidised with permanganate to the corresponding carbinol. This compound does not dissolve in dilute mineral acids, but in concentrated acids it dissolves to deep red solutions, whereas the salts formed from ordinary Malachite Green are green. The anther concludes from the difference in colour of the salts that they are essentially different in structure. The only important difference in chemical character of the two compounds is that, whereas the dimethylamino groups of Malachite Green are capable of forming ammonium groups by the addition of acid, cyanomethylamino groups are incapable of conversion into ammonium groups. Therefore the conclusion to be drawn is that the green salts of tetramethyldiaminotriphenyl carbinol are ammonium compounds of the quinonoid type as usually formulated.—E. F.

Dyestuffs derived from Pyridine; New Class of ——. W. König. J. prakt. Chem., 1904, **69**, 105—137.

When mixtures of 1 mol. of pyridine, 2 mols. of an aromatic amine, and a suitable diluent are acted upon by cyanogen bromide or cyanogen chloride, dyestuffs are formed, almost quantitatively, with elimination of 1 mol. of cyanamide. The dyestuffs as obtained are almost chemically pure. They crystallise well and vary from yellow, through orange and red, to violet, and dye silk in shades showing beautiful fluorescence. Some of the dyestuffs show marked affinity for unmordanted cotton. They are, with difficulty, soluble in water, but are usually more soluble in warm alcohol and in acetic acid, also in pyridine. The pyridine may be replaced by α-picoline (α-methylpyridine), but collidine (α-α¹-dimethyl pyridine) does not react. The dyestuffs are also formed by first acting on pyridine with cyanogen bromide and then treating the addition product so formed with 2 mols. of an aromatic amine. The reactions probably take place according to the following equations :—



$$C_5H_5N + CN.Br = CH\left\langle\begin{matrix}CH.CH\\ CH{:}CH\end{matrix}\right\rangle N(CN)Br.$$

$$CH\left\langle\begin{matrix}CH.CH\\ CH{:}CH\end{matrix}\right\rangle N(CN)Br + 2R.NH_2 =$$

$$CH\left\langle\begin{matrix}CH.CH(NH.R)\\ CH = CH\text{———}\end{matrix}\right\rangle NHBrR + CN.NH_2$$

The shades which some of the dyestuffs from various amines produce on silk are :—Aniline, orange, with yellow fluorescence ; ψ-cumidine, fiery orange ; β-naphthylamine, rose-red, with yellow-red fluorescence ; sulphanilic acid, orange, with green fluorescence, not fast to boiling water ; aminoazobenzene, heliotrope; *p*-aminosalicylic acid, brown ; dehydrothiotoluidine, red ; benzidine, violet.—E. F.

Phenolphthalein ; Constitution of ——. A. G. Green and A. G. Perkin. Proc. Chem. Soc. 1904, **20**, 50.

The authors have found that a solution of phenolphthalein, decolorised by an excess of caustic alkali, can be entirely neutralised, without any return of the colour taking place, by careful titration at a low temperature with dilute acetic acid. If, however, the colourless neutral solution is boiled, the red colour returns in its full intensity, whilst at the same time the solution becomes alkaline. If the solution is acidified and either left for some time or heated, a precipitation of free phenolphthalein occurs, which also dissolves in aqueous alkalis to a red solution. The point at which neutrality occurs in the titration with acetic acid corresponds with the presence in the colourless solution of the carbinolcarboxylic acid salt—

$$C_6H_4(CO_2M).C(OH)(C_6H_4.OH)_2.$$

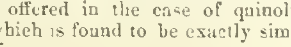
These observations do not agree with the electrolytic dissociation hypothesis, but are simply explained by the quinonoid theory if the colour changes are attributed to a variation of type from a quinonoid to a benzenoid form and *vice versâ*, due to hydration and dehydration. Thus, the first action of an alkali on the free phenolphthalein (lactone) would probably be the replacement of the phenolic hydrogen by the alkali metal. This salt being unstable may be supposed to undergo immediate transformation into the coloured quinonoid salt—

$$C_6H_4(CO_2K).C(C_6H_4.OH){:}C_6H_4{:}O,$$

by direct transference of the metal from the phenolic to the carboxylic group. With excess of caustic alkali, this coloured salt is converted, by assumption of KOH, into the colourless carbinol salt—

$$C_6H_4(CO_2K).C(OH)(C_6H_4.OH).C_6H_4.OK,$$

and this product, when neutralised with acetic acid, gives $C_6H_4(CO_2K).C(C_6H_4.OH)_2{\cdot}OH$, which is also colourless. Caustic potash is set free on boiling the latter salt, and the actone—



$$CO\left\langle\begin{matrix}-O-\\ C_6H_4\end{matrix}\right\rangle C(C_6H_4.OH)_2,$$

which is produced is simultaneously converted into the coloured quinonoid salt by the liberated alkali. A similar xplanation is offered in the case of quinolphthalein, the behaviour of which is found to be exactly similar to that of phenolphthalein.

English Patents.

Dyestuffs [Anthracene Dyestuffs] of the Anthraquinone Series ; Manufacture of Green ——. O. Imray. From Farbw. vormals Meister, Lucius und Brüning, Hoechst-on-Maine. Eng. Pat. 7353, March 30, 1903.

1.4.5.8-leuco-tetrahydroxyanthraquinone is heated with aromatic amines, when it forms dialphylaminodihydroxyanthraquinones. The products are easily sulphonated and then dye wool in clear yellowish-green shades.—E. F.

Anthracene Colouring Matters and Intermediate Products ; Manufacture of ——. J. Y. Johnson. From the Badische Anilin- u. Soda Fabrik, Ludwigshafen-on-Rhine. Eng. Pat. 7394, March 30, 1903.

A new polyhydroxyanthraquinonesulphonic acid is obtained by acting on anthraquinone-β-sulphonic acid with concentrated sulphuric acid, and either mercury or a mercury salt, in presence of nitrous acid and of either arsenic acid or phosphoric acid. This new purpurin-sulphonic acid dyes unmordanted and alumina-mordanted wool in bluish-red, and chrome-mordanted wool in bluish-brown shades. On treatment with aromatic amines, such as aniline, *o*- or *p*-toluidine, xylidine, *p*-phenylenediamine, benzidine, or α- or β-naphthylamine, with or without a condensating agent, dyestuffs are obtained. The product obtained with aniline dyes unmordanted wool violet, and chrome mordanted wool dark blue.—E. F.

Anthracene Colouring Matters [Dyestuffs] ; Manufacture of ——. J. Y. Johnson. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. Eng. Pat. 20,151, Sept. 18, 1903.

The polyhydroxyanthraquinonesulphonic acid described in Eng. Pat. 7394 of 1903 (see preceding abstract) is condensed with sulphonic acids of aromatic amino-compounds, such as sulphanilic or metanilic acids either in the presence or absence of water, and with or without a condensing agent. The products dye unmordanted wool in bluish-red, chrome-mordanted wool in reddish-blue, and alumina-mordanted wool in violet shades.—E. F.

Tetrazo-dyestuffs [Azo-dyestuffs] with aid of 2 : 5 : 1 : 7-Aminonaphtholdisulphonic Acid ; Manufacture of new ——. O. Imray. From the Society of Chem. Ind. in Basle. Basle. Eng. Pat. 28,033, Dec. 21, 1903.

One mol. of the tetrazo-derivative of an aromatic *p*-diamine of the diphenyl series is combined either with 2 mols. of 2 : 5 : 1 : 7-aminonaphthol-disulphonic acid, or with 1 mol. of this acid and 1 mol. of an aromatic amine, a phenol or a naphthol, or a sulphonic or carboxylic derivative of any of these compounds. The products dye unmordanted cotton in violet to blue tints. When diazotised on the fibre and developed with β-naphthol, they yield indigo blue shades, very fast to washing.—E. F.

Mono-azo Colouring Matter [Dyestuff] ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabr., Ludwigshafen. Eng. Pat. 7396, March 30, 1903.

See U.S. Pat. 737,445 of 1903 ; this J., 1903, 1125.—T. F. B.

Mono-azo Dyestuffs ; Manufacture of Mordant Dyeing ——. C. D. Abel, London. From Act.-Ges. f. Anilin Fabr., Berlin. Eng. Pat. 8406, April 11, 1903.

See Fr. Pat. 331,121 of 1903 : this J., 1903, 1126.—T. F. B.

Sulphur [Sulphide] Dyestuffs derived from Indophenol ; Manufacture of ——. C. D. Abel, London. From Act.-Ges. f. Anilin Fabr., Berlin. Eng. Pat. 8405, April 11, 1903.

See U.S. Pat. 736,403 of 1903 ; this J., 1903, 1041.—T. F. B.

United States Patents.

Dyestuff ; Sensitising —— *[for Photographic Purposes].* R. Berendes, Assignor to Farbenfabr. of Elberfeld. U.S. Pat. 752,323, Feb. 16, 1904. XXI., page 337.

Azo Dye [Dyestuff]; Red ——. P. Julius, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. U.S. Pat. 752,562, Feb. 16, 1904.

See addition, of Feb. 27, 1902, to Fr. Pat. 315,573 of 1901; this J., 1902, 1451.—T. F. B.

FRENCH PATENTS.

p-p'-Diaminoformyl-(acetyl)-diphenylamine; Manufacture of ——, *and its Conversion into p-p'-Diamino-diphenylamine.* Cie. Paris. Coul. d'Aniline. Fr. Pat. 328,201, Dec. 31, 1902.

See Eng. Pat. 543 of 1903; this J., 1903, 1343.—T. F. B.

Azo-Dyestuffs from 1.8-Azimino-naphthalene Sulphonic Acid; Process for Preparing ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 336,389, Jan. 14, 1903.

See Eng. Pat. 953 of 1903; this J., 1904, 16.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

Bleaching; Cost of Electrolytic ——. Fraass. Färber-Zeit., 1904, **15**, 69—70.

The cost of bleaching by electrolysing a solution of sodium chloride in which the goods are placed is discussed. 500 kilos. of goods can be bleached in the usual way by 2,000 litres of a solution containing 2·5 to 2·7 grms. of available chlorine per litre. According to the system and apparatus of Schuckert, this amount of chlorine may be produced by the electrolysis of a 10 per cent. sodium chloride solution giving a liquor containing 20 grms. of available chlorine per litre. 29 kilos. of salt are required for this, costing, at 2·2 M. per 100 kilos., 0·64 M.; the power necessary is 40 ampères, at 110 volts, for 8—9 hours, *i.e.*, 39·6 kilowatt hours, costing, say, 1·98 M.; wear and tear and insurance on the apparatus are calculated at 1·16 M. per day, and the sulphuric acid required (2 litres at 5·2 pf.), 0·10 M., making a total cost of 3·88 M., which compares favourably with the cost of 2,000 litres of bleach solution of $1\frac{1}{2}^{\circ}$—$1\frac{3}{4}^{\circ}$ B., or 12 kilos. of 32 per cent. bleaching powder and 10 litres of sulphuric acid required for the same quantity of goods by the usual method.—T. F. B.

Viscose in Printing; Application of ——. R. Haller. Zeits. Farb. u. Text. Chem., 1904, **3**, 81.

On account of its instability, viscose solution has had but little application in printing. By the addition of sodium amalgam the author has obtained a viscose solution which will remain unaltered for 22 days. Viscose solution is not altogether suitable as a thickening agent, the alkaline sulphides it contains blackening the copper rollers. It can, however, be used with success in fixing certain sulphur dyestuffs. On printing with 500 grms. of viscose solution 1 : 1, and 40 grms. of Immedial Blue C (paste), then passing through a "Mansarde" and once through a small Mather-Platt, washing with hot water, passing in open width through a soap solution and then drying, a good indigo shade is obtained which possesses an excellent fastness to light and soap. Aniline black or other steam-developed colours can be used in the same way. Other immedial dyestuffs cannot be fixed on the fibre in this way; the viscose solution on mixing with the aqueous dyestuff solution becomes gelatinous and in consequence unfit for printing. Viscose can also be used for printing with mordant dyestuffs which are fixed with chromium acetate, as follows:—700 grms. of viscose solution 1 : 1, 50 grms. of Alizarin Viridin F F (paste), 20 grms. of chromium acetate at 20° B., and 150 c.c. of distilled water. After printing, the goods are steamed, washed hot, soaped and dried as before. Shades are obtained in this manner which are somewhat duller than when gum or starch thickening is used, this being due to cellulose precipitated on the fibre. On the addition of metallic salts to viscose solution, coloured xanthates are formed. The tin salt is coloured a dark red-brown and is the best for printing. To fix this metallic salt on cotton, the goods are padded in a 5 per cent. tin chloride solution and dried in the hot flue at the lowest temperature possible; they are then printed with a dilute viscose solution (1 : 5), the tin xanthate is formed and is fixed on the fibre by passing through a "Mansarde" at 50° C. In this manner colours of unusual fastness to soap and light are stated to be obtained.—R. S.

Cellulose Nitrate; An Unstable ——. E. Knecht. XIX., page 335.

ENGLISH PATENTS.

Carbonising or destroying Cotton or Silk in Woollen Rags. S. Roberts and J. H. Crossley, Liversedge. Eng. Pat. 24,641, Nov. 13, 1903.

The material is impregnated with commercial hydrochloric acid, then squeezed or hydro-extracted to remove surplus liquid, and finally dried in a drying machine or stove in order to destroy the cotton, silk, or vegetable fibres present, without affecting the wool.—A. B. S.

Soaps developing active Oxygen and having an Antiseptic and Bleaching effect; Manufacture of Non-Caustic ——. H. Giessler and H. Bauer. Eng. Pat. 22,580, Oct. 19, 1903. XII., page 327.

FRENCH PATENTS.

Vegetable or Animal Fibres, or mixtures of these; Process for Obtaining Extra-fast Shades on ——, *with certain Colours, and particularly with Blue.* G. Caux. Fr. Pat. 328,182, Dec. 23, 1902.

See Eng. Pat. 1 of 1903; this J., 1903, 738.—T. F. B.

Textile Dyeing; Apparatus for ——. A. Henuchert and E. Lepers. Fr. Pat. 335,830, Oct. 8, 1903.

This apparatus consists essentially of two similar rectangular vessels, which open at the side and can be hermetically closed. The material to be dyed is placed on perforated plates a little above the bottoms of the vessels and pressed down by other perforated plates held in position by central rods passing air-tight through the tops of the vessels. Pipes for the supply of dye-liquor enter the vessels under the lower perforated plates and are connected together, and also to the main supply tank, by means of a three-way cock. These connections are steam jacketted. The supply tank is placed at a higher level and furnished with heating coils. A pipe for the entry of compressed air is fitted to the top of each vessel, through which also passes a pipe reaching to any required depth and fitted with a float valve. When the material is in position, the dye-liquor is allowed to flow into both the vessels up to a certain level, after which the two vessels are placed in communication. Compressed air is then turned on into one of the vessels, whereby the liquid is forced over into the other vessel. As soon as the liquid in the first vessel sinks low enough to open the float valve, the compressed air escapes through the pipe mentioned above and acts on a special piston arrangement which cuts off the compressed air from the first vessel and turns it into the second vessel, where the whole process is repeated. —A. B. S.

Dyeing Apparatus; Automatic ——. L. Mascelli. Fr. Pat. 335,949, Sept. 23, 1903.

This apparatus consists of two vessels placed one above the other, the upper one being connected with the lower by means of a central pipe which passes almost to the bottom of the latter, and is furnished with a valve operated from outside. The lower vessel is furnished with a closed steam coil at the bottom and also with a perforated spiral pipe at the top, which serves either for steam or water. If the material is to be dyed in the loose form, it is placed in a cage with a central perforated pipe; this is placed in the upper vessel and screwed down on to the opening of the central pipe; if cops or bobbins have to be dyed, they are placed on perforated spindles, which are also connected with the central pipe. The lower vessel is fitted with pipes for introducing dye-liquor, &c., and for letting out air. When the material is in position, the valve in the central pipe is shut and the dye-liquor is run in until the lower vessel is full; the inlet valves are then shut, the central one opened, and the dye-liquor is forced up the central pipe and through the material by blowing steam through the upper perforated spiral. The central valve is then closed and the lower vessel filled with dye-liquor as before from a higher tank. The inlet valve being again shut, the central one is opened and steam is also turned on in the closed coil. The hot dye-liquor is forced up the central pipe into the upper vessel, and when it reaches a certain level in the latter, it acts on a float which by a suitable arrangement shuts off the steam in the lower coil. As the lower vessel cools, a vacuum is formed, and part of the liquid in the upper vessel runs back, releasing the float and opening the steam valve again.—A. B. S.

Etching [Designs on] Metals, and especially Printing Cylinders. J. A. Déjey. Fr. Pat. 335,941, Sept. 18, 1903. XI. B., page 327.

Textile Printing; New Arrangement for ——. R. H. D. Mills. Fr. Pat. 336,061, Oct. 15, 1903.

A machine for printing both sides of a material, in which one of the pressure cylinders has a smaller diameter and also a smaller number of printing rollers than the other is claimed. The relative positions of the two cylinders can be altered for use as single printing machines if required. —A. B. S.

Lustering of Vegetable Fibres in Thread or Tissue by means of Viscose; Method for ——. J. R. Subrenat. Fr. Pat. 328,179, Dec. 20, 1902.

The textile material is impregnated with viscose (xanthate of cellulose). This can also be produced from the fibre itself by impregnating with caustic soda, and then exposing to the vapour of carbon bisulphide. The material prepared by either of the above methods is then dried carefully in a hot flue at a temperature which must not be higher than 50°—60° C., and next slightly moistened in order to dissolve the superficial layer of viscose, and then lustred either by calendering, brushing, &c. After this is finished the material is steamed at a high pressure or else passed through boiling concentrated solutions of ammonium sulphate or chloride or some other suitable salt, in order to convert the soluble viscose into the insoluble hydrated cellulose. The latter retains the lustre of the viscose.—A. B. S.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

English Patent.

Leather; Method of Dyeing —— with Sulphur Colours. R. B. Ransford, Upper Norwood. From L. Cassella and Co., Frankfort-on-Maine. Eng. Pat. 7954, April 6, 1903.

See Addition of March 30, 1903, to Fr. Pat. 322,605 of 1902; this J., 1903, 1084.—T. F. B.

French Patent.

Leather: Process of Dyeing —— by means of Sulphide Dyestuffs. Manuf. Lyon. Mat. Col. Second Addition, dated Oct. 24, 1903, to Fr. Pat. 322,605, June 28, 1902. (See this J., 1903, 363 and 1084.)

If leather be treated with formaldehyde before dyeing, or even during the tanning process, alkali sulphides have no detrimental effect during the dyeing with sulphide dyestuffs. A suitable method consists in immersing the leather in a formaldehyde solution for about an hour, and then adding the dyestuff solution to the formaldehyde bath.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Potassium-Magnesium Carbonate. F. Auerbach. Zeits. Elektrochem., 1904, **10**, 161—169.

As the double salt $MgCO_3.KHCO_3.4H_2O$ plays an important part in the potash industry at Stassfurt, the author has investigated the conditions of its formation and decomposition. Determinations of the solubility of $MgCO_3.3H_2O$ in potassium bicarbonate solutions of increasing concentrations at 15°, 25°, and 35° C., showed that at any given temperature the magnesium-content of the solution was a function of the potassium-content, and that in the graphic representation, with magnesium-contents as ordinates and potassium-contents as abscissæ, each isothermal was an ascending straight line cut by the lower part of a convex curve representing the double salt content at the same temperature. At the point of intersection the individual carbonates are in equilibrium with a solution of definite composition. By applying the principle of mass action and by making certain simplifying assumptions, the equations of the isothermals were deduced, and then verified. As the solution of $MgCO_3.3H_2O$, and also the formation and separation of the double carbonate proceed with evolution of heat, the decomposition of the latter is attended by absorption of heat. Hence, as the temperature rises its formation becomes more and more difficult. The aqueous solution of the double salt is unstable under ordinary conditions, $MgCO_3.3H_2O$ separating out.—E. H. T.

Sodium Nitrite; Action of Carbon Dioxide on ——. L. Meunier. Comptes rend., 1904, **138**, 502—503.

Marie and Marquis (this J., 1904, 252) described certain experiments from which it was concluded that nitrous acid is liberated from solutions of sodium nitrite by the action of carbon dioxide. The author contends that the results obtained in the first two experiments (*loc. cit.*) were due to the presence of the potassium iodide. This is proved by saturating a solution of sodium nitrite with carbon dioxide and adding potassium iodide to one half of it, leaving the other half blank. The solution containing the iodide shows a gradual separation of free iodine, whereas the blank solution when "spotted" on iodide and starch test paper fails to show the slightest trace of free nitrous acid. The result of the third experiment (*loc. cit.*) is explained by the presence of traces of halogen salts as impurities which act in the same way as iodides. It is therefore concluded that carbon dioxide does not liberate nitrous acid from pure solutions of sodium nitrite.—J. F. B.

Cadmium Arsenide. A. Granger. Comptes rend., 1904, **138**, 574.

When cadmium is heated to bright redness in presence of arsenic vapour, combination proceeds rapidly, and a cadmium arsenide, Cd_3As_2, condenses, in the form of brilliant red octahedra, of sp. gr. 6·21; this product is similar to that obtained by Spring by subjecting the two constituents to hydraulic pressure. Like most arsenides, it is soluble in nitric acid, and is decomposed by halogens, oxidising agents, &c.—T. F. B.

Fluorine Compounds; Preparation and Physical Characters of new ——. O. Ruff and W. Plato. Ber., 1904, **37**, 673—683.

The principle of the method is the decomposition of the corresponding chlorine compounds by heating them with anhydrous hydrofluoric acid. The acid is prepared from potassium hydrogen fluoride, which is first thoroughly dried by heating for 24 hours or more to 150° C *in vacuo* in presence of fused potassium hydroxide, the salt being freshly powdered and the potassium hydroxide remelted every 6 or 8 hours. The dry salt is then introduced into the platinum retort shown in Fig. 1, which is connected with the platinum condensing tube, and this by the copper connexion *a* with the copper vessel C, of some 500 c.c. capacity, immersed in a freezing mixture, and *b*, a guard tube with calcium chloride. The joints between platinum and platinum are made good, where necessary, with sulphur; those between platinum and copper with platinum foil. The retort, not more than two-thirds full, is heated very gradually, and the operation is ended when the bottom is red-hot. Screw caps *m* (Fig. 2) are used to close C, and the acid can be kept for any length of time.

Titanium Tetrafluoride.—The acid is distilled by means of a water-bath at 25° C. into the retort A as shown in

Fig. 2. The copper-tubes pass through a lead stopper, and are luted with sulphur. The horizontal tube contains calcium chloride, and A is immersed in a freezing mixture. The tared retort is re-weighed; half the calculated quantity of titanium tetrachloride is cooled and added to the acid drop by drop, the stopper and guard tubes are put in, and the whole left for some hours; then the retort is connected with the condenser, and heated in an oil-bath to 200° C. till all the hydrofluoric acid is distilled off. Now the condenser is removed, the copper vessel E (Fig. 3) fitted to the retort beak, and the whole retort kept hot by a flame till the titanium tetrafluoride has condensed in E, which is cooled by a lead worm coiled round it. The tetrafluoride forms a loose white sublimate, b. pt. 248° C., sp. gr. 2·798/20°, 2·833/11° C., vapour density 129 (theory 124·1).

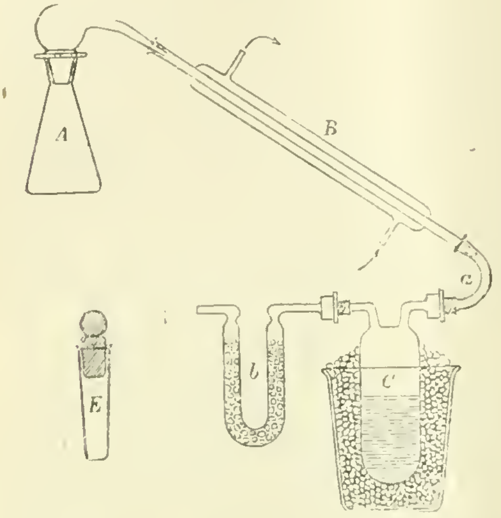


Fig. 3.

Fig. 1.

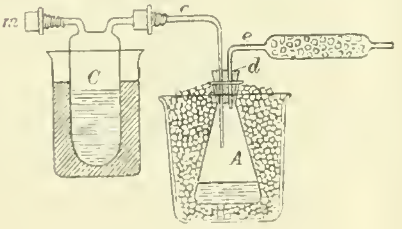


Fig. 2.

Antimony Pentafluoride.—Prepared similarly, but the mixed pentachloride and hydrofluoric acid must be heated by a water-bath at 25° C. under reflux condenser till hydrochloric acid ceases to be evolved (about 3 days). Then, after distilling off the excess of hydrofluoric acid the temperature is raised to 155° C., and the antimony fluoride distilled over. Colourless, viscous, oily liquid, solidifying when cooled; b. pt. 155° C., sp. gr. 2·993/22·7° C. Corrodes the skin; dissolves paraffin and other organic substances; absorbs moisture from the air to form the hydrate, $SbF_5.2H_2O$; dissolves in water without decomposition.

Antimony Penta- and Trifluorides.—When these fluorides are mixed, reaction occurs, and on distillation substances varying in composition, according to the proportions in the mixture, pass over. These substances thus obtained have a composition varying between $SbF_5.2SbF_3$ and $SbF_5.5SbF_3$, and are probably mixtures of these. The first of these two compounds, a colourless crystalline mass, boils at 390° C., and has a sp. gr. of 4·188/21° C.; the second is a colourless liquid, b. pt. 384° C.

Tin Tetrafluoride.—Prepared like antimony pentafluoride. After distilling off the hydrofluoric acid, tin tetrachloride passes over from 130° to 220° C. in quantity, showing that $SnCl_4.SnF_4$ had been formed. When the tetrafluoride has all passed over, a stopper with thermometer is substituted by another of plaster of Paris, carrying a thin brass spiral cooled by water, and the flask heated to redness. At 750° C. the tetrafluoride distils, and condenses on the spiral in radiating crystalline masses. It is very hygroscopic, soluble in water, and the solution, slowly at the ordinary temperature, more rapidly on heating, deposits stannic oxide. The sp. gr. of the tetrafluoride is 4·780, its b. pt. 705° C.—J. T. D.

Carbon from Carbides [*Metallic*]; *Separation of* ——, *and the formation of Graphite.* H. Ditz. Chem.-Zeit., 1904, **28**, 167—171.

Among the processes for preparing amorphous or crystalline carbon from (calcium) carbide is that devised by Frank (this J., 1900, 545). It is interesting to notice that a suitable carbide is also able to withdraw the carbon from a carbonate, *e.g.*, $3BaCO_3 + BaC_2 = 4BaO + 5CO$, whilst, if the base employed be changed to calcium, magnesium, or an alkali metal, a larger quantity of carbon is recovered in the free state. Again, one of the reactions in the Frank process shows that the decomposition of calcium oxide by carbon, which is employed to yield calcium carbide, is a reversible reaction. According to Rothmund (this J., 1902, 761) the temperature of reversion in the equation $CaO + 3C \rightleftarrows CaC_2 + CO$ is 1620° C. This reversibility has hitherto only been proved to occur in the specific case of calcium carbide, but the author believes a similar occurrence is to be found in the case of other carbides, and, if so, it may throw some light on the mechanism of Acheson's method of making artificial graphite from coal. When an Acheson furnace is opened and its contents are cut through, surrounding the central core is a mass of black crystals having the shape of carborundum (silicon carbide), but actually consisting of graphite with an amount of ash varying from 10 per cent., the ordinary commercial limit of purity (Pietrusky), down to practically nothing. This graphite cannot be produced from the amorphous carbon of the charge by the mere heat of the furnace, for, were that the case, all the carbon might be "graphitised." Such a view, too, fails to explain why a pure carbon, such as petroleum coke, yields hardly any graphite, whereas a carbon contaminated with ash, like bituminous coal or American anthracite (5 to 15 per cent. of ash), gives much. According to a recent suggestion, carbides are first produced, a purely catalytic action then taking place, the ash behaving as the active substance. (The finished graphite may contain up to 10 per cent. of ash constituents, and only very small quantities of amorphous carbon.) It is hence quite probable that the crystallisation occurs whilst the carbon still contains the bulk of the mineral matter. With regard to the nature of the foreign matter in Acheson graphite, Acheson has found that an addition of metals to the furnace charge (or of their sulphides or other salts) assists in graphitisation; but, for various reasons, it is preferable to use oxide. On the other hand, if a process of simple catalysis were alone involved, the active oxides of the original charge should be found again in the finished graphite; and, besides, it would not be comprehensible why a raw material must be taken so impure that the graphite may contain 10 per cent. of ash. Tentatively, therefore, the author puts forward a hypothesis based on the above-mentioned behaviour of carbon monoxide. The amorphous carbon, it may be imagined, first reacts with its ash oxides to yield the corresponding carbides (of Si, Fe, Al, Ca, &c.), carbon monoxide being liberated. Some of this is retained among the material of the furnace, and, if the other carbides behave like that of calcium, acts upon those carbides to form oxides again, with separation of graphite. These two reactions may go on indefinitely, always leaving metallic oxides among the carbon, until, as the temperature of the furnace rises, a larger or smaller proportion of them is driven away as vapour. Part of the carbides, perhaps, simply dissociate, the metal volatilising, and the carbon appearing as graphite. A separation of crystalline carbon on dissociation is already known to occur with calcium carbide (Moissan) as well as in the case of barium and manganese carbides (Gin and Leleux, Comptes rend., 1898, **126**, 749). The reactions of calcium carbide or acetylene with carbon bisulphide (Sandmann, this J., 1902, 932) and certain other organic sulphur compounds, whereby free carbon and sulphuretted hydrogen or calcium (penta-) sulphide are formed, seem likely to develop into processes for removing sulphur from benzol, oils, and, possibly, coal-gas.—F. H. L.

Sulphuric Acid; Determination of ——. K. Silberberger. XXIII., page 338.

Arsenic in Sulphuric or Hydrochloric Acids; Rapid Determination of ——. N. J. Blattner and J. Brasseur. XXIII., page 338.

Ammonia [Recovery from Coal-Gas]; Notes on ——. F. E. Sheriff. III., page 317.

Cyanogen from Coal-Gas; Extraction of ——. W. Feld. II., page 316.

English Patents.

Sulphate of Copper; Manufacture of ——, *by the direct Sulphurisation of the Ores.* G. Gin, Paris. Eng. Pat. 5230, March 6, 1903.

Sulphur ores of copper are roasted until the copper is oxidised, partly into sulphate and partly into oxide. The ore is then transferred to the floor of a cooling passage into which the sulphurous gases from the furnace, with air, are directed, whereby the copper oxide and ferric oxide are transformed into sulphates, the temperature being adjusted as most suitable to the formation of sulphuric anhydride, whereby the change is mainly effected, whilst the formation of ferrous sulphate is prevented. The mass is lixiviated, and the solution digested with roasted and oxidised ore, so that the basic ferric sulphate may act upon the copper oxide to form copper sulphate, with separation of ferric oxide. See also Fr. Pat. 328,801, of 1903; this J., 1903, 1002.—E. S.

Aluminium Sulphate; Manufacture of ——. H. Spence and Peter Spence and Sons, Ltd., Manchester. Eng. Pat. 6458, March 20, 1903.

See Fr. Pat. 331,836 of 1903; this J., 1903, 1195.—T. F. B.

Carbon Monoxide; Producing ——. R. Pearson. Eng. Pat. 3347, Feb. 12, 1903. II., page 316.

Gas Liquor; Treatment of ——. C. G. Moor. Eng. Pat. 4988, March 4, 1903. III., page 318.

United States Patents.

Sulphuric Anhydride; Contact Apparatus for the Production of ——. W. Hasenbach, Assignor to Ver. Chem. Fab., both of Mannheim, Germany. U.S. Pat. 752,165, Feb. 16, 1904.

See Fr. Pat. 323,491, of 1902; this J., 1903, 495.—E. S.

Bromine; Process of "Fractioning" ——, *apart from Chlorine.* H. H. Dow, Assignor to the Dow Chemical Co., both of Midland, Mich. U.S. Pat. 752,286, Feb. 16, 1904.

Brine containing bromine is oxidised, and the pure bromine first liberated, is blown out by a limited quantity of air, the remainder being blown out (without further oxidation) by a large quantity of air. Both portions of bromine thus expelled are received in suitable absorbents. Or the purest portion, that first expelled, is absorbed by means of sodium carbonate solution, the final portion by natural brine. See also the two following abstracts.—E. S.

Bromine; Process of Fractioning —— *from Chlorine.* H. H. Dow, Assignor to the Dow Chemical Co., both of Midland, Mich. U.S. Pat. 752,331, Feb. 16, 1904.

Brine containing bromine is oxidised to "excess of its bromine contents"; bromine, and mixtures of bromine and chlorine in various proportions, are obtained by passage through the oxidised brine, first, of a limited amount, and then of a larger amount of air, the fractions being separately absorbed, the pure bromine by sodium carbonate, and the mixed gases by a natural brine. See also preceding and the next following abstracts.—E. S.

Bromine; Process of Manufacturing —— *from natural Brines.* H. H. Dow, Assignor to the Dow Chemical Co., both of Midland, Mich. U.S. Pat. 752,332, Feb. 16, 1904.

In the process conducted substantially as described in the two preceding abstracts, the first and second fractions of the bromine liberated are conducted for absorption into sodium hydroxide solution; the later fractions, containing chlorine with the bromine, being passed into natural brine. Suitable apparatus for carrying out the process is shown. Compare U.S. Pats. 733,466, 733,467, and 741,637, of 1903; this J., 1903, 908, and 1243.—E. S.

French Patents.

Hydrosulphites; General Method for Preparing ——. L. Descamps. Fr. Pat. 328,191, Dec. 29, 1902.

See Eng. Pat. 6933 of 1903; this J., 1903, 950.—T. F. B.

Active Oxygen; Salts of Acids containing easily liberated ——, *Preparation of.* G. F. Jaubert. Fr. Pat. 336,062, Oct. 14, 1903.

An acid, such as boric, sulphuric, or acetic acid, is caused to react upon an alkali- or alkaline-earth peroxide, to obtain a permanent solid product from which "active" oxygen may be readily set free. For example, a mixture of 248 parts of boric acid with 78 parts of sodium peroxide is added by small portions to 2,000 parts of cold water, with agitation. The crystals which form on cooling are washed with alcohol, and dried at from 50° to 60° C. A permanganate may be used when it is desired to set the oxygen free. See Fr. Pat. 325,627 of 1902, and Addition to the same, of 1903; this J., 1903, 743 and 1318.—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

Solubility of Glass; Electro-chemical Determination of ——. F. Haber and H. Schwenke. XI. A., page 326.

French Patents.

Porcelain; Manufacture of ——. Comp. Générale de Constructions Electriques. First Addition, of Oct. 16, 1903, to Fr. Pat. 332,912, of May 9, 1903.

In order to remove rapidly the water added during the mixing, the moulded article, before burning, is placed in a receiver, from which the air is exhausted, at first gently, and then very strongly.—A. G. L.

Muffle for burning the Enamel on Porcelain and for similar applications. E. Jouannaud. Fr. Pat. 336,274, Oct. 27, 1903.

The muffle is characterised by having its walls fitted with a number of pierced and arched baffle-plates, which also divide it into three independent parts, each one of which can be heated separately. At the rear of the muffle a double flue is provided, which receives the gases from all three parts.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

English Patents.

Plaster of Paris; Manufacture of ——. W. Brothers, Prestwich. Eng. Pat. 3225, Feb. 11, 1903.

See Fr. Pat. 333,858 of 1903; this J., 1904, 20.—T. F. B.

Bricks, Artificial Stone, and the like; Manufacture of ——. F. W. Jenkins, Herne Hill. Eng. Pat. 3378, Feb. 12, 1903.

See Fr. Pat. 329,346 of 1903; this J., 1903, 998.—T. F. B.

Brick Kilns and the process of burning Bricks. J. W. D. Pratt, Oldbury. Eng. Pat. 28,103, Dec. 22, 1903.

The process of burning is carried out in three stages, the usual air-drying of the "green" bricks being omitted, a drying in a separate chamber by heat radiated from a chamber containing burnt bricks cooling down being substituted. After this drying, the bricks are further heated by the hot products of combustion from a kiln actually burning, and are then burnt in a kiln, the flues and dampers of which are so arranged that the hot gases are not directly impeded in their passage by dampers, thus preventing leakage of hot gases or entrance of cold air around the damper slots. —A. G. L.

Pipes or Conduits, or other articles; Manufacture of ——, for use underground, or in other situations where they are subject to electrical or corrosive action. J. Y. Johnson, London. From L. A. Brown and D. Tredway, both of St. Louis, Mo. Eng. Pat. 1279, Jan. 18, 1904.

The articles, *e.g.*, pipes, are made with a metallic body and an adherent coating of insulating material, consisting, *e.g.*, of 55 per cent. of sand, 35 per cent. of sulphur, and 10 per cent. of cement. The composition is made by melting the sulphur at about 280° F., mixing it with the cement, and then stirring in the sand, previously heated to about 500° F. The mass is then allowed to cool to 300° F., when it becomes sufficiently viscid to be applied to the metal.—A. G. L.

United States Patent.

Timber-treating Process. P. F. Dundon, San Francisco, Cal. U.S. Pat. 753,052, Feb. 23, 1904.

The timber is first exposed to steam-heat, moisture, and pressure in order to open the pores and expel the sap. It is then dried, and treated under heat and pressure with a "limpid mineral oil," which fills the pores. This is followed by treatment under heat and pressure with a bituminous pitch, which enters into the pores of the outer stratum only, and so forms an impervious coating for the conservation of the interior substance.—A. G. L.

French Patents.

Stone and similar substances; Process for Colouring or Hardening —— throughout its mass. Chem. Techn. Fabr. Dr. Alb. R. W. Brand and Co. Fr. Pat. 328,193, Dec. 29, 1902.

See Eng. Pat. 5594 of 1903; this J., 1904, 188.—T. F. B.

Furnace; Continuous —— for Bricks, Tiles, Cement, &c. Scheidt et Cie., Belgium. Fr. Pat. 336,166, Oct. 7, 1903.

The flues and valves of a horizontal furnace are so arranged that the temperature may be regulated at every part of each chamber.—H. B.

X.—METALLURGY.

Iron Ores; Briquetting ——. A. Weiskopf. Stahl u. Eisen., 1904, 24, 275—281.

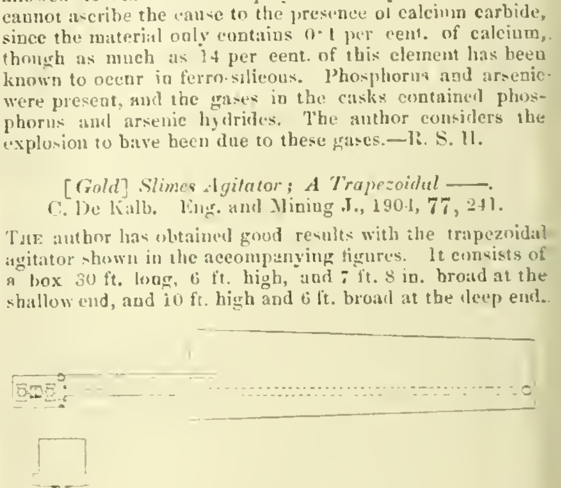
The methods devised may be grouped as those—1*a*. With inorganic binding substances (*e.g.*, clay, lime, water-glass, slags, waste liquors from certain manufactures, &c.). Some of these yield briquettes of good quality, but low in iron and high in silica and alumina. 1*b*. With organic binding substances (*e.g.*, tar, petroleum residues, rosin soaps, coal-dust, liquors from cellulose or sugar manufacture, &c.). The mixture is made with the aid of suitable machinery, the briquettes being subsequently hardened by exposure to the air, with or without compression, or by heating to sintering, with or without previous compression. The percentage of iron is not lowered so much as in 1*a*, but most of the briquettes so formed are liable to crumble in the furnace. 2. Without binding substance, the briquettes being subjected to high pressure, and hardened by exposure to air or with the aid of heat, or being hardened by heat alone (sintering) without previous application of pressure. The author considers that the problem of producing, sufficiently cheaply, briquettes which shall be mechanically resistant to the shocks of transport and the pressure in the furnace, shall stand the weather, shall not crumble at a high temperature, and shall be sufficiently porous, is not yet solved. Especially an efficient, cheap, and non-injurious binding substance is wanted. The advantages of briquettes, to be counted against the cost, are, saving of carriage of moisture, and lessening of loss in transport, saving in coke, increased production through greater regularity in working, lessened repairs to lining, lessened amount of dust in the waste gases, and consequent economies in the use of these gases.—J. T. D.

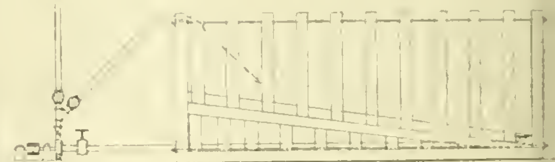
Ferro-Silicon; An Explosion of high-grade ——. G. Watson Gray. Paper read before the Faraday Soc. Electrochemist and Metall., 1904, 3, 501—503.

The author has investigated a series of explosions at Liverpool of recently imported ferro-silicon which had been allowed to stand on the quay for nearly a month. He cannot ascribe the cause to the presence of calcium carbide, since the material only contains 0·1 per cent. of calcium, though as much as 14 per cent. of this element has been known to occur in ferro-silicons. Phosphorus and arsenic were present, and the gases in the casks contained phosphorus and arsenic hydrides. The author considers the explosion to have been due to these gases.—R. S. H.

[Gold] Slimes Agitator; A Trapezoidal ——. C. De Kalb. Eng. and Mining J., 1904, 77, 241.

The author has obtained good results with the trapezoidal agitator shown in the accompanying figures. It consists of a box 30 ft. long, 6 ft. high, and 7 ft. 8 in. broad at the shallow end, and 10 ft. high and 6 ft. broad at the deep end.





A 6-in. pipe leads from near the centre of the deep end to a centrifugal pump placed 11 ft. in front of the shallow end of the box. The discharge pipe of the pump is fitted with a 45° Y-pipe, the inclined branch of which leads to just over the edge of the box. The pulp pumped from the box is discharged through this pipe at such an angle that it impinges on the surface of the pulp in the box at a distance of 10 in. from the nozzle. The pump works at an average rate of 460 revolutions per minute, and in consequence of the low "head," the pulp is discharged at a high velocity. Agitation is stated to be complete in 4½ hours, and the pulp is then forced through the vertical branch of the Y-pipe to the distributing box, and thence to the settling tanks. Detailed results obtained with this apparatus are quoted, and it is stated that the total extraction of gold and silver has increased from an average of 67·04 per cent. when agitation was effected with compressed air in the settling tanks, to an average of 74·27 per cent. with the apparatus described.—A. S.

Aluminium Powder and the Oxidation of Aluminium. E. Kohn-Abrest. Bull. Soc. Chim., 1904, 31, 232—239.

A sample of aluminium powder examined by the author had the following composition:—Metallic aluminium (including iron), 91·20; alumina, 5·80; silica, 1·30; "graphitoidal" and insoluble silicon (determined indirectly), 0·40; carbon, 0·23; moisture, loss, &c. (by diff.), 1·07 per cent. Aluminium powder in contact with alumina or aluminium hydroxide becomes oxidised, the action being especially rapid in an ammoniacal medium. If aluminium hydroxide be precipitated from a chloride solution by ammonia, and then aluminium powder be added, the latter is soon completely converted into a white gelatinous mass, probably a suboxide of aluminium.—A. S.

Arsenic and Antimony in Nickel Speiss; Determination of ——. H. Nissenson and A. Mittasch. XXIII., page 338.

Alumina [in Metallurgical Products]; Method for the direct Determination of ——. C. E. Rueger. XXIII., page 339.

English Patents.

Steel; Manufacture of ——. H. W. Lash, Cleveland, Ohio. Eng. Pat. 8026, April 7, 1903.

Low-grade iron ore is smelted in a blast furnace, and the greater part of the crude metal produced is treated in a Bessemer converter until it is partially oxidised; the remainder of the impure metal (containing metalloids) is conveyed whilst molten to a basic-lined open-hearth furnace; "basic materials" may then be added, together with the refined Bessemerised molten metal containing iron oxides. When chemical action has subsided, the refined mass is drawn off.—E. S.

Steel Armour Plates, or other Plates of Steel with a Hardened Face; Manufacture of ——. T. J. Tresidder, Sheffield. Eng. Pat. 8299, April 9, 1903.

Steel plates composed of stated proportions of iron, carbon, manganese, nickel, and tungsten are manufactured without, at any stage, "heating said plates to different temperatures in different parts of the plate at the same time." Such a plate is cemented or "supercarburised" on one side, and whilst hot, is re-forged or rolled, quenched, then uniformly heated and gradually cooled (after bending when necessary) and is again heated and quenched until the uncemented portions are in good fibrous condition. The plates are then uniformly heated and chilled. Plates so treated have "a smooth glass-hard face and a fibrous body or back." See Fr. Pat. 333,582, of 1903; this J., 1903, 1353.—E. S.

Iron and Steel; Production of —— by the Direct Reduction of Iron Ores in Crucible Furnaces. C. J. L. Otto, Dresden, Germany. Eng. Pat. 9346, April 24, 1903.

Within a portable, covered furnace, supported on trunnions for tilting, is arranged a covered crucible having a central tube (conveying fire-gases), open at the top and bottom, carrying a circular plate fitting to the sides of the crucible near its top, in which plate are tubular projections admitting passage of gases from within into the surrounding air space. The crucible is charged with a little charcoal at the bottom, and is then filled with crushed ore, in some cases mixed with scrap iron. The space around the crucible is filled with fuel, by the combustion of which the crucible is heated, without contact between the ore and the ashes of the fuel. The reduction of the ore takes place under a pressure of about two atmospheres from an air-blast. There is an air chamber about the lower part of the furnace, the air-blast supplying which, is heated by means of the fuel gases, and there are numerous passages through the walls of the furnace from the air chamber into the space filled with fuel.—E. S.

Precious Metals; Extraction of —— from Ores. C. H. Webb, Dorking, Surrey. Eng. Pat. 24,417, Nov. 7, 1902.

The crushed ore is treated with a solvent solution in a revolving vat having at either or both ends, and along its sides, continuously or at intervals, gratings covered with a suitable cloth or other filtering material. The filtering devices are so arranged within the vats that a space is left behind them, and such spaces are connected with pipes leading outside, whereby the liquid, as it filters through, is led away. The filtration is carried on under a difference of pressure between the feeding and delivery sides of the filtering devices, effected by the use of an air-pump, adapted for either compression or exhaustion, or for both alternately; or a separate suction pump may be provided.—E. S.

Blast-Furnace Tuyères or Injectors; Impts. in ——. E. Bertrand and E. Vorbach, of the Prager Eisenindustrie Ges., Kladno, Bohemia. Eng. Pat. 26,037, Nov. 28, 1903.

A hollow core is arranged in the longitudinal axis of the tuyère, so that it may be pushed forward or withdrawn by suitable mechanical means, thereby regulating the free section for the passage of the blast into the furnace. Through the action of the blast a depression of pressure is caused inside the core; this may be measured by means of a gauge, and then affords information as to the quantity of air passing. The core may be provided with an opening at its rear end, through which ore, flux, or combustibles may be sucked, and blown into the furnace by the action of the blast.—L. F. G.

Lithographic Stones [Metallic Substitute]; Manufacture of Substitutes for ——. G. Bower, St. Neots, and F. W. Gauntlett, London. Eng. Pat. 6155, March 17, 1903.

The substitutes for lithographic stones consist in metallic plates, the surfaces of which are covered with one or more metallic oxides. Thus a coating of iron oxide may be obtained on a steel plate by exposing it to heat and steam, but preferably to the action of superheated steam containing a little oil vapour, which removes any free oxygen present in the steam, so that only magnetic oxide is formed on the steel plate. Coatings of copper, tin, or zinc oxides may also be employed.—A. G. L.

United States Patents.

Iron and Steel; Process of treating ——. E. Engels, Düsseldorf. U.S. Pat. 752,054, Feb. 16, 1904.

See Eng. Pat. 25,932 of 1903; this J., 1904, 118.—T. F. B.

Metals; Extraction of —— from complex Ores. J. B. de Alzugaray, Bromley. U.S. Pat. 752,320, Feb. 16, 1904.

See Fr. Pat. 334,272 of 1903; this J., 1904, 24.—T. F. B.

French Patents.

Aluminium Alloys; Manufacture of ——, with a view to the production of Hydrogen more or less carburetted, and pure Hydrogen. N. A. Hélouis, L. Mauclaire, and E. Meyer. Fr. Pat. 335,954, Sept. 25, 1903.

Alloys of aluminium with barium, sodium, zinc, and other metals are obtained, preferably, by the aluminium-thermic process. If it be desired to obtain a carburetted hydrogen, a mixture of barium dioxide, powdered aluminium, and carbon, in stated proportions, is ignited in a magnesia-lined crucible. The product is broken up, and after several days is treated, first with water, and lastly with soda solution, to obtain the gas. If pure hydrogen be required, the alloy of aluminium-barium is produced from the described mixture except that the carbon is omitted, and that the aluminium is in granules or filings. An aluminium-sodium alloy may be similarly formed from a mixture of sodium dioxide with aluminium. On treating the product with water to obtain hydrogen, a strong solution of sodium aluminate remains as a by-product. Various applications for the pure and carburetted hydrogen thus obtained are described and claimed. Compare Fr. Pats. 333,724 and 333,725 of 1903; this J., 1903, 1347.—E. S.

Cadmium; Alloy of ——. G. Chaudoir, jun. Fr. Pat. 335,838, Oct. 9, 1903.

To form an alloy offering resistance to rupture at high temperatures nearly equal to that offered at ordinary temperature, from 1 to 3·5 parts per cent. of cadmium are melted with copper, bronze, or brass. An alloy containing

92 parts of copper, 4·5 parts of tin, and 3·5 parts of cadmium, is especially recommended. Reference is made to Eng. Pat. 10,197 of 1897 and to Ger. Pat. 97,141. —E. S.

Ores; Treatment of —— in a Furnace having a chamber to receive melted products. I. Sanfilippo. Fr. Pat. 336,069, Oct. 5, 1903.

Besides the furnace chamber proper, the furnace is provided with a second, relatively shallow chamber underneath the hearth, inclined towards a guarded opening for the outflow of melted metal or metalloid (such as sulphur), the dividing floor or partition being supplied with numerous holes or slits for passage of melted matter from the upper to the lower chamber. One means of access, or more, to the chimney is provided from the subsidiary chamber, whereby gases, such as sulphur dioxide, formed in roasting the ore, may be drawn into or through it; or the direction of the gases may be reversed.—E. S.

Air for Blast Furnaces or Converters; Process and Apparatus for removing the Moisture from ——. J. Gayley. Fr. Pat. 336,065, Oct. 15, 1903.

See Eng. Pat. 19,933 of 1903; this J., 1904, 22.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Electro-chemical Industries. F. B. Crocker and M. Arendt. School of Mines Quarterly, 1903, **25**, 1—20.

The subjects treated by the authors include: The electrolytic refining of copper; the electrolytic manufacture of aluminium, caustic soda, and potassium chlorate; electrolytic bleaching; manufacture of calcium carbide, barium compounds, alkali cyanides, carborundum, and artificial graphite; electric smelting (iron, steel, aluminium bronze); and the manufacture of ozone and of oxides of nitrogen.—A. S.

Luminous Arcs in Metal Vapours [of Mercury, &c.]. E. Weintraub. Philos. Mag., **7**, 95—124. Chem. Centr., 1904, **1**, 628.

A long arc can be readily produced in mercury vapour, with a continuous current at 100—200 volts, if a supplementary electrode be placed in the neighbourhood of the cathode, in order to render the latter active. The anode cannot be rendered active in this way. An arrangement is described in which the anode is of iron or graphite, whilst near the mercury cathode, a supplementary cathode, also of mercury, is placed. By electro-magnetic means, an iron core can be raised, whereby the film of mercury which connects the two cathodes is removed and a small arc is produced. By the ionising action of the arc on the mercury vapour, the main cathode is rendered active, and if no foreign gases be present, the main arc is produced almost instantaneously. If, however, the containing vessel or lamp has not been completely evacuated, *e.g.*, if the pressure of foreign gases (air, hydrogen, oxygen) exceed 0·01 mm., the supplementary cathode does not act so well. In such cases, a thin carbon filament may be used extending from the anode to near the cathode. The main arc extends first to the carbon filament, and then, rapidly, to the anode. Similar effects can be produced with alkali metals and amalgams in place of mercury.—A. S.

Solubility of Glass; Electrochemical Determination of ——. F. Haber and H. Schwenke. Zeits. f. Electrochem., 1904, **10**, 143—156.

The authors have worked out a rapid and simple method for determining the corrosive or solvent action of water on glass bottles such as are used for wine and beer. The method of examination recommended by the authors, consists in heating the glass bottle containing pure distilled water to 80° C. during five hours; a current of air (free from carbon dioxide) being bubbled through the water. Two small platinum electrodes are dipped into the water and the strength of current obtained by 10, 20, and 30 volts is noted every hour. From these measurements the specific conductivity of the water is obtained, and by the increase of this value, which is noted, the solubility is calculated. Comparison of the results with those obtained with previously examined bottles enables one to form an opinion of the quality of the glass of the vessel under examination.—R. S. H.

Paper [for Electrical Insulation]; Resistance of ——, to Moisture. Winkler. XIX., page 334.

Carbon from Carbides [Metallic]; Separation of ——, and Formation of Graphite. H. Ditz. VII., page 322.

Electrolytic Bleaching; Cost of ——. Franss. V., page 320.

English Patent.

Peat; [Electrical] Process and Apparatus for removing Water from ——. B. Kittler, Memel, Germany. Eng. Pat. 126, Jan. 2, 1904.

In the removal of water from peat by electro-osmotic action, the peat is warmed, kept in motion, and subjected to a vacuum. The peat is contained in a cylindrical sieve or strainer, which acts as the negative pole, and which is arranged with an outer casing carried on a central hollow shaft provided with hollow stirring blades, arranged helically around the shaft so as to act as conveyers; the shaft and stirring blades form the positive pole. Hot air is passed through the hollow shaft, and the outer casing is provided with an outlet for removal of the water and is connected with an air-pump. It is claimed that great efficiency is obtained with a small consumption of current, and that incrustation on the positive pole and short circuiting are prevented.—A. S.

United States Patents.

Electrically Heating Articles; Process of ——. E. F. Price, Niagara Falls, N.Y., Assignor to Union Carbide Co., Niagara Falls, N.Y. U.S. Pat. 752,357, Feb. 16, 1904.

The carbon articles, to be heated or baked, are arranged end to end in proximity to and around a resistance-conductor, and within or between, and in proximity to, layers of a separate material which is normally a poor conductor of electricity. The electric current is passed directly through the resistance-conductor, which is interposed between the electrodes or terminals, and the articles are heated and the layer of material is converted by the heat into a better conductor. The material thus allows the current to pass directly through it, and supplies a further quantity of heat to the articles sufficient to bake them. —B. N.

Heating Articles by Electricity; Process of ——. E. F. Price, Niagara Falls, N.Y., Assignor to Union Carbide Co., Niagara Falls, N.Y. U.S. Pat. 752,358, Feb. 16, 1904.

The process is similar to the one described in the preceding abstract of U.S. Pat. 752,357, with an additional arrangement for mechanically directing the electric current through the articles after they have been partially heated, so as to bring them to the desired temperature. It is claimed that the process is suitable for electrically baking carbon electrodes, the latter being arranged in a number of superposed or concentric layers.—B. N.

(*B.*)—ELECTRO-METALLURGY.

Steel; Examination of ——, with regard to its Electrica Conductivity. J. A. Capp. Amer. Inst. Mining Eng. New York, 1903.

The specific resistance of 45 samples of steel varied a about 20° C. between 11 and 22·7 microhms, or between 6·4 and 13·2 times that of copper. Seven samples o wrought iron showed at 25° C. a specific resistance of from 10·8 to 13·8 microhms, or 6·12—7·82 times that of copper

Curves are given showing the influence of impurities on the resistance of steel. Manganese is the element which exerts the greatest influence, and it is stated that commercial steel rails contain more manganese than is necessary to obtain the best results. For a good rail-steel having a resistance (13·8 microhms) eight times that of copper, not more than 0·15 per cent. of carbon, 0·30 of manganese, 0·06 of phosphorus, 0·06 of sulphur, and 0·05 per cent. of silicon should be present.—A. S.

Gold ; Electrolytic Analysis of ——. F. M. Perkin and W. C. Preeble. XXIII., page 339.

English Patents.

Zinc ; Process for the Electrolytic Production of ——. K. Kaiser, Berlin. Eng. Pat. 15,420, July 11, 1903.

See Fr. Pat. 333,773 of 1903 ; this J., 1903, 1356.—T. F. B.

Furnaces [*Electric*]. Le Roy W. Stevens and B. Timmerman, Chicago. Eng. Pat. 769, Jan. 12, 1904.

See U.S. Pats. 749,460 and 749,461 of 1904 ; this J., 1904, 192.—T. F. B.

Furnaces [*Electric*]. Le Roy W. Stevens and B. Timmerman, Chicago. Eng. Pat. 770, Jan. 12, 1904.

See U.S. Pat. 749,462 of 1903 ; this J., 1904, 192.—T. F. B.

French Patents.

Metals ; Manufacture of New Combinations of ——, *by Ionisation.* A. Nodon. Fr. Pat. 335,907, Oct. 14, 1903.

The electro-negative metal is fused and used as the cathode in an electric furnace, the anode being a non-attackable substance, and the electrolyte a fusible and only slightly volatile halogen compound of the more electro-positive metal. The passage of the current effects an ionisation, effecting the combination of the metals and the liberation of the halogen. To incorporate other metals, the electro-affinity of each of the new metals is first determined, and these are added to the electrolyte as halogen compounds. The proportions are regulated by the composition of the alloy to be obtained, and the liberation of the metals is effected successively by the aid of electro-motive forces proportional to the electro-affinities of the metals of the electrolyte.—B. N.

Etching [*Designs on*] *Metals, and especially Printing Cylinders.* J. A. Dejey. Fr. Pat. 335,941, Sept. 18, 1903.

The present process differs from that described in Fr. Pat. 334,499 of 1903 (this J., 1904, 67) in that the metallic reserve is tin instead of lead, and the deposition of the tin on the prepared surface is effected electrolytically from a hot bath, preferably constituted of two parts of sodium pyrophosphate to one part of stannous chloride, dissolved in distilled water. The other processes remain substantially as described in the former patent. Reference is made to Fr. Pat. 301,227 of 1900. See Addition to Fr. Pat. 301,054 of 1901 ; this Journal, 1902, 51.—E. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Oleic Acid ; Solidifying ——, *with Sulphuric Acid.* K. Hartl, jun., Vienna. Ger. Pat. 148,062, Jan. 20, 1903. Zeits. angew. Chem., 1904, **17**, 277.

Oleic acid and fatty acids in which it is contained are solidified by first submitting them to distillation with superheated steam—to remove organic impurities liable to be carbonised by sulphuric acid—and then treating the distillate with concentrated sulphuric acid in the usual manner.—C. S.

"Extraction Beeswax" ; Characteristics of ——. W. Hirschel. Chem.-Zeit., 1904, **28**, 212—213.

In the preparation of beeswax, the bulk of the wax is first separated by treatment with hot water and straining from dead bees, &c., and the residue pressed in layers with straw in a filter-press. The pressed residue is again boiled and pressed, yielding the so-called "expressed wax," and this final residue in the press is extracted with benzine to recover the 10—15 per cent. of wax that it still contains. The "extraction wax" is frequently contaminated with the material of artificial combs. The author has analysed three specimens of genuine "extraction wax" as obtained directly from the residue, previous to the partial bleaching and refining that it undergoes before being put upon the market. The crude wax was a dark brown soft mass, greasy to the touch and of unpleasant odour. In each case it was boiled with water before analysis to remove a yellow colouring matter. The filtered waxes gave the following results :—Acid value, 23·3 to 27·1 saponification value, 92 to 94·5 ; "ratio," 2·46 to 2·95 ; Buchner's acid value, 11·9 to 13·2 ; iodine value, 31·2 to 39·6 ; m. pt., 61·3 to 62·5 ; and sp. gr. at 15° C., 0·953 to 0·957. With the exception of the specific gravity and melting point these values differ greatly from the figures for normal beeswax, and particularly in the case of the iodine value and Buchner's acid value. All three specimens gave faint reactions in the tests for rosin, and in Weinwurm's test for paraffin behaved as though containing about 5 per cent. of that substance. In Fehling's test for stearic acid only a faint milkiness was obtained. Six commercial samples of "extraction wax" in a semi-bleached condition gave the following results :—Acid value, 21·9 to 53·3 ; saponification value, 91·5 to 122·2 ; "ratio," 1·29 to 3·24 ; Buchner's acid value, 10·1 to 27·9 ; m. pt., 69° to 72·5° C. ; and sp. gr. at 15° C., 0·970 to 0·984. All the samples gave more or less pronounced reactions with Fehling's stearic acid test.—C. A. M.

Oils and Fats ; Simple Thermostat for use in connection with the Refractometric Examination of ——. T. E. Thorpe. XXIII., page 338.

Edible Fats ; Analysis of ——, *particularly the Detection of Cocoanut Oil in Butter and Lard.* A. Juckernack and R. Pasternack. XXIII., page 339.

Butter-Fat ; Interdependence of the Physical and Chemical Criteria in the Analysis of ——. T. E. Thorpe. XVIII. A., page 334.

English Patents.

Wood Oil [*Tung Oil*] ; *Treatment of* —— *to form Products especially useful in the Manufacture of Linoleum and the like.* A. H. Dewar. From The Linoleum Manufacturing Co. Eng. Pat. 5789, March 12, 1903. XIII. B., page 328.

Sewage Sludge and like matters ; Treatment of [*Extraction of Fatty Matters from*] ——. H. Spence and P. Spence and Sons., Ltd. Eng. Pat. 8348, April 11, 1903. XVIII. B., page 334.

Soaps developing Active Oxygen and having an Antiseptic and Bleaching Effect ; Manufacture of Non-Caustic ——. H. Giessler and H. Bauer, Stuttgart. Eng. Pat. 22,580, Oct. 19, 1903.

Ordinary soap is mixed with a suitable proportion of "sodium or ammonium perborate," NH_4BO_3 or $NaBO_3$, or "sodium percarbonate," Na_2CO_4, either in the form of powder or as a paste with lanolin, vaselin, &c. Claim is also made for protecting such salts from the action of the carbon dioxide of the air by enveloping them in soaps, spermaceti, vaselin, paraffin-wax, &c.—C. A. M.

French Patents.

Oils and Fats ; Enzymic Decomposition of ——. M. Nicloux. Fr. Pat. 335,902, Oct. 14, 1903.

Crushed castor (or other) seeds are triturated with castor oil from a previous operation, and the oily extract filtered and subjected to centrifugal force. The deposit consists of aleurone and the active enzymic substance, and amounts to about 7·5 per cent. of the original non-decorticated seeds. As separated it still contains about 80 per cent.

of oil. It is stated that 10 kilos. of this active deposit are able to effect nearly complete decomposition of 1,000 kilos. of fats and oils in 24 hours.—C. A. M.

Solvent; Separation of —— from substances from which the Fat has been extracted. E. Bergmann. Fr. Pat. 335,964, Oct. 12, 1903.

The solvent is displaced by a liquid having a greater affinity for the substance but without chemical action on the solvent, *e.g.*, water, with or without the addition of an acid, alkali or salt, which additions may in certain cases be made to the substance before the extraction.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

Alkaline Earths [Pigment]: Mangani-manganates of the ——. V. Auger and M. Billy. Comptes rend., 1904, **138**, 500—502.

The compounds prepared by the fusion of manganese dioxide with a mixture of an earthy base and its nitrate or chlorate never possess the composition of manganates but always have a deficiency of oxygen as compared with the general formula MnO_4M''. The authors regard such compounds as mangani-manganates, the barium salt having been introduced as a pigment under the name of Cassel green. This compound is best prepared by evaporating a clear solution of baryta to a pasty consistency in a large flask, incorporating with the mass a mixture of equimolecular proportions of potassium and sodium nitrates to the extent of about five times the dry weight of the baryta and introducing powdered potassium permanganate in the proportion of 1 mol. to 4 mols. of barium oxide. The whole is then heated in an air bath in presence of a current of dry air to remove the water and is then maintained at a temperature of about 280° C. until the mass becomes green and ceases to evolve oxygen. After cooling, the green mass is thoroughly washed with boiled water and dried in the desiccator. The green pigment had the following composition:—MnO 19·9, BaO 70·8, available oxygen 6·98, H_2O (by difference) 2·4 per cent. This composition indicates an excess of barium over that required by the theoretical formula $Mn_2O_8Ba_3H_2O$, but the ratio of available oxygen to manganese corresponds exactly to the formula $O_3:Mn_2 = 48:110$.—J. F. B.

English Patent.

Paint Composition. W. A. Hall, New York.
Eng. Pat. 26,903, Dec. 8, 1903.

A water-resisting and more or less elastic paint is produced by mixing a mineral base, such as talc (200 parts), a vegetable oil, *e.g.*, tung oil (25 parts), potassium oxalate (2 parts), and water (50 parts), and adding to the mixture 100 parts of a binding composition consisting of casein (20 parts), ammonia (1 part), formaldehyde (2·5 parts), boric acid (2 parts), creosote (1 part), and water (170 parts).—T. F. B.

French Patents.

Medium for Oil Paints; Manufacture of a ——.
J. E. Kellinger. Fr. Pat. 336,317, Jan. 10, 1903.

See U.S. Pat. 738,456 of 1903; this J., 1903, 1096.—T. F. B.

Pigment, and Process of Manufacturing same. W. J. Armbruster and J. Morton. Fr. Pat. 33 ,222, Oct. 23, 1903. Under Internat. Conv., Jan. 30, 1903.

See U.S. Pat. 743,802 of 1903; this J., 1903, 1300.—T. F. B.

White Paint; Manufacture of a ——. J. E. Kollinger. First Addition, dated Oct. 23, 1903, to Fr. Pat. 328,114, Oct. 23, 1902; this J., 1904, 69.

The pigment obtained from dolomite containing 20—50 per cent. of magnesia is superior to that from a purely calcareous limestone. Magnesia may be added to a limestone, but the result is less satisfactory than when it is naturally present.—M. J. S.

(*B.*)—RESINS, VARNISHES.

Colophony; Constituents of ——. W. Fahrion.
Zeits. angew. Chem., 1904, **17**, 239—241.

In a former communication (this J., 1902, 127) the author asserted that the chief constituent of American colophony was an acid (or isomeric acids) of the formula $C_{20}H_{30}O_2$, which readily underwent spontaneous oxidation with the formation of a product insoluble in petroleum spirit. His views were opposed by Tschirch and Studer (this J., 1903, 1250). The author now replies to Tschirch and Studer, and concludes that his former theory of the "autoxidation" of colophony is completely justified by observations made.
—C. A. M.

Rosin and Rosin Oil; Practical Uses of ——. S. v. Rela-Stanislawski. Chem. Rev. Fett- u. Harz-Ind., 1904, **11**, 8—9.

The cheaper qualities of sealing-wax contain up to 40 per cent. of rosin, in addition to shellac, accaroid resin, thick turpentine, Manila copal, and colouring and weighting materials; whilst ordinary packing sealing-wax contains as much as 60 per cent. of rosin. Mixtures of heavy rosin oil and mineral oil are used as "saturation oils" in the sugar industry. Effront (see Eng. Pat. 19,354 of 1902, and Fr. Pat. (addition) 321,124 of 1902; this J. 1903, 223, 1061; also this J. 1903, 876) has described a method of improving the fermentation of molasses for the manufacture of spirit by adding rosin, rosin acids, or rosin soaps to the mash, wort, or pitching yeast. An addition of 20 to 100 grms. of rosin to 100 litres of mash increases the yield of alcohol, whilst abnormal molasses are rendered readily fermentable by treatment with rosin acids at a higher temperature. Cheap substitues for shellac have been prepared from accaroid resin, rosin, and a saponifiable wax, whilst in some cases Manila copal is present. For certain purposes these preparations give as good results as shellac. Rosin and rosin oil are added to inferior asphaltum varnishes to improve their lustre and elasticity, whilst rosin varnishes are mixed with benzene solutions of rubber, and used as insulating varnishes.—C. A. M.

Copal Resin and Kino, New; obtained respectively from the Fruit and Bark of Dipteryx Odorata, Willd. E. Heckel and F. Schlagdenhauffen. Comptes rend., 1904, **138**, 430—432.

The red secretion product contained in the bark of *Dipteryx odorata*, and probably in all trees of the genus *Dipteryx*, presents very close analogies with previously known kinos. The flowers contain a copal resin and the berries are rich in coumarin.—T. H. P.

English Patent.

Wood Oil [Tung Oil]; Treatment of —— to form products especially useful in the manufacture of Linoleum and the like. A. H. Dewar, Staines; and the Linoleum Manufacturing Co., Ltd., London. Eng. Pat. 5789, March 12, 1903.

Tung oil polymerised by heat is mixed with "solidified" (oxidised) linseed oil, yielding a product that melts at a lower temperature than the polymerised oil (300° C.). Resins, oils, siccatives, or the like may also be added, or blown castor oil, rosin oil, &c., may be added at about 180° C. instead of the solidified linseed oil.—C. A. M.

(*C.*)—INDIA-RUBBER.

Indiarubber; Valuation of ——. C. O. Weber.
Gummi-Zeit., 1904, **18**, 461.

The method of fractional precipitation (this J., 1903, 885) for the valuation of india-rubber must be used with caution in the case of rubbers not well known, and it is as well to supplement it by an elementary analysis of the original rubber, and also of each fraction, and a determination of bromine in the bromine-addition product. The author gives an instance of Uganda ball, which had all the appearance of a good rubber. The nitroso product appeared normal, but the bromide on analysis only yielded 60·27 per cent. of bromine (instead of 70·17 per cent.). The rubber itself contained no less than 32 per cent. of oxygen; yet by the Schneider method (*loc. cit.*) it yielded 92 per cent. of α-caoutchouc and 8 per cent. of resin.—J. K. B.

English Patents.

Rubber; Process of Vulcanising ——. A. O. Bourn, Bristol, R.I., U.S.A. Eng. Pat. 28,353, Dec. 24, 1903.

The object of the process is to ensure a uniform temperature in all parts of the vulcanising chamber, whether the heating be done by a steam-jacket or by coils inside the chamber. This is achieved by mechanically circulating the vulcanising medium (air or other gas) by means of suitably arranged pipes connected to a fan or pump.—J. K. B.

Adhesive Solution for sticking all kinds of Leather, Rubber, Cloth, and the like. H. E. Dancer, East Finchley. Eng. Pat. 7313, March 30, 1903.

A suitable solution for sticking together leather, rubber, cloth, &c., consists of gutta-percha (about 1 lb.) dissolved in methylated ether (1 lb.) and carbon bisulphide (4 lb.). —T. F. B.

United States Patents.

Rubber-like Gum. M. G. Brownell, Denver, Col. U.S. Pat. 752,951, Feb. 23, 1904.

A plastic, rubber-like, waterproof gum is prepared from the plant *Picradenia floribunda utilis* by grinding the plant to a pulp and treating this pulp with a volatile hydrocarbon solvent, such as light petroleum spirit, in which the gum is soluble, and separating the gum from the extract by evaporation.—J. F. B.

Rubber-like Gum. M. G. Brownell, Denver, Col. U.S. Pat. 752,952, Feb. 23, 1904.

A plastic, rubber-like body, consisting essentially of the gummy particles contained in the plant *Picradenia floribunda utilis*, separated and agglomerated into a coherent mass, insoluble in water, but soluble in light hydrocarbons is claimed. The plant is ground to a pulp with water, and the pulp is subjected to a compressive, rubbing action, whereby the gummy matter is separated from the fibre. —J. F. B.

Rubber-like Material. R. A. Leigh, Assignor to the Western Rubber Co., both of Denver, Col. U.S. Pat. 752,988, Feb. 24, 1904.

The agglomerated gummy matter obtained from *Picradenia floribunda utilis* is mixed with sulphur or sulphur compounds, rolled into sheets, and vulcanised by heating under pressure.—J. F. B.

French Patent.

Caoutchouc, Artificial; Manufacture of ——. L. L. A. Seguin and J. F. G. de Roussy de Sales. Fr. Pat. 336,206, Oct. 21, 1903.

The "caoutchouc ferment" mentioned in Fr. Pat. 334,833 (this J., 1904, 122) is prepared in the following manner. A solution of natural caoutchouc in "benzine" is exposed to daylight in a closed bottle, and the thick deposit produced is redissolved by heating at 50° C. The solution is then poured into double its volume of alcohol, the liquid decanted from the precipitate obtained, and the latter scattered on the surface of a mixture of coal-tar with boric acid, which is then kept at 50° C., in an atmosphere of oxygen. After some time, the cover and the walls of the containing vessel become coated with a brownish-grey powder, which is stated to be a very active ferment.—M. J. S.

XIV.—TANNING; LEATHER, GLUE, SIZE.

English Patents.

Cement [Glue Composition] for uniting pieces of Wood. J. H. J. Bartels, Liverpool. Eng. Pat. 4154, Feb. 21, 1903.

Ordinary animal glue is dissolved in milk of lime, and 1 to 2 parts of linseed meal are added to the glue solution so obtained (9 pints) and also about 1 part of commercial silicate of soda. The sheets to be united are coated thinly with the cement, and then brought together, and submitted to pressure and heat.—J. K. B.

Adhesive Solution for sticking all kinds of Leather, Rubber, Cloth, and the like. H. E. Dancer. Eng. Pat. 7313, March 30, 1903. XIII. C., col. 1.

French Patent.

Leather; Grained ——, *and Process of making same.* The Universal Leather Co. Fr. Pat. 336,256, Oct. 26, 1903.

See Eng. Pat. 22,872 of 1903; this J., 1904, 27.—T. F. B.

XV.—MANURES, Etc.

Phosphoric Acid in Crude Phosphates; Rendering the —— *soluble, for Manuring Purposes.* A. Ystgaard. Teknisk Ugeblad, Christiania, 1903, **50**, 329. Chem.-Zeit., 1904, **28**, Rep., 56.

If powdered apatite be fused with carnallite, reaction takes place according to the equation:—$Ca_3P_2O_8 + 3MgCl_2 = Mg_3P_2O_8 + 3CaCl_2$. The product can be easily pulverised, and of its total phosphoric acid, about 80 per cent. is soluble in 2 per cent. citric acid. The best results are obtained by using 1½ times the theoretical amount of carnallite, and fusing at about 700° C. for not longer than 10—30 minutes. The process is more economical if the carnallite be partly substituted by kieserite. The best mixture consists of 100 parts of apatite, 200 parts of carnallite, and 100 parts of kieserite; and the product, after being lixiviated with cold water, yields a residue containing from 26—30, sometimes as much as 34, per cent. of phosphoric acid soluble in 2 per cent. citric acid. Comparative vegetation experiments with the product obtained and with Thomas meal gave results favourable to the new product.—A. S.

English Patents.

Gas Liquor; Treatment of ——. C. G. Moor. Eng. Pat. 4988, March 4, 1903. III., page 318.

Brewers' and Distillers' Yeast: Treating and Drying —— *for use as a Manure.* J. L. Baker. Eng. Pat. 7921, April 6, 1903. XVII., page 333.

XVI.—SUGAR, STARCH, GUM, Etc.

Beetroot Juice; Determination of the purity of ——. H. Pellet. Bull. de l'Assoc. des Chim. de Sucr. et de Dist., 1904, **21**, 762—766.

The author agrees with Hermann (this J., 1904, 28) that the determination of the purity of beetroot juice in the analysis of the juice obtained by pressing chopped slices gives only inexact and variable results from which nothing definite can be deduced. It is sufficient to determine the quotient of the diffusion juice and the sugar content of the beetroot. The tabulation of the richness of beetroots from 7 to 20 per cent. with the corresponding purity of the diffusion juice shows that for normal roots these are strictly related when average figures are used. Roots from irrigated lands, as in Persia, Spain and Egypt, contain, according to the author's experience, a greater quantity of salts in proportion to sugar than usual. Beetroots also which have lain long on the ground after vegetation is complete are abnormal in character.—L. J. de W.

Beetroot Juice; Action of Lime on certain Nitrogenous Matters in ——. E. Sellier. Bull. de l'Assoc. des Chim. de Sucr. et de Dist., 1904, **21**, 760—762. See this J., 1903, 969.

The author criticises the method used by Andrlik (this J., 1903, 1202) for determining that portion of the nitrogen of raw juice that can be set free as ammonia by distilling with lime after clarification. It is not stated how the clarification is to be effected, nor is the proportion of lime given. Basic lead acetate would eliminate albuminoids, properly so-called, but the separation of their products of degradation is less certain. It is not known what bodies other than ammoniacal compounds and amino-acids give off ammonia when distilled with lime. There is a presumption that albuminoids are decomposed, but the proof is wanting. Glutamine forms a precipitate with basic lead acetate, which increases on standing, and the optical character of the solution changes. If part of the amino-acids are precipitated by the clarification, the determination of the ammoniacal nitrogen is rendered inexact.—L. J. de W.

Evaporation and Heating; Transmission of Heat in ——. H. Claassen. Bull. de l'Assoc. des Chim. de Sucr. et de Dist., 1904, **21**, 800—808.

The coefficient of transmission of heat increases with the fall of temperature, and does not vary much per degree within the limits of experiment, except for very steep falls, when the injurious effect of an intense evaporation at the heating surface makes itself increasingly felt. The coefficient of transmission increases with rise of temperature of the heating steam and boiling liquid. Heating-steam at temperatures above and below 100° C. in particular, seems to act very differently. The coefficient diminishes when the column of liquid on the heating surface is increased. In the evaporation of solutions, the nature of the dissolved substance and the concentration of the solution have great influence. Salt solutions have co-efficients equal to or above that of water. For solutions of sugar, and probably of all organic matters, the coefficient diminishes with the increase in concentration. The condition of the heating surface (not only incrustation and rust, but also the composition of the metallic surface) has a marked influence on the transmission of heat. Any superheating of the steam diminishes the coefficient of transmission, and at a rate increasing greatly with that of the superheating.—L. J. de W.

Sugar; Inversion of ——. L. Lindet. Comptes rend., 1904, **138**, 508—510.

It is recognised that the inversion of saccharose by boiling with pure water is due to the very feeble acid properties of the sugar; inversion is intensified by the presence of invert sugar, the acidity of the constituents of which is greater than that of the saccharose. If the electrical conductivity of distilled water "be taken as unity," that of cane sugar is 1·3, fructose 3·7, and glucose 5·1. The addition of 1 part of invert sugar to 3,000 of saccharose doubles the degree of inversion. The author's experiments were carried out by boiling a 10 per cent. solution of sugar for four hours. The nature of the vessel in which the boiling is conducted has a great influence on the inversion. With new glass vessels the inversion is retarded or even inhibited by the alkalis extracted from the glass, which neutralise the acidity of the sugar. This influence of the glass decreases with repeated use, and the proportions of reducing sugar formed, increase with each operation until the glass becomes indifferent. The maximum degree of inversion can be attained at once if the glass be first extracted with boiling water or dilute acid. With copper or aluminium vessels the inversion is considerably intensified. The author was therefore led to investigate the influence of shavings of various metals on inversion in previously extracted glass vessels. Copper, lead, tin, and bismuth considerably intensified the inversion; aluminium and antimony had a weaker intensifying effect; nickel, chromium, arsenic, gold, platinum, silver, and mercury were indifferent; cobalt, iron, zinc, cadmium, and magnesium had a retarding influence. These effects are due to the acid or basic nature of the oxides of these metals. The influence of metals on the inversion of saccharose is greater the smaller the heat of formation of their compounds, and the greater their tendency to chemical dissociation. Further, these metals intensify the inversion of sugar more powerfully the less the liability of their compounds to electrolytic dissociation, the less the heat evolved by their ionisation, and the lower their electrolytic solution-pressure. —J. F. B.

Sugar; Various methods of Refining ——. A. Aulard. Zeits. Ver. deutsch. Zuckerind., 1904, 143—186.

In a review of the progress in the sugar refining industry in the last three years, the author deals with the composition of molasses; formation of invert sugar; refinery value of raw sugars; defecation with baryta and ammonium phosphate; Roux's process for the complete drying down under vacuum of refinery massecuites; specification of complete plant for sugar refineries; sugar-grinding and cube-forming machinery; sugar-loaf and slab-forming machines with centrifugal claying; plant and working statistics of a French refinery; description of the "Perfect" sand filter for syrups. Many of the descriptions are accompanied by illustrations.—J. F. B.

Potato Starch; Composition of ——. A. Fernbach. Comptes rend., 1904, **138**, 428—430.

By determining the proportions of phosphoric anhydride in the small, light granules and in the large, heavy granules of samples of potato starch, the author arrives at the conclusion that small starch granules consist of a nucleus relatively rich in phosphorus on which are gradually superposed, so as to form larger and larger granules, layers of starch free from phosphorus. The latter element does not seem to belong entirely to the nitrogenous organic matter present, as the starch examined contained only small proportions of nitrogen.—T. H. P.

Sugar; Analysis of ——. K. Abraham. XXIII., page 340.

Sugar Analysis; Dry Defecation in optical ——. W. D. Horne. XXIII., page 340.

p-Nitrophenylhydrazine and p-Dinitrodibenzylhydrazine; Some Hydrazone derivatives of —— [*Detection of Acetone or of Wood Spirit in denatured Alcohol*]. A. van Ekenstein and J. J. Blanksma. XXIII., page 340.

Dibenzalglucosides and Benzalmethylglucosides. A. van Ekenstein. XXIV., page 341.

Mannamine: A new Base derived from Mannose. E. Roux. XXIV., page 342.

French Patent.

Starch; Preparation of Soluble ——. O. Bredt and Co. Fr. Pat. 336,030, Oct. 17, 1903.

See Eng. Pat. 22,370 of 1903; this J., 1904, 29.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Invertase; Influence of Electrolytes on the Action of ——. S. W. Cole. J. of Physiology, **30**, 281—289.

The invertase solution was prepared from a solution of commercial invertase by dialysis with distilled water in presence of chloroform. The following table shows the amount of sugar inverted in solutions containing 21·4 per

Sugar Solution containing	Percentage of Sugar Inverted after 24 Hours.	Percentage of Sugar Inverted after 42 Hours.
Without any addition............	20·0	26·2
Sodium chloride..................	11·6	12·4
Ammonium chloride............	37·3	53·7
Barium chloride..................	10·6	11·4
Potassium sulphate............	10·1	10·8
Ammonium sulphate............	41·2	58·6
Magnesium sulphate............	9·5	10·4
Sodium-potassium tartrate......	10·6	12·0
Ammonium tartrate	63·6	73·6

cent. of sugar, the concentration of the individual salts o the mixture corresponding in each case to a N/9 solution; the temperature was 40° C.

The results show that in general the retarding action of the cations of the salts preponderates over the acceleratng influence of the anions. A comparison of the results obtained with sodium, ammonium, and barium chlorides, and with potassium, ammonium, and magnesium sulphates shows that the retarding influence of salts increases with he strength of the base contained in it. In the case of ammonium salts, the retarding influence of the weak NH_4-ion is so slight that it is easily overcome by the accelerating influence of the anions, the result being that ammonium salts have a remarkable stimulating effect on nvertase. The greater acceleration of the inversion by ammonium tartrate than by ammonium chloride and sulphate s due to the fact that the proportion of injurious hydrogen ons is greater in the solutions of the inorganic salts. A small addition of hydrochloric acid (up to a concentration of N/3000), causes a remarkable increase in the action of nvertase on cane sugar. In a solution containing 23·73 per cent. of sugar, in 51 hours at 39·5° C., 4·96 per cent. of he sugar was inverted by invertase alone, 59·58 per cent. by invertase + 0·0012 per cent. of hydrochloric acid (= N/3000), and 3·24 per cent. by 0·0012 per cent. of hydrochloric acid alone. With larger proportions of acid, he amount of sugar inverted by the acid alone increases, but that inverted by invertase + acid decreases. The nfluence exerted by electrolytes on ferment action is due o an action on the ferment itself, not on the nutritive medium.—A. S.

Enzymes. H. Johnson. J. Fed. Inst. Brewing, 1904, 1, 13—27.

Proteolytic Enzyme of Malt.—When ground malt is digested with water at suitable temperatures, the acidity of the infusion increases on standing for about six hours, his being due to the production of soluble amides, peptones, and albumoses by the action of the proteolytic enzyme. The most favourable temperatures for this action lie between 105° and 130° F.; no increase of acidity takes place at temperatures above 155° F. Increase of acidity occurs to the same extent in the presence of chloroform, so that it is not attributable to bacterial activity. It takes place either at the expense of or under the influence of some of the nsoluble constituents of the malt, since a filtered infusion of malt, when tested under the same conditions, shows no ncrease of acidity. From these facts, it follows that the acidity of a sample of malt must be determined by extraction at temperatures above 158° F. The acidity of a sample of malt is a rough measure of the soluble nitrogenous bodies; excessive acidity indicates "forced" growth. In warm top fermentations the yeast is generally allowed to digest most of its own food, and high mashing temperatures are generally employed. But for cool bottom fermentations pre-digested food must be supplied, and low initial mashing temperatures are required. Any degeneration of he yeast owing to deficient nutrition can generally be corrected by slightly lowering the initial temperature of mashing, thereby favouring the activity of the proteolytic enzyme in the malt.

Liquefying Diastase. — Malt-starch which has been modified by germination, is very readily attacked and saccharified in the mash tun, but the starch of raw grain should be digested with 20 per cent. of malt for half an hour at 75° F. before treatment in the converter.

Invertase of Yeast.—Invert sugar may be prepared for brewing purposes by dissolving raw sugar in the proportion f 144 lb. per barrel, adding 3 lb. of liquid yeast per cwt. of sugar, and digesting at 133° F. for 1½—2 hours; the olution can then be used in the copper without separating he yeast.

Influence of Enzymes on Attenuation.—The various types f saccharomyces are arranged in the following order:— . apiculatus, Saaz, Frohberg, Burton, Logos—produce increasing degrees of attenuation in malt worts, owing to the ction of the different enzymes secreted by them upon the extrins. It is suggested that primary fermentation might e carried out by a low attenuating type, whilst a more powerfully attenuating yeast could be sown afterwards for conditioning.—J. F. B.

Malt; Extraction of the Nitrogenous Matters of ——. L. Pierre. Monit. Scient., 1904, 18, 190—193.

Interaction between Potassium Phosphates and Certain Calcium Salts.—Solutions of calcium bicarbonate and calcium sulphate are treated at various temperatures with primary and secondary potassium phosphates and with a mixture of the two, and for each temperature acidity and alkalinity were determined after filtration, also the quantities of lime and phosphoric acid in the precipitates. In all cases the precipitates produced above 60° C. contained calcium carbonate. In the case of a mixture of primary and secondary phosphates with calcium bicarbonate solution (a medium corresponding with the mashing liquor in the brewery), the acidity was greater than in the case of primary phosphate alone, owing to the action of the carbon dioxide liberated upon the secondary phosphate. For this reason the neutralisation of the acidity of malt by calcareous water always requires more calcium bicarbonate than is indicated by theory. The presence of primary phosphate considerably retarded the precipitation of lime and phosphoric acid. The influence of the nature of a water upon the acidity and alkalinity of a malt wort will be greater or less for a given percentage of phosphoric acid, according to whether the malt is richer in primary or in secondary phosphate. In the cold, the solutions of calcium bicarbonate with the mixed phosphates showed the highest acidities, but above 35° C. the solutions of calcium sulphate were more acid.

Cold Infusions of Malt.—When infusions of malt were prepared with distilled water at the ordinary temperature, the acidity showed that the proportion of primary phosphates increased with the duration of infusion. From the results obtained from infusions made with pure water, with solutions of tannin and with solutions of neutral potassium fluoride, the author concludes that the increase of acidity with the duration of infusion is due to the action of the bacteria occurring on the surface of the grain, and not to the extraction of acid substances or to the influence of an enzyme.

Influence of Potassium Phosphates on Extraction of Nitrogenous Matters.—Infusions were made on a scale of ascending temperatures, with pure water, with a solution of primary phosphate and a solution of secondary phosphate. The presence of primary phosphate considerably increased the extraction of nitrogenous matter; secondary phosphate had a similar but weaker effect. At temperatures below 50°C. a portion of the increase included coagulable matters.

Influence of Certain Salts on the Extraction.—The increase of acidity and non-coagulable nitrogenous matter with increasing temperature was much less rapid with calcium bicarbonate than with pure water; the quantity of non-coagulable nitrogen was always less in presence of calcium bicarbonate than with pure water. In presence of calcium sulphate there was more non-coagulable nitrogen extracted below 50° C. and less above 50° C. than with pure water at the same temperatures. Water containing sodium chloride showed the greatest extractive power for non-coagulable nitrogen at all temperatures. In all cases the acidity and extraction of nitrogen rose to a maximum at a temperature of 57°—60° C.

Influence of the Method of Mashing.—Worts prepared by the decoction process were less acid and poorer in coagulable and non-coagulable nitrogen than worts prepared at similar saccharification temperatures by infusion, except in the case of the calcium bicarbonate mash. This result is attributed to the partial sterilisation and fixation of the nitrogenous matters brought about by decoction of a portion of the mash.—J. F. B.

Malt; Percentage of Moisture in ——. A. Vogel. Zeits. ges. Brauw., 1904, 27, 163—165.

The author entirely confirms the views expressed by Windisch (this J., 1904, 261). The effect of long storage begins to show itself especially in the summer and autumn. Excessive moisture is frequently due to the old practice of storing the malt without removing the culms, which are exceptionally hygroscopic. Fries has shown that it is quite possible to preserve malt until the autumn so that the moisture shall not exceed 4—5 per cent. in the bulk. After six months' storage in a suitable bin, he found that the moisture in the malt at a depth of 10 ins. below the surface was less than 5 per cent., whilst at a depth of 2 ft. the effect of six months' storage was scarcely perceptible. Storage in silos is equally efficient. In default of such means the malt should be covered with cloths, hop-bagging, &c.; an uppermost layer of malt culms has been found advantageous for protecting the malt from the atmospheric moisture. The malt store should be ventilated with due regard to the temperature and humidity of the air admitted. Malt in which the moisture has increased to 7 per cent., will have suffered internal deteriorations which cannot fail to produce their effect on the flavour, character, and even the keeping qualities of the beer: beers of poor quality are for this reason far more common in the autumn than at any other season.—J. F. B.

Lactic Acid Bacteria; Effect of certain species of —— and of a species of Acetic Acid Bacterium on the Fermentation of Grain Mashes [Harmful Lactic Acid Bacteria]. W. Henneberg. Zeits. Spiritusind., 1904, **27**, 83—85.

In many distillery fermentation tuns the wood is found to be infected with various species of "wild" lactic acid bacteria, as distinguished from the culture species, *B. Delbrücki*, which is used for the acidification of the mashes. Some of these "wild" species are harmless, whilst others have a harmful effect upon the yeast and the yield of alcohol. The species of acetic acid baterium isolated did not grow in presence of yeast during fermentation. But all the 17 different species of lactic acid bacteria found, grew well and produced acid in presence of yeast at a temperature of 27·5°—30° C.; *B. Delbrücki* produces very little acid at so low a temperature. Those species of lactic acid bacteria which do not set up fermentation (*i.e.* with production of alcohol, carbon dioxide, and acetic acid) in mashes do no harm to the yeast or to the attenuation. It is not desirable, however, to employ them for acidifying the mashes, as the relatively low temperature at which they develop permits the growth of harmful competing bacteria. Those species which produce volatile acids (together with alcohol and carbon dioxide) in mashes, injure the yeast and the yield of alcohol. Such species are frequently found in badly attenuating potato mashes. The restriction of the attenuation by these harmful species of lactic bacteria is proportional to the quantity of volatile acid produced by them; the presence of *B. Hayducki*, *B. panis fermentati*, and *B. brassicæ fermentatæ* is for this reason especially harmful. If the harmful species, in a debilitated condition, be added simultaneously with the yeast (infected yeast), they are suppressed by the latter. If healthy bacteria and yeast be sown at the same time, both develop powerfully for 24 hours, after which the acidity does not increase unless the bacteria, in virtue of their production of volatile acid, are of such a nature as to be able to harm the yeast. Seed yeast so infected will give bad attenuations. If the yeast be first allowed to set up a vigorous fermentation in a pure condition, subsequent infection, even with healthy harmful bacteria, will have no ill effect. Many harmful species, *e.g. B. Buchneri*, when sown together with the yeast are almost completely suppressed by the latter. If the yeast be sown 24 hours after the lactic acid bacteria, the latter will continue to produce acid, and the final acidity will be greater than if no yeast were present. In practice the yeast is sown 24—48 hours after the acidifying bacteria; in this case, if acidification has been effected spontaneously or by too low a proportion of cultivated *B. Delbrücki* at too low a temperature, many harmful species of lactic bacteria will be present, and the attenuation will be even worse than in the case of infected yeast. In these experiments no appreciable differences were noted whether many or only a few bacteria were sown along with the yeast.—J. F. B.

Beer; Sarcina Disease of ——, and the Organisms which cause it. N. H. Claussen. Zeits. ges. Brauw., 1904, **27**, 117—121 and 137—142.

Sarcina disease in beer is caused by the development of certain species of pediococcus, pure cultures of which have been made by the author from single tetrads isolated from the diseased beers. These beer-pediococci are very easily separated from large quantities of yeast, and from most other organisms which accompany them by the selective antiseptic action of dilute solutions of acid ammonium fluoride, the pediococci surviving whilst the yeast, &c. perish. At least two species or groups of pediococci are concerned in the production of sarcina sickness in beer. *P. damnosus* as a rule imparts an unpleasant flavour and odour to the beer, but does not produce any notable turbidity. *P. perniciosus* makes the whole liquid turbid in addition to spoiling the flavour and taste. *P. perniciosus* produces a higher degree of acidity in unhopped wort than *P. damnosus*. One and the same pure culture of pediococcus causes through its growth in the same kind of beer always the same kind of symptoms. The author sees no reason for assuming the existence of virulent and non-virulent forms of the same organism in the same kind of beer. But certain kinds of beer exist which, owing to their composition, can withstand the development of *P. damnosus* in considerable quantities without showing any symptoms of disease. Beer-pediococci grow in hopped wort and other neutral or acid brewery culture liquids, but the presence of a small quantity of free alkali is sufficient to stop their development entirely. Ammoniacal yeast-water, which has been recommended as a favourable culture medium, is entirely unsuitable for the cultivation of pediococci in the brewery. At moderate temperatures in suitable culture media, such as wort, the beer-pediococci appear to be perfectly indifferent to the presence or absence of oxygen. Cultures of beer-pediococci are completely sterilised by the action of alcohol (50—93 per cent.) or of "antiformin" in less than 15 minutes. Bisulphites also appear to have a powerful antiseptic effect. Tartaric acid is relatively feeble, whilst fluorides and fluosilicates have a very weak action in destroying growths of pediococci.—J. F. B.

Beer; Albuminoid Turbidity in ——. F. Schönfeld. Woch f. Brau., 1904, **21**, 124—126.

On examining some bottled lager beer which had developed intense turbidity, and formed a dense deposit a week after being sent out from the brewery, no yeast or bacteria could be found, but on warming the bottles, every trace of turbidity and deposit disappeared, and the beer became quite bright; the precipitated matter consisted of resin and albuminoids. Trouble of this nature is avoided by placing the beer, immediately after filtration, in a moderately warm room (8°—10° C.), and keeping it there until sent out for consumption. New filters often cause difficulty in the direction of after-turbidity of the beer. The best way to cope with this, is to allow the filter to stand under beer for a day or so before using, and then to retain the first few barrels which pass through the filter and filter them again later; it is sometimes necessary to several times fill the filter with beer and allow to stand for a day. Experiments made by the author show that the longer beer is kept moderately warm after filtration, the quicker and greater will the formation of turbidity be when it is subsequently cooled to the temperature of the lager cellar; such turbidity mostly disappears on warming. The author supposes that the changes taking place are molecular transformations, and that, at a certain temperature, and possibly under the influence of living enzymes in the beer, the albuminoid substances assume other configurations, and then exhibit behaviour at low temperatures different from that of the original compounds.—T. H. P.

Beer; Albuminoid Turbidities in —— caused by Metals. F. Schönfeld. Woch. f. Brau., 1904, **21**, 133—135. (See also this J., 1904, 263.)

Working with a pale beer brewed by the high temperature short mashing process, the author added various small quantities of tin chloride to the beer. The addition of 0·0001 grm. of tin chloride per litre of beer produced no turbidity even after long standing, but with 0·0005 grm per litre a heavy turbidity was produced after 24 hours. With increasing proportions of tin, increased turbidities were observed, these turbidities not increasing on prolonged standing. Metals in the form of strips were immersed in the beer for a period of seven days. Aluminium, lead, copper, brass, nickel, and antimony produced no turbidity under these conditions; iron caused a precipitate of rust but not a true albuminoid turbidity; tin alone caused the characteristic albuminoid turbidity, which appeared first after 24 hours and which increased as the time of contact was prolonged. Tinned metals caused a still more intense turbidity than pure tin, and in a much shorter time. A second series of experiments of the same nature was made with two strips of different metals, so as to produce galvanic couples. At the ordinary temperature after seven days' contact, no turbidities were produced by any of the following couples:—Iron-lead, iron-copper, aluminium-copper, aluminium-brass, lead-antimony, copper-antimony, nickel-antimony. When the same tests were subsequently cooled to 2°—3° C., turbidities appeared in the following cases:—Aluminium-copper, aluminium-brass, and lead-antimony showed very faint turbidities; antimony-copper and antimony-nickel showed considerable turbidities, but to nothing like the extent of those produced by tin. Tin is the only metal which can take part in the production of these turbidities on the practical scale, and the use of tinned metallic surfaces in any part of the brewery plant is unsafe.—J. F. B.

Beer Filtration; Turbidities caused by ——. C. Sellenscheidt. Woch. f. Brau, 1904, **21**, 144—145.

The author states that all metals are inimical to beer, the worst being zinc and lead; most filter-makers use tinned-brass; the tin is generally alloyed with lead, since a coating of pure tin is difficult to apply. The Enzinger filters are constructed of pure tin with fittings of tinned brass; no filter is absolutely indifferent to beer. Corrosion of the metal by the beer may be either direct or galvanic. The best means for protecting a new filter from direct corrosion is to leave it full of waste beer for a day or two, and afterwards to clean it only with hot or cold water. The most sensitive are the immature beers containing a large proportion of carbon dioxide. The denser the metal the less the liability to corrosion, since the surface pores become more readily protected. Galvanic is far more serious than direct action in causing turbidities; aluminium is especially liable to galvanic corrosion. The author has selected pure tin as the material for the bodies of the filters, because it is the densest metal available, and because it gives rise to the fewest complaints from galvanic corrosion. Copper is too soft and silver-plated brass too expensive. Cleansing with soda, and especially with "antiformin," is a certain cause of turbidity, but such cleansing is occasionally necessary; the filter must then be treated in the same way as a new filter. The danger of turbidities is increased by the use of pressure regulators and counter-pressure bottling machines, which are also made of metal. The use of a cheap, insufficiently purified asbestos pulp for filtration may cause a characteristic bluish "clay" turbidity which is very difficult to remove.—J. F. B.

Cane Molasses; Quantity of unfermentable Sugar in ——. H. Pellet and G. Meunier. Bull. de l'Ass. Chim. de Sucr. et Dist., 1904, **21**, 797—800.

Cane molasses leaves, in practice, about 3 per cent. of the molasses unfermented in the form of reducing bodies. The determination of these reducing principles gives invariably higher results after inversion, but the difference is ess in proportion as the fermentation is more complete.
—L. J. de W.

Fermentation in the Distillery. H. Alliot. Bull. de l'Ass. Chim. de Sucr. et Dist., 1904, **21**, 783—785.

According to Effront's method, the yeast is acclimatised o substances foreign to the composition of distillery worts —hydrofluoric acid and fluorides—and the whole of the yeast and contents of the vats are rendered antiseptic, whilst by the author's method the yeast is accustomed to he presence of volatile principles, toxic to the yeast, pro-uced in the body of the molasses itself and driven off by he process of denitration. A yeast is thus prepared capable f living and developing in a wort of raw molasses which as not been boiled and to which, in the bulk, no antiseptics ave been added.—L. J. de W.

Wines, Natural and Grape Stones; Organic Phosphorus compound in ——. J. Weirich and G. Ortlieb. Chem.-Zeit., 1904, **28**, 153—154.

Analysis of a sweet wine, prepared only from the must of grapes from the island of Thera, showed that it contained 0·095 per cent. of phosphoric anhydride, whilst wines from other localities contained proportions of phosphoric anhydride varying from 0·02 to 0·060 per cent. It is found that this phosphorus exists in organic combination and has its origin in compounds of the lecithin type contained in the grape stones. The proportion of nitrogen contained in a wine varies almost directly with that of the phosphorus. Thus, a Greek wine contained 0·0535 per cent. of phosphoric anhydride and 0·025 of nitrogen; and two wines from Thera grapes—(1) 0·092 of phosphoric anhydride and 0·05 of nitrogen, and (2) 0·095 of phosphoric anhydride and 0·057 of nitrogen. It is to this presence of lecithin, which has an advantageous physiological action, that strong, natural, southern wines owe their superority over distilled alcoholic liquors, and in estimating the value of a wine for invalids, its phosphorus content, and especially that of its organically-combined phosphorus, is of the highest importance; in fortified wines the proportion of the latter is always low. In order to render wine more stable, it is often pasteurised, or else the must is heated and fresh yeast subsequently added. Neither of these methods is to be recommended, as they both lead to the destruction of the most important constituent of the wine, namely, the lecithin, which undergoes decomposition at slightly above 50° C.—T. H. P.

Nitrogenous substances soluble in water; Determination of —— *in Barley and Malt.* Guiness Research Lab. Trans. XXIII., page 340.

p-Nitrophenylhydrazine and p-Dinitrodibenzylhydrazine; some Hydrazone Derivatives of —— [*Detection of Acetone or of Wood Spirit in Denatured Alcohol*]. A. van Ekenstein and J. J. Blanksma. XXIII., page 340.

Rosin and Rosin Oil; Practical uses of ——. S. v. Rola Stanislawski. XIII. B., page 328.

English Patents.

Brewers and Distillers Yeast; Treating and Drying ——, *for use as a Manure.* J. L. Baker, London. Eng. Pat. 7921, April 6, 1903.

The yeast is heated in a steam-jacketed vessel, provided with an agitator, with a small proportion of sulphuric acid or of an alkali acid sulphate. Calcium carbonate is then added, but in such proportion as to leave the mixture acid. The mass becomes porous from escaping carbon dioxide, and may be readily dried. According to a second process, the yeast is mixed with a mineral phosphate, and is then heated and stirred with the proper proportion of sulphuric acid to constitute superphosphate. Or yeast, after being treated as first described, is mixed with a superphosphate and calcium carbonate, leaving the mass acid so as to avoid loss of ammonia.—E. S.

Distillers' Wash or Dregs and other noxious organic effluents; Process of treating ——. R. Anderson. Eng. Pat. 7658, April 2, 1903. XVIII. B., page 334.

Wine Vinegar; Ferment for the Manufacture of ——. C. Chotteau and E. Disse, Paris. Eng. Pat. 23,066, Oct. 24, 1903.

Fresh brewers' yeast, 2 parts, and sugar, 25 parts, are pounded, mixed, and compressed into a block, which is then wrapped in a thin shaving of beech-wood wound on itself. This ferment can be kept indefinitely in the dry state, and when placed in wine sufficiently aerated, it converts the wine into vinegar in a few days.—J. F. B.

French Patent.

"*Œnophile Vegetale*"; *Preparation for preserving wines and liquids poor in alcohol.* C. Gros. Fr. Pat. [illegible], Oct. 24, 1903.

Œnophile vegetale is prepared from the flowers, wood, bark, fruits, roots, leaves, seed, or pulp of plants belonging to the families of the gentianaceæ, citraceæ (bitter orange), rubiaceæ (cinchona), cruciferæ (cresses and mustard), papilionaceæ (chick pea), rutaceæ (guaiacum), *lauraceæ* (cinnamon and laurel), and *viniferæ* (vines). The preparation may be used in the form of a liquid extract (70—80 c.c. of extract per hectolitre of wine) or of a dry powder (45—50 grms. per hectolitre of wine). The preservative is mixed with the wine in the tuns, and is said to prevent decomposition for several years and otherwise to improve the quality.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A*.)—FOODS.

Butter-Fat; Interdependence of the Physical and Chemical Criteria in the Analysis of ——. T. E. Thorpe. J. Chem. Soc., 1904, **85**, 248—256.

The general relations between the analytically important chemical and physical constants of butter-fat, as disclosed by a study of the average values of these constants determined on 357 samples of butter-fat of known origin, are set out in a number of curve diagrams showing the variation of (1) specific gravity, (2) saponification equivalent, (3) Zeiss refractometer value, (4) percentage of soluble fatty acids, (5) percentage of insoluble fatty acids, and (6) mean molecular weight of insoluble fatty acids—all with Reichert-Wollny value.—A. S.

Edible Fats. Analysis of ——, *particularly the Detection of Cocoanut Oil in Butter and Lard.* A. Juckenack and R. Pasternack. XXIII., page 339.

English Patent.

Albuminous Compounds soluble in Water; Manufacture of ——. F. W. Howorth, London. From Bauer and Co., Berlin. Eng. Pat. 10,845, May 12, 1903.

See Fr. Pat. 333,334 of 1903; this J., 1903, 1362.—T .F. B.

French Patent.

Milk; Desiccation and preservation of ——. J. R. Hatmaker. First Addition, dated Oct. 2, 1903, to Fr. Pat. 324,913, Oct. 2, 1902. (See this J., 1903, 645.)

In order to preserve the casein unchanged by desiccation, sodium phosphate is added to the milk, and, in order to preserve the fat unchanged, caustic soda is added. For 100 litres of separated milk 315 grms. of crystallised sodium phosphate are added, and, for 100 litres of full-cream milk, 16 grms. of caustic soda are employed. Sugar, farinaceous matter, and other matters unaffected by the heat of the drying process may be added to the milk if desired.
—J. F. B.

(*B*.)—SANITATION; WATER PURIFICATION.

English Patents.

Distillers' Wash or Dregs and other noxious Organic Effluents; Process of treating ——. R. Anderson, Edinburgh. Eng. Pat. 7658, April 2, 1903.

Finely ground sphagnum moss and calcium sulphate are added to the crude effluent, which is then filtered or allowed to settle. By preference a succession of filter-beds made up of sphagnum moss and calcium sulphate, is employed. In the case of brewers' dregs, the comparatively clear filtrate is again treated with sphagnum moss and calcium sulphate and then neutralised by the addition of sodium hydroxide. The precipitate is allowed to settle.—W. P. S.

Sewage Sludge and like matters; Treatment of ——. H. Spence and P. Spence and Sons, Ltd., Manchester. Eng. Pat. 8348, April 11, 1903.

When sewage sludge is precipitated by ferric or aluminic compounds and curdled by heat (Eng. Pat. 12,124 of 1900; this J., 1901, 830), the fatty matters subsequently extracted from the dried sludge are liable to contain iron and alumina in combination. This is prevented by treating the precipitated sludge with a limited proportion of a mineral acid, heating the treated sludge, and removing the liquor before extracting the fatty matters.—J. F. B.

French Patent.

Water and Sewage; Purification of ——. F. Jean. Fr. Pat. 335,979, Oct. 15, 1903.

Ferrous and manganous oxides are added to the water or sewage, and then oxidised by aeration or oxidising agents. The precipitate formed, carries down with it the organic impurities present in the water.—W. P. S.

(*C*.)—DISINFECTANTS.

English Patent.

Soaps developing active oxygen and having an antiseptic and bleaching effect; Manufacture of non-caustic ——. H. Giessler and H. Bauer. Eng. Pat. 22,580, Oct. 19, 1903. XII., page 327.

French Patent.

Sulphur Baths; Preparation of a Substance suitable for Preparing ——. W. Matzka. Fr. Pat. 336,278, Oct. 28, 1903.

See Eng. Pat. 20,548 of 1903; this J., 1903, 1306.—T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

Paper Machine; Cleaning the wire cloth of the ——. Wochenbl. f. Papierfabl., 1904, **35**, 538.

The following method is recommended for cleaning the wire cloth of the paper machine:—A dilute solution of caustic soda is sprayed along one of the lower guide rolls of the wire; the upper couch roll having been removed, the wire is run round two or three times, whereby the caustic soda is distributed to all parts of the wire as it passes the roll on which the solution is being sprayed. The water sprays are then opened in order to remove the excess of soda remaining on the wire before the couch roll is replaced. By this treatment all the particles of slime and dirt which are so difficult to remove by ordinary means, are either dislodged or so loosened as to be readily removable by means of a wire brush.—J. F. B.

Paper; Resistance of —— *to Moisture.* Winkler. Papier-Zeit., 1904, **29**, 675.

In testing the suitability of papers for covering cartridges or for electrical insulation, the relative resistance to absorptio

No.	Sort of Paper.	Composition.	Grms. per Sq. Metre.	Increase of Weight.	Sizing.
				Per Cent.	
1	Wrapping paper I	Pine wood cellulose, a little rag pulp	125	13·1	Hard.
2	„ „ II.	Rags, a little pine wood cellulose, and jute	103	14·1	Moderately hard.
3	„ „ III.	Cotton, mechanical wood, a little wood cellulose, and jute	111	12·8	Soft.
4	Filter paper	Cotton	75	10·2	Unsized.
5	Cellulose wrapping paper	Pine-wood cellulose	105	12·0	„
6	Printing paper (news)	Mechanical wood, 80 per cent., pine cellulose 20 per cent.	74	9·2	Soft.
7	Normal deed paper	Linen and cotton	86	9·7	Very hard.
8	Wrapping paper IV.	Pine-wood cellulose, a little mechanical ordinary leafed wood and pine-wood	105	11·4	Hard.

f moisture was determined. The papers were placed in a oistened atmosphere, with a humidity of 90 per cent. t 20° C. for 96 hours, and the increase of weight was etermined, with the results shown in the following table. he results of these tests were apparently unaffected by e sizing, but depended on the composition, and the egree of beating. Other tests were made with the wrapping apers by floating them on the surface of water for three inutes and removing the excess by blotting-paper. No. 1 bsorbed 30 per cent.; No. 2, 45 per cent.; No. 3, 76 per ent.; and No. 8 only 22 per cent. of water; this test epends on the sizing. "Wet beaten" papers, such as nitation parchment, always contain a high proportion of oisture; at normal humidity (65 per cent.) such papers ontain 19 per cent. of moisture, as against 7—8 per cent. ith other varieties. In an atmosphere at 90 per cent. umidity they may contain as much as 20 per cent. of oisture.—J. F. B.

Cellulose Nitrate; Unstable ——. E. Knecht.

Ber., 1904, **37**, 549—552.

Vhen pure cotton is immersed in nitric acid of sp. gr. ·415, it assumes gelatinous appearance, which disappears n washing and drying; the cotton has then a normal ppearance, but has shrunk about 13 per cent. in length, is ronger, contains more moisture, and shows greater affinity r certain dyestuffs than ordinary cotton—*i.e.*, it exhibits e properties of mercerised cotton in a modified degree. If, ter treatment with nitric acid, the cotton be pressed and ried over lime *in vacuo*, a product is obtained which fumes damp air, and which gives, on treatment with water, itric acid and a cellulose hydrate. When heated to 100° C. a partial vacuum, nitrous fumes are evolved, and a roduct is obtained which is most probably identical with e oxycellulose obtained by treating cellulose with excess f nitric acid.

The appended table shows the amounts of nitric acid of arious strengths combining with cellulose, and the contrac- on produced.

Specific Gravity of Nitric Acid.	Nitric Acid Combined.	Shrinkage.
	Per Cent.	Per Cent.
1·1	3·0	1·0
1·3	3·8	1·0
1·325	7·1	1·0
1·375	7·5	1·0
1·38	10·8	2·5
1·4	27·3	10·0
1·415	35·8	13·0

Treatment with nitric acid of higher sp. gr. than 1·415 esults in the formation of nitrocellulose. The product is robably cellulose nitrate, $C_6H_{10}O_5$, HNO_3, possibly—

$$CH_2(CHOH)_4.C(O.NO_2)(OH),$$

hich requires 37·2 per cent. of nitric acid, the deficiency ound being due to the instability of the product.—T. F. B.

Celluloid; Solubility of ——. H. Flemming.

Chem.-Zeit., 1904, **28**, 213—214.

experiments with nitrated paper the author found that ly about 2 per cent. was dissolved by hot amyl acetate, hilst dichlorhydrin dissolved 10 times as much. In the tter case a clear solution was readily obtained on warm- g, but a solution containing 19 grms. of the nitrocellu- se in 50 grms. of solvent underwent some decomposition hen heated, giving off nitrous fumes and becoming more quid. The solution could be diluted with alcohol. A milar partial denitrification of celluloid was observed. hen finely-cut pieces of celluloid were warmed with 0 grms. of dichlorhydrin, solution readily occurred at 0° C. When 9 grms. of celluloid were present (tempera- re 140° C.) red fumes were evolved, which increased til 27 grms. had been added, and subsequently decreased. the concentration of the solution increased, the colour came darker, but the temperature should be kept below boiling point of dichlorhydrin (176° C.). A concen- ted solution (100 grms. in 100 grms.) solidified instantly on the addition of amyl acetate, benzene, or epichlorhydrin, and was readily miscible with linseed oil fatty acids. The addition of alcohol to the solution caused a separation of the celluloid.—C. A. M.

English Patents.

Paper for manifolding copying processes; Method of preparing —— *and printing surfaces therefrom with self-contained ink or colour supply.* W. H. Hutchinson, Shanklin. Eng. Pat. 24,532, Nov. 8, 1902.

Soft-sized paper is impregnated with melted fat, *e.g.*, with a mixture of stearic and oleic acids and paraffin wax. The excess of fat is removed by means of heated rollers at a temperature of 200°—250° F. to such an extent that the paper will not grease off at lower temperatures than that of the rolls. This treated paper is placed on a moderately soft surface, and the desired writing or design is impressed thereon with a pen, style, or die, in such a way that it stands up on the back of the paper in distinct ridges, without perforation of the paper. A special ink composed of glycerin, alcohol, and aniline dyestuff, is spread upon the positive side of the paper, which is then reversed on an inking pad. When the negative side of the paper is treated with an "inducting fluid," composed essentially of alcohol, the ink is enabled to penetrate through the paper only in those places which have been compressed by the pen; these penetrable places, standing in high relief, constitute the printing surface for taking manifold copies.

—J. F. B.

Paper and Pulp Machines; Impts. in ——. S. Milne, Edinburgh. Eng. Pat. 2420, Feb. 2, 1903.

In machines working on the principle of the cylinder paper-making machine, the endless wire sieve, instead of being carried on the walls of a cylinder revolving in a vat, is caused to dip obliquely or vertically into the vat and out on the other side. The wire in the vat is guided by a number of rolls, carried by end-pieces which make a watertight connection between the edges of the wire and the walls of the vat. In this way the wire makes a central compartment inside the vat, the pulp being outside, and the waste water inside this compartment. The pulp is caused to adhere to the wire, either by a difference of level between the liquid outside and that inside the wire, or by pumping off the water from the inside by suction boxes applied at a certain point.—J. F. B.

"Carton Pierre" [Decorative Moulding]; Preparation of ——. E. G. Jackson, London. Eng. Pat. 6703, March 23, 1903.

"Carton pierre" is prepared, in a liquid condition, by mixing 1 part of pulped paper, 2 parts of glue, 20 parts of water, 10 parts of whiting, and 10 parts of boiled plaster of Paris together, and adding to the mixture 0·05 part of sulphuric acid immediately before it is introduced into the moulds. Such a composition sets readily without shrinkage, and takes the pattern more sharply than the usual plastic composition.—J. F. B.

French Patent.

Paper and Cardboard; Process of Sizing ——. F. Dobler. Fr. Pat. 328,178, Dec. 19, 1902.

The paper is soaked in a solution or emulsion containing rosin soap, to which animal size may be added if desired. The rosin is then precipitated in the sheet of paper by treating the latter with a solution of alum, which at the same time has an astringent action on the gelatin, the sized paper being subsequently dried.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Bismutho-protocatechuic Acid. P. Thibault. Bull. Soc. Chim., 1904, **31**, 176—178.

The author has prepared this compound by the interaction of anhydrous or hydrated bismuth oxide and protocatechuic acid in water. It is a microcrystalline powder, formula $C_7H_5O_5Bi$, the bismuth being attached to the phenolic hydroxyls. The sodium, potassium, and ammonium salts and the anilide were prepared and analysed.—F. S.

Papaverinium Bases. H. Decker and O. Klauser. Ber., 1904, **37**, 520—531.

The authors discuss the constitution of the papaverinium bases and their decomposition products, and describe the formation of the *N*-methyl, *N*-ethyl, and *N*-benzyl derivatives of *iso*-papaverine, a base isomeric with papaverine, and of 6.7-dimethoxy- and 6·7-dihydroxy-2-benzyl-1-*iso*-quinolone, oxidation products of *N*-benzyl-*iso*-papaverine. —A. S.

Terpenes and Essential Oils. **65.** O. Wallach. Annalen, 1904, **331**, 318—333.

In the present communication the author describes the properties of *campherphorone*, an isomer of pulegenone; its decomposition by water in presence of alkali into acetone and 1.2-methylcyclopentanone; and a comparison of campherphorone and pulegenone with other cyclic ketones, both saturated and unsaturated.—A. S.

Camphor Synthesis. Schindelmeiser. J. Soc. Phys. Chim. Russ., 1903, 954. Chem. and Druggist, 1904, **64**, 379.

The author finds that the most favourable temperature for the production of borneol by the action of oxalic acid on pinene (see this J., 1904, 75, 266) is 110° C., and that the greatest yield obtainable is 70 grms. of borneol from 350 grms. of pinene. He points out that this small yield, apart from further loss in converting the borneol into camphor, is against the remunerative production of synthetic camphor. Moreover, borneol can be obtained more economically from the oil of *Abies siberica* (see this J., 1903, 879), which contains from 36 to 50 per cent. of bornyl acetate.—A. S.

Rare Earths; Contribution to the knowledge of the ——. W. Biltz. XXIV., page 341.

Acetanilide; Two New Reactions of [Distinction from Phenacetin] ——. E. Barral. XXIII., page 339.

Phenacetin; New Colour Reactions of ——. E. Barral. XXIII., page 339.

Cinchona Succirubra; De Vrij's Liquid Extract of, Determination of Cinchotannates in ——. J. Warin. XXIII., page 341.

English Patent.

Cream of Tartar; Manufacture of ——. U. Roux, Malaga, Spain. Eng. Pat. 7363, March 30, 1903.

See Fr. Pat. 328,713 of 1903; this J., 1903, 1011.—T. F. B.

United States Patents.

Organic Acid Compounds [Anhydrides]; Process of Making ——. W. Bauml, Assignor to Badische Anilin und Soda Fabr., Ludwigshafen. U.S. Pat. 752,947, Feb. 23, 1904.

See Eng. Pat. 24,255 of 1902; this J., 1903, 1147.—T. F. B.

[Adrenalin] Glandular Extractive Compound. J. Takamine, New York. U.S. Pat. 753,177, Feb. 23, 1904.

The compounds claimed are the salts of the extract of the suprarenal glands ("adrenalin," "suprarenin," "epinephrin," this J., 1901, 746, 1903, 818, and 1904, 213) with halogen acids, which are stable in aqueous solution, and possess all the physiological and therapeutic properties of the uncombined extract.—T. F. B.

French Patent.

Pinene Hydrochloride; Production of Pure ——. Chem. Fabr. Uerdingen, Lienau and Co. Addition, dated Dec. 19, 1902, to Fr. Pat. 328,009, June 27, 1902. See this J., 1903, 1101.

Concentrated sulphuric acid, while resinifying the impurities associated with pinene hydrochloride, does not materially decompose or dissolve the hydrochloride itself, even at fairly high temperatures. The crude hydrochloride may, therefore, be agitated with an equal volume of concentrated sulphuric acid, and the product cooled by ice and distilled with steam. Or the impurities may be removed as far as possible by saponification, as in the principal patent, and the product treated with concentrated sulphuric acid in a centrifugal separator, and the hydrochloride purified by sublimation.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Development and Fixing; Combined ——. T. T. Baker. Phot. J., 1904, 1—6.

Although Lumière and Seyewetz have found that traces of thiosulphate in the developer give rise to "dichroic fog" (this J., 1903, 759), it appears that, by the use of a suitable solution, plates may be developed and fixed simultaneously, giving a negative quite free from "dichroic fog," even when 25 per cent. of thiosulphate is present. Although development is more rapid at first, the whole time required for development is considerably increased, and to obtain a negative of good density it is essential that the image shall appear very rapidly, as otherwise fixation will proceed too rapidly. The developer used must be one which, when used in the usual way, has very little tendency to fog, and must contain alkali hydroxide; "edinol" and quinol (hydroquinone) were found to give the best results. The following is a typical example of the combined solution:—Edinol, 2 grms; potassium metabisulphite, 3 grms.; sodium sulphite, 10 grms.; sodium carbonate, 20 grms.; sodium hydroxide, 1 grms.; thiosulphate 40—50 grms.; water, 200 c.c.; the addition of small quantities of bromide was found to give negatives of increased contrasts with the solution mentioned, whilst the exposure necessary is less than that required when an ordinary developer is used.—T. F. B.

Carbon Tissue; Sensitising ——. H. W. Bennett. Phot. J., 1904, **44**, 7—9.

The sensitising solution used consists of potassium bichromate, 4 parts; citric acid, 1 part; water, 200 parts; and "ammonia," about 3 parts; the amount of ammonia may vary with different tissues. Papers prepared in this way require about 50 per cent. longer for printing than the ordinary tissues.—T. F. B.

Silver Halides; Photo-chemical Behaviour of Unemulsified ——. K. Schaum and W. Braun. Zeits. wiss. Phot through Phot. J., 1904, **44**, 13.

An image which can be developed is formed by the action o light on silver bromide, precipitated from dilute solutions the plates are also susceptible to "ripening" to a certai extent, the gradation being increased considerably thereby "Solarisation" is clearly marked. Röntgen rays affec silver halides directly, and not owing to the fluorescenc of the support, and "solarisation" was observed afte 80 minutes exposure.—T. F. B.

Pyrogallol Developer; Properties of the ——, *and a caus of the production of "Fog."* W. Vaubel. Chem.-Zeit 1904, **28**, 213, 232—234.

The rate of absorption of oxygen by alkaline pyrogallol greatest when sodium hydroxide solution of about 3 pe cent. strength is employed. The amount of oxygen al sorbed is greatest (3—3½ atoms of oxygen per mol.

yrogallol) with a concentration of alkali of from 0·5 to ·3 per cent. With a higher concentration of alkali, the mount of oxygen absorbed, decreases. The oxidation roducts formed vary according to the nature and concen ation of the alkali. Among them are hexahydroxydihenyl (see Harries. Ber., 1902, **35**, 2954), the compounds $C_4H_4O_3)_n$ and $C_{20}H_{20}O_{16}$ (see Berthelot, this J., 1898, 603, nd Comptes rend., 1898, **126**, 1459), and a compound, ${}_{20}H_{15}O_7(OH)_3$ isolated by the author. The production f "fog" on photographs which have been treated with a yrogallol developer is in most cases due to the formation f larger or smaller amounts of oxidation products of yrogallol insoluble in alkali, but can be completely or lmost completely prevented by the addition of sodium ulphite to the developer.—A. S.

English Patents.

ellulose Acetate [for Photographic Films, &c.]: Manufacture of ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer & Co., Elberfeld. Eng. Pat. 7346, March 30, 1903.

ee Addition of Jan. 30, 1903, to Fr. Pat. 317,007 of 1901; is J., 1903, 1015.—T. F. B.

ollodion Emulsions; Method for the Preparation of Durable —— for all Colour Rays of the Spectrum, suitable for the production of Negatives for half-tone in natural colours. F. Nusch, London. From the Franklin Tarsulat, Budapest. Eng. Pat. 14,073, June 24, 1903.

ollodion emulsions are treated with di-iodofluorescein, c., or with "sensitive salts or solutions." The emulsions hus prepared may be treated with suitable dyestuffs (free rom silver) to increase their sensitiveness for particular ays.—T. F. B.

richromatic Photography. B. Jumeaux and W. N. L. Davidson, Brighton. Eng. Pat. 3730, Feb. 17, 1903.

hree negatives are prepared as usual by using red, blue, nd green light filters. A silver chloride print (or transarency) is prepared from the negative taken through he red screen, and is toned blue; thin films of bichroated gelatin are exposed under the other two negatives, nd immersed in dilute acid. The film from the negative aken through the green screen is now stained red and uperimposed on the blue print already made, and that rom the negative taken through the blue screen is stained ellow and superimposed on the red film, and the whole astened together.—T. F. B.

hotographs and Photo-Mechanical Prints: Process and Apparatus for the Production of Coloured ——. A. A. Gurtner, Berne. Eng. Pat. 7924, April 6, 1903.

ee U.S. Pat. 730,454 of 1903; this J., 1903, 820.—T. F. B.

hotographic Printing Paper or the like; Process for Preparing ——. I. Hoffsümmer, Düren, Germany. Eng. Pat. 25,390, Nov. 21, 1903.

rior to being coated with the emulsion, paper is treated ith "zapone" or similar substance, *i.e.*, a solution of elluloid in amyl alcohol, amyl acetate, acetone, &c.; it is aid that the emulsion is not absorbed by paper thus repared, but adheres strongly to it.—T. F. B.

United States Patents.

yestuff; Sensitising —— [for Photographic purposes]. R. Berendes, Elberfeld, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 752,323, Feb. 16, 1904.

y treating with sodium hydroxide the compound obtained y the action of diethyl sulphate on quinaldine, a dye-stuff obtained which is soluble in water, alcohol, and chlororm, giving a violet solution, and which has the property of imparting greater sensitiveness to photographic emulsions for "distinct colours of the spectrum."—T. F. B.

Photographic Emulsion; Sensitive ——. A. Eichengrün, Elberfeld, and A. Braun, Mülhausen, Assignors to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 752,388, Feb. 16, 1904.

See Fr. Pat. 326,468 of 1902; this J., 1903, 820.—T. F. B.

French Patent.

Photographic Emulsions; Process for "Optically Sensitising" ——, by means of Dyestuffs. Soc. Anon. Prod. F. Bayer et Cie. Fr. Pat. 336,298, Oct. 29, 1903.

Emulsions suitable for the preparation of panchromatic plates, films, and papers are prepared by emulsifying with collodion, gelatin, &c., freshly precipitated silver halides which have been previously stained by means of a solution of a suitable dyestuff. For instance, silver bromide is stained by a five minutes immersion in a 0·01 per cent. solution of Erythrosin, washed until the washings are colourless, and emulsified with a 4 per cent. gelatin solution in the usual manner.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

Paper [for Cartridges]; Resistance of —— to Moisture. Winkler. XIX., page 334.

English Patents.

Nitroglycerin; Manufacture of ——. F. L. Nathan, J. M. Thomson, and W. Rintoul, Waltham Abbey, Essex. Eng. Pat. 3020, Feb. 9, 1903.

The object of the invention is to prevent the formation and separation of nitroglycerin in the waste acids after the nitroglycerin initially formed in the nitrating vessel has been separated and removed. It has been found that if a relatively small quantity of water be added to the waste acid, all further separation of nitroglycerin is prevented, and the strength of the waste acids is so slightly reduced that their separation and re-concentration are not affected. "After-separation" is thus done away with, and the nitroglycerin plant simplified and its output increased. The operation may be carried out in the apparatus described in Eng. Pat. 15,983 of 1901 (this J., 1902, 927). After nitration, separation is commenced at a temperature such that when all the displacing acid has been added, and the separation of the nitroglycerin is complete the temperature of the contents of the nitrating vessel shall not be lower than 15° C. A sufficient quantity of displacing acid is then run off through the waste-acid cock, to allow of the remaining acids being air-stirred without splashing over the top. A small quantity of water (from 2 per cent. to 5 per cent., according to strength of acid and temperature) is now slowly added through the separation cylinder, and the contents of the nitrator are air-stirred, but not cooled, the temperature being allowed to rise slowly and regularly as the water is added—usually about 3° C. for each per cent. of water added. When air-agitation has been stopped, the acids are kept at rest for a short time, in order to allow of any small quantity of initially formed nitroglycerin adhering to the coils and sides of the vessel rising to the top. When this has been separated by displacement, the acids are ready for denitration, or can be safely stored without further precaution.
—G. W. McD.

Guncotton; Manufacture of ——. J. Selwig, Brunswick. Eng. Pat. 6409, March 19, 1903.

See Fr. Pat. 327,803 of 1902; this J., 1903, 963.—T. F. B.

Explosives. J. Wetter, London. From Westfälisch-Anhalt. Sprengstoff Act.-Ges., Berlin. Eng. Pat. 8898, April 2, 1903.

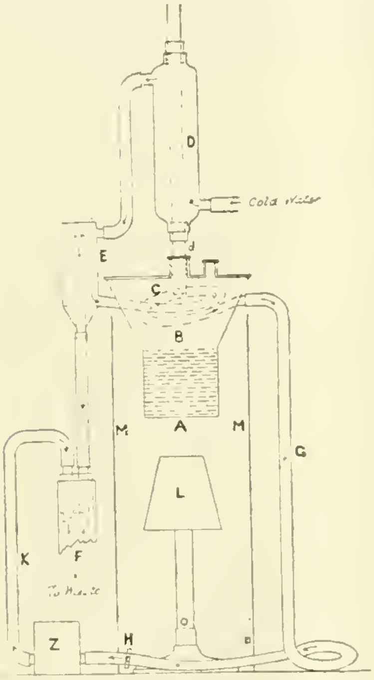
See Fr. Pat. 329,031 of 1903; this J., 1903, 1015—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Thermostat for Use in connection with the Refractometric Examination of Oils and Fats; Simple ——. T. E. Thorpe. J. Chem. Soc. 1904, **85**, 257—259.

In examining oils and fats in the Zeiss butyro-refractometer, it is generally necessary to allow a current of water of constant temperature to flow through the apparatus for some little time before making the readings. By means of the device shown in the figure, it has been found possible to secure a steady current of water not varying more than about 0·1° C. in temperature throughout the day. In the figure, A is a metallic cylindrical vessel, 5 cm. in diameter and 5 cm deep, containing about 100 c.c. of water, &c., for generating the heating vapour. B is a conical vapour chamber in which is suspended the coil C of copper or "compo." tubing, 25—30 cm. long, and with an internal diameter of about 3 mm. The cover of C has a diameter of 10 cm. D is a reflux condenser. E is an arrangement for maintaining a constant head of water at the point of entrance to the coil, so as to reduce variations in the pressure of the current of water. F is a stout glass tube acting as a "tell-tale" to indicate whether or not the overflow and the current of water through the instrument Z are running properly. G and K are pieces of thick-walled caoutchouc tubing, H a screw-clamp for regulating the flow of water, and M a metal cylinder to reduce loss of heat by radiation from the walls of the vapour generator.—A. S.



INORGANIC—QUANTITATIVE.

Sulphuric Acid; Determination of ——. R. Silberberger. Monatsh. Chem., 1904, **25**, 220—248.

The inaccurate results obtained in the determination of sulphuric acid as barium sulphate, in the presence of iron, chromium, aluminium, and potassium salts, are stated to be due to the co-precipitation of complex barium salts. Sulphuric acid in the presence of iron, aluminium, and chromium can, however, be accurately determined by precipitation with strontium chloride in alcoholic solution, and the method is especially suitable for the rapid determination of the sulphur in pyrites. About 0·5 grm. of the pyrites is decomposed by 20 c.c. of *aqua regia*, evaporated several times with hydrochloric acid, the residue treated with hot hydrochloric acid and filtered. In the filtrate the sulphuric acid is precipitated by alcoholic strontium chloride solution and 100 c.c. of alcohol are added. The precipitate is digested at a moderate heat for 1 hour, allowed to settle in the cold, and the clear solution poured off through a filter. The precipitate is stirred with 2 c.c. of hydrochloric acid (2:1) and 50 c.c. of alcohol, allowed to settle, the clear solution again poured off, and the precipitate washed with alcohol, three times by decantation, and finally on the filter. The precipitate filters well and is free from chlorine. The results are concordant and are 0·89 per cent. higher than those obtained by Lunge's method and 0·53 higher than those obtained by Küster's method (Zeits. anorg. Chem. **19**, 100).—A. S.

Arsenic; Rapid determination of —— *in Sulphuric and Hydrochloric Acids.* N. G. Blattner and J. Brasseur. Chem.-Zeit., 1904, **28**, 211.

The method is based on the conversion of the arsenic into arsenic tri-iodide, as in Seybel and Wikander's qualitative method (Chem.-Zeit., 1902, **26**, 50)—

$$As_2O_3 + 6HCl + 6KI = 2AsI_3 + 6KCl + 3H_2O \text{ or}$$
$$As_2O_5 + 10HCl + 10KI = 2AsI_5 + 10KCl + 5H_2O \text{ and}$$
$$AsI_5 = AsI_3 + I_2.$$

The arsenic tri-iodide is nearly insoluble in hydrochloric acid or sulphuric acid, and is filtered off through cotton wool or glass wool, and converted into arsenious acid $2AsI_3 + 3H_2O = As_2O_3 + 6HI$. The arsenious acid is neutralised with sodium bicarbonate and the resulting sodium arsenite titrated with a standard solution of iodine.

Hydrochloric Acid.—50 c.c. of the acid, preferably of 20° to 22° B. (if necessary strengthened with pure sulphuric acid) are mixed with constant stirring with 5 c.c. of a 30 per cent. solution of potassium iodide, and the liquid filtered after one minute through a Soxhlet's tube containing cotton-wool or glass-wool, the beaker being washed out with a few c.c. of pure strong hydrochloric acid containing 10 per cent. of the potassium iodide solution. The precipitate is then dissolved off the filter by water, and the aqueous solution rendered slightly alkaline with pure sodium bicarbonate and titrated with N/10 iodine solution. Twice the number of c.c. used, multiplied by 0·00375 and divided by the specific gravity of the acid, gives the percentage of arsenic.

Sulphuric Acid.—In this case the concentration of the acid should be about 45° B. With a strength above 50° B. some iodine is liberated from the potassium iodide, whilst an acid below 45 B. dissolves some of the arsenic tri-iodide. The disturbing effect of chlorine on the reaction, as also of ferric chloride, or selenium in hydrochloric or sulphuric acid is prevented by the addition of a few drops of a concentrated solution of stannous chloride. Although arsenic is also precipitated by stannous chloride the reaction does not take place for some time. Lead in sulphuric acid also gives a precipitate with potassium iodide, but the addition of sufficient strong hydrochloric acid prevents the precipitation of lead or tin. In the determination, 25 c.c. of the sulphuric acid (brought to about 45° B.) are mixed with 25 c.c. of pure hydrochloric acid, and treated with potassium iodide solution as described above. Four times the number of c.c. of iodine solution used multiplied by 0·00375 and divided by the specific gravity of the acid gives the percentage of arsenic in this acid of 45 B. The whole determination can be made in about 10 minutes, and is stated to give very accurate results with acids containing as little as 0·001 per cent. of arsenic. When the amount exceeds 0·2 per cent. a smaller amount of acid should be taken for the test and made up to 50 c.c. with pure concentrated hydrochloric acid.—C. A. M.

Arsenic and Antimony in Nickel Speiss; Determination of ——. H. Nissenson and A. Mittasch. Chem.-Zeit., 1904, **28**, 184—186.

The following modification of the Györy method (for determining antimony in lead) is recommended (see this J., 1903, 967): 0·5 grm. of the substance is digested at 300°—400° C. with 8 c.c. of concentrated sulphuric acid until the mass is nearly or quite white. After cooling it is heated to boiling with a little water, to dissolve any basic salts, and treated with sulphuretted hydrogen to throw down arsenic, antimony, and copper. The precipitate is filtered and washed with a little acidified sulphuretted hydrogen water, after which it is heated with 7 c.c. of concentrated sulphuric acid to dissolve the sulphur compounds. The cooled solution is made up to about 100 c.c. with water, strongly heated and titrated with decinormal potassium bromate, in presence of three drops of a sulphuric acid solution of indigo as indicator, preferably added towards the end of the operation. To separate the arsenic and antimony the solution is treated with an excess of potassium bromate, a portion is then evaporated, treated with ½—1 grm. of tartaric acid when cold, then rendered alkaline with ammonia and treated with 30 c.c. of magnesia mixture. After standing several hours the precipitate is filtered off, washed with a little ammoniacal water, the filtrate concentrated, acidified with sulphuric acid, and the antimony and copper precipitated with sulphuretted hydrogen. Finally, the treatment with sulphuric acid and titration with potassium bromate are repeated, the arsenic being estimated by difference.—C. S.

Gold; Electrolytic Analysis of ——. F. M. Perkin and W. C. Prebble. Paper read before the Faraday Soc. Electro-Chemist and Metall., 1904, **3**, 490—494.

The authors propose the use of ammonium thiocyanate in place of the potassium cyanide which is generally recommended. With a current density of 0·2 ampère per q. dcm. the deposition of 0·05 to 0·08 grm. of gold is omplete in five to six hours in the cold, and with 0·4 to 0·5 ampère in 1½ to 2 hours. The solutions employed ontained 5 grms. of ammonium thiocyanate in 120 to 50 c.c., the gold chloride solution which was used for the ests being added in measured volume. The deposit of gold is redissolved from the platinum by use of potassium yanide and an oxidising agent, *e.g.*, hydrogen peroxide. The completion of deposition is judged by testing a sample f the electrolyte with stannous chloride after the thioyanate has been decomposed with sulphuric acid. For most of the determinations the gauze flag electrodes esigned by one of the authors (this J., 1903, 1064) were employed; a suitable form of stand for platinum asins, as also a heating bath to keep the temperature onstant at from 55° to 60° C., are described.—R. S. H.

Alumina [in Metallurgical Products]; Method for the direct determination of ——. C. E. Rueger. Eng. and Mining J., 1904, **77**, 357.

The following modification of a method proposed many ears ago by Wöhler, based on the precipitation of alumina om a slightly acid solution by sulphur dioxide, is stated to e sufficiently accurate for technical purposes. The precipitate of aluminium and iron hydroxides obtained in the usual manner is washed, dissolved in hydrochloric acid, the solution nearly neutralised with sodium carbonate, and sodium sulphite added till a precipitate begins to form. The precipitate is redissolved in a slight excess of hydrochloric acid, and the solution boiled vigorously till all the sulphur dioxide is expelled. The precipitated alumina is stated to be compact and granular; it is filtered off, washed, redissolved in hydrochloric acid, and precipitated again in the same manner as before. The precipitate is finally ignited and weighed as alumina. The results are stated to be accurate within 0·3 per cent. Zinc, manganese, nickel, and copper have no influence on the results, but the latter are affected by the presence of titanium, phosphorus, lead, arsenic, and antimony.—A. S.

ORGANIC—QUALITATIVE.

Edible Fats; Analysis of ——, *particularly the Detection of Cocoa-nut Oil in Butter and Lard.* A. Juckenack and R. Pasternack. Zeits. Untersuch. Nahr. Genussmittel, 1904, **7**, 193—214.

The author shows that on subtracting 200 from the saponification value and further subtracting the result from the Reichert-Meissl value, a figure is obtained which, in the case of pure butter, varies from − 4·14 to − 3·39, whilst with cocoanut oil the figure lies between − 47·0 and − 50·7. Again, the mean molecular weight of the volatile, water-soluble fatty acids of butter is stated to be from 95·0 to 99·0, and that of the non-volatile insoluble fatty acids is from 259·5 to 261·0. The volatile soluble fatty acids of cocoanut oil have a mean molecular weight of 130·0 to 145·0, and the non-volatile insoluble acids 208·5 to 210·5. The phytosteryl acetate test affords the most certain means of detecting cocoanut oil, or other vegetable oil, in butter and lard. The melting point of the acetate after the fifth re-crystallisation never exceeds 115° C., if vegetable oils be absent. When the melting point is 117° C. or higher, vegetable oil is certainly present. In the determination of the Reichert-Meissl value of cocoanut oil only about 37 per cent. of the total volatile fatty acids are found in the distillate, whilst in the case of butter, about 80 per cent. pass over during the distillation. If further successive quantities of water be added to the distillation flask and the boiling continued, distillates are obtained containing the remainder of the volatile acids. In the case of butter, the fifth distillate is practically free from volatile acids, but with cocoanut oil, even the eighth distillate still contains an appreciable quantity of volatile acids, requiring 0·45 c.c. of N/10 alkali for their neutralisation. The results of numerous analyses and experiments are given, and are summarised in the following table:—

Fat.	Reichert-Meissl Value (*a*).	Saponification Value (*b*).	"Difference" *a*−(*b*−200).	Butyro-Refractometer.	Phytosteryl-Acetate Test. M.P.	Mean Molecular Weight of Insoluble Fatty Acids.
ure butter...............	27·51	223·37	+ 4·14	+ 0·4	..	260·15
utter fat + 10 per cent. of cocoanut oil..........	25·27	226·96	− 1·69	−0·5	..	254·05
utter fat + 20 per cent. of cocoanut oil..........	24·06	230·22	− 6·16	− 1·5	..	249·02
ommercial butters containing cocoanut oil ...	24·40	232·24	− 7·84	− 2·4	..	248·79
	19·20	230·50	11·30	− 1·6	121·2° C.*	246·41
	24·35	235·83	−11·48	− 3·2	115·0° C.†	247·99

* After fifth crystallisation. † After seventh crystallisation. —W. P. S.

Acetanilide; Two new Reactions of [Distinction of —— *from Phenacetin].* E. Barral. J. Pharm. Chim. 1904, **19**, 237.

Phosphomolybdic acid reagent, added to a solution of cetanilide, gives a bright yellow precipitate, soluble on warming. Phenacetin gives a similar precipitate which emains insoluble when heated.

Mandelin's reagent (1 grm. of ammonium vanadate in 00 grms. of sulphuric acid) gives a red colour, rapidly changing to greenish brown, with acetanilide. With phenacetin the colour at first is olive green in the cold, becoming reddish brown when warmed.—J. O. B.

Phenacetin; New Colour Reactions for ——. E. Barral. J. Pharm. Chim. 1904, **19**, 237—238.

Sodium persulphate produces a yellow colour when warmed with phenacetin; this deepens to orange on prolonged boiling.

Bromine water, when heated with a few crystals of phenacetin, colours them rose; the liquid becomes orange yellow, and, on cooling, a brown precipitate is gradually formed.

Millon's reagent (1 part of mercury treated with its own weight of strong nitric acid and heated to about 60° C. for solution. Two vols. of water are added, the liquid let stand, and the clear liquid decanted for use) heated with phenacetin gives a yellow colour passing to red; nitrous fumes are given off and a yellow precipitate is formed.
—J. O. B.

p-Nitrophenylhydrazine and p-Dinitrodibenzylhydrazine; Some Hydrazone Derivatives of —— [Detection of Acetone or of Wood Spirit in denatured Alcohol]. A. van Ekenstein and J. J. Blanksma. Zeits. Ver. deutsch. Zuckerind. 1904, 190—194.

p-Nitrophenylhydrazine can be utilised for the detection of wood spirit in denatured alcohol, in virtue of the acetone contained therein. A quantitative determination of acetone in alcohol is performed by mixing a solution of 5 c.c. of the spirit in 15 c.c. of water with a solution of 400 mgrms. of the hydrazine in 5 c.c. of 30 per cent. acetic acid. The *p*-nitrophenylhydrazone of the acetone, m. pt. 148° C., separates almost immediately, and after standing for 30 minutes, is collected on a tared filter, washed with a little 20 per cent. alcohol, and dried at 105° C. Any aldehyde originally present must first be destroyed by caustic potash. *Glucose* yields two isomeric *p*-nitrophenylhydrazones. One of these is obtained by heating 2 grms. of glucose in 30 c.c. of strong alcohol for 10 minutes on the water-bath with 2 grms. of the *p*-nitrophenylhydrazine. This hydrazone melts at 185° C., $[\alpha]_D = +21 \cdot 5°$; it is sparingly soluble in alcohol. The other is obtained at ordinary temperatures from a solution of 3 grms of glucose in a little water, 3 grms. of *p*-nitrophenylhydrazine and 30 c.c. of glacial acetic acid. It melts at 195° C., $[\alpha]_D = -128 \cdot 7$. Both these hydrazones yield the same osazone, m. pt. 257° C., $[\alpha]_D = -21 \cdot 1°$. In the same way *mannose* yields two hydrazones, m. pt. 190° C. and 202° C. respectively, the latter being produced in presence of acetic acid. The following sugars yield only one *p*-nitrophenylhydrazone respectively: *fructose*, m. pt. 176° C., $[\alpha]_D = +16°$ (osazone identical with that from glucose); *galactose*, m. pt. 192° C., $[\alpha]_D = +45 \cdot 6°$; *xylose*, m. pt. 156° C., readily soluble in alcohol; *rhamnose*, m. pt. 186° C., $[\alpha]_D + 21 \cdot 4°$; *arabinose*, m. pt. 168° C., $[\alpha]_D + 48 \cdot 3$; *maltose* and *milk sugar* do not react in alcoholic solution. The *p*-nitrophenylhydrazones are readily decomposed by heating with the calculated quantity of benzaldehyde, regenerating the sugars.—J. F. B.

ORGANIC—QUANTITATIVE.

Sugar; Analysis of ——. K. Abraham. Zeits. Ver. deutsch. Zucker-Ind., 1904, 187—188.

It is proposed that in the analysis of a white sugar the following determinations shall be made:—Moisture = W; ash = A; difference between the alkalinity of the sugar and alkalinity of the ash = D; organic non-sugar (empirical coefficient = 3) = 3D; invert sugar = I. The saccharose is then calculated as equal to 100—(W + A + 3D + I) and the result is said to be more accurate than by polarisation. Any raffinose which may be present is shown by the difference between the polarisation and the calculated percentage of saccharose.—J. F. B.

Sugar Analysis; Dry Defecation in optical ——. W. D. Horne. J. Amer. Chem. Soc., 1904, 26, 186—192.

In determining the polarisation of a raw sugar, an error is introduced, owing to the fact that a precipitate is formed by the lead subacetate added to the solution of the normal weight of sugar before making up to 100 c.c. In order to obviate this error, the author recommends defecating in such a way that the normal weight of sugar shall remain dissolved in 100 c.c. of the solution. This is done by making the solution of the normal weight up to 100 c.c. and then adding small quantities of powdered, anhydrous lead subacetate until the impurities are all precipitated. Some refinery solutions, notably such as have been subjected to the influence of bone-black, have a tendency to coat the grains of lead salt with insoluble adherent crusts and so prevent the solution of the interior portions; this difficulty may be overcome by adding coarse dry sand, with the lead salt, to the solution before shaking. Comparison of the numbers yielded by this method of working with those obtained by the old method and making allowance for the volume occupied by the lead precipitate, show that it gives good results.—T. H. P.

Nitrogenous Substances soluble in Water; Determination of —— in Barley and Malt. Guiness Research Lab. Trans., 1903, 1, 61—78.

Standard conditions have been determined under which the soluble nitrogenous matters may be extracted from barley and malt in such a way that the changes which take place in these substances during germination may be ascertained. In order to compensate for the changes in the weight of the grain which occur during malting, advantage is taken of the fact that the dry weight of 1,000 corns always represents an average sample for statistical purposes, whereby the altered grain can be referred to the original. In performing the actual extractions it was found that the time of digestion and the ratio of grain to water employed had a considerable influence on the results, owing in the one case to proteolysis and in the other to the influence of the concentration of mineral salts present on the solubility of certain proteids like the globulins. A standard concentration was therefore selected, whether in dealing with barley or malt, such that the total final volume (extract + residue) always represented the equivalent of 20 grms. of the dry original barley per 100 c.c. The volume of the mixture during the extraction proper was always taken at three-quarters of the total final volume, the deficit being adjusted at the end of the process. The finely ground sample was mixed with water in a flask in the proportions indicated, the flask was then agitated by mechanical means for a standard time of six hours; the volume was then adjusted and the extract filtered. The nitrogen was determined in the filtrate, direct and after the removal of the substances coagulated by boiling; the volume of the dried residue being then calculated from its weight and specific gravity, the results were all finally expressed in terms of the dry original barley. Preliminary determinations showed that, in the case of barley, a period

Solvent.	Percentage of Nitrogen Extracted in Six Hours from Dry Barley and its Equivalent Weight of Malt (concentration 20 grms. of Barley or its Malt Equivalent per 100 c.c.).			Nitrogen Extracted per Cent. of Total Amount present in Original Barley (Dry).		
	Total.	Coagulable.	Non-coagulable.	Total.	Coagulable.	Non-coagulable.
Barley.						
Water	0·251	0·090	0·161	14·7	5·3	9·4
5 per cent. salt solution ...	0·388	0·128	0·260	22·8	7·5	15·2
Malt.						
Water	0·523	0·142	0·381	30·7	8·3	22·4
5 per cent. salt solution...	0·669	0·212	0·457	39·3	12·5	26·8

of six hours was necessary for complete extraction of the soluble nitrogenous matters. When extraction was prolonged beyond 12 hours, a slight proteolytic action was observed, whereby the non-coagulable matters were increased at the expense of the insoluble proteids of the grain, the coagulable soluble proteids being unaffected. In the case of malt, extraction was probably complete in less than six hours; when it was further prolonged, a noticeable proteolysis occurred, just as in the case of the barley except that in this case the coagulable soluble proteids were attacked. The effect of doubling the proportion of water to grain was shown, in the case of barley, by a marked decrease in the quantity of nitrogenous matter extracted, whereas in the case of malt there was no difference. Extraction with a 5 per cent. solution of sodium chloride instead of water, caused a considerable increase in the quantity of nitrogenous matter dissolved. The addition of salicylic acid to the extraction mixture had no influence in restricting proteolysis during prolonged periods of extraction. In the foregoing table are shown the results obtained with a sample of good Wiltshire barley and the kiln-dried malt prepared from it. A few experiments with air-dried malt indicated that with such malt, proteolysis during extraction for prolonged periods was distinctly more active than with kiln-dried malt; it is, therefore, somewhat doubtful whether the standard period of six hours is perfectly safe in such cases.—J. F. B.

Cinchona Succirubra, De Vrij's Liquid Extract of ——; *Determination of Cinchotannates in* ——. J. Warin. J. Pharm. Chim., 1904, **19**, 233—236.

The author has previously shown (this J., 1903, 569) that evaporation *in vacuo* as prescribed by De Vrij for the preparation of the fluid extract of *cinchona succirubra* is unnecessary. Criticism is now directed to the method of De Vrij for determining the amount of alkaloïdal cinchotannates in the fluid extract and to the modification of that process at present official in the supplement to the Dutch Pharmacopœia, 1902. The latter reads as follows:—"10 grms. of the liquid extract are mixed with 2 grms. of sodium acetate and 10 c.c. of water. The reddish-brown precipitate is collected on a filter, washed with a little water, dried, and weighed." It is found, not only that this washing with water removes a notable amount of alkaloids, but that, even without washing, the whole of the alkaloids are not precipitated by the acetic acid set free in the process. When the precipitate was merely collected and dried without washing, the weight from 10 grms. of fluid extract was 1·03 grm., and the filtrate yielded 0·1473 grm. of alkaloids. Where the precipitate from the same amount of fluid extract was washed with 5 c.c. of water, its weight when dried was 0·990 grm., and the washings, collected apart, gave 0·062 grm. of alkaloids. A third similar quantity, precipitated as before, but the cinchotannates washed with 10 c.c. of water, gave only 0·825 grm., and the washings contained 0·0868 grm. of alkaloids. Increasing the amount of sodium acetate employed was not found to materially affect the results. The addition of 5 per cent. of acetic acid to the wash-water was tried, but this menstruum was found to remove more alkaloids than water alone. The method is therefore condemned, since more than 20 per cent. of the total alkaloids present are not precipitated, the washing with water removes yet more, and the results obtained have but little definite value. In valuing the fluid extract of cinchona, the determination of the total alkaloids, by precipitation as such, is preferable. If it be desired to determine the cinchotannic acid, this can be done in the ammoniacal mother-liquor, after shaking out the bases with ether, in the usual manner.—J. O. B.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Rare Earths; Contribution to the Knowledge of the ——. W. Biltz. Annalen, 1904, **331**, 334—358.

The author describes the preparation and properties of the acetylacetonates of thorium, didymium, praseodymium, neodymium, samarium, cerium, lanthanum, and aluminium, and also experiments on their application to the determination of the valencies of thorium and the cerite earth metals, and of the atomic weight of thorium.—A. S.

Magnetic Oxide of Iron; Formation of —— *by heating Metallic Iron in a current of Carbon Dioxide.* J. Donau. Monatsh. Chem., 1904, **25**, 181—187.

By heating metallic iron in the form of very fine wire in a current of carbon dioxide, at 1100°—1200° C., protosesquioxide of iron is produced, identical in appearance, hardness, density, and magnetic properties with natural magnetite. The presence of a small amount of moisture in the carbon dioxide has a favourable effect on the crystalline condition of the oxide produced.—A. S.

Light; Chemical Action of ——. G. Ciamician and P. Silber. Phot. J., 1904, **44**, 12.

o-Nitrobenzaldehyde, in alcoholic, benzene, &c., solution, is converted by light into *o*-nitrosobenzoic acid. A colourless compound of the composition $C_9H_9O_3N$ was also obtained.
—T. F. B.

Aniline; Direct hydrogenation of ——. *Synthesis of Cyclohexylamine and of two other new Amines.* P. Sabatier and J. B. Senderens. Comptes rend., 1904, **138**, 457—460.

When the vapours of aniline, together with an excess of hydrogen, are passed over reduced nickel maintained at a temperature of about 190° C., a considerable absorption of the gas takes place, and a liquor with an ammoniacal odour is collected by condensation. This liquor contains cyclohexylamine, together with two other bases hitherto undescribed, dicyclohexylamine and cyclohexylaniline.

Cyclohexylamine, $C_6H_{11}NH_2$, is a very powerful base, boiling without decomposition at 134° C. It has an ammoniacal odour: its density, $0°/0° = 0·87$. It turns litmus blue, and absorbs carbon dioxide from the air with great avidity, forming a well crystallised carbonate; the hydrochloride melts at 206° C.

Dicyclohexylamine, $(C_6H_{11})_2NH$, is produced by the union of two molecules of cyclohexylamine with elimination of ammonia. It boils with slight decomposition at 250° C.; its density, $0°/0° = 0·936$. It is a fairly strong base, alkaline to litmus, and yields a crystalline carbonate which dissociates in presence of dry air. The hydrochloride is very sparingly soluble in ether. It is a secondary amine, possessing characters similar to those of the amines of the fatty series, and does not yield colour reactions with oxidising agents.

Cyclohexylaniline, $C_6H_5NH.C_6H_{11}$, results from the partial decomposition of dicyclohexylamine. It boils at 275° C. with considerable decomposition and formation of diphenylamine and hydrogen. It is only slightly soluble in water; its density $0°/0° = 1·016$; its hydrochloride crystallises in tufts of fine needles, which, when exposed to the air, turn grey, and finally green. It turns red litmus blue, but does not form a solid carbonate. Owing to the presence of a benzene nucleus this amine yields colour reactions analogous to those of diphenylamine.—J. F. B.

Dibenzalglucosides and Benzalmethylglucosides. A. van Ekenstein. Zeits. Ver. deutsch. Zuckerind., 1904, 188—190.

The sugars condense with benzaldehyde in exactly the same manner as with formaldehyde. Sugar, 2 parts, is treated with freshly distilled benzaldehyde, 3 parts; phosphorus pentoxide, 3 parts, is then added with continued stirring. After standing for half-an-hour, the product is diluted with ice-cold water, and the precipitate is dissolved in methyl alcohol. Only the pentoses yield well crystallised products, the hexoses giving uncrystallisable syrups. The constitution of the products is analogous to that of the corresponding formaldehyde derivatives. The carbonyl group having disappeared, the derivatives do not reduce Fehling's solution; they contain two benzal residues. The pentose derivatives contain no hydroxyl group, but the hexose derivatives still contain one free hydroxyl. *Dibenzalarabinose*, m. pt. 154° C., $[\alpha]_D = +27°$ (in methyl alcohol), *dibenzalxylose*, m. pt. 130° C., $[\alpha]_D = +37·5$,

and *dibenzalrhamnose*, m. pt. 128° C., $[\alpha]_D = +56°$ are described. The glucosides react with benzaldehyde far more readily than the sugars; derivatives are obtained by boiling the glucosides for a few hours with benzaldehyde in presence of a little aqueous sodium sulphate. The monobenzal derivatives of α and β-methylglucoside and of methylmannoside, and the dibenzal derivative of the last are well defined, crystalline, optically active products.
—J. F. B.

Mannamine: New Base derived from Mannose.
E. Roux. Comptes rend., 1904, **138**, 503—505.

When mannose-oxime is reduced by sodium amalgam according to the general method adopted for the preparation of glucamine (this J., 1901, 605, 817) a base exactly analogous to the latter is obtained, to which the name of *mannamine* is given. According to Maquenne's notation mannamine is amino-1-hexanepentol $^{4.5.}_{2.3.}.6$.

$$NH_2.CH_2[CH(OH)]_4CH_2OH$$

The mannose oxime is readily prepared from the crude syrup obtained by the hydrolysis of ivory nuts, and the mannamine is separated, after reduction of the oxime, in the form of the oxalate. Mannamine resembles glucamine very closely in its general properties. It occurs as a colourless crystalline mass, very soluble in water, and fairly soluble in alcohol; it melts at about 139° C., and possesses a caustic and sweet flavour. In 10 per cent. solution its rotatory power $[\alpha]_D = -2°$. It precipitates nickel sulphate and yields a white amorphous product with mercuric chloride, insoluble in excess of the base.—J. F. B.

New Books.

The Textile Technical Schools and Development of the Textile Industries: Germany. Foreign Office Miscellaneous Series, No. 602. Eyre and Spottiswoode. Price 5*d*.

List of schools giving instruction in textile manufactures. Plan of instruction of the course in textile industry at the Brunswick Technical University. Detailed descriptions of various schools established in Germany to provide instruction in dyeing, spinning, weaving, &c. Examination of the present extent and importance of German textile industries. Tables showing value of imports and exports of raw materials for textile industry, and of exports of textile goods to other countries. Factors which have aided the development of the German textile industry.

Mineral Tables, for the Determination of Minerals by their Physical Properties. By Arthur S. Eakle, Ph.D., Asst. Prof. of Mineralogy, University of California. John Wiley and Sons, New York. Chapman and Hall, Ltd., London. 1904. Price 5*s*. 6*d*. nett.

8vo volume, containing introduction, 7 pages of physical properties, an analytical key and 59 pages of tables, each grouped under the following columns:—"Name," "Composition," "Colour," "Streak," "Lustre," "System," "Cleavage or Fracture," "Common Structure," and "Observations." At the close there is an alphabetical index. In the preliminary chapter, "Physical Properties," definitions are given of the precise intent of each column heading just referred to. A list is also furnished of the very simple apparatus needed for utilising the tables mentioned for the purpose set forth.

Directions for Laboratory Work in Physiological Chemistry. By Holmes C. Jackson, Ph.D. 2nd Edition. John Wiley and Sons, New York. Chapman and Hall, Ltd., London. 1903. Price 5*s*. 6*d*. nett.

8vo volume, containing preface, 142 pages of subject-matter, and the alphabetical index. The following subjects are treated of in the book:—I. Carbohydrates. II. Fats. III. Proteids. IV. Muscular Tissue. V. Bone. VI. Nervous Tissue. VII. Salivary Digestion. VIII. Gastric Digestion. IX. Pancreatic Digestion. X. Intestinal Putrefaction. XI. Bile. XII. Blood. XIII. Milk. XIV. Urine. XV. Sediments.

Anleitung zur Quantitativen Bestimmung der organischen Atomgruppen. Von Dr. Hans Meyer. 2te, vermehrte und umgearb. Auflage. Julius Springer's Verlag, Berlin. 1904. Price M. 5.

8vo volume, containing prefaces, table of abbreviations, introduction, 198 pages of subject-matter with 23 illustrations, and an alphabetical index. The subject is treated under the following heads:—I. Determination of the Hydroxyl Group; II. of the Carboxyl Group; III. of the Carbonyl Group; IV. of the Alkyl Oxide Group; V. of the Methylene Oxide Group; VI. of the Primary Amine Group; VII. of the Imino Group. VIII. Quantitative Determination of the Typical Hydrogen of the Amines. IX. Determination of the Nitrite Group; X. of the Methyl- and Ethylimino Group; XI. of the Acid-amino Group; XII. of the Diazo Group; XIII. of the Azo Group; XIV. of the Hydrazine Group; XV. of the Nitroso Group; XVI. of the Nitro Group; XVII. of the Iodo and Iodoso Groups; XVIII. of the Active Oxygen of the Peroxides and Peracids. XIX. Determining the Double Linkage and the Triple Linkage.

Trade Report.

I.—GENERAL.

Mines and Quarries; General Report and Statistics for 1903.

Home Office Report, 1904.

Output of Minerals under the Coal Mines Regulations Acts.

——	1902.	1903.
	Tons.	Tons.
Coal	227,084,871	230,323,391
Clay and shale other than fire-clay and oil shale	161,053	219,018
Fire-clay	3,013,095	3,066,835
Igneous rock	..	2,646
Iron pyrites	7,551	8,314
Ironstone	7,214,310	7,471,822
Limestone	33,346	38,514
Oil shale	2,107,534	2,009,602
Petroleum	25	..
Sandstone (including "Ganister")	95,914	102,540
Total	239,717,699	243,242,682

Output of Minerals under Metalliferous Mines Regulation Act.

——	1902.	1903.
	Tons.	Tons.
Arsenic	2 181	902
Arsenical pyrites	829	57
Barytes	22,908	23,671
Bauxite	9,047	6,128
Chalk	8,666	6,885
Chert and flint	2,929	3,690
Clay and shale	95,963	112,848
Copper ore and copper precipitate	6.112	6,867
Fluor spar	4,970	10,697
Gold ore	29,953	28,600
Gypsum	170,196	176,980
Igneous rock	93,664	90,236
Iron ore	1,700,411	1,605,868
Iron pyrites	1,617	2,739
Lead ore	23,615	25,635
Limestone	571,721	573,011
Manganese ore	1,278	818
Ochre, umber, &c.	8,423	5,658
Rock salt	162,193	167,769
Sand	13,075	15.053
Sandstone	201,760	183,520
Silver ore	..	58
Slate	159,540	164.278
Tin ore (dressed)	6,698	6,499
Uranium ore	52	6
Wolfram	9	272
Zinc ore	25,060	24 888
Total	3,322,820	3,243,633

The figures do not in all cases represent the total roduction of the minerals for the year. Large quantities f several important minerals, such as iron ore, limestone, andstone, slate, clay, &c., are obtained from quarries under he Quarries Act, and from other open workings, the returns rom which are not yet available. The totals for coal, and he ores of copper, lead, and zinc may, however, be egarded as substantially complete. The total mineral utput of the United Kingdom, including the returns from uarries, &c., will appear in Part I. of the General Report.

Germany; Tariff Modifications.

Bd. of Trade J., March 10, 1904.

The following are some recent modifications in the tariff lassification of Germany :—

Half- and wholly-tanned skins, with the hair on, of calves, attle, seals, and reindeer, are to pay duty as leather under No. 21 of the tariff.

Artificial sweetening substances, having a greater sweetening power than refined cane or beet sugar, but of less nutritive value are to be admitted duty free under No. *5m* of the tariff, permission to import such substances being first obtained.

In addition to the foregoing, the duty payable on certain articles has been fixed as follows :—

	Mks. per 100 kilos.
Lime-sandstone (artificial stone made of a mixture of lime and sand) :—	
In the form of bricks (ebenflächig)	Free
Other kinds, including figured (profilirt)—	
Imported by sea...........................	Free
" land	1 00
Rolled films of celluloid	200·00

New York Chemical Imports.

Chem. and Druggist, March 5, 1904.

Among the imports at New York in 1903, were 49,369 lb. of bismuth, 940,662 lb. of barium sulphate, 67,480 tons of crude chalk, 642,616 lb. of precipitated chalk, 15,139 tons of china clay, 66,687 lb. of cobalt oxide, 3,103 tons of fullers' earth, 637,184 lb. of lithopone, 346,200 lb. of mica, 8,062,051 lb. of ochre, 979,829 lb. of ozokerite, 3,765,083 lb. of potassium carbonate, 198,432 lb. of potassium permanganate, 1,793,876 lb. of potassium ferrocyanide, 112,154 lb. of sodium hyposulphite, 298,886 lb. of sodium nitrite, 5,239,448 lb. of talc, 1,048,976 lb. of ceresin, and 1,396,310 lb. of zinc oxide. Great Britain and Germany furnished the bulk of these imports.

Egyptian Market for Chemical Products and Manures.

Ch. of Comm. J., March 1904.

The French Consul at Cairo calls attention to the increased importation into Egypt of chemicals, notably of disinfectants, refrigerants, and preparations used in electrical and photographic processes. The principal shipments consist of sulphuric, citric, and hydrochloric acids, sal ammoniac, alum, sulphate of iron and sulphate of magnesia, corrosive sublimate, soda crystals, caustic soda, carbolic acid, and aniline dyes. Italy and Germany are becoming dangerous competitors, owing to the lowness of their prices. It is noteworthy as regards the consignments of chemical manures that France took first place in 1902, displacing the United Kingdom. A group of Egyptian agriculturists are promoting the use of chemical manures. Experiments are being undertaken by various landowners who recommend the establishment of experimental stations under the auspices of the Agricultural Union of Alexandria. This society will keep in touch with the chemical manure manufacturers. The principal product cultivated in Egypt, namely cotton, requires phosphate as dominant together with potash ; maize, potash as dominant together with phosphate of lime ; and barley and wheat, nitrogen. From the foregoing it will be observed that manufacturers of chemical products may do well to make themselves acquainted with the requirements of the Egyptian market.

VII.—ACIDS, ALKALIS, Etc.

Sodium Sulphite : U.S. Customs Decision.

Jan. 13, 1904.

A shipment of sodium sulphite containing sodium sulphate as an impurity was held by the Board of General Appraisers to be dutiable at 25 per cent. *ad valorem* under paragraph 3 of the present Tariff Act. The claim of the importer that it was dutiable at 12 cents per hundred lb. as "salt," under paragraph 284, was contradicted by analysis and was overruled.—R. W. M.

Lead Sulphate ; Impure —— : U.S. Customs Decision.

Jan. 25, 1904.

Merchandise invoiced under the above name was assessed for duty at 25 per cent. *ad valorem*, as a "chemical compound," under paragraph 3 of the present Tariff Act. Analysis showed it to contain selenium, iron, silica, water, free sulphuric acid and lead sulphate. The sample contained 52·80 per cent. of lead sulphate, and the sample was a residue from sulphuric acid chambers. Following a previous decision, the Board of General Appraisers held the article to be dutiable at 10 per cent. *ad valorem*, as "waste," under paragraph 463.—R. W. M.

Barium Peroxide : U.S. Customs Decision.

Jan. 21, 1904.

The Board held that barium peroxide was properly assessed for duty at 25 per cent. *ad valorem* as a "chemical salt" under paragraph 3 of the present Tariff Act, and overruled the claim of the importer that it was dutiable at 5·25 dols. per ton as "manufactured barytes" under paragraph 44.—R. W. M.

Barium Sulphate ; Artificial —— : U.S. Customs Decision.

Jan. 19, 1904.

An importation of goods invoiced as barium sulphate was assessed for duty at ½ cent per lb. as "artificial sulphate of barytes" under paragraph 46 of the present Tariff Act. The Board of General Appraisers affirmed the assessment of duty and overruled the several claims of the importer that it was dutiable at 25 per cent. *ad valorem* as a "chemical salt" under paragraph 3, or at 75 cents per ton under paragraph 44 as "barytes, unmanufactured," or at 5·25 dols. per ton as "manufactured barytes" under the same paragraph, or at 20 per cent. *ad valorem* as a "manufactured article unenumerated" under section 6.
—R. W. M.

X.—METALLURGY.

Spelter Production ; The World's ——, in 1903.

H. R. Merton and Co. Eng. and Mining J., Feb. 25, 1904.

The following figures approximate closely to the details of the world's spelter production in 1903 ; the figures for 1902 are added for comparison.

——	1902.	1903.
	Tons.	Tons.
Belgium, the Rhine, and Holland	200,140	215,690
Silesia........................	115,280	116,835
Great Britain.........................	39,610	43,415
France and Spain....................	27,030	27,920
Austria and Italy...............	8,460	9,025
Poland	8,150	9,745
Total Europe	398,670	422,630
United States.........................	141,273	139,570
Total	539,943	562,200

Pig Iron Production of Canada in 1903.

Bd. of Trade J., March 3, 1904.

The American Iron and Steel Association, has received direct from the manufacturers the statistics of the production of all kinds of pig iron in Canada in the year 1903. They show a decrease of 54,139 tons, or nearly 17 per cent., as compared with 1902, but an increase of 20,442 tons as compared with 1901.

The total production in 1903 amounted to 265,418 tons, against 319,557 tons in 1902, and 244,976 tons in 1901. Of the total production in 1903, 247,905 tons were made with coke and 17,513 tons with charcoal. Nearly one-half of the total production was basic pig iron, namely, 126,892 tons. Less than 1,000 tons of Bessemer iron were made. Spiegeleisen and ferromanganese have not been made since 1899.

The following table shows the total production of all kinds of pig iron (including spiegeleisen and ferromanganese) in Canada from 1899 to 1903 :—

	Tons.
1899	94,077
1900	86,090
1901	244,976
1902	319,557
1903	265,418

The un-sold stocks of pig iron in Canada on 31st December, 1903, amounted to 19,168 tons.

XII.—FATS, FATTY OILS, Etc.

OLIVE OIL PRODUCTION OF SOUTH AUSTRALIA.

Bd. of Trade J., March 3, 1904.

In the prefatory report on the agricultural and livestock statistics of South Australia for the year ended 31st March, 1903, it is stated that olive cultivation has for many years been carried on in that State, the climatic conditions, nature of the soil, and the introduction of the best varieties all tending to the success of a highly remunerative industry in the production of fruit and oil of the best quality. The number of trees returned for the period under review is 78,642, against 66,852 in 1901–02, and the quantity of oil expressed 12,422 galls., as against 11,327 galls. in 1901–02.

CARNAUBA WAX.

Pharm. Weekblad, 4, 78, 79 ; *through Pharm. J.*, 1904, 72, 246.

About 1,000 tons of Carnauba wax are exported annually from Brazil, chiefly to Hamburg. The greater portion of the wax is collected along the banks of the Jaquariba, in the provinces of Ceará and Parahyba. The leaves of the plant which yield the wax are left to dry in the sun for two or three days and the wax brushed or scraped from the surface. It is then melted in hot water, skimmed off, and allowed to solidify, when it forms a yellow or pale greenish wax of sp. gr. 0·995, and m. pt. 84° C.—A. S.

CHINESE WOOD OIL.

U.S. Cons. Reps., Feb. 24, 1904.

Wood oil is rapidly becoming an important article of export from China. During the past season there has been over 1,890,000 dols. worth of it shipped from Hankow. There are two kinds of this oil—one yellow, the other a dark colour. Only the former has been exported, being considered of a higher quality than the latter. The price of the yellow variety during the past season has varied from 4·92 dols. to 6·05 dols. per picul (133⅓ lb.). The price at this date is about 5 dols. gold. The oil is brought to the port in bamboo baskets lined with oiled paper, each basket containing about 1 picul of oil.

SOAP TREE OF ALGERIA.

U.S. Cons. Rep., March 1, 1904.

German papers report that steps are being taken in Algeria to manufacture natural soap on a large scale from a tree known as "*Sapindus utilis*." This plant, which has long been known in Japan, China, and India, bears a fruit of about the size of a horse-chestnut, smooth and round. The colour varies from a yellowish green to brown. The inner part is of a dark colour and has an oily kernel. The tree bears fruits in its sixth year and yields from 55 to 220 lb. of fruit, which can easily be harvested in the fall. By using water or alcohol the saponaceous ingredient of the fruit is extracted. The cost of production is said to be small.

YELLOW GREASE : U.S. CUSTOMS DECISION.

Jan. 14, 1904.

A hard yellow grease was assessed for duty at 20 per cent. *ad valorem* as a "manufactured article unenumerated" under section 6 of the present Tariff Act. The Board of General Appraisers, on examining the sample, held it to be properly dutiable at ½ cent per lb. as "wool grease," under paragraph 279.—R. W. M.

XIII. B.—RESINS, VARNISHES, Etc.

GUAIACUM RESIN : U.S. CUSTOMS DECISION.

Jan. 25, 1904.

Resin guaiacum was decided to be dutiable at ¼ cent per pound and 10 per cent. *ad valorem*, under paragraph 20 of the present Tariff Act, as a "gum advanced in value," and not free of duty as a "crude drug" under paragraph 548.
—R. W. M.

"MIXTION CLARIFIÉ": U.S. CUSTOMS DECISION.

Jan. 22, 1904.

Merchandise described on the invoice as above, and according to analysis consisting of turpentine oil, drying oils, and resinate of lead, was decided to be dutiable at 35 per cent. *ad valorem*, as "varnish," under paragraph 53 of the present Tariff Act, and not at 20 cents per gallon, as "linseed oil oxidised," under paragraph 37.—R. W. M.

XIV.—TANNING; LEATHER; GLUE, Etc.

TANNING INDUSTRY IN BURMA.

Bd. of Trade J., March 3, 1904.

In its issue of 6th February, "Indian Engineering" calls attention to the fact that the Forest Department at Rangoon are working a tanning factory, which may be the means of introducing a new industry into the province of Burma, whose forests and coasts supply tanning material in abundance.

GROUND SUMACH : U.S. CUSTOMS DECISION.

Jan. 27, 1904.

Sumach leaves, ground and containing 15 per cent. of lentisco leaves also ground, were assessed for duty at 20 per cent. *ad valorem*, as a "manufactured article unenumerated," under section 6 of the present Tariff Act. The Board of General Appraisers sustained the claim of the importer that they were dutiable at 0·3 cent. per pound, as "ground sumach," under paragraph 85, the evidence showing that such was their commercial designation.—R. W. M.

XVI.—SUGAR, STARCH, Etc.

SACCHARIN AND SIMILAR SUBSTANCES ; IMPORT OF ——, INTO SPAIN.

Bd. of Trade J., March 10, 1904.

The regulations which have been issued for giving effect to the law governing importation of saccharin, &c., into Spain (this J., 1904, 143), provide that the importation of saccharin and similar products is to be effected only through the Custom-houses of Irun, Port Bou, Barcelona, Seville, Bilbao, and Grao de Valencia, and only in the name and for account of certificated apothecaries. Until the Ministry of the Interior has fixed the quantity of saccharin, &c., which is to be considered as the maximum necessary for the pharmaceutical purposes of each importer, the amount of each consignment is not to exceed 2 kilos.

SUGAR EXPORTS OF BRITISH GUIANA.

Bd. of Trade J., March 3, 1904.

The following figures are taken from official sources, and give the destination of the exports of sugar from British Guiana for the years ending March 31st :—

Year.	United Kingdom.	United States.	Canada.
	Tons.	Tons.	Tons.
1898–9	17,612	78,609	218
1899-1900	15,931	68,422	331
1900–1	16,902	76,216	1,588
1901–2	12,868	85,099	7,774
1902–3	16,326	89,805	13,777

For the period from 1st April to 3rd November 1903, the sugar exports to Canada reached a total of 32,683 tons.

XVII.—BREWING, WINES, SPIRITS, *Etc.*

WINE PRODUCTION IN ITALY IN 1903.

Bd. of Trade J., March 10, 1904.

The following table, showing the amount of wine produced in Italy in 1903, as compared with the productions of 1902 and 1901, has been compiled from official figures published in the *Gazzetta Ufficiale* of 25th February :—

Districts.	1901.	1902.	1903.
	Hectols.	Hectols.	Hectols.
Piedmont	6,130,000	5,370,000	2,800,000
Lombardy	2,250,000	1,995,000	1,550,000
Venetia	3,000,000	2,270,000	1,920,000
Liguria	420,000	370,000	200,000
Emilia	4,940,000	3,415,000	3,230,000
Umbria	4,500,000	3,945,000	3,000,000
Tuscany	4,985,000	4,210,000	3,100,000
Lazis	1,150,000	1,600,000	1,440,000
South Adriatic	7,200,000	9,370,000	6,430,000
South Mediterranean	3,500,000	4,100,000	5,060,000
Sicily	4,155,000	3,180,000	3,960,000
Sardinia	1,950,000	1,615,000	2,410,000
Totals	44,180,000	41,440,000	35,100,000

SPIRIT DRAWBACK.

At a meeting of the Associated Chambers of Commerce held at the Whitehall Rooms, W.C., on Thursday, March 10, on the motion of Mr. Ivan Levinstein, seconded by Mr. Thos. Tyrer, the following resolution was passed :—

Having regard to the great advantages resulting from the extensive employment of untaxed alcohol for industrial purposes, and for the generation of power abroad, this Association is convinced that the retention of the existing duty on alcohol for such purposes is a very serious obstacle to the progress of British industry, and that a letter be forthwith addressed to the Chancellor of the Exchequer asking him to receive a deputation on an early date for the purpose of demonstrating to him the importance and urgency of exempting from duty alcohol for industrial uses.

WINE PRODUCTION OF SOUTH AUSTRALIA.

Bd. of Trade J., March 3, 1904.

Vine growing in South Australia is becoming one of the most important industries, the production of wine having increased fourfold during the past decade. In 1893 there were 15,418 acres, with 4,206,880 vines in bearing and 4,545,737 non-producing. In 1903 the area had increased to 21,692 acres, the number of productive vines to 10,067,139, and 1,723,787 vines not in bearing, aggregating nearly 12,000,000 vines.

The future of the vine industry must depend more and more on extraneous demand, especially from consumers in Great Britain. The consumption of Australian wine in the United Kingdom was in 1860 only 951 galls.; in 1870, 36,147 galls.; in 1880, 55,000 galls.; in 1890, 314,401 galls.; and at the close of the century, 822,503 galls.

XVIII. C.—DISINFECTANTS.

"SACARBOLATE": U.S. CUSTOMS DECISION.

Jan. 12, 1904.

An article described as sacarbolate, which on analysis was shown to be a preparation of soap containing phenolic compounds and pyridine bases, was assessed for duty, as a "medicinal soap," at 15 cents per lb. under paragraph 17 of the present tariff. The evidence showed that it was principally used for disinfecting railway cars and refrigerators, and was not suited for use on the human body. The claim of the importer that it is properly dutiable at 20 per cent. *ad valorem* as "soap not specially provided for," under paragraph 72, was sustained by the Board.

—R. W. M.

XX.—FINE CHEMICALS, *Etc.*

QUININE EXPORTS FROM JAVA DURING 1903.

Chem. and Druggist, March 5, 1904.

The exports of quinine from Java from Jan. 1 to Dec. 31 were as follows :—

	Cases.
1899	1,600
1900	1,921
1901	2,255
1902	1,986
1903	1,917

ENFLEURAGED GREASES, CONCRETE ESSENCES, AND OILS: U.S. CUSTOMS DECISIONS.

Jan. 27, 1904.

The Board held that concrete essence of violet, concrete essence of cassie, and pomade lily are "enfleurage greases," and free of duty under paragraph 626 of the present Tariff Act; and oil of jasmine also free under same paragraph, by specific designation. Articles described as oil of gardenia, oil of muguet, and oil of thyme were held to be dutiable either "as essential oils," under paragraph 3, at 25 per cent. *ad valorem*, or at 60 cents per lb. and 45 per cent. *ad valorem*, under paragraph 2, as "alcoholic compounds," according to the presence or absence of alcohol. It was also held that certain concrete essences and oils, described as concrete clover blossoms, oil of jasmin, oil of chypre, solid carnation pink, concrete rose, concrete violet, concrete May lily, concrete tuberose, concrete fleur-orange, and solide oeillet are also free of duty, under paragraph 626 as "efleurage greases." In another case, decided Feb. 10, concrete essences, fleur d'oranges, cassie, heliotrope, rose, tuberose, reseda, violette de parme, and jasmine were also decided to be free of duty, as above, while glycine, gardenia, and lilas blanc were held to be dutiable at 25 per cent. *ad valorem* as "essential oils" under paragraph 3, as being compounds of essences. In a further case, decided Feb. 15, essence naturelle pure violette and essence naturelle concrete mimosa were held to be dutiable at 25 per cent. *ad valorem* as "essential oils."—R. W. M.

GUAIACOL CARBONATE AND PIPERAZINE: U.S. CUSTOMS DECISION.

Feb. 8, 1904.

The Board of General Appraisers held guaiacol carbonate and piperazine to be "medicinal preparations in the preparation of which alcohol is used" and dutiable at 50 cents per lb. under paragraph 74 of the Tariff Act.—R. W. M.

ARISTOL: U.S. CUSTOMS DECISION.

Feb. 8, 1904.

Aristol, derived from thymol and iodine, was found to be non-alcoholic in character and dutiable at 25 per cent. *ad valorem* as a "medicinal preparation" under paragraph 76 of the Tariff Act.—R. W. M.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.], "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 5094. Soc. Anon. L'Industrie Verrière et ses Dérivés. Processes for heating coal, applicable for chemical and other similar processes. March 1.

,, 5257. Berry and Penholm. Means for and methods of evaporating, densifying, or like treatment of liquids. March 3.

,, 5366. Willis (Dupuis). Distilling apparatus. March 4.

,, 5370. Knight. Filters. March 4.

,, 5688. Johnson (Badische Anilin und Soda Fabrik). *See under* XI.

,, 5735. Deacon and Rowe. Mill for grinding purposes. March 9.

,, 5791. Imray (Stanton). Apparatus for producing a vacuum, supplying an absorbent, and preventing back atmospheric pressure.* March 9.

,, 6037. British Thomson-Houston Co., Ltd. (Gen. Electric Co.). Apparatus for producing high vacua. March 11.

[C.S.] 5649 (1903). Lévy. *See under* VII.

,, 6372 (1903). Kestner. Apparatus for concentrating liquids. March 9.

,, 7426 (1903). Wollaston. Apparatus for removing suspended matters from liquids by continuous decantation. March 16.

,, 7957 (1903). Houghton and The United Alkali Co., Ltd. Apparatus for separating liquid from solid matter, and for partially drying the solid matter. March 16.

,, 8671 (1903). Theisen. Centrifugal apparatus for treating gases. March 9.

,, 9182 (1903). Round. Receivers, condensers, and similar vessels, such as are used in connection with nitric acid and other chemical manufacturing plants, and similar purposes. March 9.

,, 9689 (1903). Alzugaray. Crucible furnaces. March 9.

,, 458 (1904). Seger. Centrifugal separating apparatus. March 9.

,, 514 (1904). Robinson. Grinding mills. March 16.

II.—FUEL, GAS, AND LIGHT.

[A.] 4944. Russo. Arc lamps, and carbons therefor. Feb. 29.

,, 4995. Schlickeysen. Process for converting raw peat into solid peat fuel. Feb. 29.

,, 5218. Badger. The burning of liquid fuel. March 2.

,, 5333. Dewey. Mantles for incandescent gas burners. March 4.

,, 5468. Oldham. Self-lighting mantle. March 5.

,, 5479. Cutler and Cutler. Gas purifiers. March 5.

,, 5529. Grafton. Argand gas burners. March 7.

,, 5535. Smith and Grant. Gas producers. March 7.

,, 5674. Lord. Apparatus for generating gas for heating and illuminating purposes. March 8.

[A.] 5726. Atkinson. Incandescent gas mantles. March 8.

,, 6124. Lake (Hardt). Bunsen burners. March 12.

[C.S.] 5781 (1903). Jones. Manufacture of gas. March 9.

,, 7251 (1903). Gibbons and McEwen. Inclined gas-retort mouthpieces. March 9.

,, 9950 (1903). Boyd. Gas producers. March 16.

,, 10,416 (1903). Faucheur. Manufactures of briquettes for fuel. March 16.

,, 11,119 (1903). Hansen. Rotary furnaces. March 9.

,, 2358 (1904). Peters. Process for utilising the waste ends of carbons from arc lamps. March 16.

,, 2181 (1904). Brooks. Apparatus for the generation of gas. March 9.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 5955. Sellars. Extraction and recovery of by-products from shales, coal dust, or other bituminous or carbonaceous matters. March 11.

[C.S.] 8596 (1903). Bengough. Process for the production of highly sulphuretted hydrocarbons. March 9.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 4997. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters. Feb. 29.

,, 4998. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Feb. 29.

,, 5303. Imray (Basle Chemical Works). Manufacture of indoxyl, its homologues and their derivatives. March 3.

[C.S.] 8905 (1903). Imray (Meister, Lucius und Brüning). Manufacture of dyestuffs of the anthracene series. March 9.

,, 9598 (1903). Imray (Meister, Lucius und Brüning). Manufacture of cyanine dyestuffs. March 9.

,, 10,074 (1903). Newton (Bayer and Co.) Manufacture of new derivatives of the anthraquinone series. March 9.

,, 11,004 (1903). Abel (Act.-Ges. f. Anilinfabr.) Manufacture of red monazo dyestuffs. March 9.

,, 11,717 (1903). Newton (Bayer and Co.). Manufacture of dyestuffs of the anthraquinone series. March 9.

,, 2738 (1904). Imray (Basle Chemical Works). Manufacture of new basic dyestuffs. March 9.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 5247. Goddard. Apparatus for dyeing warps for weaving and otherwise treating them with liquids. March 3.

,, 5585. Sunderland and The Bradford Dyers' Association, Ltd. Production of colour or other effects on textile fabrics. March 7.

,, 5782. Newton (Bayer and Co.). Printing. March 9.

[C.S.] 9849 (1903). Fielding. Rendering permanent embossed and like effects on woven goods. March 16.

,, 23,310 (1903). Muntadas y Rovira. Continuous bleaching, washing, dyeing, and like apparatus. March 9.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 5067. Lee. Manufacture of cyanide of potassium. March 1.

[A.] 5101. Bloxam (Gibbs). Manufacture of salts of oxy-acids of chlorine and salts of chromic acid. March 1.

,, 5173. Ashcroft. *See under* XI.

,, 5194. Kenyon. Process and apparatus for extracting nitrogen from atmospheric air. March 2.

,, 5195. Kenyon. Manufacture of nitrogenous compounds. March 2.

,, 5293. Pearce and Couchet. *See under* XI.

,, 5360. Woltereck. Process for producing hydrocyanic acid. March 4.

,, 5540. Pauling and Pauling. Process for the production of nitric acid from air. March 7.

,, 5603. Lennard. Improvements in and apparatus for the manufacture of carbonate of ammonia. March 7.

[C.S.] 5649 (1903). Lévy. Process for the separation of gases from gaseous mixtures, particularly oxygen and nitrogen from atmospheric air, and apparatus therefor. March 16.

,, 8478 (1903). Swan and Kendall. Apparatus to be employed in the manufacture of cyanides. March 9.

,, 768 (1904). Stevens and Timmerman. *See under* XI.

,, 2284 (1904). Lake (Fallows). Production of phosphoric acid. March 16.

VIII.—GLASS, POTTERY, AND ENAMELS.

[C.S.] 297 (1904). Imray (Window Glass Machine Co.). Methods of and apparatus for drawing and annealing glass. March 9.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 4940. Seaton-Snowdon. Flame-preventing compositions. Feb. 29.

,, 4986. Wouldham Cement Co., 1900, Ltd., and Fennell. The linings of rotary kilns or furnaces. Feb. 29.

,, 5487. Curry. Manufacture of refractory bricks. March 5.

,, 5648. Stringfellow. *See under* X.

,, 5711. Bidtel, Bidtel, and Nutz. Magnesia cement composition, and process for making artificial stone from the same.* March 8.

,, 5712. Shedlock. Manufacture of artificial asphalt or like composition. March 8.

,, 5853. Brothers. Manufacture of plaster of Paris, and apparatus therefor. March 10.

,, 5913. Törno. Process of manufacturing artificial marble or artificial stone.* March 10.

,, 6007. Steger. Manufacture of artificial stone, blocks, or bricks.* March 11.

,, 6112. Robinson and Sons, Ltd., and Smith. Plasters. March 12.

[C.S.] 388 (1904). Gogler and Seinfeld. Process for manufacturing white cement. March 16.

X.—METALLURGY.

[A.] 4973. Trezel and Comte de Monthy. Alloy for and process of soldering and brazing aluminium and alloys containing aluminium. Feb. 29.

,, 4975. Moore and Heskett. Manufacture of iron and steel from ferruginous ore.* Feb. 29.

,, 5011. Moore and Heskett. Apparatus for treating ferruginous ore for the manufacture of iron and steel therefrom. March 1.

,, 5276. Alzugaray. The refining of iron, steel, and other metals. March 3.

,, 5349. Bower. Oxidising metallic surfaces. March 4.

,, 5361. Proctor and Jackson. Method of soldering aluminium. March 4.

[A.] 5591. Alton and Ramsay. Treatment of zinc ore or zinciferous flue dust. March 7.

,, 5648. Stringfellow. Treating blast-furnace slag, and utilising the products thereof. March 8.

,, 5649. Wheatley. *See under* XI.

,, 5671. Lake (Bassett, Parker, and Strout). The brazing of metals, and fluxes for use therein.* March 8.

,, 6046. Wemyss-Just and Hurry. Metallic alloy. March 11.

[C.S.] 5683 (1903). Prescott and E. Green and Son, Ltd. Manufacture of metallic alloy. March 16.

,, 768 (1904). Stevens and Timmerman. *See under* XI.

,, 912 (1904). Matzek. Method of filling up cavities produced in steel blocks during casting or cooling. March 16.

,, 2460 (1904). Cadotte. Case-hardening compound. March 9.

,, 3235 (1904). Schulte-Steinberg. Manufacture of briquettes from friable ores. March 16.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 5173. Ashcroft. Production of metals of the alkali group by electrolysis. March 2.

,, 5193. Macaulay. Device for collecting gases which are driven or given off electrical furnaces. March 2.

,, 5293. Pearce and Couchet. Electrolytic process for manufacturing nitrites. March 3.

,, 5297. M. I. P. Electrical Syndicate, Ltd., and Blackman. Electric accumulators or secondary batteries. March 3.

,, 5528. Brindle. Composition for insulating and other purposes. March 7.

,, 5649. Wheatley. Plating aluminium or its alloys with a metal or alloy by electrolysis. March 8.

,, 5683. Johnson (Badische Anilin und Soda Fabrik). Apparatus for producing reactions in gases by means of electricity. March 8.

[C.S.] 10,251 (1903). Wokes and Street. Apparatus for purifying air and generating ozone by electricity. March 16.

,, 11,276 (1903). Roderbourg. Manufacture of electrodes for secondary batteries. March 9.

,, 768 (1904). Stevens and Timmerman. Furnaces for extracting metals, and making carbides and similar compounds. March 16.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 5,000. Kirton. Soap or compound applicable for cleaning gloves and the like. Feb. 29.

,, 5399. Taylor. *See under* XVIII A.

,, 5609. Fearnhead. Apparatus for the manufacture of candles, &c. March 8.

,, 6028. Rÿk. Absorbent for lubricants, and method of lubricating with the aid thereof. March 11.

,, 6080. Slater and Slater. Manufacture and subsequent treatment of soap. March 12.

[C.S.] 8954 (1903). Finlay. Preparation of soap and other commodities liable to evaporation. March 9.

,, 10,324 (1903). Delahaye. Manufacture of artificial wax. March 16.

,, 1303 (1904). Parziale. Soap. March 16.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

[C.S.] 8335 (1903). Strange and Graham. Manufacture of improved paint vehicles. March 16.

[C.S.] 28,800 (1903). Armbruster and Morton. Pigments, and processes of making the same. March 9.

(*B.*)—Resins, Varnishes.

[A.] 5186. Hannay. Anti-fouling compositions for ships' bottoms. March 2.

,, 5292. Charlesworth and Gray. Medium for colouring or staining purposes. March 3.

[C.S.] 6823 (1903). Blumer. Synthetical production of resinous substances. March 9.

XIV.—TANNING; LEATHER, GLUE, SIZE, Etc.

[A.] 5475. Richardson. Treating leather to adapt it for being united to other material. March 5.

[C.S.] 5305 (1903). Zacharias. Manufacture of leather. March 16.

,, 9944 (1903). Banham and Co., Ltd., and Sagar. Impregnating woven belting and other fabrics with balata, gutta-percha, &c. March 9.

,, 11,625 (1903). Jensen (Maetschke). Process of manufacturing a limpid solution of agar agar. March 9.

XV.—MANURES, Etc.

[A.] 6101. Crone, Taylor, and Williams. Manufacture of fertilisers. March 12.

XVI.—SUGAR, STARCH, GUM, Etc.

[A.] 5574. Kantorowicz. Manufacture and production of starch materials. March 7.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 4974. Squire, Squire, and Squire. Manufacture of yeast for bakers' use. Dec. 29.

,, 5263. Dymond. Kilns for drying brewers' grains, &c., and machinery and apparatus therefor. March 3.

,, 5272. Kenneth and Murray. Method of manufacturing alcohol. March 3.

,, 5445. Frew and Dempster. Fermented beverages. March 5.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—Foods.

[A.] 4974. Squire. *See under* XVII.

,, 5102. Van Dalfsen. Production of an article of food from sweet cassava.* March 1.

,, 5399. Taylor. Preparation and preservation of cream and similar fatty substances or emulsions. March 4.

,, 5789. Leetham. Process for bleaching, conditioning, or sterilising flour, milk, and other food products or fermentable materials. March 9.

,, 5790. Leetham. Process for bleaching or sterilising, and apparatus therefor. March 9.

,, 5946. Butler. Manufacture of milk in the form of milk powder, also applicable to the treatment of other solutions containing fatty matter. March 10.

[C.S.] 12,045 (1903). Daseking and Paradies. Treatment of milk for purifying and preserving same. March 9.

(*B.*)—Sanitation; Water Purification.

[C.S.] 4759 (1903). Nesfield and Crerar. Sterilisation of water and other liquids and of alimentary substances to render same potable or edible. March 9.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 4996. Jackson. Manufacture of paper pulp from printed paper. Feb. 29.

,, 5126. Voigt. *See under* XXII.

,, 5277. Alzugaray. Manufacture of paper. March 3.

,, 5280. Ortmann. Manufacture of celluloid. March 3.

,, 5286. Howorth (Soc. Franc. de la Viscose). Apparatus for treating viscose. March 3.

,, 5730. Howorth (Soc. Franc. de la Viscose). Apparatus for the treatment of viscose. March 8.

,, 5994. Greening. *See under* XX.

[C.S.] 4863 (1903). Schmerber and Morane. Manufacture of celluloid. March 9.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 5549. Richardson. Manufacture of camphors. March 7.

,, 5994. Greening. Method of producing artificial camphor and rendering same a solvent for nitrocellulose forming celluloid. March 11.

[C.S.] 10,095 (1903). Zimmerman (Chem. Fabrik auf Actien vorm. E. Schering). Manufacture of methylene hippuric acid. March 9.

,, 11,138 (1903). Imray (Meister, Lucius und Brüning). Manufacture of esters of trimethylcyclohexenone carboxylic acid. March 9.

,, 1180 (1904). Evers. Process for obtaining liquorice juice from partly or completely dried liquorice root. March 9.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 4941. Heskiel. Colour photography. Feb. 29.

,, 4994. Imray (Meister, Lucius und Brüning). Manufacture of coloured photographic images or prints and of sensitive surfaces therefor. Feb. 29.

,, 5814. Bennion-Booth. Photographic printing process resembling mezzotint. March 9.

,, 5917. Spitzer. Process for producing etchings from negatives or diapositives of any kind. [German Appl., Oct. 29, 1903.]* March 10.

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[C.S.] 10,836 (1903). Brock. Explosive for blasting, signalling, and other purposes. March 16.

,, 11,990 (1903). Christensen. Manufacture of matches. March 16.

,, 23,472 (1903). O'Donnell (Frank). Process of manufacturing a safety explosive. March 9.

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Notices.

THE MEDAL.

At a meeting of the Council of the Society held on March 23rd last, it was unanimously resolved to present the Society's medal for 1904 to Prof. Ira Remsen, President of the Johns Hopkins University, Baltimore, Md., U.S.A., for conspicuous services rendered by him to Applied Chemistry.

ANNUAL GENERAL MEETING, NEW YORK, 1904.

The Annual General Meeting will be held in New York City on Thursday, Sept. 8th, and following days. Members who contemplate attending are requested to communicate with the General Secretary as soon as possible, in order that suitable travelling arrangements may be made. A revised programme appeared in the March 31st issue.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

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Whiffen, Thos. (of Battersea), at Cerris House, West Hill, Putney, S.W. March 27.

Canadian Section.

Meeting held at Ottawa, on February 18th, 1904.

PROF. W. R. LANG IN THE CHAIR.

NOTE ON THE FRACTIONAL CONDENSATION OF AIR, WITH A VIEW TO THE COMMERCIAL PRODUCTION OF OXYGEN.

BY ERNEST A. LE SUEUR, B.SC.

The problem of the cheap preparation of oxygen, or of an atmosphere rich in oxygen, has long been recognised as a technically important one. The number of uses to which a really cheap oxygen could be put is exceedingly large. Hitherto, for almost all purposes requiring oxygen, air has had to be used. In the case of the combustion of fuel, for instance, for every ton of coal burnt at least ten tons of inert nitrogen are loaded into the flame. This dilution, or some of it, may be advantageous for certain purposes, as in the case of steam boiler work, but for practically all metallurgical operations it is highly objectionable, and for some it is even fatal, as in the case of the direct production of calcium carbide in a blast furnace. In industrial chemical operations, also, there are many processes demanding oxygen and, as in the cases of the Deacon and Mond chlorine processes, receiving air to their great prejudice.

The development in late years of methods of liquefying air has led to an active investigation as the practicability of producing cheap oxygen by purely mechanical means. Parkinson took out a patent (Eng. Pat. 44,418, 1892 ; this J., 1893, 545) for a method of refrigerating air until the oxygen (which has the higher boiling point) liquefied. This was impracticable owing to the fact that the two gases, oxygen and nitrogen, invariably liquefy together in a mutual solution. Some eight or nine years ago, Prof. James Dewar, of the Royal Institution, investigated the relative proportions in which oxygen and nitrogen liquefy when a mass of air is exposed to partial liquefaction. Unfortunately he arranged matters so that the only possible result was a complete liquefaction of a fraction of the air instead of a fractional liquefaction from the whole of it. That is to say, the mass of air as a whole was not only not chilled to the liquefying point, but, save for the portion withdrawn, was maintained at ordinary temperatures, while the separated portion was not only chilled below the point at which the most condensible constituents liquefied, but far below the condensing point of nitrogen itself. Naturally, the air exposed to this treatment liquefied in its entirety, and the conclusion was drawn that air, in its initial stages of condensation, could only deposit a liquid of its own composition. This conclusion seems to have been accepted throughout that section of the scientific world which has interested itself in this field of investigation. One result of this has been that, if a liquid, and subsequently a gas, rich in oxygen was desired to be obtained through the agency of liquefaction, it was considered necessary to liquefy air as a whole and then subject it to fractional distillation, when an atmosphere weak in oxygen would leave the liquid and a residue rich in oxygen remain behind. Carl Linde developed, in addition, a process in which he prepared liquid air under great pressure and at a comparatively high temperature, and then, by relieving the pressure, obtained a fractional distillation due to ebullition which accompanied the drop in pressure and temperature. An additional feature of his process consists in the further concentration in oxygen strength by fractional distillation induced on the regenerative principle. His process is undoubtedly the cheapest at present publicly known for preparing atmospheres rich in oxygen. There remains yet, however, much to be desired in Linde's process owing to the great power consumption, and labour and repair charges required when working at the pressures of between 100 and 200 atmospheres.

The following will serve to indicate the lines along which a remarkably cheap and efficient method has been developed. To begin with, in order to attain anything approaching efficiency in the use of a gas such as air (as distinct from a vapour, liquefiable by pressure alone, like ammonia) as the working fluid of the refrigerative cycle, it is imperative that the power represented by the drop of pressure of the gas should be abstracted from it as far as possible in the act of expansion. This fact has long been recognised, and Sir W. Siemens made application of it in the attempt to liquefy air by expanding previously cooled compressed air through an engine. His apparatus, however, was entirely inadequate to attain the extremely low temperature required for his purpose.

Now, inasmuch as it is required to develop power from our compressed gas, the latter must not be in the liquid condition. In the second place, any oxygen separated can only be secured by being first in the liquid condition. Thirdly, if we resort to a partial liquefaction of air so as to get oxygen from the liquid and power from the expansion of the unliquefied gaseous residue, and if, as Dewar believes, the portion liquefied is of the same composition as air, the method presents no notable advantages. Fortunately Dewar was wrong in his conclusions, and the device of working a motor with the unliquefied portion of the compressed air, thereby developing chilling effect, and of using the liquid rich in oxygen as a source of gaseous oxygen, is an excellent one.

A simple experiment suffices to determine the fact that air partially liquefied under a comparatively low pressure is rich in oxygen. I immersed in a boiling mixture of oxygen and nitrogen, richer in oxygen than air is, the lower end of an empty, unstoppered, test tube. After immersion for some minutes, examination showed the tube to contain a small quantity of a decidedly blue liquid, and this, on analysis, turned out, of course, to be a mixture of oxygen and nitrogen rich in oxygen. I say "of course" because, since the temperature of the boiling bath was higher than that of boiling liquid air (because it was richer in oxygen than air), it was impossible for liquid air to exist (at atmospheric pressure) under so high a temperature, and the liquid had therefore to be something which could be condensed out of the atmosphere and exist at atmospheric pressure at the temperature in question. It could not be oxygen, because oxygen and nitrogen invariably condense from air together in a mutual solution; in fact, I found on analysing it that the precipitation was a mixture of oxygen and nitrogen approximating in composition to, but slightly richer in oxygen than the boiling bath itself. I found that no liquefaction occurred at all when the oxygen strength of the bath rose to 50 per cent., because then the atmosphere boiling away from the bath was richer in oxygen than was air, and, obviously, the bath's temperature must be above that at which air can precipitate any portion of itself as a liquid under atmospheric pressure.

In the light of the recent publication of certain results by M. Georges Claude which appear to be along somewhat the same line, it may be proper to mention that I established theoretically the necessity for the occurrence of the above phenomena in 1889, and took steps at that time to make certified disclosures to that effect with certain authorities in Washington.

THE IMPROVEMENT OF BOILER-FEED WATER.

BY A. McGILL, M.A., F.R.S.C.

Part I.—Introductory.

The great demands made upon the modern locomotive have intensified the importance of using soft water in steam production. Rossel* states that the best water for boiler use would be pure distilled water rendered slightly alkaline. All naturally occurring water contain matter in solution. The carbonates, sulphates, chlorides, and silicates of lime, magnesia, soda, iron, and alumina are most usual; and organic matter must often be taken into consideration. In 1900 the Lancashire and Yorkshire Railway instituted an inquiry into methods of feed purification as then in use by the different railways of the world (Proc. Inst. Civil Eng., Lond., 1901, 68). Reports from eleven countries show that 25 out of a total of 58 roads used some system of water softening. The mean cost of treatment was 6½ cents. per 1,000 gallons. It is safe to say that the practice of softening boiler feed water has increased ten-fold during the past four years. Only one American road reported in 1900. I know of 27 American railways that have systematic treatment in use to-day. Evidence of the attention given to this matter is afforded by the fact that this Journal for 1902 contains abstracts of 24 patents, taken out in England in that year, for apparatus only.

It was formerly the custom to attempt treatment in the boiler. For valuable opinions on this subject see Maignen (this J., 1886, 224), Fisher,† and other high authorities.

The problem of making hard water soft is not a problem of pure chemistry. It is a practical problem, which must be solved subject to many limitations. These have reference to cost of reagents, of plant, of skilled labour. They include complexity of process and apparatus, time required in treatment, potability of the resultant water. In general the reactions must be carried out in cold dilute solution, while at the same time economy precludes the use of reagents in excess. The problem is not that of producing perfectly pure water, but of achieving the best possible result under given conditions of limitation.

We recognise three respects in which natural waters may be objectionable or impracticable for steam making:—(1) They may be corrosive; (2) They may foam or prime; (3) They may form scale. Corrosive waters of natural recurrence are rare. Air as dissolved by water contains 35 per cent. of oxygen, instead of 21 per cent. as in the atmosphere; but the corrosive action of dissolved air can only be held as proven in the absence of free carbon dioxide. Moist carbon dioxide, especially at boiler temperatures, acts strongly on iron, which is dissolved as ferrous carbonate. This is oxidised to the ferric salt by the dissolved air: the iron is precipitated as oxide and the carbon dioxide set free to make a fresh attack on the boiler plate; so that a small quantity of carbon dioxide is enabled, by this regenerative action, to effect very serious corrosion. It

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* Report to the Swiss Steam Users Association, 1888.

† "Die Chemische Technologie des Wassers," p. 278.

is true that the oxygen dissolved plays a part in this process, but it is as auxiliary to carbon dioxide in solution. It has further been demonstrated (Petit, Comptes rend., 1896, 1278; this J., 1897, 128) that while sodium chloride attacks iron even in the absence of carbon dioxide, the corrosive action is much intensified by its presence. Pfeifer (this J., 1894, 134) recommends that the feed pipe be placed near low water level, so that the feed water may meet the hottest layers, and air be immediately expelled with the steam.

Corrosion undoubtedly results from the use of acid waters (alum springs, mine waters, or streams receiving the waste from chemical manufactures), as well as from waters containing notable amounts of magnesium salts (sea water, western prairie waters, &c.) In the latter case dissociation occurs, basic salts are precipitated, and the liberated acid attacks the boiler plate. Cribb (Analyst, **22**, 169) has shown that magnesium chloride undergoes marked dissociation in solution, when distilled under high pressure. Bailey (this J., 1899, 456) finds that hydrochloric acid does not appreciably volatilize with the steam until a concentration of 1 per cent. is reached. Hence injury to boiler plate will occur long before any acidity is apparent in the steam.

Corrosive qualities can generally be counteracted by the judicious use of soda; but, unless care is taken, there may result a foaming water, nearly or quite as impracticable as the original. Each case of this kind must be studied by itself.

Foaming waters are much more common, and frequently present problems of great difficulty to the chemist. Plateau (Pogg. Ann., 141, 44) has established the fact that foaming is due to increase of viscosity and decrease of surface tension, as well as to the property which he has named "superficial viscosity." It is closely allied to the power of forming emulsions. I have approached the subject from the empirical side, with the object of getting practical guidance in the treatment of feed waters, and have recently published an account of apparatus (Can. Elect. News, Jan. 1904). The following synopsis of results may be given here:—

1. The first general condition which causes foaming is the sudden superheating of the water in the boiler, due to reduction of boiler pressure by drawing off steam.

2. With distilled water, foaming does not result under the conditions named.

3. With a clear space of 1 inch between the water surface and the safety-tube, foaming does not occur with distilled water, even on addition of 500 mgrms. of powdered chalk.

4. When sodium carbonate is in solution in the proportion of 1 grm. per litre, the escaping steam is charged with much water, even though the water in the boiler is quite free from particles of solid matter in suspension.

5. When sodium carbonate is present to the extent of 0·25 grm. per litre, the steam is distinctly wet, but no great amount of water is thrown out.

6. On addition of powdered chalk to the last-named solution, very violent projection of water occurs.

7. All sodium salts that I have tried produced foaming waters, even when the water is clear, when present to the extent of 1 grm. per litre.

8. Sodium salts seem to produce intensity of foaming in the following (decreasing) order:—stearate, carbonate, silicate, sulphate.

9. The presence of solid particles in suspension invariably increases the violence of the foaming.

10. Saturated solution of caustic lime does not foam violently; but the addition of a minute trace of any saponifiable fatty matter causes violent foaming.

11. Fatty matter, in a certain amount, will produce foaming, even if added to distilled water; but a mere trace, having no appreciable effect in the case of a neutral water, causes violent foaming if the water be alkaline either with lime or with soda, but more markedly with the latter.

12. Pectous matter (swamp waters), if at all concentrated, produces foaming, and especially when solid particles are present.

13. Tannin, in small amount, does not seem to cause foaming.

The following practical inferences may be drawn:—

First. The content of sodium salts must be kept down to a minimum. Marked foaming takes place, under 10 lb. pressure, when the soda (Na_2O) reaches 1,500 parts per million. At 200 lb. pressure it is presumable that the foaming limit will be reached at a much lower concentration. Practical men have assured me that no water containing 300 parts of Na_2O per million is fit to make steam with. A concentration of 5 : 1 would bring such a water up to 1,500 parts per million.

Second. Caustic lime in excess will cause foaming in presence of saponifiable fats, which are always present, in traces, in boiler concentrates. Hence the necessity of avoiding excess of lime in water treatment. Of course, this applies still more strongly to the case of caustic soda in excess.

Third. Solid matter in suspension predisposes to foaming. It is impossible that boiler concentrates should be free from suspended matter, but care should be taken to provide a feed water which is clear at first and is of such a character as to deposit a minimum of solid matter on being boiled.

Hillyer's recently published work on soap solutions (J. Amer. Chem. Soc., **25**, 511) corroborates these conclusions.

Since caustic lime and soda are amongst the most available reagents for softening hard waters, it is important to fix a limit of causticity for the resultant water, as well as a limit for its content of sodium salts. I propose the following maxima for causticity (basicity due to free alkali):—

Causticity due to	Limit.	Reasons.
Soda............	10°	Economy of reagent and danger of saponifying fats.
Lime	50°	Same reasons.
Baryta..........	0°	Same, with additional one of preventing poisonous water.

Note.—Degrees of causticity express the causticity to phenolphthalein, in terms of CaO per million.

It is rather a matter for surprise that the quality of foaming in boiler water has received so little attention. Driffield, in 1887, used the following language (this J., 1887, 178): "that tallow be not used for lubricating engine cylinders, if the exhaust steam from the cylinders be used directly to heat the feed water." It is probable that the author had in mind the formation of a special kind of scale, rather than the production of foaming qualities, by saponification. As a matter of fact, a trace of saponifiable fat, incapable of giving trouble in a merely mechanical way, will cause serious foaming in the presence of alkaline water under 200 lb. pressure, and a temperature of 380° F. —the condition usually obtaining in locomotive boilers.

Numberless analyses of boiler scale have been published. These exhibit wide differences of composition, depending upon the character of the water supply, the rate of evaporation, the pressure carried, the attention given to the boiler as regards frequency of blowing-off, cooling before blowing-off, and other conditions. But they all contain calcium and magnesium as sulphate, carbonate, or oxide, to form by much the largest constituents. Silica, iron, alumina, and organic matter make up the balance; although exceptional scales contain small amounts of chlorine and metallic bases. In the sequel I shall consider the conditions under which calcium and magnesium salts can be removed from the water. In their removal, other scale-forming substances are either incidentally got rid of, or are rendered harmless.

With regard to silica, I may say that in the analysis of 130 samples of water, chiefly from the Canadian North-West, the highest dissolved silica I have found is 70 parts per million; and this is altogether exceptional. The usual amounts vary from 10 to 30 parts per million. Headden (Amer. J. Science, 1903, 169) has found the water of mountain streams to be highly charged with silica, derived from the action of carbon dioxide and organic acids on the weathered feldspars of the gathering ground. This silicic acid is removed from solution by combination with lime and magnesia of the lower levels. The following maximum amounts of silica, cited by him, are interesting—

Source.	Total dissolved Solids.	Silica as percentage of Solids.	Silica per million.
The Great Geyser. Iceland	1,230	42	517
A spring in Yellowstone Park.	1,910	32	611
Rio Grande del Norte.........	89	27	24
Spriesterbach's well..........	400	27	108
Bucher's well.................	228	47	107

Part II.—Methods of Analysis.

In the light of ionisation theory, it is incorrect to speak of salts in solutions, in the ordinary sense. What is really of importance to us, for present purposes, is not the way in which acids and bases are combined in solution, but in what combinations they separate out, under the conditions of steam-making, or of softening processes. The form given to his report by an analyst, should be that which most clearly and simply lends itself to calculations for treatment. On this subject it is interesting to read the comments of such authorities as Fresenius,* Leffmann and Beam,† and A. H. Allen (this J., 1888, 799).

Since lime is now, and is likely to remain, the chief agent in treatment, there can be no difference of opinion about choosing the form in which we handle this article, as the basis of notation. But if we express lime as CaO we must represent the acid radical as the difference between the base and the salt. This requires us to write sulphuric acid as SO_3, &c. Lime is not only the most important substance used in softening water, but is also the most important substance to which hardness is due. For this reason it naturally constitutes the unit in which the hardness of a water should be stated. The German unit is 1 part of CaO per 100,000. The English unit of hardness is 1 part of calcium carbonate per 70,000 (*i.e.*, 1 grain per gallon). It has a historical interest, dating from 1841, when Clark published his celebrated process, together with his soap test for determining hardness. The most convenient unit of hardness, as conforming with our use of metric measures and weights; and further, as avoiding the necessity of using decimal points, is the mgrm. litre unit, or 1 part CaO per million. This is the unit which I employ throughout the following paper. Its magnitude is 1/10th of the German and 1/8th of the English unit.

Although hardness is expressed in terms of lime, it may in reality be due to magnesia. If it be desired to express it in terms of magnesia (MgO) the factor 5/7ths may be used.

If a water which reacts alkaline to phenolphthalein be titrated to neutrality (with this indicator), using decinormal hydrochloric acid, and operating on 100 c.c. of the sample, the required number of c.c. of N/10 acid, multiplied by 28, gives, in terms of CaO per million, what I call the "causticity" of the sample. The fact implied by the term "causticity" need have no reference to lime. It may be due to soda or magnesia, or to the mono-carbonates of these, or other, bases. Owing to the limited solubility of some of these substances, it cannot exceed a certain maximum in their case. Thus the maximum causticity for magnesium hydroxide is 20° (Macnab and Beckett, this J., 1886, 267); for calcium hydroxide is about 1,800°; for magnesium mono-carbonate is about 175°, and for calcium mono-carbonate about 30° (Thorp, this J., 1888, 804). Magnesium carbonate is much more soluble than the hydroxide. If, however, calcium be present as hydroxide, magnesium cannot be present as carbonate; so that the maximum causticity due to magnesia, in the presence of lime, is 20°. Soda, in a similar way, is incompatible with magnesium carbonate. If, therefore, lime is absent, and the causticity exceeds 20°, the excess must be due to soda, f soda is present.

The analysis of water for purposes of softening is, of course, to be distinguished from analysis for strictly scientific purposes. Pfeifer (Zeits. Angew. Chem., 1902, 193) has ridiculed certain elaborate analytical results, which nevertheless, failed to furnish him with the data he wanted for calculating treatment. When the general character of a supply is known, very simple analytical operations suffice for guidance in treatment. Seasonal changes are to be looked for; but these are more likely to involve variations in the absolute, than in the relative amounts of substances in solution. It is quite unusual for a supply rich in lime at one period of the year to become decidedly magnesian at another period.

In the first examination of a water sample, it is, however, desirable to learn all that we can about it.

Hardness.—This determination has quite recently been discussed by Procter (this J., 1904, 8). The soap test, originally described by Clark in 1841, has now passed into ancient history; although I find that Winckler (Zeits. anal. Chem., 1901, 82), has described a modernised form of it, using pure potassium oleate, instead of ordinary soap. Grossman (Chem. News, 1879, 258), Hehner (Analyst, **8**, 77), Allen (this J., 1888, 796), Leeds, and many others have demonstrated its shortcomings.

Hehner (*loc. cit.*) was one of the first to suggest a more rational method of determining hardness. Before describing this method, in its present form, it is necessary to consider the modes in which carbon dioxide exists in water.

Carbon Dioxide.—This exists in most natural waters in three conditions, viz., fully-bound, half-bound, and free. By fully-bound, is meant that which is combined with bases to form normal or mono-carbonates. Thus 62 Na_2O; 56 CaO; 40 MgO or 153 BaO combine with 44 CO_2 to form respectively 106, 100, 84, and 197 parts of the corresponding mono-carbonate. The solubility of the bases named is increased by excess of carbon dioxide, except in the case of soda. The maximum solubility of the other three is reached when for 56 CaO, 40 MgO or 153 BaO, 88 parts CO_2 is present. The bicarbonate is then said to be in solution. These bicarbonates have not been obtained other than in solution, except in the case of soda.

All the monocarbonates react alkaline to phenolphthalein, and, although with the exception of sodium carbonate they are only soluble in very limited amount, the reaction is easily appreciable. The bicarbonates are neutral to phenolphthalein. Towards certain indicators, such as Methyl Orange, Erythrosin (this J., 1891, 856), &c., they react more or less like the free base. The monocarbonates are quite permanent as solids, as well as in solution, under ordinary conditions. Bicarbonates in solution are by no means stable. If the solution is violently shaken, more or less carbon dioxide goes off and a corresponding amount of monocarbonate is formed. If this is in excess of the solubility of the monocarbonate, the excess is precipitated. The solubility of the carbonates in question is approximately as follows:—

Substance.	Parts per million.	
	Monocarbonate.	Bicarbonate.
Sodium carbonate	200,000	90,000
Calcium „	*30	900
Magnesium „	175 +	1,320 +
Barium „	70	?

* Thorp.—This J., 1888, 804.

Archbutt (this J., 1891, 515) prepared a solution of magnesium bicarbonate containing 4,890 parts of magnesia per million. Such a solution could only be kept constant under pressure, or under a continuous current of carbon dioxide.

It follows that in a solution of carbonates which reacts neutral to phenolphthalein only bicarbonates can be present. The combined carbon dioxide exists half in the fully-bound, and half in the semi-bound state. By titrating 100 c.c. of

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* "Quantitative Analysis" (Grove's Transl.) Vol. II., 171.
† "Examination of Water, &c." p. 70.

such a water with decinormal acid in presence of an indicator not affected by carbon dioxide, the amount can be determined.

If v = c.c. N/10 acid used in titrating 100 c.c. sample to neutrality (phenolphthalein).

If w = c.c. N/10 acid used in titrating 100 c.c. sample to neutrality (methyl orange) after phenolphthalein.

(17) CO_2 in monocarbonate = 22 v. Formula 17.

(18) „ „ bicarbonate = 44 w. Formula 18.

(19) Total combined $CO_2 = 22\ (v + 2\ w)$. Formula 19.

Besides the carbon dioxide which is combined with bases as mono- or bi-carbonates, most natural waters contain it in the free state. Although carbon dioxide constitutes only four parts in 10,000 of our atmosphere, it is much more soluble than the other constituents.

This dissolved carbon dioxide is even more readily expelled from solution than the half-bound, so that if a carbonated water is vigorously shaken, it will lose the whole of its free acid. When shipped for analysis, unless especial care has been taken to quite fill the container, and to properly cork it, the free carbon dioxide is lost through the shaking incident to transportation. The only safe way to estimate free carbon dioxide in water is, therefore, to make the determination on the spot.

Direct estimation by use of decinormal sodium carbonate solution was suggested by Leeds (J. Amer. Chem. Soc., 1891, 98). The process has lately been examined and favourably reported on by Ellms and Beneker (J. Amer. Chem. Soc. 1901, 405). Vignon and Meunier (this J., 1899, 865) describe a somewhat similar method, in which they use alcohol, and work to a standard depth of colour. An indirect method, described by Forbes and Pratt (J. Amer. Chem. Soc., 1903, 747), and ascribed to Dr. Brown, depends upon the separate estimation of total and fixed carbon dioxide.

So far as my observation goes, the free carbon dioxide in natural waters varies from a trace to about 300 parts per million. I have also found that, although excellent duplicates may be obtained at the time, the amount found in solution at intervals of a few weeks, varies greatly. It is certain that in the case of sparkling waters, the amount of free carbon dioxide held in solution is influenced by rainfall, temperature, and other conditions. I am convinced that the unsatisfactory results so often observed in water treatment, are largely due to a failure to take account of the part played by free carbon dioxide.

The earliest mention of free carbon dioxide as affecting treatment, I find in a paper by Macnab and Beckett (this J., 1886, 267). The authors say: "An excess of carbonate of soda must be used, because of free carbon dioxide in the water. The resultant water contains excess of alkali, which is objectionable for many purposes." They recommend the use of caustic soda, which takes up this free carbon dioxide, and then acts as sodium carbonate in softening the water. Lawrence (this J., 1891, 624) patented this same reaction in 1890, as a means of providing sodium carbonate to reduce permanent hardness. Koyl (this J., 1901, 830) recently obtained a patent in England, covering the use of lime in excess, as a means of neutralising the free carbon dioxide in water.

Free carbon dioxide is so easily got rid of by mere agitation—as by paddles, or by blowing air or steam through—that the addition of chemicals cannot be justified. The addition of lime produces unnecessary sludge, while the use of soda produces carbonate, which we have seen to be a main cause of foaming. If the water be of a kind to which sodium carbonate must be added for reduction of permanent hardness, it might, at first sight, seem plausible to urge that the carbonate produced in this way could be utilised for precipitation of calcium sulphate. But when we consider the prices at which caustic soda and sodium carbonate are sold, the speciousness of the plea is apparent.

The best and cheapest way of getting rid of free carbon dioxide is by agitation. For this purpose the mixing apparatus, needed in any plant, will suffice. The resultant water is in carbon dioxide equilibrium, and the proper quantities of reagents can be calculated with certainty.

Hardness.—A water is said to be hard when it contains more than 7 grains of mineral matter per gallon (Maignen, this J., 1866, 324), that is, 100 parts per million. The terms permanent and temporary have reference to whether or not the hardness persists after boiling the water. Permanent hardness is generally due to the presence of calcium or magnesium sulphates, or to magnesium carbonate. Temporary hardness is due to calcium bicarbonate. Sodium sulphate or chloride may be quite largely present in either kind of hard water. Sodium bicarbonate may exist along with temporary, or with some forms of permanent, hardness, but, although it may exist in cold solution along with calcium sulphate, these salts are not generally found together in natural waters. Flow over stones, change from higher to lower pressure, rise of temperature, and other causes, bring about loss of carbonic dioxide, and the resulting sodium carbonate enters into reaction with calcium sulphate, so that finally sodium sulphate is found in solution, and calcium carbonate is precipitated. Magnesium carbonate is fairly soluble, and is not precipitated by sodium carbonate; but experience shows that when magnesia and soda are both present in natural waters, these contain high sulphates or chlorides, or both sulphates and chlorides, and the soda remains in solution, when the water is concentrated by boiling, combined as sulphate or chloride.

In the following table, which gives analytical data for natural waters high in sodium salts, the waters of Group I. contain but little scale-forming material, and the soda remains, at least partly, in solution as carbonate, on concentration.

Natural Water Supplies, rich in Soda.

Parts per million.

No.	Name.	Dissolved Solids.			Lime, CaO.	Magnesia, MgO.	Soda, Na_2O.	Sulphuric Acid, SO_3.	Carbonic Acid in Normal Carbonate, CO_2.	Hydrochloric Acid, Cl.
		Dry at 100° C.	Ignited.	Loss.						
	GROUP I.									
25	Langdon	1129	1024	105	81	57	413	374	199	6
91	Carstairs	1050	964	86	17	11	467	323	197	1
92	Innisfail	782	752	30	6	0	435	..	287	2
	GROUP II.									
34	Moosomin	1998	1806	192	298	114	200	781	176	64
62	Whitewood	2408	1926	482	446	220	209	959	211	39
78	Thornhill	1762	1354	408	204	237	234	537	229	29
33	Morse	1840	1511	329	199	141	419	636	309	30
60	Exp. Farm	3814	2849	965	290	544	576	1440	321	116
66	Grenfell	5610	4246	1364	476	847	564	2184	383	41
71	Pembina	3276	2668	608	360	303	524	1305	299	24
77	Snowflake	2640	2218	422	494	166	331	1121	150	24
	GROUP III.									
70	La Salle	1814	1514	300	159	161	490	210	121	600
80	Winkler	1690	1564	126	189	80	516	314	91	520
83	Yellowgrass	5071	3900	1171	676	519	680	1737	295	660

Waters of Group II., containing high sulphates and low chlorides, yield solution of sodium sulphate on concentration. Those of Group III. give sodium chloride under similar conditions.

Determination of Temporary Hardness.—On titrating 100 c.c. with N/10 hydrochloric acid, the number of c.c. of acid used (Methyl Orange as indicator) is a measure of the bases existing as carbonates, and may be interpreted in terms of lime (CaO). This number is called the "alkalinity" of the sample.

$$(2)\ \text{"Alkalinity"} = A = 28\,(w + v).\quad \text{Formula 2}$$

(see table at end of paper, page 357, and page 354.)

In the absence of sodium carbonate this number is identical with the temporary hardness. If the sodium carbonate is present, it will be included in the alkalinity, and this number will be correspondingly larger than the true temporary hardness.

The true temporary hardness (Ht) is obtained by subtracting the permanent hardness (Hp) from the total hardness (H): $Ht = H - Hp$.

Total Hardness.—After titrating with N/10 hydrochloric acid, the whole of the bases exist as permanent hardness. If a proper precipitant is now added, in sufficient quantity, the lime and magnesia may be thrown out of solution, up to their limit of solubility. The most convenient reagent for this purpose is a decinormal solution of soda, in which half the soda is present as carbonate and half as hydroxide. It is advisable to use it in distinct excess of the theoretical quantity required. The solution is only one-twentieth normal from the point of view of precipitating either lime or magnesia since the object is to throw down the first as carbonate and the second as hydroxide. It is also of importance to remember that the carbon dioxide liberated in the "alkalinity" determination must be boiled off, before adding this carbonate-hydroxide mixture (of which I shall hereafter speak as "soda-reagent"), as otherwise the hydroxide in it will be more or less fully converted into carbonate.

The following equations explain the action of the "soda-reagent." The terms "neutral" and "alkaline" have reference to behaviour with Methyl Orange:—

$$(1)\ \underset{\substack{\text{neutral}\\ 56,\ 80}}{\mathrm{CaO, SO_3}} + \underset{\substack{\text{alkaline}\\ 62,\ 44}}{\mathrm{Na_2O, CO_2}} = \underset{\substack{\text{neutral}\\ 62,\ 80}}{\mathrm{Na_2O, SO_3}} + \underset{\substack{\text{precipitated}\\ 56,\ 44}}{\mathrm{CaO, CO_2}} \qquad \text{Alkalinity lost.}$$

$$(2)\ \underset{\substack{\text{neutral}\\ 40,\ 80}}{\mathrm{MgO, SO_3}} + \underset{\substack{\text{alkaline}\\ 62}}{\mathrm{Na_2O}} = \underset{\substack{\text{neutral}\\ 62,\ 80}}{\mathrm{Na_2O, SO_3}} + \underset{\substack{\text{precipitated}\\ 40}}{\mathrm{MgO}} \qquad \text{Alkalinity lost.}$$

$$(3)\ \underset{\substack{\text{neutral}\\ 56,\ 88}}{\mathrm{CaO\ (CO_2)_2}} + \underset{\substack{\text{alkaline}\\ 62}}{\mathrm{Na_2O}} = \underset{\substack{\text{alkaline}\\ 62,\ 44}}{\mathrm{Na_2O, CO_2}} + \underset{\substack{\text{precipitated}\\ 56,\ 44}}{\mathrm{CaO, CO_2}} \qquad \text{Alkalinity unchanged.}$$

$$(4)\ \underset{\substack{\text{neutral}\\ 40,\ 88}}{\mathrm{MgO\ (CO_2)_2}} + \underset{\substack{\text{alkaline}\\ 2\,\times\,62}}{\mathrm{2NaO_2}} = \underset{\substack{\text{alkaline}\\ 2\,(62\,+\,44)}}{\mathrm{2\ Na_2O, CO_2}} + \underset{\substack{\text{precipitated}\\ 44}}{\mathrm{MgO}} \qquad \text{Alkalinity unchanged.}$$

The first and second equations show that when the "soda-reagent" is added to a neutral solution of lime or magnesia as sulphates (or chlorides) the earthy bases are precipitated, and a proportional loss of basicity appears. The operation is conveniently performed on 100 c.c., and the liquid boiled. It is then cooled, made up to 200 c.c., and 100 c.c. of the filtrate is titrated back. From the loss of basicity the bases (lime and magnesia) are calculated as follows:—

If Q^1 = volume of "soda-reagent" added
and r^1 = c.c. of N/10 acid used in titration

$$(3)\ H = 28\,(Q^1 - 2\,r^1).\quad \text{Formula 3.}$$

Equations (3) and (1) show that when "soda-reagent" is added to a neutral solution of lime or magnesia as bi-carbonates, the whole of the lime or magnesia is precipitated, but the alkalinity remained unchanged. In this case the caustic soda component of "soda-reagent" is alone affected: and for each equivalent of caustic soda that disappears, an equivalent of carbonate of soda is formed, which last behaves like caustic soda towards Methyl Orange.

Permanent Hardness ($= Hp$) is directly determined by treating 100 c.c. of the sample (neutral to phenolphthalein) with an excess of "soda-reagent," boiling a few minutes; cooling; making up to 200 c.c., and titrating back to 100 c.c. If Q^2 represent the volume of "soda-reagent" used and r^2 the volume of N/10 acid used in titrating back, then—

$$(4)\ Hp = 28\,(Q^2 - r^2).\quad \text{Formula 4.}$$

True temporary hardness ($= Ht$) is the difference between total hardness (H) and permanent hardness—

$$(20)\ Ht = H - Hp.\quad \text{(Formula 20.)}$$

In most natural waters this quantity is identical, or nearly so, with the "alkalinity." Where "alkalinity" exceeds "temporary hardness," this is due to the presence of carbonate of soda—

$$(21)\ \underset{\substack{\text{(naturally}\\ \text{present)}}}{\mathrm{Na_2CO_3}} = \frac{53}{28}\,(A - Ht).\quad \text{(Formula 21.)}$$

From equations on page 20, it may be seen that (working on volumes of 100 c.c.) we need 0·07 c.c. "soda-reagent" for each 1 part per million of lime; 0·10 c.c. "soda-reagent" for each part magnesia existing as sulphate (or chloride); 0·20 c.c. "soda-reagent" for each part magnesia existing as bi-carbonate. In practice we must allow about 50 per cent. excess of "soda-reagent"; and duplicate estimations, using different volumes of "soda-reagent," should always be made.

Lime and Magnesia.—The number for total hardness gives us the sum of lime and magnesia, expressed in terms of CaO. Several methods of distinguishing the amount of each base are in use.

First Method.—Pfeifer (Zeits. angew. Chem., 1902, 193) adds a standard lime water in excess. This precipitates magnesia, with corresponding loss of alkalinity and phenolphthalein, since an equivalent of lime is precipitated as carbonate.

Second Method.—Depends (d'Auseline, Bull. Soc. Chem., **29**, 14) upon the fact that ammonium chloride prevents the precipitation of magnesia by "soda-reagent."

Third Method.—Depends upon the precipitation of lime only, by standard solution of oxalate of ammonia. The excess of this solution is determined by a back titration with standard permanganate.

Fourth Method.—I prefer to precipitate the lime with ammonium oxalate; to wash the precipitate with boiling water till free from oxalic acid; dissolve it from the filter with sulphuric acid, heat and titrate with N/10 permanganate. I have checked this mode of working, and find it quite accurate. If the operation is performed on 250 c.c. of the sample, and k = c.c. N/10 permanganate used—

$$\mathrm{CaO}\ \text{(per million)} = 11{\cdot}2\,k.\quad \text{(Formula 19.)}$$

Soda.—The most convenient way of estimating the total soda is the sulphating of the residue obtained by evaporating to dryness a known volume of the sample in platinum. The method (recommended by Fresenius) has been adversely criticised by Rössing (Zeits. Anal. Chem., **36**, 359), but the critic himself points out that by using ammonium carbonate in the solid state, the excess of sulphuric acid may be got rid of without entailing serious loss. If notable amounts of silica, iron, or alumina are present, suitable modifications must be made, but for ordinary waters the sulphated residue may be considered as normal sulphates of lime, magnesia, and soda.

Sulphuric Acid.—A volumetric method for determining sulphuric acid in presence of benzidine chloride has been described by Wolf Muller (Ber., 1902, 1587), and is highly spoken of by Procter (this J., 1904, 8). The gravimetric method, as barium sulphate, is the only one that I can recommend from experience.

Hydrochloric Acid.—Is easily determined by the silver nitrate method, with chromate indicator, or by the method of Volhard.

Methods for determination of silica, iron, alumina, and organic matter, when necessary, are too well known to need description here.

In order to learn fully the nature of a new supply, a full analysis must be made. When the general character is known, and a decision as to treatment made, very simple analytical operations suffice to furnish data for the calculations as to quantity of reagents.

Part III.—Treatment.

So long as lime was the only reagent used in softening water, the silver test described by Clark in 1841 answered the purpose of fixing the minimum of lime to be added, and gave an approximate indication for a maximum. Modern methods of treatment generally involve the use of at least two reagents, and simple tests for carrying out treatment are not available. Makers of apparatus for effecting treatment on the large scale frequently supply elaborate testing vessels, guaranteed to furnish the workmen with all needful information as to the progress of the softening. I have had opportunity of examining some of these, and find them quite misleading. If sufficiently delicate to give any useful information, they require greater nicety of manipulation than can be expected from ordinary labourers; and, if sufficiently strong to meet this requirement, their indications are too vague to have any value. Their most important failure, however, results from the assumption that the changes we aim at producing in the water take place immediately, and that the character of the water as it will be fed to the boiler is identical with that which it possesses a few minutes after the reagents are mixed with it. The fact is that in dilute and cold solutions the chemical changes desired are very slowly brought about, and time is a most important factor in treatment.

A compound treatment can best be carried out by adhering as closely as possible to a prescription, resulting from careful study of the supply. It is possible from time to time, by means of simple tests, to ascertain the quality of the resultant water; and such tests should be applied as often as convenient. Every natural supply undergoes periodic changes, and some supplies suffer cataclysmic change. This is specially true of small supplies. But these variations soon come to be well known, and can even be predicted, as statistics accumulate. Determinations of causticity, alkalinity, and total hardness are simple and easy, and I know of no simpler or more practical way of learning the satisfactory character of water in process of treatment.

Mono-carbonate of lime is soluble in water to the extent of 20 parts CaO per million, *i.e.*, 20°. Magnesia is soluble to the extent of 17°. Since these are the forms in which lime and magnesia are precipitated, we need not expect to reduce the lime hardness below 20°, nor the magnesia hardness below 17°. Where both these bases are present, the minimum hardness will be about 37° (= 4·5 English degrees).

Schierholz asserts (Chem. Centralbl., 1901, 139) that an excess of 50—80 parts of lime per million, and 100—200 parts of soda ash, effect a still more complete removal of lime and magnesia. Of course, the extra costs of reagents would prohibit the employment of such excess, even if the resultant causticity of the water were unobjectionable.

Reagents.—The following list of substances which have been proposed for use in softening water makes no pretence to completeness; still less is it intended to concede any high degree of efficiency to many of them. The fact that their cost makes it impossible to use them on the large scale is sufficient to make them unimportant for our purpose.

Reagent.	Proposer.	Reference
Aluminate of soda	Macnab and Beckett..	This J., 1886, 267.
" "	Mayberry and Baltzley	J. Amer. Chem. Soc., 1899, 23.
Barium chloride ..	Porter	This J., 1881.
" carbonate	Kosmann	" 1903, 1303.
" "	Reisert	" 1902, 1550.
" hydroxide	Zabrowski	" 1891, 238.
" "	Dudley	J. Amer. Chem. Soc., 1899, 667.
" oxalate ...	Burton	This J, 1886.
Calcined dolomite.	"	" "
Hydrochloric acid.	de Visser	" 1900, 13.
Sal ammoniac.....	"	" "
Lead hydrate	Zabrowski	" 1891, 238.
" nitrate	Villon	" 1894, 271.
Oleic acid.........	D'Huart and Glasener	" 1897, 552.
Soda lime.........	Dudley	J. Amer. Chem. Soc., 1899, 667.
" fluoride	Doremus.............	J. Amer. Chem. Soc. 1890, 308.
" oxalate	Challis................	This J., 1903, 507.
" phosphate...	Davis..................	" 1888, 321.
" silicate	Maignen..............	" 1886.
Soap powder	Challis................	" 1903, 507.

The reagents, which on the ground of cheapness and efficiency, are available for our purpose, are quick-lime, soda-ash, and caustic soda. It is sincerely to be hoped that barium, as hydroxide or oxide, may become available in the near future, as it would supply a real need. Many natural waters, especially those of our western prairies, contain so much soda that the further addition of this substance produces a foaming water. These waters are at the same time high in lime and magnesia sulphates. The United Barium Company of Niagara Falls, is, I believe, prepared to supply barium oxide, of 90 per cent. purity, at 3 cents a pound. The high combining weight of barium makes the article too costly to be extensively used at this figure.

Caustic Lime.—When made from calcite, may contain 95 per cent. of lime, or even more; but most limestones contain silica, magnesia, and other impurities, so that it is not unusual to find samples containing less than 70 per cent. of real lime. It deteriorates appreciably on exposure to air, absorbing water and carbonic acid. It is applied either in solution as lime water, or, in the dry state, is weighed in.

Lime Water.—Water dissolves from commercial lime only such portion as is valuable for softening water; the magnesia, clay, and unburnt carbonate remaining undissolved. On this account, as well as because a saturated solution of lime has (theoretically) a definite composition, the employment of this reagent in the form of saturated lime water, would seem to be far away preferable to the method of weighing in. In practice, however, difficulties occur which counterbalance apparent advantages. The chief difficulty is in saturating the lime water, or in so conditioning it as to produce a lime water of constant strength.

According to Wittstein, a saturated solution, at ordinary temperatures, should contain 1,040 parts of lime per million. Macnab and Beckett (this J., 1886, 267) claim for the Stanhope purifier, that it furnishes a solution containing 1,000 parts of lime per million. The Devereux apparatus is claimed (Zeits. angew. Chem., 1902, 206) to produce a solution containing 1,100 parts of lime per million. Vignon and Meunier state (this J., 1899, 865) that a saturated lime water should contain 1,360 of lime per million. I prepared nine solutions by shaking water with excess of lime for three hours (mechanical shaking), and obtained solutions containing from 1,120 to 1,344 parts of lime per million. In most of the automatic apparatus, the lime water is made by causing a small stream to flow continuously through a long cylinder in which slaked lime is suspended. Since the rate of flow varies, the strength of the solution must vary, and it can never be truly saturated.

Another obvious advantage of the use of lime water is the fact that the lime is applied in true solution. The importance of this condition cannot be over-estimated, and when lime is applied in any other way than as clear lime water, we must furnish means of ensuring true solution in the water being treated. This means, of course, vigorous and prolonged agitation, either by paddles, or by a current of air or steam.

Weighing-in.—Owing to the uncertainty of the strength of lime water made by any continuous process, as well as to the large and costly apparatus needed for its preparation and use, the weighing-in method of working has much in its favour. Of course the workman in charge must know the real strength of his lime. This may be furnished to him by the chemist, or he may himself determine it very easily by the following apparatus.

A stock bottle containing hydrochloric acid of 1:8 strength, to which phenolphthalein has been added, is fitted with a burette reading centimetres. The burette should be attached to the bottle, and arranged so as to be filled by pressing a rubber bulb. The upper end of the burette is loosely covered by a glass cap. Acid of the strength given is such that 100 c.c. exactly suffice to neutralise 5 grms. of lime. An apothecary's scale and a 5-grm. weight are wanted, together with a few boiling flasks and a lamp; this s the whole outfit, although it may be well to furnish a mortar and a sieve for use in preparing the sample.

If the chemist has reported the lime to contain 85 per cent. of lime, and it is desired to know whether any deterioration has taken place, the workman runs 85 c.c. of he acid into a boiling flask, dilutes and adds 5 grms. of his (properly prepared) sample. On prolonged boiling, to complete solution, the red colour of phenolphthalein should persist. If it does not do so the sample has deteriorated, and the operation is repeated with 84 c.c. or less, until the colour persists. The number of c.c. used in the final est, gives directly the percentage strength of the sample.

The lime furnished to a given station is usually obtained from a single source, and the relative content of magnesia s once for all determined by the chemist, but need not be known to the workman, who uses his lime on a basis of its causticity.

Uses of Lime.—Lime is used to neutralise the half-bound carbon dioxide in bi-carbonates, thus causing the precipitaion of all lime existing as carbonate, except 30 parts per million, and of all magnesia existing as carbonate, except 175 parts per million; these numbers representing the solubilities of the mono-carbonates in pure water. Under special conditions, lime may be used to precipitate magnesia as oxide (hydrate), but caustic soda is a more efficient precipitant. Lime is often used, along with soda ash, to effect the liberaon of caustic soda *in sitû.* In this case the lime is recipitated as mono-carbonate, and is added to the sludge. The only reason for working with carbonate of soda and me, instead of with caustic soda directly, is cheapness. Caustic soda is now quoted in Montreal (on a basis of 90 per cent. oxide) at 4 cents a pound (Na_2O), and soda ash on the same basis) at 2 cents. Against this first cost must e set the facts (1.) that more sludge has to be removed 2.) that the reaction between soda ash and lime is never mplete in the cold (Macnab and Beckett, this J., 1886, 267), whence results a waste of soda ash, an incomplete precipitation of magnesia, and an undesirably caustic water. When all is considered, it may be that less real difference of cost exists than would at first appear.

Soda Ash.—Seems to have been known as an efficient softener of hard water since 1823, when Muspratt established the soda industry in England. Soda ash is used to precipitate lime from compounds like the sulphate and chloride; and also to furnish caustic soda, by interaction with caustic lime, as already explained.

Caustic Soda.—This is the best precipitant for magnesia. It is available for neutralising the half-bound carbon dioxide, but is less desirable for this purpose than lime, by reason of its greater cost and the fact that it leaves carbonate of soda in solution. When this substance (carbonate of soda) is required for reduction of permanent hardness, it is cheaper to supply it as soda ash than to produce it by the carbonating of caustic soda.

Occasions, however, do arise in which the use of caustic soda is preferable to any other treatment. These must be regarded as exceptional. Schreif (Zeits. angew. Chem., 1892, 514) asserts that a slight excess of caustic soda does no harm to the boiler.

Barium hydrate has not found extensive application, by reason of its cost. At 3 cents a pound, for 90 per cent. purity, it is three and a half times as expensive as caustic soda at 4 cents. It is to be hoped that improvements in manufacture, may reduce the cost to about 1 cent. per pound. Its special advantage is in the fact that hardness can be reduced without increasing the content of soda salts in the supply. Some experimental work with a view to determining the most economical way of applying barium oxide (or hydrate) is given in the fourth part of this paper.

A supplementary treatment with carbon dioxide has been recommended by Archbutt and Deeley (this J., 1891, 511) for the purpose of converting colloid hydrate of magnesia into carbonate. This colloid substance, they state, is immediately deposited when the water enters the boiler, choking the nozzle of feed-pipe or injector. By carbonating the water (for which purpose the authors have patented a special apparatus) this objection is successfully met. A carbonating device has more recently been patented by Lawrence (this J., 1893, 171). I have no knowledge of the difficulty complained of, and find that efficient agitation ensures a satisfactory precipitation of magnesia.

Formulas for use in calculating treatment are readily deducible from the equations already given. Comprehensive formulas, intended to be of general applicability, have been published by Kalmann (this J., 1890, 1065), Pfeifer (Zeits. angew. Chem., 1902, 193), and others. It is evident that no formula can be universally applicable if best results are sought. The real difficulty is less in finding how much lime or soda is wanted to effect a given reaction than in deciding what reactions should be brought about in a given case.

No.	Wanted.	Given.	Formula.	No.
1	"Causticity" = a	v	$a = 28\,v$.	1
2	"Alkalinity" = A	w, v	$A = 28\,(w + v)$.	2
3	Total hardness = H	Q^1, r^1	$H = 28\,(Q^1 - 2\,r^1)$.	3
4	Permanent hardness = H_p	Q^2, r^2	$H_p = 28\,(Q^2 - 2\,r^2)$.	4
5	Lime (CaO) to neutralise free CO_2 = C	C	$CaO = 1{\cdot}273\,C$.	5
6	Lime (CaO) to neutralize the half-bound CO_2	c	$CaO = 0{\cdot}637\,c$.	6
7	Lime (CaO) equivalent of the magnesia	M	$CaO = 1{\cdot}4\,M$.	7
8	Lime (CaO) to reduce H_t	G, $\frac{1}{2}\,c, m$	$CaO = 1{\cdot}273\,(C + \frac{c}{2}) + 1{\cdot}4\,m$.	8
9	" " " H_t	A, a, m	$CaO = 28\,(A - a) + 1{\cdot}4\,m$.	9
0	Caustic soda (Na_2O) to replace CaO in treatment	CaO	$Na_2O = 1{\cdot}107\,CaO$.	10
1	Soda ash (Na_2CO_3) to precipitate magnesia (must be used with lime as in P. 7).	M	$Na_2CO_3 = 2\,65\,M$.	11
2	Soda ash, to reduce the permanent hardness	H_p	$Na_2CO_3 = 1{\cdot}893\,H_p$.	12
3	Baryta (BaO) to precipitate sulphuric acid	SO_3	$BaO = 1{\cdot}912\,SO_3$.	13
4	Carbon dioxide in monocarbonates	v	$CO_2 = 22\,v$.	14
5	" " bicarbonates	w	$CO_2 = 44\,w$.	15
6	Total combined CO_2	v, w	$CO_2 = 22\,(v + 2\,w)$.	16
7	True temporary hardness	H, H_p	$H_t = H - H_p$.	17
8	Sodium carbonate (Na_2CO_3) naturally present	H, H_t	$Na_2CO_3 = \frac{53}{28}\,(A - H_t)$.	18
9	Lime present, per million	k	$CaO = 11{\cdot}2\,k$.	19

The following formulas give the number of parts per million for the reagents named. They may be interpreted as pounds per 1000 galls. by moving the decimal point two places to the left.

a = "causticity" (*i.e.*, alkalinity to phenolphthalein) as CaO.

A = "alkalinity" (*i.e.*, alkalinity to methyl orange) as CaO.

$(A - a)$ = bi-carbonates, in terms of CaO. (In normal waters $a = 0 \therefore (A - a) = A$.)

H = total hardness in terms of CaO.

H_p = permanent, in terms of CaO.

$(H - H_p) = H_t$ = temporary, in terms of CaO.

C = free carbonic acid, in terms of CO_2.

c = combined carbonic acid, in terms of CO_2.

$\frac{1}{2}c$ = fully-bound = half-bound, in terms of CO_2.

v = c.c. N/10 acid used in titrating 100 c.c. to phenolphth.

w = c.c. N/10 acid used in titrating 100 c.c. to methyl orange, after making neutral to phenolphth.

M = total magnesia, in terms of MgO.

m = magnesia of temporary hardness.

$(M - m)$ = magnesia of permanent hardness. (Where H_p is large, $m = 0 \therefore (M - m) = M$.)

Q^1 = c.c. "Soda Reagent" used with 100 c.c. sample in determination of H (see p. 21).

Q^2 = c.c. "Soda Reagent" used with 100 c.c. sample in determination H for H_p (see p. 21).

r^1 and r^2 = c.c. N/10 acid used in titrating back 100 c.c. from a total volume of 200 c.c (see p. 21).

K = c.c. N/10 permanganate in CaO estimation (as on p. 22).

Nottingham Section.

Meeting held at Nottingham, on Wednesday, February 24th, 1904.

MR. J. T. WOOD IN THE CHAIR.

THE SOLUBILITY OF ATMOSPHERIC OXYGEN IN SEA-WATER AND IN WATER OF DIFFERENT DEGREES OF SALINITY.

BY FRANK CLOWES, D.Sc., AND J. W. H. BIGGS.

Introductory.—It is usual to measure the injurious effect produced by sewage and by other deoxidising refuse liquids upon the water of rivers, of estuaries and of the sea, by ascertaining the extent to which the dissolved atmospheric oxygen of the water has become reduced in amount by the action of these foreign liquids. The reduction in the amount of dissolved oxygen is not only a measure of the proportion of reducing matters present in the water, but also a measure of the extent to which the pollution is dangerous in restricting or preventing the respiration of fish.

The amounts of dissolved oxygen found in polluted water are usually calculated as percentages of the maximum possible under the conditions of the determination.

The determinations, the results of which are recorded in this paper, were made with the view of establishing standard percentages of aeration for estuary waters of varying salinity. The standard for sea-water is well known to be about 20 per cent. lower than that for distilled water under similar conditions; but it does not appear that determinations have been made for water intermediate in salinity between sea-water and fresh water.

Method of Determination.—The method selected for determining the aeration of the water was that of Winkler ("Die Bestimmung des im Wasser gelösten Sauerstoffes"; Ber. der deutschen Chem. Gesellsch., 1888, p. 2851). This method is more easily carried out than those of Bunsen and of Schutzenberger, and is free from the inaccuracies of the original method of Mohr.

In collecting the sample of water, care must be taken to avoid agitating it and exposing it for any length of time to the air. It is transferred with similar precautions by siphoning to a stoppered bottle of known capacity which can contain about 300—400 c.c. About 1 c.c. of strong manganous chloride solution (containing about 40 grs. $MnCl_2.4H_2O$ per 100 c.c.) is added, followed by 2 c.c. of a solution containing 33 per cent. of alkaline hydroxide and 10 per cent. of potassium iodide. The bottle, which must be full of liquid, is now closed with the stopper without including any air-bubble, and the liquids are mixed by several times inverting the bottle. The manganous hydroxide precipitate which forms will be more or less discoloured by higher hydroxide according to the proportion of oxygen which was dissolved in the water sample. Since the oxidation of the manganous hydroxide is not immediate, and the action of light influences the result, the bottle is put by in the dark for about 15 minutes; its contents are then acidified with from 2 to 3 c.c. of strong, pure hydrochloric or sulphuric acid. The acid causes the precipitate to disappear, and leaves the liquid coloured with dissolved iodine. The iodine is titrated with standard thiosulphate, of which the oxygen value should be known so as to give the amount of oxygen directly. It is usual, however, when possible, to determine the amount of thiosulphate required in the above process by the same volume of the fully aerated unpolluted water of similar character or of distilled water, and then to calculate the percentage of the possible amount of oxygen present in the polluted water directly from the amounts of thiosulphate which equal volumes of the two samples require.

It is noteworthy that the manganous chloride used in the process must be free from iron. All reagents must also be free from nitrite, and accordingly the alkaline solution when mixed with starch solution and potassium iodide must not yield an immediate blue colour when it is acidified with the strong acid. Probably potassium hydroxide is more frequently free from nitrite than sodium hydroxide.

Amounts of Atmospheric Oxygen dissolved by mixtures of distilled with Sea-water, stated as approximate percentages of the amount dissolved by distilled Water under similar conditions.

Description of Water, with Percentage of Sea-water present.	December 22-23, 1903. Temp. 16° C.		January 1-2, 1904. Temp. 13°·8 C.		January 6-7, 1904. Temp. 14°·8 C.	
	Percentage of dissolved Oxygen.	Chlorine as Chloride per 100,000.	Percentage of dissolved Oxygen.	Chlorine as Chloride per 100,000.	Percentage of dissolved Oxygen.	Chlorine as Chloride per 100,000.
stilled water	100·0	0	100·0	0	100·0	0
„ „ with about 10 per cent	96·4	205	..	..	..	..
„ „ „ 20 „	94·0	395	93·4	402	95·9	394
„ „ „ 30 „	92·5	590	..	..	..	..
„ „ „ 40 „	90·3	780	91·3	781	91·2	772
„ „ „ 50 „	87·0	982	..	..	..	..
„ „ „ 60 „	83·6	1,163	86·8	1,169	88·1	1,169
„ „ „ 70 „	82·4	1,365	..	..	..	..
„ „ „ 80 „	80·7	1,555	83·7	1,560	84·7	1,555
„ „ „ 90 „	79·0	1,735	..	..	..	..
Sea-water	78·7	1,950	81·1	1,950	82·2	1,950

Results obtained with waters of different salinity, distilled water being the standard.—The early experiments showed that the following procedure was the most simple for avoiding errors from differences of temperature, from super-saturation with oxygen and from suspended air bubbles. Both samples were allowed to attain the temperature of the laboratory, and were then saturated with atmospheric oxygen by frequent agitation with fresh portions of air; they were then allowed to stand overnight at the laboratory temperature in a cool incubator, to cause the suspended air bubbles to separate completely; this interval was especially necessary in the case of sea-water, which froths when it is shaken. Three determinations were made of each water sample, and they showed fair agreement. Thus in a particular case the three separate estimations in the same sample of sea-water gave the following percentages of the oxygen dissolved by distilled water under the same conditions, 83·3, 82·9, 82·9.

The amount of oxygen dissolved in sea-water shows a gradual increase for some time when the same sample is repeatedly shaken with air at intervals of some days. The natural inference is that the sea-water contains either oxidisable matter or organisms which remove oxygen, and that its maximum power of solution is therefore only attained when these deoxidising agencies are removed. The results tabulated indicate the extent to which this deoxidation occurs, since by further prolonging the period no higher aeration was attained. The same sea-water was used throughout these experiments, and a fresh portion was diluted for each test.

It will be seen that the approximate percentage of sea-water in the mixture of distilled water with sea-water is stated in the first column, and that the amount of chlorine as chloride was also determined in each mixture.

These results show that the solubility of atmospheric oxygen diminishes regularly with the proportion of sea-water present.

An experiment was made by dissolving sufficient sodium chloride in distilled water to give chlorine approximately equivalent to that present in sea-water, and the amount of atmospheric oxygen dissolved both by the original distilled water and by the salt solution under similar conditions was then determined. The salt solution with a chlorine content of 1,930 per 100,000 dissolved 82·9 per cent. of the amount of oxygen dissolved by the distilled water; the corresponding percentage for sea-water containing 1,950 parts of chlorine was 82·2. From this result it would appear that the sodium chloride in the sea-water is he constituent which determines its power of dissolving tmospheric oxygen.

Discussion.

Mr. F. R. O'**Shaughnessy** said he took it that the modified results were not the outcome of chemical action bsolutely but were chiefly owing to a physical one. At Birmingham the greatest variation was found in the amount f dissolved oxygen in effluents and river water. He hought that the case of sea-water was an extreme one, nd that the results obtained from effluents of the river as odified by the amount of saline matter present must be a egligible quantity.

Dr. **Caven** said it was interesting to note that the presnce of inorganic salts reduced the solubility of oxygen. t was the inorganic matter rather than any possible organic atter, which prevented the full complement of oxygen eing present.

Mr. **Ward** said that the amount of carbon dioxide ssolved in water was very considerably affected by the esence of salts. Was the salt used in the distilled water a salt or common salt?

Dr. **Clowes** said that the aeration experiments were rried out on the lower reaches of the Thames, and were tended into the North Sea. He was surprised to find at when they entered the estuary the water samples never owed 100 per cent. aeration as compared with distilled ter. He was quite certain that this water had not been oxidised by any sewage pollution. In the open sea nilar results were obtained. In working with salt water it was found impossible to get 100 per cent. aeration when distilled water was the standard. In working with common river water, however, unless it was largely salted by the sea, they were able to get 100 per cent. aeration. As regards the nature of the reducing matter present in sea water he had evaporated some years ago samples of sea water and made an organic combustion of the residue in order to determine the amount of carbon and nitrogen which it contained, and he was surprised at the high results obtained. The carbon and nitrogen might have been derived from either living or dead organic matter, possibly it was the de-aerating matter.

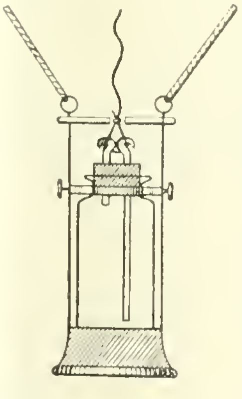
It was a well-known fact that the solution of alkali chloride in water increased its power of dissolving carbon dioxide; this might be attributed to chemical change; but it was not so easy to put down chemical change as the cause of decreased solubility of oxygen in water when sodium chloride was in solution.

NUMBER OF BACTERIA IN THE WATER OF THE NORTH SEA, AND THE EFFECT OF SEA AND RIVER WATER AND OF BIOLOGICAL TREATMENT ON THE NUMBER OF BACTERIA PRESENT IN SEWAGE.

BY FRANK CLOWES, D.Sc.

Opportunity has been recently afforded me to determine the total number of bacteria in the water of the North Sea, of the Thames estuary, and of the lower reaches of the Thames. The samples were collected from the deck of the steamship "Burus," Captain Vivlash, one of the large sludge-steamers of the London County Council. The steamer was itself converted into a bacteriological laboratory, the saloon being utilised for putting down cultivations, and roomy quarters being equipped with the necessary incubators. By this arrangement the samples could be put down for cultivation immediately after collection, and no question could arise regarding increase in the number of organisms between the time of the collection of the sample and its treatment in the laboratory.

Samples of water were collected from the surface, from the bottom, and in some places from the intermediate depths. In many places samples of the sea-bottom itself were also secured.



The surface samples were taken by dipping in a clean metal pail.

The samples from the bottom were obtained by sinking a heavily weighted glass bottle, which was closed by a rubber stopper carrying two glass tubes; one tube terminated immediately beneath the stopper and served for egress of the air displaced by the entrance of the water through the other tube which extended nearly to the bottom of the bottle. Both glass tubes terminated above the stopper in recurved capillaries, which were sealed at their ends; a loop of strong twine was slipped over these hooked capilliaries. The twine was held by the hand with plenty of slack, while the bottle was being lowered from the ships rail by two oblique lateral cords. By this arrangement the bottle was readily lowered in a vertical position to the sea bottom, and a jerk of the twine then served to break off the closed capillaries, and allowed the bottle to become filled in about three minutes with bottom-water.

The samples from intermediate depths were collected by lowering over the side of one of the ship's boats a known length of stout canvassed rubber tube weighted at the end and pumping up the water into a clean metal pail. These methods of collection were devised by Mr. J. W. H. Biggs.

For the purpose of collecting samples of the sea-bottom itself a strong canvas bag attached round its mouth to a heavy iron ring was suspended by a chain and lowered to the bottom. By steaming ahead, a sample of the sea-bottom was picked up in the bag, and this was raised by the steamer's steam-winch. This arrangement was devised by the captain. A washing, obtained from this bottom material by means of sterilised water, was also subjected to cultivation, and the total number of bacterial "colonies," as well as the colonies of *B. coli communis* and of *B. enteriditis sporogenes*, were counted as in the direct cultivations of the water samples.

The sample which was actually subjected to cultivation was usually an average sample; it was obtained either by mixing equal volumes of the water samples collected at one particular spot, or in the case of a dredged sample of the sea-bottom by mixing the matter brought up.

Effect of Sea Water on Bacterial Life.—It appeared desirable to ascertain by preliminary experiments whether bacterial life was prejudicially affected by sea water as compared with fresh water. This was determined in the following way.

Two series of parallel experiments were started by mixing one cubic centimetre of clarified sewage with a litre of sterilised distilled water, and another c.c. of the clarified sewage with a litre of sterilised sea water. One cubic centimetre of each of these liquids was at once mixed separately with 10 c.c. of gelatine medium, poured into Petri-dishes, and then incubated at 65° F.: this process was repeated with the inoculated waters at the intervals stated below, and the total number of "colonies" which developed in each culture were counted. The following results were obtained :—

Date. 1903.	Interval since Inoculation.	Period of Cultivation in Gelatine.	Number of Colonies per c.c.	
			In the Inoculated Sea Water.	In the Inoculated Distilled Water.
March 13	None	72 hours	8,748	7,100
„ 16	3 days	43 „	281,000	288,360
„ 18	5 „	45 „	531,000	421,200
„ 19	6 „	48 „	348,000	113,000

It is evident that the organisms were rapidly decreasing in number after the fifth day, probably on account of deficient nutrition.

A further similar series of experiments was made by incubating cultivations, put down at stated intervals, of ordinary sea water, and of the same sea water inoculated with clarified sewage in the proportion of 750 to 1. The following results were obtained :—

Date. 1903.	Interval of Standing.	Period of Cultivation.	Number of Colonies per c.c.	
			In Natural Sea Water.	In Inoculated Sea Water.
March 27	None	96 hours	1,115	11,000
„ 28	1 day	96 „	94,250	238,000
„ 30	3 days	96 „	230	1,976,000
April 1	5 „	48 „	109	2,373,000

A consideration of the results of these experiments leads to the conclusion that sea water exerts no inhibitory effect upon the life and multiplication of bacteria, and that the organisms thrive in sea water in much the same way as in water free from dissolved saline matter. It will be noted that inoculation of the sea water with sewage enabled the organisms to increase for a longer period, probably owing to the introduction of their nutriment in the sewage.

Number of Bacteria in the Water of the North Sea.—A bacterial examination was made of the water of the North Sea by collecting samples of the surface water in the neighbourhood of the Galloper light-ship, which is stationed about 25 miles seaward of the sea end of the Barrow deep, and is therefore in the open sea.

Samples of water were collected every five minutes for two hours, and equal volumes of the samples taken during each half hour were mixed together to constitute one average sample. In this way four average or compound samples were produced and were subjected to cultivation in the manner already described. The following results were obtained :—

	Number of Colonies per c.c.
High water, 11th April, 1903, 11.40 p.m. ……	373
5.5 a.m. to 5.35 a.m. ……	215
5.35 a.m. to 6.5 a.m. ……	191
6.5 a.m. to 6.35 a.m. ……	357
6.35 a.m. to 7.5 a.m. ……	298

Tests were made for *bacillus coli* and for *bacillus enteriditis sporogenes*; neither organism was detected in 1 c.c. of the water.

The results indicate that the open sea water contained a small number only of bacteria, an average of 287 per c.c.: and that what are ordinarily considered organisms of intestinal origin were absent.

Bacteria in Sewage "Effluent" and in Sewage "Sludge."—Before giving the results of the bacterial examination of the river water below the points at which the effluent from the settled sewage from London is discharged into the Thames, the results of the bacterial examination of the sewage effluent itself may be stated. And similarly the bacterial condition of the "sludge," or matter separated from the sewage by sedimentation, may be stated before the bacterial examination of the estuary water into which the sludge is discharged is referred to.

A comparison of the bacterial condition of the sewage effluent and sludge with that of the water of the lower river and of the estuary will then indicate the reduction in the number of bacteria effected by dilution and by other means after the discharge of these organisms has taken place.

Number of Bacteria in 1 c.c. of "Sludge" at both Outfalls.

Barking. 1903.	Bacteria which grow at 20° C.	Bacteria which grow at 37° C. (Blood-heat).	Spores.
April 29…	121,000,000	60,000,000	6,250
May 2…	126,000,000	74,200,000	8,100
„ 4…	119,500,000	45,000,000	10,550
„ 5…	131,000,000	64,000,000	11,800
„ 6…	135,000,000	70,000,000	11,400
Average…	126,500 000	62,640,000	9,620

Crossness, 1903.	Total Number of Bacteria.	Number of *Bacillus Coli Communis.*	Number of *B. Enteriditis Sporogenes.*
June 8…	118,000 000	At least 1,000,000	At least 10,000, but not 1,000,000
„ 9…	57,000,000	At least 10,000, but not 1,000,000	„ „
„ 10…	149,000,000	At least 1,000,000	„ „
„ 11…	163,000,000	„ „	„ „
„ 12…	132,000,000	„ „	„ „
„ 13…	177,000,000	„ „	„ „
Average…	132,666,666	..	..

The average number of bacteria in the sludge is therefore 129,583,333 per c.c.

The total number of bacteria in the sewage effluent ischarged at both outfalls is as follows :—

Date and Outfall.	Bacteria which grow at 20° C.	Bacteria which grow at 37° C. (Blood-heat).	Aerobic Spores.	Number of Estimations.
Barking, March, 1903	8,585,714	5,100,000	234	Average of 7 samples.
Crossness, June, 1903	6,300,000	..	..	Average of 6 samples.
Average	7,442,857	..	..	..

The average for both outfalls is therefore 7,442,857.

Reduction in Number of Bacteria by passage down River.—The samples were taken from the surface water y dipping, and were collected at low water in mid-stream nd near either shore. The average of the results obtained rom six series of samples collected on the 3rd, 4th, 5th, nd 6th of March, 1903, are stated below :—

Locality.	Approximate Distance in Miles from Crossness.	Average Number of Bacteria per c.c.
Mucking light	21·3	4,837
Hole haven	24·3	3,431
Chapman light	27·0	1,662
Tantlet creek	29·5	711
Southend pier	31·5	379
Garrison point	33·5	381
Nore light	35·8	186
Below the Nore	39·3	145

It will be seen that the average number of 7,442,857 bacteria per c.c., which were present in the sewage effluents discharged from the Barking and Crossness outfalls, have become reduced by the action of the river water to 4,837, at a distance down-stream 21 miles from Crossness, and hat off Southend, 31 miles from Crossness, a further eduction to 379 has taken place. When the Nore lighthip is reached, the bacteria number only 186 per c.c.

Each water sample was further examined for gasorming bacteria, which are generally considered to be hose of intestinal origin. Out of 45 samples examined, nly seven contained such bacteria, and these seven amples were all of them collected between the Mucking nd the Chapman lights. No gas-forming bacteria were ound in the water below the Chapman light. Hence it ppears that the intestinal bacteria in the sewage effluent ad disappeared from the river 27 miles below the point t which they had been introduced into the stream.

Reduction in Number of Bacteria per c.c. introduced to the Estuary Water by Sewage Sludge.—Several series examinations have been undertaken at different times ith the view of ascertaining the bacterial content of tuary water into which sewage sludge is constantly being troduced, and very many samples have been subjected examination. The following statement briefly summarises e results obtained :—

On April 2nd and 3rd, 1903, surface samples were llected throughout the length of the Barrow deep in the tuary immediately after the fleet of sludge steamers had posited their sewage sludge. The average number of cteria found in the water was 1,940 per c.c., as compared th 129,583,333 contained in the discharged sludge.

On the 9th and 10th April 1903 the surface water wing from the Barrow deep into the river during an coming tide was examined. This represented the estuary ter which had been mingled with sludge in the estuary. mples were taken every five minutes throughout the e of rising tide. The average number of bacteria per . found was only 458.

During September, 1903, further experiments were made h the view of ascertaining whether the diminution in number of bacteria was due to sedimentation or to eral diffusion by dilution. Immediately after the dark-coloured sludge had been discharged, a drifter, which was suspended from a float, and was cross-shaped and 8 sq. ft. in area, and which remained 10 ft. beneath the surface (the depth at which the sludge is discharged from the bottom of the steamers), was immersed in the discoloured water. This enabled a boat to be kept in the middle of the area of discharge for the purpose of taking samples at different depths. The examination of these samples furnished the following results. Samples were taken every five minutes, and those collected during each hour were mixed to produce an hourly average sample.

Date, 1903.	Interval after Discharge of Sludge, at which Sample was Collected.	Total Number of Bacteria per c.c. found at following Depths.		
		Surface.	10 Feet.	40 Feet, or Bottom.
Sept. 28th	None	940,000	13,000	140
	One hour	32,700	2,910	690
	Two hours	1,470	790	320
	Three „	340	140	130
	Four „	380	220	..
„ 29th	None	8,000	2,000	..
	One hour	21,400	580	..
	Two hours	6,200	700	..
	Three „	5,800	610	..
	Four „	5,300	610	..
	Five „	1,700	500	..

These results seem to indicate that the number of bacteria per c.c. is not reduced by the sinking of the organisms to lower levels in the water, but by a lateral diffusion or mingling.

The final series of samples, bacterially examined, consisted of water taken at different depths in the different channels of the estuary, of the bottom materials, and of the sands which were exposed at low water. In no case were bacteria found to be present in any considerable number.

Reduction in number of Sewage Bacteria occurring during the Biological Purification of Sewage.—Observations were made for some time with the object of ascertaining how the total number of bacteria present in the final effluent from the bacterial treatment of sewage compared with the number present in the corresponding sewage before it had undergone the treatment.

Two classes of sewage in different localities were placed under careful observation, the cultures for counting the colonies which developed being put down at the time and place of collection of each sample.

One sewage was of purely domestic origin, being that derived from the residents in Christ's Hospital, Horsham. The sewage flowed into a settling tank, its passage through which occupied about 24 hours. The effluent from the tank passed through coke-beds contained in shallow tanks which were alternately allowed to stand full of effluent and full of air. The bacterial action taking place in the settling tank disposed of all the settled suspended solid matters, and the subsequent bacterial action in the coke-beds removed all putrescible dissolved matters.

The other sewage which was placed under observation was the average sewage delivered to the Northern Sewage Outfall Works from the sewers of North London. This sewage had been roughly screened, then mixed with small proportions of chemicals in order to expedite the subsequent sedimentation during its slow passage through settling channels, and the effluent from these channels constituted the feed to an intermittently worked coke-bed which was similar to that at Horsham. The feed to this bed, and the effluent from it, were subjected to systematic bacterial examination.

It should be stated that the lower part of the coke-bed at the northern outfall consisted of somewhat fine and compacted material, which may to some extent have mechically reduced the number of bacteria. It should also be explained that while the screened London sewage contained only finely comminuted fæcal matter, because it had been subjected to the process of pumping and a flow of many miles, the Horsham sewage contained comparatively unbroken fæces, since it had flowed by gravitation only for a short distance. This would probably tend to diminish the number of bacteria found in the Horsham sewage, since the sample was collected by dipping the liquid from a collecting chamber outside the settling tank. Both sewages were, however, clarified by passage through a filter-paper before they were subjected to cultivation.

The results obtained are summarised in the following tables :—

Average Horsham Samples taken quarter-hourly during maximum flow of Sewage.

Date of Collection, 1903.	Total Number of Bacteria per c.c. (average of Cultivations).		
	Crude Sewage.	Effluent from Settling Tank.	Effluent from Coke-beds.
June 9th	7,390,000	13,650,000	8,750,000
„ 12th	9,800,000	10,850,000	9,500,000
„ 16th	9,000,000	5,750,000	6,650,000
„ 19th	8,750,000	9,800,000	8,050,000
„ 23rd	12,700,000	8,200,000	5,100,000
July 8th	16,150,000	3,650,000	3,000,000
„ 14th	23,450,000	21,700,000	18,200,000
Average numbers	12,492,857	10,514,285	8,464,285
Percentage decrease in numbers ...	..	15·8	32·2

It is necessary to calculate the decrease in bacteria from the average results, since the samples of effluent obtained on the same day cannot altogether correspond to that day's discharge of untreated sewage.

It may be noted that the results obtained from each of these samples when put down at once for cultivation were compared with the results obtained by putting down the same sample 21 hours after its collection. The average percentage increases in the number of bacteria counted, after keeping the samples 21 hours before cultivation, were 106 in the case of the sewage, 60 in the effluent from the tank, and 54 in the effluent from the coke-bed. As might have been anticipated, the highest rate of increase occurred in the more largely polluted liquid, and this indicates the necessity of not delaying cultivation of impure liquids which are under bacterial examination. It was found that a delay of 21 hours not unusually occurs between the collection of a sample and its arrival at and cultivation in the laboratory. This delay evidently leads to results which, in certain cases at least, do not correspond with those which would be yielded by the sample at the time of its collection, and in series of samples, such as those taken above, the delay very seriously affects the ratio between the numbers of bacteria found in the different series.

In the case of the London sewage, samples were taken every ten minutes during the filling and emptying of the coke-bed, and the samples of the sewage and of effluent for each date were mixed to form the average samples for examination for the day. The following results were obtained :—

Average Samples from the Barking Coke-bed.

Date, 1903.	Total Number of Bacteria per c.c.	
	Settled Sewage.	Coke-bed Effluent.
May 9th	8,000,000	70,000
„ 13th	11,500,000	814,000
„ 14th	5,300,000	829,000
„ 16th	10,000,000	1,180,000
„ 19th	10,800,000	Lost.
„ 20th	6,600,000	1,070,000
„ 27th	7,900,000	1,675,000
Average number	8,585,714	939,667
Percentage reduction in the number of bacteria		89

The average numbers at the foot of the table form a fairer means of judging the extent of reduction in the number of bacteria than the daily numbers do, since the effluent and feed of the bed on the same day are not precisely corresponding liquids.

It will be seen that in the case of both sewages a marked reduction in their bacterial content takes place. As far as the effluent from bacteria beds is concerned it is therefore not right to consider the bed as a means of increasing the number of bacteria; the bacteria rather appear to carry out their active functions in the bed, and to pass away in large numbers in the effluent in a lifeless condition.

The large amount of experimental work upon which the above results and conclusions are founded, involving the collection and examination of several thousand samples, has been carried out by Messrs. J. W. H. Biggs and E. B. Pike under my general direction.

Discussion.

The Chairman said he had always looked upon it that the salts in the sea water acted as nutriment for bacteria, and asked Dr. Clowes what media were used for cultivations.

Mr. S. R. Trotman said that, having frequently to make bacteriological examinations of water from a distance, he had found an ice-box to answer perfectly well for transportation of samples. Had Dr. Clowes any experience of this?

Mr. Golding, after referring to the preservation of milk by simply getting rid of the oxygen, asked how much salt was added to Dr. Clowes's medium in which the organisms germinated. He further asked if many fluorescent bacteria were found in the sea water.

Mr. O'Shaughnessy said Birmingham sewage was very deficient in organic life, which was something more than 400,000 organisms per c.c. The number of bacteria present in the land effluent was about the same. One must be struck by the fact that it was not the absolute number of bacteria present in the liquid which was alone the question of prime importance. One must consider the potentialities of the liquid itself. He maintained that the method of estimating the number of bacteria was distinctly an arbitrary method, but was agreed that the medium in which the organisms were determined ought to approximate in some way with the natural conditions.

Mr. Thorp asked if Dr. Clowes regarded the action of the coke bed as dependent upon some substance which possessed the physical action of absorption.

Dr. Clowes in reply drew attention to the results obtained by Dr. Dunbar, who had found that fragments of coke or other material were able, when in contact with sewage, to produce an oxidising effect; and he stated that this purifying action was exerted before any bacterial growth had formed on their surfaces. It seems, therefore, to be certain that these fragments retained on their surface absorbed oxygen which exerted an active oxidisation. Possibly the reason why putrefaction of meat took place with greater rapidity in fresh water than in salt water was in part due to the fact the fresh water contained less dissolved oxygen than sea water did. The action of putrefactive organisms was in abeyance as long as they were in the presence of oxygen or of dissolved oxygen in water. The bacteria which he had been dealing with were not putrifying bacteria; they were bacteria which were carrying on their changes without the production of any smelling gases. The medium used in cultivations was stated in the paper, and this had not been varied in the case of salt water.

In reply to Mr. Trotman, he recognised the difficulties of transport and remarked that he had repeatedly tried ice when conveying bacteria from long distances to the laboratory, but he had not made comparative experiments to ascertain whether any advantage resulted from using ice. He agreed with Professor Frankland that no results could pretend to be absolute if the cultivations were not put down on the spot. So far as fluorescent organisms were concerned they had not made any special observations with the view of detecting them. He was astonished to hear from Mr. O'Shaughnessy that Birmingham sewage contained only 400,000 organisms per cubic centimetre. This was possibly accounted for by the introduction of large quantities of acid chemicals into the sewage.

In the water of the upper part of the lower river, the amount of sodium chloride did not vary much. Pollution could be measured by de-aeration in the lower river, but no appreciable indication could be obtained out in the estuary.

There was no medium quite so efficient as coke for bacteria beds.

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I.—PLANT, APPARATUS AND MACHINERY.

English Patents.

Filters; Impts. in ——. W. B. Smith, Perth Amboy. Eng. Pat. 3938, Feb. 19, 1903.

An outer perforated tube is slipped over an inner perforated tube, closed at its upper end by a suitable cap, and fixed with its lower extremity in a socket. Round the outer tube is wrapped a filter-cloth, extending inside the outer tube, and enclosing the inner tube when slipped over it. The liquid to be filtered enters the inner tube from below, and percolates through two layers of filtering material before reaching the outside of the outer tube. This filtering may take place in the reverse direction. Any number of these tube filters may be arranged in a tank. —L. F. G.

Concentrating Liquids; Apparatus for ——. P. Kestner, Lille. Eng. Pat. 6372, March 19, 1903.

See Addition, of Nov. 15, 1902, to Fr. Pat. 315,973 of 1901; this J., 1903, 788.—T. F. B.

Evaporators for Distilling or Concentrating Liquids, or for Generating Steam or Gas; Impts. in ——. J. W. Gordon, London. From C. Licardie, Guatemala. Eng. Pat. 27,621, Dec. 16, 1903.

The liquid enters at the highest point of a continuous coil arranged in a furnace, whilst the residuum is discharged from the lowest point. At various points of the coil, side tubes are placed as outlets for the vapours, whilst baffles extend across the interior of the coil to retard the flow of the liquid. If the coil is to be used as a steam or gas generator, all these outlet pipes are connected together. If the apparatus is intended for use as a still, the pipes can be led separately to condensers, thus enabling products of different boiling points to be continuously collected. —W. H. C.

Centrifugal Separating Apparatus; Impts. in ——. E. Seger, Stockholm. Eng. Pat. 458, Jan. 7, 1904.

The separation of a mixture of solids and liquids, without the use of a gauze or other straining medium, is effected by means of bucket wheels, rotating in cases placed in an outer rotating cylinder. The bucket wheels rotate in consequence of the centrifugal force produced by the rotation of the outer casing acting on the mixture to be separated. Means are provided for drawing off the solid and liquid separately. The bucket wheels may be set vertically or horizontally in the outer casing.—W. H. C.

Rotary Furnaces; Impts. in ——. N. M. Hansen, Berlin. Eng. Pat. 11,119, May 15, 1903.

Between the outer metal casing of the furnace and the inner lining of firebricks or other refractory material there is placed a layer of asbestos or material which is not only refractory but also a bad conductor of heat, the object being to prevent loss of heat by radiation from the shell of the furnace.—W. H. C.

Furnaces; Impts. in ——. J. Ritz, Schw. Gumend. Eng. Pat. 27,613, Dec. 16, 1903.

The grate bars of the furnace are inclined, so that the fuel, which is fed in at the upper end, gradually slides down towards the clinker hole placed at the bottom. From underneath, a "poking appliance" is periodically set to work to remove the clinker as it is formed, and rake it into the clinker hole. To prevent the clinker from caking on to the masonry of the furnace, the grate bars are protected at the side by an iron ledge of suitable design.—L. F. G.

Briquette Machine. F. Meyer, Chicago. Eng. Pat. 2137, Jan. 28, 1904. Under Internat. Conv., Jan. 29, 1903.

This machine consists of a mould, or series of moulds, arranged in a frame, with a conveyor to supply the material to be compressed. There is a series of plungers, each acting in the same mould and compressing the material to successively varying degrees. Means are provided for bringing the mould or moulds successively opposite the various plungers and for expelling the briquette when formed. Claim is also made for a type of mould in which the compression is effected by two plungers, and for means of operating the plungers, &c.—W. H. C.

United States Patents.

Cooling Tower. C. F. Hettinger, Boston. U.S. Pat. 753,573, March 1, 1904.

An enclosed water-cooling tower is provided with air and water shafts, the latter being divided into several compartments by horizontal perforated partitions. Fans are provided at the bottom, and the air is driven horizontally across the falling spray of liquid towards the air-exhaust shaft. Means are provided for supplying the liquid to be cooled in the form of spray, for regulating the supply of air, and for collecting the cooled liquid in a tank at the base of the tower.—W. H. C.

Drying and Calcining Kiln. C. E. Pickett, Bayonne. U.S. Pat. 753,624, March 1, 1904.

The kiln consists of two concentric horizontal cylinders with external means for rotating. There is a hopper and worm-conveyor for feeding the material to be treated, and means are provided for heating the annular space between the cylinders and for drawing off the gases from the annular space and from the inner cylinder separately. The outlet end of the cylinder is closed by a movable end-piece with arrangements for oil-burners for heating, and for removing the dried or roasted material.—W. H. C.

Centrifugal [Separating] Machine. J. H. Ostrander, Ticonderoga. U.S. Pat. 754,796, March 15, 1904.

Through a vertical tank passes an upright shaft carrying a perforated bowl with a flanged upper edge extending over the top of the tank. Surrounding the upper parts of the bowl and tank is a casing, which is provided with a drain pipe and with an opening, through which a feed-pipe passes into the interior of the perforated bowl. Inside the perforated bowl is fixed a vertical worm conveyor, arranged to discharge material from the bowl into the casing.
—L. F. G.

French Patents.

Supersaturator for Solutions [Brine] which are to be Concentrated. J. L. Gauthier. Fr. Pat. 336,138, Oct. 20, 1903.

The apparatus is specially adapted for the concentration of common salt solutions. The evaporating pan is surrounded by an annular chamber containing the fresh salt solution, which is heated by the waste furnace gases from the fire, and by a pipe lying throughout the length of the chamber, through which pass the hot vapours escaping from the evaporating pan. The liquid in the annular chamber gets heated up to 85° or 90° C., and is then siphoned off into the evaporating pan, where it discharges on to the surface of the concentrated, and therefore specifically heavier, salt solution, and readily gives up its water. A drain-cock is provided for the condensed water in the pipe serving to heat up the annular chamber.—L. F. G.

Gummy Substances, Rapid Process for Drying ——. Maschinenfabrik St. Georgen b. St. Gallen Ludwig von Süsskind. Fr. Pat. 336,230, Oct. 23, 1903.

The substances, in the form of small pieces, are placed on a series of horizontal sieves, arranged in a chamber open at the top. Compressed air is blown in from below, the rate of escape of the air being regulated by means of dampers fixed to the cover of the chamber.—L. F. G.

Receptacles containing Highly Inflammable Liquids; Device for Preventing Explosions in ——. Fabr. Explosionssicherer Gefässe. Fr. Pat. 336,757, Nov. 17, 1903.

See Eng. Pat. 25,547 of 1903; this J., 1904, 110.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Water-Gas; Introduction of —— into the Carbonising Retorts. H. Croissant. J. Gasbeleucht., 1904, **47**, 219—222.

The passage of water-gas through the retorts during the carbonising period is a process which requires careful supervision, but is attended with advantages that outweigh the extra trouble involved. The water-gas inlet pipes are apt to become stopped, and require to be frequently cleaned, and the removal of graphite from the retorts demands the same attention as before. A manometer attached to the inlet tube affords a useful control of the pressure within the retorts. The quality of the gas produced is subject to serious fluctuations unless the introduction of the water-gas be limited to the first two hours or so after charging the retorts, otherwise the gas of low grade, which distils off during the later period of the carbonisation, becomes so highly diluted that the mixture in the gas-holder does not become homogeneous, and consequently the gas does not burn well. If considerable proportions of water-gas are to be mixed with the coal-gas (say 40—50 vols. of the former to 100 vols. of the latter, the mixture being carburetted with benzol so as to have a calorific value of 5100—5300 cal.), it is necessary to provide air-regulating collars to the incandescent burners fed with the gas, otherwise lighting back is apt to occur. One of the advantages of the process is the relatively large yield of gas from the coal used, the gain in heating value amounting generally to from 7 to 12 per cent. If the introduction of the water-gas be properly regulated, stoppages of the ascension pipes, otherwise so frequent, are almost entirely prevented, and the tar is appreciably more fluid. The carburetted mixed gas costs from 0·75 to 1 pfennig less per cubic metre than pure coal-gas. The result of carburetting the gas with benzol is to almost entirely prevent the deposition of naphthalene in the gas mains, so that a lower supply pressure suffices.—H. B.

Calcium Carbide; New Mode of Formation of ——. H. Moissan. XXIV., page 388.

English Patents.

Gas; Manufacture of ——. W. R. Jones, Beckton. Eng. Pat. 5781, March 12, 1903.

Illuminating gas is obtained by mixing crude coal-gas from the retorts with water-gas at a high temperature, and then superheating the mixture, whereby the hydrocarbons become fixed and incondensable.—H. B.

Gas Retort Mouth Pieces; Impt. in Inclined ——. G. B. A. Gibbons, Lower Gornal, and C. J. McEwen, Liverpool. Eng. Pat. 7251, March 28, 1903.

One or more holes are made in the lower part of the retort mouth-piece or its lid, each hole being provided with a valve or stopper. By this means the tar which accumulates at the lower end of the retort can be run off from time to time.—H. B.

Gas Retorts. W. Angus and C. McPherson, Birmingham. Eng. Pat. 8135, April 8, 1903.

The patent relates to methods of attaching to the door the coal stop employed in an inclined retort, so that the use of intermediate joints between the door and the stop can be dispensed with.—H. B.

Gas [from Wood]; Apparatus for the Generation of —— W. H. Brooks, Adelaide. Eng. Pat. 2481, Feb. 1, 1904

Gas obtained by the carbonisation of wood, &c., in a retort is passed through a series of horizontal pipes arranged i the furnace flue, and then successively through a condense a washer, a gas-holder, and scrubbers. By means of branc pipes the gas may be drawn directly from the scrubbers or may be passed through an enricher. All the pipes are straight, and all the unions are made rectangular, being provided with screw-plugs, to facilitate cleaning.—H. B.

Arc Light Electrodes. O. Vogel, Berlin. Eng. Pat. 11,442, May 19, 1903.

In arc-lamp electrodes, which may or may not contain light-emitting additions, there are provided one or more centrally-placed passages or tubes of pure carbon, into which are introduced substances (*e.g.*, peroxide of barium, chlorate of potash) capable of liberating free oxygen when exposed to the heat of the arc.—H. B.

United States Patents.

Coke Oven. H. Koppers, Essen-on-the-Ruhr. U.S. Pat. 753,146, Feb. 23, 1904.

The coke oven, besides the usual coking chambers and heating flues, has "nozzles at the bottom for the admission of a vertically ascending gas column," and "inclined channels connecting the air conduits with the base part of the heating flues, the inclination being out of line with the ascending gas-column in order to leave it undisturbed, and circulate around it." See also Eng. Pats. 18,159 and 23,278 of 1901; this J., 1902, 1127 and 762 respectively.—E. S.

Retort for making Gas and Coke. A. C. Kloman, Assignor to J. Scott, both of Pittsburg. U.S. Pat. 754,459, March 15, 1904.

A series of coke retorts are placed in battery, each retort having a bottom inclined in both directions from a middle ridge, and discharge openings, which can be closed by doors, at the ends of this bottom. The retorts have arched flues, which are connected at one end to a common combustion chamber placed transversely, and at the other end to a stack-flue, and are provided with gas eduction pipes leading to a gas-main, and can be suitably heated.—L. F. G.

Gas; Method of Producing ——. P. Naef, New York. U.S. Pat. 753,294, March 1, 1904.

See Eng. Pats. 20,658 and 20,659 of 1899; this J., 1900, 1094 and 1095.—T. F. B.

Gas; Method of Making ——. P. Naef, New York. U.S. Pat. 753,295, March 1, 1904.

ee Eng. Pat. 20,660 of 1899; this J., 1900, 1095.—T. F. B.

Gas Producer. J. M. Wight and H. Hyatt, Cleveland. U.S. Pat. 753,340, March 1, 1904.

hrough the centre of the top of the producer a water-ooled coal-supply tube extends down to the fire. The atter rests on a rotating conical grate, carried by a rotating nnular water-pan, and having a feed-screw at its apex xtending up into the tube. The blast-pipe opens under he grate, and over the latter are fixed water-cooled pokers. —H. B.

French Patents.

oal and Minerals; Process for Enriching ——. F. Blanc. Addition, dated Jan. 16, 1903, to Fr. Pat. 317,908, Jan. 18, 1902.

e Eng. Pat. 14,328 of 1902; this J., 1903, 287.—T. F. B.

riquettes; Process for Increasing the Calorific Power of ——. C. Melhardt. Fr. Pat. 336,235. Oct. 24, 1903.

he coal dust from which the briquettes are to be made is ated in a closed vessel with compressed air, containing y or fatty substances in a state of fine division. —L. F. G.

al [Small] and like Matters; Simultaneously Washing nd Sorting ——. Schüchtermann and Kremer. Fr. Pat. 36,241, Oct. 24, 1903.

e small coal is delivered on to a wire mesh stretched oss a trough, below the top, such mesh allowing passage fragments of less, say, than 10 mm. diameter. Such fine ff, passing the sieve, accumulates in the bottom of the trough, whence it may be subsequently discharged from a suitable outlet, and treated apart. The larger fragments, of, say, from 10 to 80 mm. diameter, above the screen, separate, during the washing, into a lower layer of the heavier shale, which is caught in a side channel having a bent-over top or cover, and is discharged thence by action of an endless screw, and an upper layer of coal fragments, which flow off from the top down an inclined sluice, and are washed in the usual way in a second trough.—E. S.

High Temperatures; Process and Apparatus for Production of —— *by Means of Combined Chemical and Electrical Energy.* R. Schnabel. Fr. Pat. 326,452, Nov. 5, 1903. XI. A., page 377.

Power-Gas; Process and Apparatus for Production of —— *by Continuous Combustion under High Pressure.* S. Wigelius and P. L. Laurell. Fr. Pat. 336,450, Nov. 5, 1903.

Air is pumped at high pressure into the annular space between two concentric cylindrical vessels, and enters the inner cylinder at the bottom, where it meets with a regulated supply of "petrol." Combustion takes place continuously and completely. The heat generated raises the air to a high temperature before it reaches the "petrol." The gas produced by the combustion, at very high pressure, is led from the inner cylinder to the motor, where it is utilised directly, in the same way as steam is used.—H. B.

Gas Producer. E. Hovine and H. Breuillé. Fr. Pat. 336,786, Nov. 19, 1903.

The producer consists of two compartments in open communication with each other; the one, forming the producer proper, being supplied with superheated steam and a hot-air blast, and having a bed of fuel of but little depth, which is always kept incandescent, and the other, acting merely as a regulator of the composition of the gas, being filled with fragments of coke or anthracite, through which the gas produced in the first chamber is drawn down by a fan. The steam and air supplies for the first chamber are led through heating boxes, arranged beneath the grate of the second chamber in the path of the gas produced. In certain cases, the second chamber may contain, instead of fuel, merely pieces of flint, or the like, when the carbonaceous deposit forming on the flint is sufficient to regulate the composition of the gas.—H. B.

Sulphur; Extracting —— *from Residues of Gas Purification, and from Poor Ores.* E. Vaton and A. Zuaznavar. Fr. Pat. 336,661, Nov. 14, 1903. VII., page 371.

Carbons for Arc Lamps; Manufacture of Cored ——. F. von Hardtmuth. Fr. Pat. 336,748, Nov. 17, 1903.

The carbon paste is extruded through a draw plate, in the centre of which is a helicoidal steel core, mounted so as to rotate on a support. The rifled carbon tube thus obtained is then filled with a paste to form the core.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

English Patent.

Hydrocarbons; Process for the Production of Highly Sulphuretted ——. J. E. W. Bengough. Eng. Pat. 8596, April 15, 1903. XX., page 383.

United States Patents.

Wood; Apparatus for Distilling ——. W. C. Douglas, Raleigh. U.S. Pat. 753,376, March 1, 1904.

The retorts are arranged in two rows, a short distance apart, and the furnace is situated centrally for the retorts. Each pair of retorts is connected by three or more pipes, and all these cross pipes are connected by pipes running the length of the apparatus. These longitudinal pipes are connected by a single vertical pipe, from which discharge pipes lead the vapours away. All the pipes are heated and protected from draughts, so as to keep the temperature above the condensing point of the lighter vapours. A stack leading from the furnace is situated at one end of the still, between the two rows of retorts, "closing the space between the retorts and preventing atmospheric draught therebetween."—T. F. B.

Wood Distillation Apparatus. C. M. Palmer, New London. U.S. Pat. 754,232, March 8, 1904.

A vertical retort or still is provided with a horizontal grate or perforated partition on which the wood rests; the vapours are conveyed from the top of the retort by means of a pipe, which is provided with a tar trap and a creosote trap between the retort and the condenser; the tar trap is connected with a pipe, which conveys the tar and heavy distillates back to the retort, which it enters below the grating. On leaving the condenser, the distillates are passed through filters into receiving tanks. Provision is made whereby the warm water from the condenser is introduced into the discharge-pipes of the condenser, mixing with the distillates and passing through the filters with them.—T. F. B.

Petroleum; Apparatus for Refining Crude ——. J. M. O'Neall, Dallas, Assignor to British American Power Co. U.S. Pat. 754,687, March 15, 1904.

The oil is passed through a narrow pipe which is coiled around a pipe of larger diameter, through which hot furnace gases pass; the whole is surrounded by a pipe or vessel, through which steam is blown. The portions of the oil pipe outside the steam pipe are insulated by suitable means. Means are provided "for forcing the vapour into a liquid and a condenser consisting of a series of pipes of different diameters and connected at different angles."—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

2.6-Dibromo-p-phenylenediamine; Action of Bromine on ——. C. L. Jackson and D. F. Calhane. Amer. Chem. J., 1904, **31**, 209—220.

By the action of an ethereal solution of bromine on an ethereal solution of 2·6-dibromo-*p*-phenylenediamine, a green precipitate was obtained, which showed all the properties of the hydrobromide of a base, which was most probably 2.6-dibromo-*p*-phenylenedi-imine. 1 mol. of bromine was found to react with two mols. of dibromo-*p*-phenylenediamine. The base could not be isolated owing to its instability, but its hydrobromide was converted into dibromoquinone on treatment with bromine and water. On treating *p*-phenylenediamine in ethereal solution with bromine, a blue substance was obtained, similar in properties to that from the dibromo compound, and reacting like the hydrobromide of *p*-phenylenedi-imine.—T. F. B.

Amino- and Aminohydroxydiphenylamines [for Blue Sulphide Dyestuffs]. R. Gnehm and H. Bots. J. prakt. Chem., 1904, **69**, 161—175.

Dimethyl-*p*-amino-*p*-hydroxydiphenylamine was prepared both by the action of dimethyl-*p*-phenylenediamine on quinol and by reduction of the corresponding indophenol by means of zinc dust and dilute acetic acid. The latter method yields the best results. The product yields diacetyl and dibenzoyl derivatives, and combines with 1 mol. of alkyl iodide. On nitrating the diacetyl compound a tetranitro derivative of the mother substance is obtained. On melting dimethyl-*p*-amino-*p*-hydroxydiphenylamine with sodium polysulphide at 110° C. for 24 hours, a leuco compound of a blue sulphide dyestuff is obtained. The dyestuff is isolated by dissolving in dilute acetic acid, filtering, making alkaline with caustic soda, oxidising by means of a current of air, and precipitating with hydrochloric acid. The composition of the dyestuff is represented by the formula $C_{14}H_{12}N_2S_3O_2$. It forms salts of silver and zinc soluble with difficulty in water, and with sodium bisulphite yields an addition product, $C_{14}H_{12}N_2S_3O_2 + NaHSO_3 + 2H_2O$, which forms orange-yellow needles. By the action of stannous chloride and acetic anhydride the sulphide dyestuff is converted into the diacetyl derivative of its leuco compound, from which the original dyestuff is regenerated on boiling with solution of a caustic alkali. *p*-Aminotolyl-*p*-hydroxydiphenylamine was prepared by reduction of the corresponding phenol (from *o*-toluidine and *p*-aminophenol) with sodium sulphide. It can be acetylated. The thiosulphonic acid of dimethyl-*p*-amino-*p*-hydroxydiphenylamine was obtained by oxidation of equimolecular proportions of dimethyl-*p*-phenylenediamine-thiosulphonic acid and *p*-aminophenol, and reduction of the dyestuff so obtained by means of sulphuretted hydrogen.—E. F.

Benzidine Transformation. A. F. Holleman and J. Potter Van Loon. Konink. Akad. Wetenschappen, Amsterdam, 1902, 377—378; 1903, 262—267. Chem. Centr., 1904, **1**, 792—793.

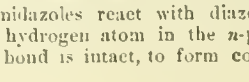
The authors have examined quantitatively the transformation of hydrazobenzene into benzidine and diphenyline (*p*-*p*- and *o*-*p*-diaminodiphenyl). At the ordinary temperature, 84 per cent. of the hydrazobenzene is converted into benzidine by means of N/10 hydrochloric acid, and 90 per cent. by means of N/1 hydrochloric or hydrobromic acid. At 100° C., N/10 hydrochloric, nitric, sulphuric, and hydrobromic acids effect the transformation of 66·4, 67·3, 63·1, and 65·8 per cent. respectively of the hydrazobenzene into benzidine. At 25° C. the velocity of the reaction increases with, but more rapidly than the concentration of the acid. The course of the reaction is altered by the use of a solvent. For example, if the hydrazobenzene be employed in ethyl or methyl alcoholic solution, the proportion of benzidine produced is less, and that of diphenyline is greater.—A. S.

Gallorubin. W. Feuerstein and K. Brass. Ber., 1904, **37**, 827—831.

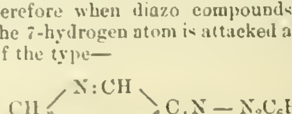
For the preparation of Gallorubin 14·7 grms. of isatin and 16·6 grms. of dihydroxycumarone are dissolved in 150 c.c. of water and heated for one hour at 100° C. with 450 grms. of hydrochloric acid. From the resulting hydrochloride the dyestuff is separated by treatment with hot water. It crystallises from alcohol in reddish-brown needles, melting at 300° C., and dyes brownish-violet shades on mordanted cloth. When Gallorubin (2 grms.) is boiled with aniline (15 grms.) for a short time, the red solution assumes a greenish-yellow colour with formation of anilinodihydroxygallorubin according to the equation: $C_{16}H_9NO_5 + C_6H_5.NH_2 = C_{22}H_{16}N_2O_5$. It crystallises in greenish-yellow laminæ, melting at 257° C., and yields brownish to greenish-yellow shades according to the mordant used.—D. B.

Diazoamino Compounds of Imidazoles and Purine Substances. R. Burian. Ber., 1904, **37**, 696—707.

Substituted imidazoles react with diazo compounds if there is a free hydrogen atom in the *n*-position, and the amidine double bond is intact, to form compounds of the type—



The relations in the purine group are quite analogous. In a similar manner purine compounds react with diazo-bodies unless the imino hydrogen atom (7) of the imidazole nucleus is substituted or the amidine double bond broken down. Thus theophylline, which is 1.3-dimethylxanthine reacts with diazo compounds, whereas theobromine (3.7-dimethylxanthine) and caffeine (1.3.7-trimethylxanthine) do not. Therefore when diazo compounds act on purin derivatives, the 7-hydrogen atom is attacked and diazo-amin compounds of the type—



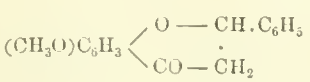
are formed. They are obtained by adding a diazo solutio to an alkaline solution of a purine compound and hav marked tinctorial properties. Those obtained from tetrazo-compounds dye vegetable fibres directly from an alkaline bath.—E. F.

2-Hydroxyflavonol ; Synthesis of ——. S. v. Kostanecki and V. Lampe. Ber., 1904, **37**, 773—778.

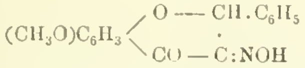
Quinacetophenone-monomethylether—

$$C_6H_3(OH)(COCH_3)(OCH_3)[1:2:4]$$

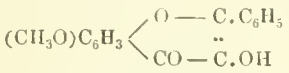
and benzaldehyde are condensed to 2-methoxyflavonone—



This is converted by nitrous acid into its iso-nitroso derivative—



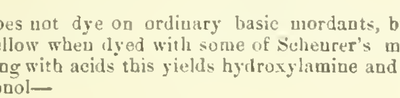
which does not dye on ordinary basic mordants, but gives a fine yellow when dyed with some of Scheurer's mordants. On boiling with acids this yields hydroxylamine and 2-methoxyflavonol—



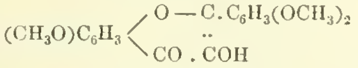
This substance gives rather weak yellow dyeings on alumina-mordanted cotton. The dyeings on iron mordant are very weak. On boiling with strong hydriodic acid it yields 2-hydroxyflavonol, which shows similar dyeing properties to its ether.—E. F.

Fisetin ; Synthesis of an Isomer of ——. S. v. Kostanecki and S. Kugler. Ber., 1904, **37**, 779—781.

3.4 - Dimethoxybenzaldehyde (veratric aldehyde) is condensed with quinacetophenonemonomethyl ether (see previous abstract) to form 2.3′.4′-trimethoxyflavanone—



With nitrous acid this yields an isonitroso compound, which, on boiling with acids, yields 2.3′.4′-trimethoxyflavonol—



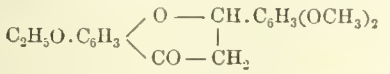
On de-methylation with hydriodic acid this yields 2.3′.4′-trihydroxyflavonol, which is an isomer of fisetin. It dyes strongly on basic mordants, orange-yellow on alumina and olive-brown on iron mordant.—E. F.

Fisetin ; Synthesis of ——. S. v. Kostanecki, V. Lampe, and J. Tambor. Ber., 1904, **37**, 784—791.

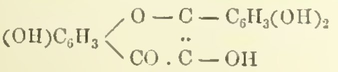
2′-Hydroxy-4′-ethoxy-3.4-dimethoxychalkone—

$$C_2H_5O.C_6H_3(OH).CO.CH:CH.C_6H_3(OCH_3)_2,$$

prepared by condensing resacetophenonemonoethyl ether with methylvanillin (Ber., 1899, **32**, 2257), is boiled with dilute mineral acid, and the product so obtained is converted by boiling with absolute alcohol into 3-ethoxy-3′.4′-dimethoxyflavanone—



With nitrous acid this yields an isonitroso compound, which is converted by boiling with acid into 3-ethoxy-3′.4′-dimethoxyflavonol. This can be de-methylated with hydriodic acid, yielding fisetin, which is 3.3′.4′-trihydroxyflavonol—



—E. F.

2.4′-Dihydroxyflavonol ; Synthesis of ——. S. v. Kostanecki and M. L. Stoppani. Ber., 1904, **37**, 781—784.

The substance is prepared in a manner analogous to that by which 2.3′.4′-trimethoxyflavonol is obtained (see previous abstracts), the veratric aldehyde being replaced by anisaldehyde. It dyes bright yellow on alumina, weak brown on iron-mordant.—E. F.

2.3′-Dihydroxyflavonol ; Synthesis of ——. S. v. Kostanecki and A. Ottmann. Ber., 1904, **37**, 957—960.

2.3′-Dimethoxyflavanone is obtained by condensing quinacetophenonemonomethylether with *m*-methoxybenzaldehyde. It is converted into 2.3′-dihydroxyflavonol by methods described in the preceding abstracts for the preparation of 2.3′.4′-trihydroxy- and 2.4′-dihydroxyflavonol. The dyeing properties of this substance are similar to those of 2.4′-dihydroxyflavonol.—E. F

Nile Blue Base ; Some Properties of ——. L. Michaelis. Pflüger's Arch., **101**, 183—190 ; Chem. Centr., 1904, **1**, 834.

The author, in reply to Heidenhain (this J., 1904, 183), maintains his previously expressed view that the properties of Nile Blue are best explained by the assumption that the free base exists in two modifications, one red, the other blue.—A. S.

English Patents.

Dyestuffs of the Anthracene Series, and Materials therefor ; Manufacture of New —— *[Anthracene Dyestuffs].* O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst. Eng. Pat. 8905, April 20, 1903.

See U.S. Pat. 748,375 of 1903 ; this J., 1904, 113.—T. F. B.

Cyanine Dyestuffs [for Sensitising Photographic Emulsions] ; Manufacture of ——. O. Imray. From Meister, Lucius und Brüning. Eng. Pat. 9598, April 28, 1903. XXI., page 384.

Anthraquinone Series ; Manufacture of New Derivatives of the —— *[Anthracene Dyestuffs].* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld. Eng. Pat. 10,074, May 4, 1903.

See Fr. Pat. 331,616 of 1903 ; this J., 1903, 1126.—T. F. B.

Dyestuffs of the Anthraquinone Series ; Manufacture of —— *[Anthracene Dyestuffs].* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld. Eng. Pat. 11,717, May 22, 1903.

See Fr. Pat. 332,261 of 1903 ; this J., 1903, 1192.—T. F. B.

Monazo Dyestuffs ; Manufacture of new Red ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 11,004, May 14, 1903.

See Fr. Pat. 332,145 of 1903 ; this J., 1903, 1192.—T. F. B.

Basic Dyestuffs ; Manufacture of New —— *[Pyrone Dyestuffs].* O. Imray, London. Assignor to the Basle Chemical Works, Basle. Eng. Pat. 2738, Feb. 3, 1904.

Red dyestuffs suitable for dyeing cotton, silk, and wool, are obtained by heating the Rhodamine-bases with derivatives of halogenised fatty acids either alone or in presence of some diluent, such as alcohol, glycerin, &c. The products are easily salted out from their solutions in water. All the Rhodamine-bases of the phthalic acid series and also of the succinic acid series may be used, and analogous dyestuffs are obtained by heating them with chloracetamide, dimethyl chloracetamide, ethyl chloro-acetate or similar derivatives of other fatty acids.—A. B. S.

United States Patents.

Trisazo Dye [Azo Dyestuff]. A. Israel and R. Kothe, Elberfeld, Assignors to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 748,076, Dec. 29, 1903.

See Fr. Pat. 334,140 of 1903 ; this J., 1904, 16.—T. F. B.

Anthraquinone Dye [Anthracene Dyestuff], and Process of Making same. O. Bally, Mannheim, Assignor to Badische Anilin und Soda Fabr., Ludwigshafen. U.S. Pat. 749,918, Jan. 19, 1904.

See Eng. Pat. 20,151 of 1903; this J., 1904, 319.—T. F. B.

Anthracene Dyestuff, and Process of Making same. O. Bally, Mannheim, Assignor to Badische Anilin und Soda Fabr., Ludwigshafen. U.S. Pat. 753,657, March 1, 1904.

See Eng. Pat. 20,719 of 1900; this J., 1901, 1205.—T. F. B.

Anthracene [Indanthrene] Derivative, and Process of Making same. R. Bohn, Mannheim, Assignor to Badische Anilin und Soda Fabr., Ludwigshafen. U.S. Pat. 753,659, March 1, 1904.

See Addition, of Oct. 26, 1903, to Fr. Pat. 319,018 of 1902, next column.—T. F. B.

Azo Dyestuff, and Process of Making same. P. Julius and E. Fussenegger, Assignors to Badische Anilin und Soda Fabr., Ludwigshafen. U.S. Pat. 754,315, March 8, 1904.

See Eng. Pat. 5689 of 1903; this J., 1904, 183.—T. F. B.

Azo Dyestuff; Red-Violet ——. A. Dorrer, Assignor to Badische Anilin und Soda Fabr., Ludwigshafen on Rhine. U.S. Pat. 754,856, March 15, 1904.

See Eng. Pat. 20,000 of 1902; this J., 1903, 903.—T. F. B.

Anthraquinone Dyestuffs; Manufacture of [Blue] ——. E. Hepp and E. Wolpert, Assignors to Farbwerke vorm. Meister, Lucius und Brüning, Höchst-on-the-Maine. U.S. Pat. 754,768, March 15, 1904.

Blue dyestuffs, dyeing mordanted or unmordanted wool in blue shades, distinguished by their fastness to light, acids, and alkalis, are produced by condensing 1.4.5.8-leucotetrahydroxyanthraquinone with the sulpho-acids of primary aromatic amines such as aniline.—A. B. S.

French Patents.

Monazo Dyestuff for Wool; Process for Preparing a Pure Blue ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 336,423, Jan. 15, 1903.

See U.S. Pat. 739,118 of 1903; this J., 1903, 1126.—T. F. B.

Phenylglycine-o-Carboxylic Acid; Manufacture of —— *[Indigo Dyestuffs].* Cie. Paris. Coul. d'Aniline. Second Addition, dated Jan. 19, 1903, to Fr. Pat. 306,302 of Dec. 15, 1900.

The alkali salts of o-chlorobenzoic acid and of glycocoll are heated together in equimolecular proportions in aqueous solution in presence of an alkali carbonate and of copper powder or copper salts. The presence of copper or its salts greatly facilitates the reaction.—E. F.

Azo Dyestuffs ranging from Clear Yellow to Deep Brown; New ——. Soc. Anon. des Mats. Colorantes et Prods. Chim. de Saint-Denis. Fr. Pat. 336,559, Jan. 20, 1903.

Sulphanilic acid, 1.3.6-*α*-naphthylaminedisulphonic acid, *m*-sulphanilic acid, disulphanilic acid, sulphonated *m*-nitraniline, *p*-amino-*o*-sulphophenol, *p*-amino-*o*-sulphodiphenylamine, *p*-amino-*p*-nitro-*o*-sulphodiphenylamine, the naphthionic acids, aminonaphtholdisulphonic acid H, aminonaphtholsulphonic acid *γ*, *o*-amino-*o*-nitro-*p*-sulphophenol, 1.2.4-*o*-aminophenol-*p*-sulphonic acid, 1.2.4.6-*o*-aminophenoldisulphonic acid, 1.2.4-*o*-aminophenol-*p*-carboxylic acid, *m*-aminobenzoic acid, or *p*-aminosalicylic acid are diazotised and coupled with *m*-aminophenol in neutral, acid, or alkaline solution. The products dye wool from an acid bath. The shade of the product varies according to the acid or alkaline nature of the medium in which it was produced. The products produced from components which yield mordant dyeing dyestuffs, such as *o*-amino-*o*-nitrosulphophenol, dye in shades which vary with the mordant employed.—E. F.

Sulphide Dyestuff dyeing Unmordanted Cotton Blue-Black; Preparation of ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 336,630, Jan. 22, 1903.

2.4-dinitro-3′.5′-dichloro-4′-hydroxydiphenylamine, obtained by the condensation of 1-chloro-2.4-dinitrobenzene with 2.6-dichloro-4-aminophenol, is heated with an alkali sulphide and sulphur. The product dyes unmordanted cotton in blue-black shades, which turn to reddish-blue on treatment with hydrogen peroxide.—E. F.

Anthracene Dyestuffs; Production of ——. Badische Anilin und Soda Fabrik. First Addition, dated Oct. 26, 1903, to Fr. Pat. 319,018 of Feb. 24, 1902 (this J., 1902, 1451).

According to the main patent a blue dyestuff is obtained by acting on indanthrene with chlorine. It is now found that a chlorinated product dyeing cotton in blue shades, perfectly fast to chlorine, is obtained by the action of sulphuryl chloride on either pure or crude indanthrene. A similar product, also perfectly fast to chlorine, and dyeing in greener shades than indanthrene, especially suitable for printing on cotton, is obtained by acting on pure or crude indanthrene with a mixture of fuming nitric and fuming hydrochloric acids and reducing the product, for instance, with sodium hydrosulphite.—E. F.

Lakes [from Azo Dyestuffs]; Process for Preparing ——. Soc. Anon. Prod. F. Bayer & Co. Fr. Pat. 336,433, Oct. 20, 1903.

Bluish red lakes are obtained from dyestuffs resulting from coupling the diazo derivative of aminoazobenzenedisulphonic acid with various naphtholsulphonic acids, of which the following are mentioned:—naphtholmonosulphonic acids 1.4, 1.5, 2.8; naphtholdisulphonic acids 1.3.8, 1.4.8, 2.3.6, and 2.6.8; and naphtholtrisulphonic acid 2.3.6.8. An aqueous solution of the azo dyestuff is added to a suspension of aluminium hydroxide in water, the dyestuff being precipitated by means of a 5 per cent. solution of barium chloride.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Benzine; Spontaneous Inflammation of —— *[in Dry Cleaning].* G. Just. Zeits. Elektrochem., 1904, **10**, 202—204.

In the cleaning of fabrics with "benzine" (petroleum spirit) it sometimes happens that the goods suddenly burst into flame when withdrawn from the bath. M. M. Richter, in 1893, showed this to be due to electrification, caused by the friction between fabric and benzine, and stated that the addition of 0·02—0·05 per cent. of magnesium oleate renders the benzine incapable of spontaneous inflammation. By determinations of the conductivity of benzine with and without the addition of magnesium oleate, the author found that the inhibiting action of the oleate depends upon its neutralisation of the electric charges by conduction, and so preventing sparks. The author has examined a number of other substances in this connexion, but finds none so effective as magnesium oleate.—W. A. C.

Blue-Red Prints with Paranitraniline. G. v. Block. Zeits Farben- u. Textil-Chem., 1904, **3**, 102—103.

According to the method of Pluzanski, a basic blue dyestuff is printed on the material and developed by steaming and passing through tartar emetic. The printed material is then padded with *β*-naphthol solution and developed with diazotised paranitraniline. This blue is very fast to soaping, but not easy to manufacture. A new and shorter method is is to first prepare the goods with *β*-naphthol, then to print Nitroso Blue in the usual way, and, after steaming, &c., to develop with diazotised paranitraniline. The goods must only pass for a very short distance through the diazo solution, and then at once in the open width through squeezing rollers into the tartar emetic solution.—A. B. S.

Sizing of Textiles; Recent Developments in ——. H. B. Stocks and H. G. White. J. Soc. Dyers and Colourists, 1904, **20**, 55—62.

A starch which is likely to be much used in future for sizing purposes is obtained from the cassava root, which grows in Central America. The roots contain only about 25 per cent. of starch, but the yield of roots per acre is very large. The fermentation of flour is of great importance in sizing. A change takes place during the first two weeks. Most of the albuminoids become soluble in water, nearly all the sugar is destroyed, and the acidity is largely increased. After two weeks the changes are much slower, and there is a slight increase of insoluble albuminoids, due probably to the growth of moulds and bacteria. By acting on fresh flour with ½ per cent. solution of acetic or lactic acid, it was found that most of the albuminoids were converted into the soluble form. It is, therefore, possible to effect one of the chief aims of fermentation without its defects and without loss of time. Lactic acid is a very powerful preservative, a 1 per cent. solution being better than a 3 per cent. solution of zinc chloride, sp. gr. 1·5, in preventing growth of mould. (See also this J., 1903, 4.)—A. B. S.

Cellulose; Constitution of ——. A. G. Green.
XIX., page 382.

English Patents.

Impregnating Woven Belting and other Fabrics with Gutta-percha, Balata, and like Substances; Impts. in ——. G. Banham and Co., Ltd., and C. R. Sagar. Eng. Pat. 9944, May 2, 1903. XIII. C., page 378.

Bleaching, Washing, Dyeing, and like Apparatus; Continuous ——. M. Muntadas y Rovira, Barcelona. Eng. Pat. 23,310, Oct. 27, 1903. Under Internat. Conv., Sept. 29, 1903.

See Addition, of Sept. 29, 1903, to Fr. Pat. 327,931 of 1902; this J., 1904, 251.—T. F. B.

Hydrosulphite Compounds; Manufacture of ——, *and Methods of Dyeing and Printing with their Aid.* O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine. Eng. Pat. 5867, March 13, 1903.

Double compounds of hydrosulphurous acid or hydrosulphites and aldehydes (particularly formaldehyde) are produced by the action of hydrosulphurous acid on aldehydes or their derivatives, or by the action of sodium bisulphite (or sulphurous acid and zinc) and an acid on the bisulphite compounds of aldehydes, or by the action of sodium sulphite, sodium bisulphite, zinc, and acid on aldehydes. For instance, 450 grms. of "solid, concentrated sodium hydrosulphite" are mixed with 250 grms. of 40 per cent. formaldehyde. On cooling, the compound separates in the form of white needles. Or, 210 grms. of sodium bisulphite solution (38° B.) are mixed with 180 grms. of 25 per cent. formaldehyde; 50 grms. of zinc dust, 210 grms. of 38° B. sodium bisulphite solution and 75 grms. of sulphuric acid (52° B.) are introduced into the solution, which is cooled. After standing, the compound is salted out and filtered. These compounds are suitable for use as discharges in dyeing, padding, and printing. At moderate temperatures they have no reducing action, but are decomposed by steam heat or by bisulphites, hydrosulphurous acid being liberated.—T. F. B.

French Patents.

Cellulose and Fibres difficult to Bleach; Liquid for the Preparation of ——. A. Braun, jun. Fr. Pat. 336,594, Jan. 21, 1903.

The material is heated under a pressure of from 4 to 10 atmos., for from 10 to 24 hours with a neutral solution of ammonium sulphite. The latter is prepared by passing ammonia into a weak aqueous solution of sulphurous acid until it is completely neutralised. The ammonia is recovered. —A. B. S.

Textile Materials; Apparatus for the Treatment —— *of with the Aid of the Circulation of Liquids, Especially Applicable to the Maceration of Silk Waste and other Silky Fibres.* V. Mazzucchelli. Fr. Pat. 336,280, Oct. 28, 1903.

The material is placed in a carriage which fits into a horizontal cylindrical boiler. This latter is connected by means of cocks with a pump and with inlet and outlet pipes for liquids, which are contained in reservoirs in which they can be heated by indirect steam. The boiler can first be evacuated if desirable, and the liquids are then introduced at any desired temperature and pressure.—E. F.

Dyeing; Apparatus for ——. Soc. Colell and Bentner. Fr. Pat. 336,215, Oct. 22, 1903.

The apparatus consists of a vat for dyeing loose textile fibres. The material to be dyed is placed between perforated horizontal plates, and there are arrangements for pumping the liquid up and down alternately through the vat, so that the material in each compartment is pressed against the upper and lower perforated plate alternately. —E. F.

"Bleeding" in Dyed or Printed Tissues; Process for the Prevention of ——. Comp. Parisienne de Couleurs d'Aniline. Fr. Pat. 336,113, Jan. 5, 1903.

In order to prevent "bleeding" of the dyestuff in the processes of fulling, rinsing, soaping, and other cleansing operations, a hydrosulphite is added to the bath. This destroys any small quantity of dyestuff removed from the fibre, and so prevents it from staining the white portions of the fabric.—E. F.

Finishing of Textiles; Process for ——. E. X. Béranger. Fr. Pat. 336,482, Nov. 7, 1903.

The fabric is rolled on a perforated cylinder. Steam is forced into this cylinder by means of a pipe which is in communication with a receptacle containing the finishing liquid. The latter is under pressure and is forced into the steam pipe, and so carried with the steam through the perforations of the cylinder, and thus into the cloth. The process is especially used for finishing with fatty or other substances such as glycerin, which give the fabric a soft feel.—A. B. S.

Metallisation of Fibrous Substances generally, Process for the ——. A. Forster. Fr. Pat. 336,451, Nov. 5, 1903.

See Eng. Pat. 24,289 of 1903; this J., 1904, 184.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

French Patent.

Furs and Hides; Machine for Dyeing and Preparation of ——. C. et E. Chapal Frères et Cie. Fr. Pat. 336,714, Nov. 14, 1903.

The skins to be treated are made to pass by a system of clips, round a revolving cylinder. The latter can be stopped automatically as desired. Under the cylinder is placed a brush, which is partly immersed in a bath of the dye-liquor or other liquid to be applied; the upper end of this brush is in contact with the skin, and applies the liquid to it by capillary action. Next to this is placed a brush with a to and fro motion, which rubs the liquid into the skin to a depth which can be regulated by altering the pressure of the brush. A third brush smoothes the fur and removes excess of liquid.—A. B. S.

VII.—ACIDS, ALKALIS, AND SALTS.

Sodium Nitrite; Action of Carbon Dioxide on Solution of ——. C. Marie and R. Marquis. Comptes rend., 1904, **138**, 694—696.

The authors uphold, against Meunier (this J., 1904, 321), their conclusion (this J., 1904, 252) that carbon dioxide

decomposes sodium nitrite solution. They have substituted for potassium iodide and starch as a reagent, an aqueous solution of a mixture of β-naphthylamine and sulphanilic acid, decolorised, if necessary, by means of zinc. This is coloured orange-red by a trace of nitrous acid, and gives a red precipitate of azo-dyestuff if the quantity of nitrous acid be a little greater. The experiments quoted in the former paper give the same results with this reagent as with iodide and starch. These results are indicated by theory—for sodium nitrite solution containing NO_2-ions and Na-ions, and carbonic acid containing HCO_3-ions and H-ions, a mixture of the two contains simultaneously NO_2-ions and H-ions, that is, nitrous acid. Though the amount of nitrous acid thus liberated is very small, yet even if it be destroyed, it is renewed; and many reactions can be carried out with it—as, *e.g.*, the authors' synthesis of nitroprussides by the action of nitrous acid liberated from sodium nitrite by carbonic acid on alkali ferrocyanides, or Meunier's preparation of diazoaminobenzene, by acting with carbonic acid on a solution of sodium nitrite and aniline (this J., 1904, 56).
—J. T. D.

Chlorides; General Method for the Preparation of Anhydrous ——. C. Matignon and F. Bourion. Comptes rend., 1904, **138**, 631—633.

A CURRENT of dry chlorine is passed through a vessel containing sulphur chloride heated to a suitable temperature, the mixed vapours are then conducted over a layer of the oxide of the metal in a glass tube, which, in most cases, is preferably heated to dull redness. The chlorides produced are isolated by distillation and condensation either of the metallic chloride, if volatile, or of the excess of the chlorinating vapours if the reverse. Chlorides have been prepared from silica, alumina, thoria, the oxides of praseodymium, neodymium, and samarium, and from vanadic anhydride.
—J. F. B.

Nitrogen Oxides from Air; Yield of —— *by the Flame Discharge. Influence of Length of Flame and Temperature.* F. v. Lepel. XI. A., page 376.

Carbon Dioxide; Determination of —— *in presence of Chlorine.* M. Schlötter. XXIII., page 386.

English Patents.

Receivers, Condensers, and similar Vessels, such as are used in connection with Nitric Acid and other Chemical Manufacturing Plants, and for analogous Purposes. W. Round, Birmingham. Eng. Pat. 9182, April 23, 1903.

RECEIVERS, condensers, and the like are made in two separable parts. The upper part of the lower section is in the form of an annular channel, of which the outer wall is of greater height than the inner wall, such channel being adapted to receive the mouth or lower edge of the crown or top section, for forming a liquid or mercury seal.—E. S.

Cyanides; Manufacture of ——, *and the Recovery of By-Products.* Grossmann's Cyanide Patents Syndicate and J. Grossmann, Manchester. Eng. Pat. 4513, Feb. 26, 1903.

A SATURATED solution of potassium ferrocyanide is heated by live steam, with a slight excess of dilute sulphuric acid (or other suitable acid or acid sulphate), in a partial vacuum. The hydrogen cyanide evolved is collected in a solution of an alkali hydroxide; or in milk of lime, if it be desired to obtain calcium cyanide. Or the gas may be absorbed by a solution of potassium or sodium sulphate with lime.

The Everitt's salt remaining in the still after the distillation, is boiled with solution of a suitable ferric salt in the presence of free acid, and the Prussian blue thus produced is separated by filtration or otherwise from the ferrous salt in solution. The ferrous salt (or other suitable corresponding salts of low oxidation) may be utilised for the conversion of another portion of Everitt's salt into Prussian blue in acid solution with injection of air. The Prussian blue is converted into a soluble ferrocyanide by boiling with an equivalent quantity of caustic alkali. See Fr. Pat. 331,331, and Eng. Pat. 36, both of 1903; this J., 1903, 1130 and 1194.—E. S.

Cyanides; Apparatus to be employed in the Manufacture of ——. J. W. Swan and J. A. Kendall, London. Eng. Pat. 8478, April 14, 1903.

THE reaction vessel is a horizontal closed cylinder of nickel or cobalt, supported within a jacket, hydrogen being admitted to the space thus formed. A contracted continuation of the cylinder within the jacket space is joined to an outlet steel tube traversing a plate, against the outer face of which a removable box is supported, so as to obstruct too free access of air to the cyanide which flows down the outer surface of the plate into a receptacle. A nickel or cobalt tube is autogenously soldered at one end to an opening in a highly heated part of the cylinder, the tube passing through the hydrogen-filled space to the front of the apparatus, to enter the bottom of a closed nickel vessel in which an alkali hydroxide is melted, a device being arranged whereby graduated portions of the molten hydroxide may be delivered through the tube into the carbon-charged cylinder.—E. S.

Alumina and By-Products; Processes of Making ——. L. R. Keogh and B. Broughton, Hamilton. Eng. Pat. 23,918, Nov. 4, 1903.

SEE U.S. Pat. 744,765 of 1903; this J., 1903, 1347.—T. F. B.

United States Patents.

Sulphuric Acid; Making ——. N. Heinz and H. Hegeler, Lasalle. U.S. Pat. 752,677, Feb. 23, 1904.

THE invention consists in returning nitrogen compounds from any part of the system, in the "Glover process" of manufacture, and introducing and mixing them with the sulphurous gases entering the Glover tower.—E. S.

Aluminium Sulphate; Process of Preparing ——. H. F. D. Schwahn, St. Louis. U.S. Pat. 752,927, Feb. 23, 1904.

ALUMINOUS materials containing iron and silica are subjected to the action of a chlorinating agent, to convert the iron into ferric chloride, and the mass is heated to a temperature sufficient to volatilise the ferric chloride, and then to a higher temperature to render the silica insoluble in acids, but below the point at which aluminium compounds become insoluble. The resulting product is treated with sulphuric acid, in portions of successively gradually increasing strength, simultaneously with the injection of hot air. The aluminium sulphate solution is then separated from insoluble matters, and is concentrated.—E. S.

Sulphate of Aluminium; Process of Making [*Basic*] —— H. Spence, Manchester. U.S. Pat. 754,824, March 15, 1904.

SEE Fr. Pat. 331,836 of 1903; this J., 1903, 1195.—T. F. B.

Nitrogen Compounds [*Cyanides*]; *Making* ——, *from Atmospheric Nitrogen.* H. Mehner, Steglitz. U.S. Pat. 754,474, March 15, 1904.

A CLOSED chamber, having a hopper inlet on one side of its top, and at the opposite side of its bottom an outlet into a "separator," is charged with fragments of carbon. A molten, white hot alkaline silicate is caused to percolate downwards through the carbon, whilst near the middle of the side of the chamber air is admitted in such manner as to diverge within the mass into an upward, and a weaker, downward current, in both burning the carbon, but in the upward current forming carbon dioxide, and in the downward current, carbon monoxide "preventing the reaction being disturbed by the presence of carbon dioxide." As this fluid reaches the reservoir, alkaline matter is added to it, and it is again run through the apparatus, and so on successively. The cyanides and other nitrogen compounds which are said to collect in the reservoir, are separated, and decomposed into ammonia and an "alkaline compound," which latter is utilised with the alkaline silicate as described.
—E. S.

Cyanides and Nitrates; Process of Making ——. W. E. Everette, Tacoma. U.S. Pat. 754,647, March 15, 1904.

"Pulverised material containing carbon" is cooled by means of liquid air, and is then immediately rendered "incandescent by exposure to a source of intense heat, whereby cyanides, nitrates, &c., are formed by the union of the nitrogen of the air with the disrupted elements" occurring on the explosion.—E. S.

Lead Salts; Process of Making ——. W. Mills, London, Assignor to A. O. Granger, Cartersville. U.S. Pat. 754,667, March 15, 1904.

Substances containing lead are treated with hydrofluosilicic acid; the solution of lead silicofluoride formed is treated with a nitrate to form lead nitrate, and the latter acted upon by the proper reagent to form the lead salt desired.—E. S.

Ammonium Nitrate; Process of Making ——. W. Mills, London, Assignor to A. O. Granger, Cartersville. U.S. Pat. 754,668, March 15, 1904.

A mixture of lead or of a compound containing lead with hydrofluosilicic acid "of about 1·80 sp. gr." is heated, a nitrate is added to the solution of lead silicofluoride thus formed, and the lead nitrate is decomposed by ammonium fluoride.—E. S.

French Patents.

Sulphurous Acid; Recovery of —— from Mixed Solutions of Monocalcium Phosphate and Calcium Sulphite. Rheinische Gelatinwerke G. m. b. H., and R. Arens. Fr. Pat. 336,507, Nov. 9, 1903.

The solution containing calcium sulphite and calcium monophosphate (such as is obtained on dissolving tricalcium phosphate in sulphurous acid) is run into a solution of calcium monophosphate heated to 90° C., whereby sulphurous acid is set free, and is recovered, whilst dicalcium orthophosphate is formed.—E. S.

Barium Hydroxide; Process of Making ——. Harrison Bros. and Co., Incd. Fr. Pat. 336,657, Nov. 14, 1903. Under Internat. Conv., Feb. 2, 1903.

See U.S. Pat. 741,920 of 1903; this J., 1903, 1347.—T. F. B.

Copper Sulphate; Manufacture of ——. G. Gin and the Soc. Anon. la Métallurgie Nouvelle. Addition, dated Sept. 25, 1903, to Fr. Pat. 328,800, Jan. 26, 1903. See this J, 1903, 996.

Mattes or ores derived from cupreous sulphides, are subjected to an oxidising roasting, and after powdering, are digested with moderately diluted sulphuric acid in an autoclave, heated by steam to from 155° to 170° C., and provided with means of discharge. The iron present is thus mainly separated as a basic, insoluble salt, or as ferric hydroxide. Copper sulphate crystals, obtained from the liquor of a second crystallisation, may be digested in solution with a precipitate obtained by adding to a separate part of the solution a small proportion of sodium carbonate. Any iron salt remaining with the copper salt is thus eliminated.
—E. S.

Supersaturator for Solutions [Brine] which are to be Concentrated. J. L. Gauthier. Fr. Pat. 336,138, Oct. 20, 1903. I., page 364.

Reduction of Compounds of Substances which are Reduced and Volatilised at nearly the same Temperature [Silicon]; Process and Apparatus for the ——. F. J. Tone. Fr. Pat. 336,469, Nov. 6, 1903.

See U.S. Pat. 745,122 of 1903; this J., 1903, 1356.—T. F. B.

Sulphur; Extracting —— from Residues of Gas Purification and from Poor Ores. E. Vaton and A. Zuazuavar. Fr. Pat. 336,661, Nov. 14, 1903.

The residues or other materials are dried by exposure to air and to carbon dioxide, and are then heated in retorts, to which series of condensers are so connected that only vapours (not molten sulphur) may reach them. The first in order of the condensing chambers is of such dimensions as to maintain a temperature greater than 150° C. and under 440° C., so that only pure sulphur is condensed therein.
—E. S.

Nitrogen and Oxygen, Atmospheric; Apparatus for Separating ——. R. P. Pictet. Addition, dated June 27, 1903, to Fr. Pat. 322,600, June 28, 1902. See this J., 1903, 364.

The apparatus is a large rectangular metal case divided into two unequal vertical compartments, the larger of which is intended for the accumulation of nitrogen, and the smaller for oxygen. The lower portion of the first compartment contains a bath for liquid air divided into sections and provided with immersed coils for passage of cooled compressed air, which latter in liquefying, causes ebullition, and the nitrogen passes off, first into the upper part of the compartment in which is a serpentine acting as an exchanger. The liquid air, now enriched in oxygen, passes by a U tube in the bottom of the compartment into the smaller, oxygen compartment, in which is an exchanger similar to that in the first compartment. Air liquefied in the second compartment is, after filtering off the frozen carbon dioxide, made to spray on to a series of shelves in the first compartment, where it aids in the refrigeration, and also parts with nitrogen, which escapes, nearly pure, from an outlet tube in the top of the compartment. From a corresponding outlet in the lesser compartment, oxygen gas finds exit.—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

English Patents.

Plate Glass; Apparatus for Manufacturing ——. H. Mielisch, Doebern. Eng. Pat. 18,339, Aug. 25, 1903.

The liquid glass is forced out of a closed hopper by air pressure, emerging between two adjustable rollers rotating in opposite directions, from which it is deposited in a layer of adjustable thickness upon a travelling table. No further rolling is required.—A. G. L.

Glass; Methods of and Apparatus for Drawing and Annealing ——. O. Imray, London. From The Window Glass Machine Co., Pittsburg. Eng. Pat. 297, Jan. 5, 1904.

The glass is drawn upwards from a bath which is protected, at the point at which the glass is drawn, from the surrounding heat by means of shields. The glass passes into a drawing chamber, designed to prevent breakage, mechanism being provided to hold the edges of the sheet and prevent its narrowing in width. Warping or bowing is prevented by supplying heat to the drawing chamber in such a way that the intermediate parts of the sheet are cooled in advance of the edges. When it has reached the desired length, the lower end of the sheet is severed from the bath, and then passes into a leer, where it is annealed and cooled.—A. G. L.

Muffle Furnaces or Kilns [for Pottery, &c.]; Impts. in Continuous ——. L. L. Grimwade, Stoke-on-Trent. Eng. Pat. 26,712, Dec. 7, 1903.

This is an improvement on Eng. Pat. 1805 of 1899 (this J., 1900, 146), and consists essentially in arranging two concave tracks on the floor of the kiln to retain the balls (on which the endless or rotating table moves) in position. The bottom of this table is provided with flat plates underneath of sufficient width to allow some lateral motion without permitting the balls to get away from the flattened portion. Friction wheels are placed in the side wall of the muffle to act as guides.—W. H. C.

French Patent.

Glass in Sheets; Process and Apparatus for Making ——. J. Hirst. Fr. Pat. 336,695, Oct. 20, 1903. Under Internat. Conv., June 12, 1903.

See Eng. Pat. 21,782 of 1903; this J., 1904, 63.—T. F. B

Kaolin ; Process to Separate —— from Rocks by Levigation. R. Frugier. Fr. Pat. 336,490, Nov. 9, 1903.

The rock to be treated is charged into the annular space formed between a central cylindrical cage of open-work and the walls of the containing vessel. Water passes upwards into the cage, where it is agitated by a suitable stirrer, and flowing through the perforations of the cage, disintegrates the rock and becomes charged with kaolin and sand. The kaolin remains in suspension sufficiently long to pass with the water into another outer vessel, from which it is carried to settling tanks. The heavier sand, on the other hand, falls down a sloping channel under the cage, through which the water is introduced, and is carried away by means of a mechanical lift, on the endless chain principle.
—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

English Patents.

Building Materials ; Artificial ——. B. J. B. Mills, London. From A. Seigle, Lyon-Monplaisir. Eng. Pat. 4048, Feb. 20, 1903.

See Addition, of June 4, 1903, to Fr. Pat. 323,666 of 1902; this J., 1903, 1294.—T. F. B.

Brick Kilns ; Impts. in ——. W. Morris, Oldbury. Eng. Pat. 26,751, Dec. 7, 1903.

The kilns are arranged in a series and connected at both ends by a main flue with the chimney, so as to enable them to be worked in either direction. The hot products of combustion from one kiln are made to pass into the next one through the ash-hole, fire-hole, and fire-bags on one side, being exhausted on the opposite side through louvres in a steam-flue running the length of the kiln. The use of side flues is obviated by using a separate inlet flue to each ash-hole. All the dampers used are set obliquely to the flues, so as to press by their own weight against their slides and more effectually to prevent leakage of hot gases or entry of cold air.—A. G. L.

Cement ; Bituminous —— chiefly for Marine Purposes. W. Briggs, Dundee. Eng. Pat. 4907, March 3, 1903.

Seventy parts of crushed or ground asphalt, natural or artificial, are mixed with 20 parts of powdered calcined magnesite. The mixture is made into a paste with 10 parts of magnesium chloride dissolved in sufficient water to give a solution of sp. gr. 1·2, and the whole is then mixed with five parts of sodium silicate previously dissolved in water.
—A. G. L.

United States Patent.

Portland or other Hydraulic Cements ; Process of Maturing ——. H. A. Gerdes, Assignor to F. W Cappelen, A. H. Elftman and J. B. Cull, all of Minneapolis. U.S. Pat. 753,385, March 1, 1904.

The cement is matured by subjecting it to a temperature of 360° F., and to a current of air charged with moisture and carbon dioxide.—A. G. L.

French Patents.

Refractory Products ; Process of Manufacturing extremely ——. J. Bach. Fr. Pat. 336,518, Nov. 10, 1903.

See Eng. Pat. 24,041 of 1903 ; this J., 1904, 64.—T. F. B.

Distemper ; Manufacture of a powdered ——. H. Beissier. Fr. Pat. 336,539, Nov. 12, 1903.

The distemper is prepared by mixing 7 parts of dry powdered casein, 20 parts of slaked lime, 100 parts of covering material (calcium carbonate, ochre, barium sulphate), 8 parts of dextrin, 8 parts of powdered soap and suitable colouring matters. The powder is mixed with water for use, and when applied to walls forms a surface impervious to moisture.—W. P. S.

X.—METALLURGY.

Cast-Iron ; Recent Investigations and Discoveries in ——. A. E. Outerbridge. J. Franklin Inst., 1904, **157**, 121—136.

By alternately heating and cooling cast-iron, a considerable increase in the volume of the metal takes place. The greatest increase is produced by heating to about 1450° F. (788° C.). On heating a bar, $14\frac{13}{16}$ in. long by 1 in. square, 27 times at 1450° F. for one hour each time, an increase of $1\frac{11}{16}$ in. in length and $\frac{1}{8}$ in. in cross-section was observed, *i.e.*, an increase in volume of over 40 per cent. The metal, after the repeated heating and cooling, suffers a loss of strength, sometimes of more than 30 per cent. Among the technical applications of this property of cast-iron are mentioned the enlargement of small castings and of a piston which had become too small through wear.—A. S.

Cast-Steel ; Mechanical Properties of —— at High and Low Temperatures. C. Bach. Zeits. Ver. Deutsch. Ing., 1903, **47**, 1762—1770, 1812—1820. Science Abstracts (B), 1904, **7**, 205.

Three samples of steel marked O, K, and M respectively, were tested at temperatures ranging from 20° C. to 500° C., with the following results :—

——	O.	K.	M.
Tensile strength in kilos. per sq. cm. :—			
At 20° C.	4,285	3,953	3,788
At 300° C.	4,788	4,242	4,319
At 500° C. (after ½ hour)	2,691	2,043	2,274
At 500° C. (after 8—12 hours)	..	1,561	1,911
Extension per cent. :—			
At 20° C.	25·5	29·0	27·2
At 200° C.	7·7	17·7	15·2
At 500° C.	33·3	51·3	26·1
At 500° C. (long heating)	..	41·4	19·5
Sectional contraction :—			
At 20° C.	50·4	56·1	48·7
At 300° C.	15·8	49·4	34·7
At 500° C.	44·6	75·7	42·1
At 500° C. (long heating)	..	57·0	31·1

In general it may be stated that the tensile strength decreases steadily as the temperature rises. Minimum values for the extension and contraction are shown at about 200° C. The results show that the ordinary mechanical tests of boiler plates, &c., should be supplemented by others made at higher temperatures.—A. S.

Carbon Tool Steel ; Tempering ——. H. Le Chatelier. Rev. de Metall., 1904, **1**, 184—187.

The author has determined the conditions of quenching and annealing, under which tool steel of the best quality is obtained. The best temperature at which to quench, is one just above the transformation point of the steel, and this temperature may be accurately ascertained in the following manner, without the use of a pyrometer. The pieces of steel are introduced successively at equal intervals of time into a muffle heated to a temperature a little above the transformation point of the steel. If, after a certain time, the pieces be taken out in the reverse order, they will at first show progressively increasing degrees of brightness, but afterwards there will be a certain number of pieces all showing the same degree of brightness, these pieces being at the transformation point. When the transformation point is passed, the pieces again rapidly acquire a brightness superior to that of their neighbours, and should then be immediately quenched. The best temperature for annealing is about 220° C., the melting point of a mixture of equivalent quantities of sodium and potassium nitrates. The bath containing the fused salts is heated to about 30 higher than the melting point of the mixture, and the piece of cold steel introduced. The latter becomes coated with a solid crust, which gradually melts as the steel becomes hot. The steel is removed from the bath when this crust has completely disappeared. It is stated that by this method of annealing, the life of a tool may be increased by 50 per cent.—A. S.

Chrome Steels. L. Guillet. Rev. de Metall., 1904, **1**, 155—183.

Two series of chrome steels were investigated, the first containing only from 0·043 to 0·464 per cent. of carbon; and the second from 0·741 to 0·973 per cent. of carbon. These alloys are divided into three classes, as follows :—

Class.	Structure.	Percentage of Chromium.	
		Series 1.	Series 2.
1	Perlite, like that of ordinary carbon steel	0— 7	0— 5
2	Martensite	7—20	5—18
3	Special, due to a double carbide of iron and chromium	> 20	> 18

The second class may be further subdivided as follows :—In the first series of alloys, those containing from 7—8 per cent. of chromium show a structure of *α*-iron and martensite; from 10—13 per cent. of chromium, pure martensite; and from 13 to 20 per cent. of chromium, martensite and the double carbide of iron and chromium. In the second series of alloys, those falling in the second class may also be subdivided into three kinds showing a structure of *α*-iron and martensite, martensite and troostite, and martensite, troostite, and the double carbide, respectively. With regard to mechanical properties, the breaking strength, elastic limit and hardness of the alloys with a perlite structure, increase with the percentage of chromium; the elongation and contraction are high, and the resistance to shock depends chiefly upon the content of carbon. The mechanical properties of these alloys are considerably modified by quenching at 850° C., the effects being similar to those observed in the case of ordinary carbon steels, except that with the alloys containing only a small percentage of carbon, the breaking-strength and elastic limit are increased, and the elongation and contraction diminished to a much greater degree than with steels containing no chromium. In the alloys showing a structure of martensite or troostite, the breaking strength, elastic limit and hardness are high, the elongation and contraction low, and the brittleness depends upon the content of carbon. These alloys are slightly softened by annealing and by quenching. The alloys showing the structure of a double carbide of iron and chromium have a somewhat high breaking strength and elastic limit, a somewhat low elongation and contraction, and are very brittle. They are softened by quenching at 850° C., and to a still greater degree by quenching at 1,200° C., owing to the disappearance, at least in part, of the double carbide. Annealing produces a similar effect.
—A. S.

Silver Trial-Plates; Constant Standard ——. E. Matthey. Proc. Roy. Soc., 1904, **73**, 124—127.

ᴛʜᴇ author has previously (this J., 1894, 889) shown that lates of sterling silver of an average weight of 4—5 kilos., nd of a uniform standard could be obtained by casting rom thin castings. Having regard to the difficulty experienced at the Royal Mint in obtaining large silver plates of onstant standard, the author has made further experiments. le finds that by sufficiently rapid cooling, liquation can be lmost completely prevented, which is the direct converse f the view hitherto accepted, viz., that a uniformity of andard is best attained by slow and uniform cooling. By asting the melted silver into a cold mould furnished with a ate, so that the metal entered the mould proper from the ottom, a plate was produced which, when rolled till it was mm. thick, measured 75 cm. × 90 cm., weighed 7·87 los., and showed a constant proportion of silver (925 parts r 1,000) nearly all over the plate.—A. S.

opper Losses in Blast-Furnace Slags. W. A. Heywood. Eng. and Mining J., 1904, **77**, 395.

Fig. 1 the ratio of the amount of copper in the slag from e blast-furnace to that contained in the matte produced at the same time is shown. 2,500 assays, extending over a period of 2½ years, were made, and as it was found that the percentage of copper in the slag was considerably influenced by the amount of silica also present, the results were plotted to form a number of curves representing slags containing varying percentages of silica. The ore smelted was heap-roasted pyrrhotite containing only from 10—20 per cent. of silica, and the deficiency of silica was made up by the addition of quartz. The copper was determined by the cyanide method, after precipitation with aluminium. The insoluble matter in the slag was represented as silica, the results obtained in this way being from 1·5 to 2 per cent. higher than those obtained by direct determination of the silica. The average composition of the slag produced during one month was :—Silica, 31·04; ferrous oxide, 51·40; alumina, 4·84; lime, 6·30; magnesia, 1·37; sulphur, 1·36; zinc, 2·01; manganese, 0·51; and copper, 0·45 per cent. The curves in Fig. 2 represent the actual losses of copper in slags containing different percentages of silica, allowance being made, in the case of the more silicious slags, for the increased amount of slag produced from the additional quartz added.—A. S.

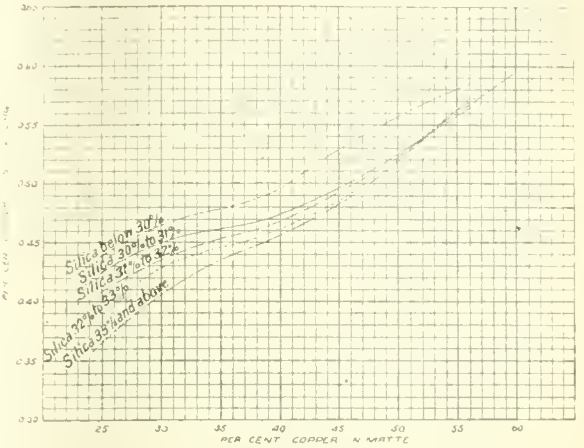


Fig. 1.

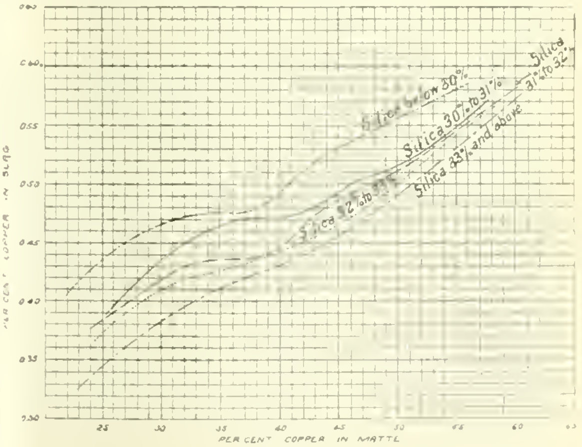


Fig. 2.

Zinc Retorts; Changes Produced in —— during use. O. Mühlhaeuser. Zeits. angew. Chem., 1903, 277.

ᴛʜᴇ flying ash constituents of the bituminous coal used in the furnace attack the clay substance of the retorts and form a continually thickening glaze, whilst on the inner side zinc spinel and tridymite are formed. When the wet charge is inserted, a network of cracks is formed on the outer surfaces, and these become filled with the glaze produced, which may even penetrate right through the walls and corrode the material. At the same time similar cracks are formed on the inside, these in turn filling up with fused slag which attacks the surrounding material and increases its density, the resulting inequalities in expansion easily inducing fracture. The same result ensues from the difference in temperature to which the mouth and body of the retort are exposed. The influence of the life of a retort on its usefulness is shown by the fact that the loss of zinc in a new retort is over 32 per cent. on the first day, but falls to 8·3 per cent. by the seventh day.—C. S.

Silicon; Solubility of ——, in Zinc and in Lead. H. Moissan and F. Siemens. Comptes rend., 1904, **138**, 657—661.

The results obtained by the author were as follows:—

Lead dissolves		Zinc dissolves	
At temp.	Per cent. Si.	At temp.	Per cent. Si.
° C.		° C.	
1,200	trace	600	0·06
1,250	0·024	650	0·15
1,330	0·070	730	0·57
1,400	0·150	800	0·92
1,450	0·210	850	1·62
1,550	0·780		

—J. T. D.

Metals; Crystalline Structure of ——. S. Kalischer. Phys. Zeits., 1903, **4**, 854—856. Science Abstracts (B), 1904, **7**, 204.

The author states that the crystallisation of hot platinum recently described by Holborn and Henning was observed by him in 1882, as also were similar changes in silver and gold. Zinc becomes crystalline above 150° C. The crystalline structure of the following metals is greatly developed by heating:—Rolled cadmium (at 200°—250° C.), rolled tin (200° C.), iron, copper, brass, alloys of copper, zinc and tin, tombac, bronze, and German silver.—A. S.

Density of certain Bodies (Metals); Diminution of —— by Strong Pressure. W. Spring. Bull. Acad. roy. Belg., 1903, 1066—1082. Chem. Centr., 1904, **1**, 776—777.

By the action of a very strong pressure (over 10,000 atmospheres) on a number of metals, and on certain other substances, a diminution of density (from 1·773 to 1·750 in the case of ammonium sulphate) instead of an increase is caused. The author considers that bodies composed of particles which are not perfectly spherical, have a tendency to "flow" when under the influence of strong pressure acting on all sides, the substance, in consequence, undergoing an alteration of molecular structure ("pseudofusion"), involving a diminution of viscosity. This hypothesis is in agreement with the fact that there is a connection between the phenomenon described above and the alteration of the volume of a substance on fusion. Metals like tin, lead, cadmium, and silver, which expand when fused, have their density increased when subjected to strong pressure; but bismuth, which contracts when fused, has its density diminished by pressure. Wires were prepared from different metals by forcing them through narrow openings. The fact that the bismuth wire was quite pliable at first, and only reverted to the brittle condition when it had been bent several times, was regarded as a confirmation of the view that the strong pressure had caused the particles of the metal to "flow." Each of the wires was divided into two portions, of which one was heated to near the melting point, causing the metal to revert to its normal condition. When the two portions of the wire prepared from each metal were now immersed in a solution of a salt of the metal, a weak electric current was set up, the cathode being the portion of the wire just as prepared, in the case of tin, lead, cadmium, and silver; but the portion which had been heated or "annealed," in the case of bismuth. In the following table the density of some metals at 16° C. after various treatments is shown:—

Metal.	Density of the Metal after the particles have been caused to "Flow."	Density of the Rolled Metal.	Density of the "Annealed" Metal.
Lead........	11·3351	11·3348	11·3410
Tin.........	7·3011	7·3016	7·3137
Cadmium...	8·6558	8·6603	8·6633
Silver.......	10·2485	10·2531	10·2596
Bismuth ...	9·8522	..	9·8354

It is stated that a distinction must be drawn between the "true" solid condition, in which a metal can suffer no notable deformation, and the "apparent" solid condition, which is characterised by loss of crystalline structure, and the capacity of "flowing." Certain substances (plastic metals) have the power of easily passing into this "apparent" solid state, whilst others have the power in very small degree or not at all. Substances of the latter class (coal, sand) are composed of particles which will not cohere and form a single mass even when subjected to strong pressure.—A. S.

English Patents.

Cast-Steel Ingots; Process of Perfecting ——. R. W. Hunt, Chicago. Eng. Pat. 23,821, Nov. 3, 1903.

The invention has for its object the prevention of blowholes and "pipes" in cast-steel ingots, and particularly in such as are intended to be made into rails. The molten steel is poured into a suitable ingot mould, which is allowed to stand until a substantial crust is formed upon it; then, immediately before stripping the mould from the ingot, a bar of steel, preferably of a higher quality than that of which the ingot is made, is driven into its central molten portion by appropriate mechanism. This is effected beneath a stripping machine, which, after driving in the bar, draws off the mould, and thus the "probable cavity" within the ingot is filled, and the quality of its axial portion is improved.—E. S.

Steel and Armour Plates; Process for Treating ——. E. Engels, Düsseldorf. Eng. Pat. 1842, Jan. 25, 1904.

The steel plates are heated to redness in a closed furnac in presence of oxygen, or of an oxygen-yielding substance then cooled in molten lead; mechanically treated by rolling &c.; again heated to redness in presence of carbides, t which substances decomposing these at a red heat hav been added; hardened in oil or the like; and then heate to a lower temperature than before in a furnace or met bath, and finally rolled and pressed. Or the plates ma be at once heated with carbides as described, withou undergoing the preliminary process, and after hardening i oil, be again heated, but to a lower temperature than befor Reference is made to Eng. Pat. 25,932 of 1903; this J 1904, 118.—E. S.

Furnaces; Puddling and similar Melting and Reheatin ——. J. Jones, Tipton. Eng. Pat. 4894, March 3, 190

A puddling or reheating furnace is constructed wi double walls, between which air passages proceed fro the chimney end of the furnace to the front of the fi chamber, where they meet in a common space. The a heated by traversing these passages, after passing throu perforations in the inner walls at the front end separatin the space in front from the fire chamber, issues throu the open top of the said chamber, and thus suppo combustion and obviates smoke.—E. S.

Crucible Furnaces. J. B. De Alzugaray, London. —— Eng. Pat. 9689, April 29, 1903.

The crucible rests on a pedestal, concentric with which an inner and an outer or main wall, in the annular spa between which the fire-bars are placed. A shallow annu trough beneath the grate contains water, the steam fr which mingles with the fire-gases above. The annu space between the inner wall and the pedestal, forms a down-flue for products of combustion, into a horizontal passage beneath, leading to the chimney. The furnace is covered by a dome, and a passage to the combustion chamber is provided for the fuel. The crucible has a tapping hole near the bottom. A modified form of furnace, in which the crucible is directly heated by the fuel, and in which a chimney may be dispensed with, is also claimed.—E. S.

Bronze and the like Metallic Powder; Production of ——. L. Lauer, Nürnburg. Eng. Pat. 9064, April 22, 1903.

The metal is melted, and caused to flow into a receptacle in a thin film, or rain, whilst being exposed to the action of a current of air, or of a non-oxidising gas, compressed or otherwise. Or a jet of water may be caused to impinge against the metal films falling in a uitable receptacle. The process may be modified in a ariety of ways, the object being, in any case, to produce he bronze as leaves, foil, or the like, to be then reduced to owder.—E. S.

Case-hardening Compound. J. Cadotte, Suncook. Eng. Pat. 2460, Feb. 1, 1904. Under Internat. Conv., April 16, 1903.

See U.S. Pat. 748,842 of 1904; this J., 1904, 118.—T. F. B.

United States Patents.

Steel; Process of Manufacturing ——. O. Massenez, Wiesbaden. U.S. Pat. 754,154, March 8, 1904.

See Fr. Pat. 329,132 of 1903 and addition thereto; this J., 1903, 1002 and 1353.—T. F. B.

ron or Steel; Cleansing and Improving the Quality of ——. F. C. Weber, Chicago. U.S. Pat. 754,262, March 8, 1904.

The process consists in adding to iron or steel, in a molten tate, "soluble binary metallic borides decomposable in olution under heat, furnishing nascent atoms for cleansing he metal, and a titanium alloy, whereby impurities and ccluded nitrogen will be eliminated by chemical reaction, nd the radical metals of the crystalline borides and titanium lloy will be united with the iron or steel."—E. S.

Steel Projectiles or other Articles; Manufacture of Hardened ——. R. A. Hadfield, Sheffield. U.S. Pat. 754,301, March 8, 1904.

ee Eng. Pat. 6089 of 1901; this J., 1902, 410.—T. F. B.

Gold [and Platinum]; Extracting —— from Rebellious Ores. E. C. Broadwell, Chicago, Assignor to J. A. Lyons, Chicago, and Sarah A. Starring, Springfield. U.S. Pat. 753,822, March 1, 1904.

he powdered ore is mixed with an alkali or alkaline-earth ypochlorite solution, and to the mixture is added "a salt e.g., copper sulphate) of a heavy metal having an acid ature, precipitable by hydrogen sulphide from its acid olution, and capable of acting with the alkali hypochlorite give the hypochlorite of the heavy metal."—E. S.

Metallurgical Furnace. F. Kepp, Brooklyn. U.S. Pat. 753,712, March 1, 1904.

he furnace includes a vertical discharge flue, a melting amber, of which the hearth has an inclined table and a shed portion or crucible, and a superposed initial heating amber or set of chambers communicating independently ith the flue at their rear ends. Each chamber has a fire-x at its front end, separate controllable air flues and parate heaters. A vertical shaft having a cover passes om each of the superposed heating chambers to the elting chamber beneath, admitting flow of molten metal om one to the other. The melting chamber is supplied th air by a valved "diving flue"; a pair of intersecting ches extends conjointly from the front of the fire-box to e front of the discharge flue, constituting the top wall, e arches having their point of intersection above the ucible, so as to deflect the flames downwards against the olten metal therein, and subsequently against the charge metal supported by the inclined table.—E. S.

Roasting Furnace. S. D. Craig, G. E. Kelly, and W. Turner, Laharpe. U.S. Pat. 754,194, March 8, 1904.

The furnace comprises a long casing, having a floor inclined downwards, on which track rails extend, carrying a carriage-agitator, on which is a swinging frame, having on each side two sets of scraper plates, the plates of the series at the ends being at reverse angles, and the plates at one end being at reversed angles to the plates of the other end, with means for holding the sets of plates in reversed position as to elevation. The material being roasted is thus forced, as the agitator traverses the furnace, successively towards and away from the centre rail. The furnace has a series of arched roof-plates, some of which form the bottom walls of a flue. The side walls have openings with removable doors. Fire-boxes communicate with the interior of the furnace, the ends of which latter have swinging doors. —E. S.

Blast Furnace. J. W. Pack, Berkeley. U.S. Pat. 754,337, March 8, 1904.

A slag-chamber and crucible are located in the lower part of a vertical stack, the slag-chamber being surrounded by a water-jacket. In the narrowest part of the furnace, above the slag-chamber and horizontally coinciding with the outer water-jacket, is an interior hollow water-jacket, having an interior open chamber, and the upper portion converging toward the bosh or neck of the furnace, to form inclined walls, which support and arrest the ore on its passage through. Oil burner pipes open through the interior water-jacket into the ore chamber, and through the outer jacket into the slag-chamber.—E. S.

Zinc; Process of Obtaining ——. E. H. Hopkins, London. U.S. Pat. 754,141, March 8, 1904.

See Eng. Pat. 12,859 of 1902; this J., 1903, 701.—T. F. B.

Zinc Blende; Separating Iron Pyrites from ——. K. Danziger, Kattowitz. U.S. Pat. 754,643, March 15, 1904.

Zinc blende containing iron pyrites is subjected "to the action of air, moisture, and heat," and the ferrous salt thus formed is washed out by water.—E. S.

Ores, Mattes, &c.; Treating ——. J. A. Potter, New York. U.S. Pat. 754,159, March 8, 1904.

A furnace, the bed of which is separated into two pockets by a transverse central elevation of the bed, is so supported that either end may be sufficiently elevated to allow flow of the melted contents of the elevated pocket into the depressed pocket. A molten metallic bath is formed in one of the pockets, and a separate charge of solid materials is "preheated" in the other pocket; the molten charge is then, by tilting the furnace, caused to flow over the solid material; a portion of the combined mass is then tapped out, and another charge of solid material is "preheated" in the pocket from which the molten charge was poured. Compare U.S. Pat. 710,300 of 1902; this J., 1902, 1333. —E. S.

Ores; Process of Separating —— from Magnetic Gangue. T. A. Edison, Llewellyn Park. U.S. Pat. 754,756, March 15, 1904.

A magnetic ore, such as "pyrrhotite" associated with a relatively small proportion of a non-magnetic ore (a nickel ore for instance) is ground to a fineness sufficient to free the non-magnetic particles, and is mixed with a larger bulk of a coarser non-magnetic material. The mixture is then treated in a magnetic separator, and the non-magnetic tailings are screened to separate the added coarse material from the nickel ore.—E. S.

Matters in Fusion [Metals, &c.]; Process of Treating —— [with Sodium]. P. L. Hulin, Clavaux. U.S. Pat. 754,566, March 15, 1904.

See Fr. Pat. 327,982 of 1902; this J., 1903, 1052.—T. F. B.

Tins; Method of Printing on ——. I. Kitsee, Philadelphia. U.S. Pat. 753,144, Feb. 23, 1904.

A metal is printed on with an ink containing a second metal in solution; and the printed-in parts are subjected to the action of a sulphur compound. Tins or tin cans may be printed on with an ink containing an acidulous compound of copper, thickened with gum, followed by application of a sulphur compound.—E. S.

French Patents.

Steel; Process for the Deoxidation and Desulphurisation of ——. Soc. Electro-Métallurgique Française. Fr. Pat. 336,705, Nov. 2, 1903.

Calcium carbide, together with silica or other flux for lime, is added to the scoria associated in the furnace with molten steel. The scoria thus deoxidised, reacts on the metal to deoxidise or desulphurise it, as the case may be. The process is stated to be particularly applicable in an electric furnace. Reference is made to Fr. Pat. 320,682 of 1902; this J., 1903, 148. See also U.S. Pat. 724,770 and Fr. Pat. 328,350, both of 1903; this J., 1903, 557 and 955; and Add. to Fr. Pat. 328,350 and Eng. Pat. 8101 of 1903; this J., 1904, 25 and 118.—E. S.

Cementation Furnace. A. Gueur, H. Mertens, and J. Lalemant. Fr. Pat. 336,116, Oct. 19, 1903.

The furnace is adapted to receive on its hearth a covered case containing the iron, and the cementation is effected by exposure to the heat of the fire-gases entering from centrally and laterally arranged flues, through openings in the bottom of the sole, and through the sides of the chambers. The loaded case, placed on a truck, travels on rails to the front of the furnace, and arrangements are provided for drawing the case inwards to its place on the hearth, on opening a counterpoised sliding door, which is afterwards closed.—E. S.

Solder for Aluminium or Aluminium Alloys. M. Forest. Fr. Pat. 336,354, Jan. 13, 1903.

The solder consists of foil, sheet, bar, wire, or the like, of zinc, or of a zinc alloy, coated with a layer of nickel.—E. S.

Alloy for Soldering Aluminium. A. A. Bancal and A. Sturm. Fr. Pat. 336,297, Oct. 29, 1903.

The solder is obtained by melting together in stated order and with certain precautions, magnesium, 20 parts; borax, 50 parts; zinc, 1,000 parts; zinc phosphide, 40 parts; tin, 260 parts; and powdered copper sulphate, 250 parts. The proportions may be varied to suit special requirements. The introduction of magnesium in any convenient proportion is claimed as a characteristic feature of the invention.—E. S.

Mineral Briquettes; Furnace for making ——. G. Gröndal. Fr. Pat. 336,605, Oct. 27, 1903.

See Eng. Pat. 23,764 of 1903; this J., 1904, 118.—T. F. B.

Lead Ores; Desulphurising ——. A. Savelsberg. Fr. Pat. 336,540, Nov. 12, 1903.

Fuel, alternating with layers of limestone fragments, is ignited at the bottom of an ordinary converter, into which air is blown, and well moistened lead ore is added in successive layers, and at intervals between layers of limestone, &c., the proportion of the latter used being usually from 15 to 20 per cent. of the weight of the lead ore treated. The ore is wetted, not merely to prevent occurrence of dust, but also to increase the proportion of sulphuric acid formed in the process. The final product is a silicate containing lead oxide, which admits of ready treatment in a cupola furnace.—E. S.

Zinc and Lead, and generally all Metals having less Affinity for Sulphur than Copper; Extracting ——, *from their Sulphides.* A. H. Imbert. Fr. Pat. 336,660, Nov. 14, 1903.

The process consists in heating the sulphide ore with granulated copper, and, if necessary, a flux. The copper sulphide produced, after separation of the reduced metal, is treated for recovery of the copper in a Bessemer converter.—E. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Nitrogen Oxides from Air; Yield of —— *by the Flame Discharge. Influence of Length of Flame and Temperature.* F. v. Lepel. Ber., 1904, **37**, 712—719. (Compare this J., 1903, 303 and 636.)

When the discharge occurs between a copper wire anode and a carbon cathode, the poles are clearly differentiated, both by the naked eye and by the spectroscopic appearance of the flame; and this difference is also shown in the chemical effects of the discharge, for the gases drawn from the immediate vicinity of the cathode contain a much larger proportion of nitric oxide than those taken close to the anode. Receding from anode and cathode, however, the proportions respectively increase and decrease, so that at 5 mm. from the anode, the air surrounding the flame is richer in nitric oxide than at 20 mm. from the cathode. Naturally the highest total yield of nitrogen oxide is got by taking the air surrounding the flame along its whole length. The author considers that the formation of nitrogen oxides is due to direct electrical action, and is not solely thermal, as Muthmann and Hofer suppose. In experiments in which the voltage and current in the primary were kept constant, the temperature of the air at a certain distance from the flame (and hence presumably that in the flame itself) rose as the speed of rotation of the anode was increased from zero, and also as the length of the flame was increased. The yield increased with the temperature (to a quickly reached maximum) only when the anode was fixed. The best yield was always obtained with a medium temperature. The frequency of the interrupter was also varied, but moderate frequency was found to give the best results: a Wehnelt interrupter is not suitable. The yield is increased by soaking the cathode in various salt solutions, such as potassium hydroxide, copper sulphate, or titanium chloride. The solution of nitrate and nitrite obtained by neutralising with sodium carbonate the aqueous solution of the nitrous gases produced by the process can be used as manure, and is apparently as efficient as Chili saltpetre, so that for this purpose the conversion of the nitrite into nitrate is not necessary.—J. T. D.

Calcium Carbide; New Mode of Formation of ——. H. Moissan. XXIV., page 388.

English Patents.

Lead Peroxide on Plates of Electric Accumulators; Impts in forming ——. J. Diamant, Hungary. Eng. Pat 6954, March 25, 1903.

Lead peroxide is formed on the surface of plates of larg superficial area for accumulators by adding to the electrolyte about 0·1 per cent. of a sulphonic acid or hydroxy sulphonic acid derivative of methane, or a mixture of thes substances.—B. N.

Coating and Impregnating Porous Materials [Insulatin Materials] with Oils, Varnishes, or the like; Method of ——. E. A Carolan, London. From Gen. Elec. Co New York. Eng. Pat. 7134, March 27, 1903.

The fabric is saturated with a volatile liquid, such gasolene, and then immediately dipped into an insulatin substance, such as linseed oil or varnish, which is soluble i the gasolene, and preferably heated. The sheets are drie and subjected to pressure at a high temperature.—B. N.

Electrodes for Secondary Batteries; Manufacture of — C. Roderbourg, Hagen. Eng. Pat. 11,276, May 18, 1903

Nickel compounds are applied as a paste to a suital support, and the pasted electrodes are first suspended in alkali so as to form a layer of nickel hydroxide on t surface, and then subjected to the oxidising action of electric current so as to form highly-oxidised nickel oxide —B. N

Solutions for Use in the Cells of Galvanic Batteries; Impts. in ——. W. H. Wheatley, London. From the Atwood Electric Co., Boston. Eng. Pat. 28,057, Dec. 21, 1903.

The positive or carbon electrode is immersed in a solution repared as follows:—7 lb. of sodium nitrate are added to 6 lb. of nitric acid, 30° B., and the mixture poured into ½ lb. of sulphuric acid, 25° B. Sulphuric acid is added to 4 galls. of water till the sp. gr. reaches 1·2, and the two iquids are then mixed. The negative or zinc electrode is mmersed in a solution prepared thus:—Sulphuric acid is dded to 30 galls. of water till the sp. gr. is 1·2, and 1½ lb. f ammonium carbonate, 10 oz. of sodium carbonate, and 0 oz. of mercury bisulphate are then added, the liquid eing afterwards diluted with 6 parts of water.—B. N.

United States Patents.

lectrodes for Storage-Battery Cells; Process of Preparing ——. O. Frank, Assignor to L. J. Lennox and Michigan Storage Battery Co., all of Detroit. U.S. Pat. 753,383, March 1, 1904.

HE lead electrodes are first immersed in an electrolyte onsisting of "95 per cent. of water, 5 per cent. of sodium ulphate, and 0·7 per cent. of potassium chlorate," and an lectric current of one ampère is passed through the elecrodes for 50 hours at a temperature of about 20° C. The lates are removed, washed with distilled water, and the ositive plates placed in a weak solution of sulphuric acid. hese positive plates are used as the negative electrodes, nd sheets of lead as the positive, and a current of two mpères is passed for 50 hours; the plates are removed, ydrochloric acid extracted by thorough washing with dislled water, and the electrodes dried at a temperature of 00° C., preferably in a current of air charged with lead mes.—B. N.

lectrodes; Process of Preparing ——. G. J. Atkins, Tottenham. U.S. Pat. 754,114, March 8, 1904.

E Fr. Pat. 330,849 of 1903; this J., 1903, 1092.—T. F. B.

itrogen or other Compounds; Apparatus for the Electrical Production of ——. J. von Kowalski and I. Moscicki, Freiburg. U.S. Pat. 754,147, March 8, 1904.

E Eng. Pat. 20,497 of 1903; this J., 1903, 1297.—T. F. B.

French Patent.

lectrodes. G. Cornaro. Fr. Pat. 336,817, Oct. 15, 1903.

HE electrodes are made from one or more powdered tals or non-metals, pure, or mixed together, or mixed h carbon, metallic or non-metallic oxides, oxygen salts, .—B. N.

ectrodes for Accumulators; Process of Producing Plates f Active Material for use as ——. Pflüger Accumulaorenwerke A.-G. Fr. Pat. 336,549, Nov. 12, 1903.

E plates of lead or lead alloy, furnished with active terial in the usual manner, are heated to a temperature ve the melting point of the metal employed to form grids; the metal melts and runs off, but leaves a porous allic pellicle on the surface of the active material, and s maintains the latter intact.—B. N.

vement of Liquid during Electrolysis; Process and pparatus for Producing ——. Soc. Consortium für lektrochem. Ind. G. m. b. H. Fr. Pat. 336,213, Oct. 22, 903.

T electrolyte is circulated from the anode to the cathode o the surface of the diaphragms, so as to remove by s tion the cathode liquid which is travelling by diffusion t ards the anode. Two forms of diaphragms are described, t first made up of wedge-shaped pieces of material p ed one above the other, and the second of pieces disp d like bricks in a wall, the interstices being enlarged b ronves so as to admit of a better circulation of the li d.—B. N.

High Temperatures; Process and Apparatus for the Production of ——, by means of Combined Chemical and Electrical Energy. R. Schnabel. Fr. Pat. 336,452, Nov. 5, 1903.

This invention relates to a process and apparatus for electrically heating a gas, or other combustible matter, before or during combustion. The gas passes first into a hollow vertical positive carbon electrode, and then, by means of small openings below, into an annular space between the two electrodes, this space being filled with high-resistance material. In an alternative form, the outer cylindrical negative electrode is surrounded by a space into which the gas passes, small openings at the base serving to conduct the heated gas into the annular space containing high-resistance material. The air or oxygen in this case is conveyed by a tube nearly to the top of the hollow positive electrode, and as before, into the annular space, so as to be mixed with the gas; or the mixture of gases may be carried by a porcelain tube from the annular space surrounding the negative electrode to the inside of the positive electrode, and thence to the annular space containing the resistance material. In a second form, the gas is heated by being passed through the hollow vertical positive electrode of an electric arc, two or more horizontal electrodes forming the negative pole. The former is filled with fragments of carbon to increase the heating surface, or may contain a rod of carbon so placed as to form an annular space around the rod, which is filled with high-resistance material. The current passes through the latter from the rod, and the gas is subjected to the combined heating effect of the arc and resistance material. Water-gas may be used, or this may be produced by passing steam over the carbon forming the resistance material, the products of decomposition being afterwards heated and burnt.—B. N.

Ozonising Apparatus. G. Labille. Fr. Pat. 336,530, Nov. 11, 1903.

The dielectrics are made of agglomerated mica, and between these is placed a vessel of metal, such as aluminium, which is not easily oxidised, and through which a current of cooled conducting liquid is circulated. A space is left between the dielectrics and the metal vessel, and through this space air or oxygen is circulated, the joints being made gas-tight with asbestos. Into the liquid in the metal tube is plunged a glass vessel containing a conducting liquid, with suitable connections, so as to act as a condenser for producing oscillating discharges.—B. N.

(B.)—ELECTRO-METALLURGY.

United States Patents.

Iron Alloys; Electrical Manufacture of ——. G. Gin, Paris. U.S. Pat. 753,875, March 8, 1904.

See Eng. Pat. 12,702 of 1902; this J., 1903, 872.—T. F. B.

Furnace; Electric ——. C. A. Keller, Paris. U.S. Pat. 754,656, March 15, 1904.

See Eng. Pat. 24,234 of 1901; this J., 1902, 354.—T. F. B.

French Patents.

Furnace; Electric —— with Induced Currents. A. Fauchon-Villeplée. Fr. Pat. 336,313, Oct. 30, 1903.

An electric furnace, in the form of a retort or crucible, in which the material to be treated, instead of being placed in an annular trench surrounding the core of the transformer, is intercalated in the circuit of the armature. The lines of force pass from one pole to the other through the armature and return through the material, the induced currents in the latter raising the material to the desired temperature. —B. N.

Furnaces; Impts. in Electric ——. C. A. Keller. Fr. Pat. 336,403, Nov. 2, 1903.

The electrodes of different polarity are disposed in separate cavities, communicating below by a space which contains the material to be treated, and through which the whole of the current must pass. The electrode spaces are separated by a hollow dome of non-conducting material, closed by a plug which permits of access to the material, or of the introduction, if necessary, of a current of air.—B. N.

Iron Sand and other Refractory Ores; Method of and Apparatus [Electric Furnace] for Treating ——. D. R. S. Galbraith and W. Steuart, New Zealand. Fr. Pat. 336,726, Nov. 16, 1903.

Iron sand, or other refractory powdered ore, with or without addition of carbon or a flux, is showered down in a vertical electric furnace, in the lower part of which (in one form of the furnace) are set transversely a number of resistance rods, which may be provided with shields or screens, either surrounding them or protecting their upper surfaces. These incandescent resistance bodies are set in such alternate order, row below row, as to deflect the falling grains from side to side, and to bring them successively into contact with such bodies in the zone of greatest heat, whilst meeting an upward current of a previously heated redneing gas or vapour, such as the vapour of a mineral oil injected into a closed chamber through an electrically heated side passage, into which chamber the treated mineral passes through an outlet in the bottom of the furnace; this chamber is provided with outlets for the slag.—E. S.

Iron Sand, Iron Oxides, and other Refractory Ores; Process and Apparatus [Electric Furnace] for the Reduction of ——. D. R. S. Galbraith and W. Steuart, New Zealand. Fr. Pat. 336,727, Nov. 16, 1903.

The process described in the preceding abstract is modified in certain details, and especially in respect to the heating zone of the furnace, in which series of non-conducting screens, having electrical conductors touching their ends, are arranged in similar order to the resistance bodies described in the former patent. The grains of ore are showered upon these screens through perforations in V-shaped troughs, and on reaching them they complete the electric circuit and become incandescent, and similarly, as they fall from screen to screen, always against an upwardly passing current of a heated reducing gas or vapour.—E. S.

Nickel from Garnierite and other Minerals; Electric Process for the Extraction of ——. Soc. Elec. Metall. Française. Fr. Pat. 336,376, Oct. 30, 1903.

A mixture of a mineral of nickel with a flux and carbon is treated in an electric furnace with suitable metals, so as to obtain nickel free from sulphur and silicon. The alloy may be refined by oxidation, and a product richer in nickel is obtained, the slag being returned to the reducing furnace. With iron, nickel, and cobalt an alloy known as "electric nickel" is obtained, which is useful in the manufacture of nickel steel. The crucible has a base of refractory material covered with metal, and the walls are of a non-reducible mineral and are kept cool.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Bears' Fat; Characteristics of ——. P. N. Raikow. Chem.-Zeit., 1904, **28**, 272—273.

Fresh bears' fat is white and very similar to lard in appearance. The flare fat is softer and more transparent than the kidney fat, and its odour recalls that of fresh bacon. Bears' fat differs from the fats of the dog, fox, and cat in having a lower specific gravity, a very low melting point, and a fairly high iodine value. The specimens examined by the author gave the following results:—

Origin.	Sp. Gr. at 15°/15° C.	M. Pt. of Insol. Fatty Acids.	Acid Value.	Ester Value.
		° C.		
Flare fat....	0·9209	32—32·25	2·2	192·6
Kidney fat..	0·9211	30·5—31	2·2	198·1—198·3

Origin.	Iodine Value.	Reichert-Meissl Value.	Refractometer Reading.	
			at 25° C.	at 40° C.
Flare fat....	98·5	1·66	61·2	53·0
Kidney fat..	106·5—107·4	1·15	61·2	53·0

The author points out that these iodine values do not confirm the statement of Henriques and Hansen, that the iodine value decreases with the nearness of the fat to the interior of the body.—C. A. M.

Cocoanut Oil in Butter; New Method for Determining ——. E. Polenske. XXIII., page 387.

English Patents.

Edible Fats, and Process of Making same. N. N. Cronholm. Eng. Pat. 27,449, Dec. 15, 1903. XVIII. A., page 382.

Soap; Manufacture of ——. B. M. Knox, Kilbirnie. Eng. Pat. 6590, March 21, 1903.

Soap is prepared from stearine, palm oil, rosin, refined soda ash and water, in approximately specified proportions. For washing wool, water is added to the soap in sufficient quantity to give it the consistency of soft soap.—C. A. M.

Soap Suds; Process of Treating Refuse ——. S. and J. Turner, Sowerby Bridge. Eng. Pat. 4420, Feb. 25, 1903.

See U.S. Pat. 743,959 of 1903; this J., 1903, 1299.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

English Patents.

Pigments, and Processes of Making the same. W. J Armbruster and J. Morton, St. Louis. Eng. Pat. 28,800 Dec. 31, 1903.

See U.S. Pat. 751,444 of 1904; this J., 1904, 260.—T. F. B

French Patents.

Lakes [from Azo Dyestuffs]; Process for Preparing —— F. Bayer & Co. Fr. Pat. 336,433, Oct. 20, 1903. IV page 368.

Ultramarine; Manufacture of ——. C. F. Cross. Fr. Pat. 336,486, Nov. 7, 1903.

See Eng. Pat. 3174 of 1903; this J., 1904, 69.—T. F. B.

(*B.*)—RESINS, VARNISHES.

United States Patent.

Resinous Substances; Production of ——. G. Fry, Berwick-on-Tweed. U.S. Pat. 751,298, March 8, 1904.

See Eng. Pat. 19,626 of 1902; this J., 1903, 918.—T. F.

(*C.*)—INDIA-RUBBER, &c.

English Patent.

Impregnating Woven Belting and other Fabrics w Gutta-Percha, Balata, and like Substances; Impts. ——. G. Banbam & Co., Ltd., and C. K. Sagar, both Manchester. Eng. Pat. 9941, May 2, 1903.

One or more strands of gutta-percha, balata, or like su stances are interspersed amongst the warp or weft threa and the woven belting is afterwards heated and pressed as to force the melted or softened substance thoroug through the material to impregnate it.—B. N.

XIV.—TANNING; LEATHER, GLUE, SIZ

French Patent.

Furs and Hides; Machine for Dyeing and Preparat of ——. C. et E. Chapal Frères et Cie. Fr. 336,714, Nov. 14, 1903. VI., page 369.

XV.—MANURES, Etc.

Nitrogen Oxides from Air; Yield of —— by the Flame Discharge. Influence of Length of Flame and Temperature. F. v. Lepel. XI. A., page 376.

English Patent.

Brewers' and Distillers' Yeast; Utilisation of —— in the Manufacture of Artificial Manures. W. Wardle, Burton-on-Trent. Eng. Pat. 10,581, May 9, 1903.

A mixture is made of about 2 parts of yeast with 1 part of sodium chloride and 5 parts of calcium sulphate, by weight, for use as a manure. Pure or impure yeast, or yeast previously treated for the extraction of a portion of its constituents, may be used, and the gypsum may be replaced by other "earthy substances of a like non-corrosive nature." See Eng. Pat. 6971 of 1901; this J., 1902, 183.—E. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Maltose and Dextrin; Hydrolysis of —— by Dilute Acids, and the Determination of Starch. W. A. Noyes and others. J. Amer. Chem. Soc., 1904, **26**, 266—280.

In all the experiments the hydrolysis proceeded more slowly towards the end of the reaction, and never followed the course of a normal mass reaction. The authors have found that, whilst the cupric-reducing power of glucose was scarcely affected by heating with hydrochloric acid of 2·5 per cent. strength, that of the products formed by the hydrolysis of maltose decreased after reaching a maximum after about one hour at 100° C.; the maximum reducing power corresponded to a hydrolysis of 96—98 per cent., which is 98—99 per cent. of the cupric-reducing power which would be attained on complete hydrolysis. The hydrolysis was more complete in solutions containing 2—4 per cent. of maltose than in 0·5 per cent. solutions. The rate of hydrolysis for dextrin (prepared by malt) was about one-half of that for maltose. The hydrolysis reached 90 per cent. in one hour, and rather less than 95 per cent. in two hours at 100° C. The mixed products of the conversion of starch by malt, containing 74—78 per cent. of apparent maltose, gave a maximum reducing power at 100° C. after about one hour, the copper oxide reduced by a 2 per cent. solution being 97·1 per cent. of the quantity corresponding o complete hydrolysis. By the direct treatment of maize starch with 2·5 per cent. hydrochloric acid, a hydrolysis of 17 per cent. was attained in one hour, and 98 per cent. in four hours at 100° C. in 0·5 per cent. solution; in this case no decrease of cupric-reducing power occurred on prolonged heating. For the determination of starch, the solution obtained by conversion with malt should be treated, after iltration, with 10 per cent. by volume of hydrochloric acid, p. gr. 1·125. The solution should be heated up in a boiling water bath and subsequently maintained at that emperature for one hour. The solution is then cooled and reated with caustic soda sufficient to neutralise 90 per cent. f the acid present; it is then made up to a definite volume nd filtered if necessary, the cupric reducing power being etermined by Fehling's solution, previously standardised with pure glucose; 100 parts of glucose may then be taken o represent 93 parts of starch in the original material.

—J. F. B.

Saccharose; Combinations of —— with certain Metallic Salts. D. Gauthier. XXIV., page 388.

nzyme Action; Studies on ——. I. Correlation of the Stereoisomeric α- and β-Glucosides with the corresponding Glucoses. E. F. Armstrong. XXIV., page 388.

Glucose; Bi-rotation of ——. R. Behrend and P. Roth. XXIV., page 388.

Starch Syrups; Examination of ——. A. Rössing. XXIII., page 386.

French Patent.

Sugar Juice; Process and Apparatus for Crystallising ——. H. Mathis. Fr. Pat. 336,796, Nov. 19, 1903.

The syrups are concentrated to a high degree of supersaturation so as to contain 6—8·5 per cent. of water, the formation of fine grain being prevented by gradually increasing the temperature to a high degree. The syrup is then transferred to a closed vessel provided with stirrers and an external heating jacket, the temperature being maintained between 92° and 100° C., whilst a vigorous agitation is kept up and a current of high-pressure steam or air is introduced into the mass through a longitudinal slit in the bottom of the vessel. Subsequently, the crystals produced are increased in size by a slow process of evaporation, by aspirating a current of heated air across the surface of the mass and adding from time to time small quantities of suitably diluted molasses, the stirrers being kept in motion.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Barley; Germination of ——. A. Nilson. J. Amer. Chem. Soc., 1904, **26**, 289—294.

The author contends that enzymes are not the primary cause of the germination of grain, but that they only play their part when germination has been fully started, their appearance being rather the result than the cause of growth. He suggests that the real starting agents of germination are the lactic acid bacteria, always present on the surface of the grain. These develop acid under the hulls of the corn during steeping, at the expense of the ready-formed sugars. The lactic acid produced, then dissolves the insoluble albumin, thus in some way starting the liberation of enzymes which carry on the metabolism. If barley be steeped in a decinormal solution of sodium hydroxide for 24 hours, it turns a dark brown colour, and a condition is established under which any enzymes, if present, would be absolutely paralysed. But if the steeped grain be transferred to a germinating tray, pale spots gradually appear on its surface; subsequently rootlets are formed and the corn regains its natural colour. On the other hand, if the grain be steeped in solutions which are inimical to bacteria but harmless towards enzymes, no growth will take place. Such a result occurs if barley be steeped for 24 hours in toluene-water, even if the steeped grain be subsequently thoroughly washed with water. If, however, germination be started in the ordinary way, the sprinkling of the growing seedling with toluene-water has no effect. Unlike sodium hydroxide, a N/20 solution of ammonia so debilitates the lactic acid bacteria that barley, when steeped in this reagent, will not germinate. Since the ammonia has no effect upon the putrefactive bacteria, these soon obtain the upper hand.—J. F. B.

Steely Malt in Modern Brewing, and the Filter-Press. C. B. Davis. Amer. Brewing Inst.; through Brewers' J., 1904, **40**, 184—185.

The effect of steely corns in reducing the yield of extract is shown by determining the quantity of extract in worts made by mashing the fine meal and coarse grist respectively, the difference between the two results being proportional to the percentage of steely corns. In preparing the grist in the brewery, the steely corns are merely cracked by the grinding rolls, and the starch is largely protected from the action of the diastase. It must be borne in mind, however, that the portion of mash withdrawn for the decoction (about 23 per cent. of the total) is completely converted, and yields the whole of its extract in the mash-tun, whether the corns are steely or not. The loss of extract due to insufficient sparging is estimated at about 5 per cent. In working the filter-press method, the malt is ground to flour, and the proportion of steely corns does not affect the yield. With steely malt, a portion of unconverted starch may pass into the wort, causing turbidity, or at least an excessive acidity due to lactic fermentation, which is liable to upset the normal composition of the proteid constituents, thus causing "albuminoid" turbidities. The wort from such grists also does not "run off"

rapidly, and does not show a normal "break." New malt, straight from the kiln, is also liable to cause turbidities; the malt should always be kept in store for 2—3 weeks. Lastly, turbidities may occur even with well milled malt, if the temperature of the sparging water exceed 67°—68° C.
—J. F. B.

Wort: Determination of Colour of ——. Comparison between the New Style (Berlin Congress) and the Old Style of Expressing the Colour-type of Malt. H. Hanow. Woch. Brau., 1904, **21**, 153—154.

Referring to the new method of expressing the colour-type of a malt in terms of the number of c.c. of N/10 iodine per 100 c.c. of water required to match the colour of the standard laboratory wort as prepared for analysis (see this J., 1903, 1205), the author amplifies the table there given for comparing the results found by the new method with that hitherto in use. The numbers given in the second, third, fourth, and fifth columns of the table (*loc. cit.*) represent the colour-types expressed according to the old style, employing N/100 iodine and calculating the results per cent. of extract in the malt. In the present article, an extended table relating only to the paler types of malt, yielding worts of colour values between 0·13 and 0·75 (new style) is given, showing the equivalents of these grades for worts of gravities between 7·5° and 8·8° Balling in terms of the old style of colour-types, *i.e.*, the number of c.c. of N/100 iodine per 100 c.c. of water required to match the colour of 100 grms. of malt extract.—J. F. B.

Beer; Causes of the "Head"-retaining Property of ——. O. Mohr. Woch. Brau., 1904, **21**, 149—150.

From experiments on the "head"-retaining power of a solution of commercial peptone, before and after filtration, and after the addition of 0·005 per cent. of zinc sulphate to the filtered solution, the author concluded that the "head"-retaining properties of beer are absolutely independent of its viscosity, but are caused by the presence of suspended particles of colloidal bodies in an infinitely minute state of division, such as can only be detected by the "ultramicroscope." This instrument has shown that solutions of colloidal substances are made up of such particles, the shape of which depends on the nature of the colloid; such observations applied to beer should reveal the nature of the particles which impart the "head"-retaining properties. It is known that any influence which tends to agglomerate these fine particles to form larger ones, *e.g.*, turbidity caused by chill, also detracts from the permanence of the "head."—J. F. B.

Wines: Turbidities of Sparkling ——. L. Mathieu. Bull. Assoc. Chim. Sucr. et Dist., 1904, **21**, 854—872.

The subject is treated under the following headings:—I. Classification of forms of turbidity. II. Mineral matters. III. Organic salts. IV. Amorphous organic matters. V. Coagulation by metallic salts. VI. Coagulation by oxidation. VII. Turbidity from various causes. VIII. Dead organised matters. IX. Living micro-organisms. X. *Saccharomyces ellipsoideus.* XI. Maladies caused by microbes. XII. Various micro-organisms. XIII. Special turbidity of gassed wines.—L. J. de W.

Oak-Wood; Extractive Action of Spirit of Various Strengths on ——. Gelatin; Solubility of —— in Spirit. G. Heinzelmann. Zeits. Spiritusind., 1904, **27**, 95—96.

Shavings were taken from new oak-wood staves of Hungarian and Russian origin; these were treated with spirit of 95, 90, and 86 per cent. strength (by volume) respectively for 10 days, and the non-volatile extractive matter absorbed by the spirit was determined. Both samples of Hungarian wood yielded more extract than the Russian; the quantity of extract dissolved increased as the strength of the spirit was decreased; the first extracts were considerably heavier than subsequent extracts, but distinct quantities were found even after four extractions; in the later extracts the differences between the behaviour of the different strengths of spirit disappeared. It is concluded that the solid wood in the form of casks would yield extractive matter even after the casks had been in use for a considerable time. Previous extraction of the wood with boiling water for 2—6 hours failed to remove the resinous extractive matters, but appeared to facilitate the complete exhaustion of the wood when subsequently treated with spirit. Experiments with gelatin, such as is employed for glazing the interior of casks used for rectified spirits, showed that the gelatin was quite insoluble in 95 per cent. spirit, but 90 per cent. spirit dissolved 0·1 grm. and 86 per cent. spirit dissolved 0·25 grm. of gelatin per litre. When the spirit contained tannin matters extracted from previous contact with wood, the gelatin removed some of the tannin matter from 90 per cent. and 86 per cent. spirit; in presence of 95 per cent. spirit the reaction between gelatin and tannin did not take place. On account of the solubility of gelatin in spirit it is not advisable to use glazed casks for crude spirits, in order to protect them from the wood, unless their strength is above 90 per cent.—J. F. B.

Enzyme Action; Studies on ——. I. Correlation of the Stereoisomeric α- and β-Glucosides with the corresponding Glucoses. E. F. Armstrong. XXIV., page 388.

Malt; Determination of Moisture in —— by Hoffmann's Apparatus. J. H. Schulze and G. Marienhagen. XXIII., page 386.

Aldehydes; Aromatic and Fatty, Basic Reaction for ——. [Acetone in Wood Spirit and Acetaldehyde in Grain Spirit.] S. S. Sadtler. XXIII., page 387.

Alcohol in Dilute Solutions; Determination of —— by Nicloux's Method. M. E. Pozzi-Escot. XXIII., page 387.

ENGLISH PATENT.

Brewers' and Distillers' Yeast; Utilisation of —— in the Manufacture of Artificial Manures. W. Wardle. Eng. Pat. 10,581, May 9, 1903. XV., page 379.

UNITED STATES PATENT.

Honey; Process of Fermenting ——. A. V. Kouba, Milligan. U.S. Pat. 754,461, March 15, 1904.

Honey is dissolved in water to a saccharometer gravity of 21°, the solution is boiled and skimmed, chalk is added in the proportion of 40 lb. per 100 galls. of liquid, boiling and skimming are continued, animal charcoal in the proportion of 50 lb. per 100 galls. is added and the liquid is cooled allowed to settle, and drawn off clear. A suitable ferment is added consisting of 15 lb. of wine yeast, 6 oz. of ammonium phosphate, 15 oz. of ammonium tartrate, 25 oz. of potassium bitartrate, 11 oz. of tartaric acid, and 6 oz. of magnesium sulphate per 100 galls. of liquor.
—J. F. B.

FRENCH PATENTS.

Brewing; Saccharifying and Filtering Apparatus for ——. L. Dacier. Fr. Pat. 336,477, Nov. 7, 1903.

The mash tun is provided with agitating rakes mounted on vertical and horizontal shafts and moving in different directions. The strong wort is drawn off clear by a pipe situated at some distance from the bottom of the tun; the thick residues of the mash are then discharged from the bottom into a special filter-press composed of alternate filter-plates and spacing frames. The frames are provided with agitators, which can be operated from the outside to prevent the mass clogging the cloths. The filter-plates are divided by corrugated partitions into two compartments, one to each filtering surface. The washing waters can be caused to flow in two directions, to discharge on either side of the cakes. The first compartments of the filter may, if desired, be closed by valves, which are opened one by one after the further compartments have been filled.—J. F. B.

Alcoholic Liquids; Purification of ——. F. Verbièse and E. Darras. Fr. Pat. 336,795, Nov. 19, 1903.

Crude alcoholic liquids, distillery phlegms, &c., are treated with peroxides or dioxides of alkalis or alkaline earth before rectification, in proportions calculated from the acidity of the liquor, and varying generally between 1 and 50 grms. per hectolitre of phlegms. The base liberated by the decomposition of the peroxide serves to neutralise the free acidity of the phlegms.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Formaldehyde; Action of —— on Milk. A. Trillat. Comptes rend., 1904, **138**, 720—722.

Milk, to which formaldehyde in varying quantity had been added, was curdled with rennet; and casein from freshly curdled milk was also suspended in vessels of water containing varying amounts (1/10,000—1/20,000) of formalin. All were then subjected to digestion with pepsin, along with untreated casein from the same source. The undigested residues were in the first series 5—6 per cent., in the second 30 per cent. greater than those from the untreated casein. It is proved, then, that formalin, even in these small doses, impairs the digestibility of milk. Moreover, formalin added to milk is there as formalin as long as the milk remains unaltered, so that the absorption of formalin-treated milk implies the absorption of the whole dose of formalin added. Both by its action on the gastric mucous membrane and from its rendering casein less digestible, formalin in small daily doses is thus at least a possible danger to health, and its use, like that of other preservatives, should be prohibited. —J. T. D.

Cooked Vegetable Foods; Chemical Composition of ——. Katharine I. Williams. J. Amer. Chem. Soc., 1904, **26**, 244—252.

The chemical composition was determined of various vegetable foods cooked in the usual manner, except that no salt or flavouring substances, sugar, &c., were added. The results are shown in the following table :—

——	Price per lb.	Refuse.	Used for Cooking.	Composition of the Edible Portion of the Cooked Foods.							
				Water.	Ash.	Protein (N × 6·25).	Woody Fibre.	Cellulose.	Fats.	Starch.	Undetermined.
	Pence.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Brussels sprouts	2½	6·34	93·66	89·27	0·56	2·84	1·12	1·05	0·07	4·29	0·80
Rice	4	..	100·00	80·93	0·06	0·13	0·02	0·09	0·01	16·87	0·89
Rhubarb	2¼	19·55	80·45	95·25	0·56	0·61	0·75	0·77	0·09	1·74	0·23
Lentils	2½	..	100·00	66·04	0·70	8·82	0·45	0·82	0·19	20·53	2·45
Oatmeal (water)......	2½	..	100·00	72·54	1·16	3·74	0·59	0·13	1·84	18·48	1·72
Oatmeal (milk).......	..	..	100·00	64·74	1·55	4·39	0·44	0·84	2·10	25·96	0·02
Asparagus	9½	35·13	64·87	93·04	0·70	2·08	0·61	1·18	0·09	2·10	0·17
Peas	2½	..	100·00	62·18	0·67	9·40	2·21	2·53	0·70	23·16	..
Tapioca..............	5	..	100·00	80·62	0·09	0·58	0·03	0·04	0·03	16·65	3·55
Artichokes...........	2½	72·70	27·30	84·72	1·15	2·95	1·01	1·70	0·26	7·68	0·53
Petit pois...........	5¼	..	100·00	84·18	0·63	4·28	2·13	1·42	0·06	8·92	..
Baked beans..........	5¼	..	100·00	69·85	1·78	4·99	1·20	0·20	0·19	21·69	2·10
Leeks................	1½	74·69	25·31	86·12	0·80	1·45	1·54	1·54	0·13	7·80	0·65
Macaroni	8	..	100·00	66·13	0·23	5·59	0·23	0·14	0·11	27·90	..
Broccoli	1¼	67·97	32·03	91·69	0·58	2·53	1·02	0·96	0·24	2·63	0·60

—A. S.

'eeding Stuffs; Yield and Components of Bodies called "Fibre" and "Carbohydrates" in ——. P. Schweitzer. J. Amer. Chem. Soc., 1904, **26**, 252—262.

n a comparative investigation of the [American] Official gric. Chem. method, the chlorate method, and the bromine ethod of preparing the "crude fibre" in cattle foodstuffs, was found that the O.A.C. method gave the lowest yields f fibre, but that the chlorate method, on the average, gave ields not very different; the bromine method, on the other and, gave considerably higher yields, owing to the fact iat the pectose is not removed from the fibre by this agent. The different "crude fibres" were separated into rce portions by extraction with Schweitzer's reagent, the llowing being the average proportions of the three groups components in the fibres prepared from the green foods udied :—

——	O.A.C. Method.	Chlorate Method.	Bromine Method.
	Per Cent.	Per Cent.	Per Cent.
bre undissolved by Schweitzer's reagent	14·07	2·29	3·28
luble, and reprecipitated by acid	75·61	83·57	71·76
rmanently soluble (hydrolysed)	10·32	14·14	24·95

The table in which the results of the author's analyses e summed up includes the following determinations for samples of cattle foods :—"Crude fibre," by O.A.C. thod; "carbohydrates," by difference; "true fibre," , the "crude fibre" *minus* the pentosan contained in it; ibro-pentosan," from the furfural yielded by "crude re"; "pectose," *i.e.*, the "crude fibre" by the bromine thod *minus* the "crude fibre" by the O.A.C. method; ecto-pentosan," from the difference between furfural determinations in "crude fibres" by bromine and O.A.C methods; "pentosan," from difference between total furfural in foodstuff and furfural in "crude fibre" by bromine method (this "pentosan" is mainly associated with the "indefinite carbohydrates"); "sugar"; "starch"; "indefinite carbohydrates" of unknown composition, by difference.—J. F. B.

Wheat Flour; Determination of Gliadin in ——, by means of the Polariscope. H. Snyder. XXIII., page 387.

Cocoanut Oil in Butter; New Method for Determining ——. E. Polenske. XXIII., page 387.

English Patents.

Water and other Liquids and Alimentary Substances; Sterilisation of ——. V. B. Nesfield and A. Crerar. Eng. Pat. 4759, Feb. 28, 1903. XVIII. B, page 382.

Liquid Extracts [Coffee, &c.]; Apparatus for the Production of ——. E. H. Schofield, Atlanta, and L. C. Cole, Bowling Green. Eng. Pat. 11,450, May 19, 1903.

The apparatus consists of a horizontal cylinder, heated preferably by steam or hot water. The solvent enters at one end, and the body to be extracted, packed in suitable permeable cartridges or cases, is introduced at the other end. Arrangements are provided for pushing forward, rotating, and discharging the cartridges.—W. H. C.

Milk; Process of Purifying and Preserving ——. Marie Daseking and H. Paradies, both of Hanover. Eng. Pat. 12,045, May 26, 1903.

The milk is heated to a temperature of about 85° C. for 20 minutes, then subjected to centrifugal action while still hot, and finally cooled to a temperature of 3° C., in an open cooler.—W. P. S.

Edible Fats and Process of Making same. N. N. Cronholm, Chicago. Eng. Pat. 27,449, Dec. 15, 1903.

A MIXTURE of edible fats of suitable consistency, *e.g.*, "oleo-oil," 5 parts, neutral lard, 7 parts, and butter, 1 part, is mixed with albuminous "batter," 4 parts, with the addition of 1 part of salt as a preservative. If the albuminous constituent be composed of the whites and yolks of eggs beaten to a foam, the product will have the consistency and colour of butter. The molten fats are added to the egg-"batter," and the whole is stirred at a temperature sufficient to produce coagulation of the albumin (150°—200° F.); the mass is then cooled gradually with continuous stirring, and the salt is worked in.—J. F. B.

UNITED STATES PATENT.

Centrifugal Liquid [Milk] Separator. T. H. Springer, Washington. U.S. Pat. 754,909, March 15, 1904.

THE apparatus is cylindrical in form, with a screwed-on conical top, provided with a cylindrical neck containing an opening for the cream, and a central feed-tube for the whole milk. The lower end of the feed-tube is enlarged conically, and above this end are fitted a number of concentric deflecting discs inclined downwards and pierced by vertical openings near the central tube, and having a series of bent pipes leading from their outer periphery through the neck of the apparatus and outwards.—L. F. G.

FRENCH PATENT.

Cream in Milk; Apparatus for Determining ——. F. Billet. Fr. Pat. 336,788, Nov. 19, 1903. XXIII., page 386.

(*B.*)—SANITATION; WATER PURIFICATION.

ENGLISH PATENT.

Water and other Liquids and Alimentary Substances; Sterilisation of ——. V. B. Nesfield and A. Crerar, both of London. Eng. Pat. 4759, Feb. 28, 1903.

THE water is treated with chlorine, the latter being afterwards destroyed by the addition of a suitable reagent. The chlorine may be added to the water either in the liquid form enclosed in glass tubes, or in the shape of tablets composed of mixtures of bleaching powder with tartaric acid or sodium bicarbonate. The neutralising reagent which is afterwards added consists of sodium sulphite or thiosulphate, and may be enclosed or embedded in the tablet. It is separated from the chlorinating material of the tablet, by surrounding it with a layer of soluble substance, such as gelatin or sugar. Alimentary substances are sterilised by subjecting them to the action of the chlorinated water.—W. P. S.

FRENCH PATENT.

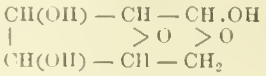
Sterilisation of Water by means of Ozone; Apparatus for the systematic Treatment of Liquids with Gases, applicable especially to the ——. A. Schneller and D. Koeleman. Fr. Pat. 336,614, Nov. 10, 1903.

THE apparatus consists of a cylindrical vessel in which are placed a number of horizontal partitions of fine metallic gauze, which reach nearly across the whole cylinder, but leave a part free, preferably always on alternating sides, and end in a number of vertical perforated partitions which extend nearly to both the next higher and lower horizontal partitions. The liquid to be treated is fed in at the top of the apparatus, flows on to the first horizontal partition, over the vertical one, then on to the next horizontal one, and so on, whilst the gas is led in at the bottom, and forces its way up through the perforations, passing through the liquid in doing so.—A. G. L.

XIX.—PAPER, PASTEBOARD, Etc.

Cellulose; Constitution of ——. A. G. Green. Zeits. Farben- u. Textil-Chem., 1904, 3, 97—98.

THE formula of cellulose is usually considered to be some multiple of $C_6H_{10}O_5$, chiefly from the supposed existence of intermediate nitrates, and also from the fact that cellulose is a colloid. The latter is no proof of high molecular weight since silica and alumina both form colloidal hydrates, and yet are given a simple formula. The author prefers the $C_6H_{10}O_5$ formula, and suggests the following structure:—



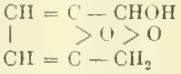
$$\begin{array}{l} \mathrm{CH(OH) - CH - CH.OH} \\ | \qquad\qquad\qquad\quad > \mathrm{O} \quad > \mathrm{O} \\ \mathrm{CH(OH) - CH - CH_2} \end{array}$$

This formula represents cellulose as an inner anhydride of glucose, and easily explains its conversion into the latter by simple hydrolysis. It also demonstrates the possibility of formation of a tri-nitrate and a tri-acetate. The formation of a tetra-acetate is doubtful, and can only be explained by a previous partial hydrolysis of the cellulose (one of the central O atoms being converted into an OH group). The fact that cellulose itself does not contain CO groups, but apparently does so after a simple hydrolysis, can be explained thus:—

$$\begin{array}{l} \text{The } \mathrm{-CH-OH} \text{ group is converted first into } \mathrm{-CH(OH)_2} \\ \qquad\quad > \mathrm{O} \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad \mathrm{-CH_2(OH)} \\ \qquad \mathrm{-CH_2} \qquad \text{and then into } \mathrm{-CHO} \\ \qquad\qquad\qquad\qquad\qquad\qquad\quad \mathrm{-CH_2OH} \end{array}$$

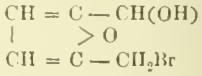
The behaviour of cellulose on mercerisation with caustic soda is explained by the conversion of the central O atoms into ONa groups, and then into OH groups. The suggested formula also explains Fenton's formation of bromomethylfurfural by treatment with hydrobromic acid gas. The compound I is possibly formed first by dehydration, and this absorbs HBr and gives II.:—

I.



$$\begin{array}{l} \mathrm{CH = C - CHOH} \\ | \qquad\quad > \mathrm{O} > \mathrm{O} \\ \mathrm{CH = C - CH_2} \end{array}$$

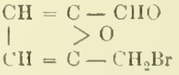
II.



$$\begin{array}{l} \mathrm{CH = C - CH(OH)} \\ | \qquad\quad > \mathrm{O} \\ \mathrm{CH = C - CH_2Br} \end{array}$$

Bromomethylfurfural III. is formed from II. by the separation of one molecule of water:—

III.



$$\begin{array}{l} \mathrm{CH = C - CHO} \\ | \qquad\quad > \mathrm{O} \\ \mathrm{CH = C - CH_2Br} \end{array}$$

The substance I. has the empirical formula of lignone, and is possibly related to it. The other reactions of cellulose can also be explained in a simple way by this formula.

—A. B. S.

ENGLISH PATENTS.

Pulp water; Regulating the Supply of ——, *to Pulp catchers or Savers in the Manufacture of Paper.* R. Dietrich, Merseberg. Eng. Pat. 4378, Feb. 24. 1903.

BETWEEN the circulation tank, in which the "backwaters" from the machine are collected, and the pulp-catchers are interposed suitable distributing tanks, which maintain a constant supply of "backwater" to the pulp-catchers, by means of valves operated by floats, in spite of any irregularities in the level of water in the circulation tank. These distributing tanks are fed by a trumpet-shaped overflow pipe in the circulation tank, pierced with holes, which increase in area towards the top of the overflow pipe. A trumpet-shaped overflow pipe is also provided in the first distributing tank, in order to remove any scum or floating impurities. The chamber in which the pulp-catching cylinder revolves is fed with "backwater" from below, in order to catch the fibres as they ascend.

—J. F. B.

Paper; Process of Making ——. W. B. Meixell and T. Holt, Sayro. Eng. Pat. 28,186, Dec. 22, 1903.

SEE U.S. Pat. 748,968 of 1904; this J., 1904, 128.—T. F. B.

Celluloid; Manufacture of ——. J. Schmerber and L. Morane, Paris. Eng. Pat. 4863, March 2, 1903.

SEE Fr. Pat. 324,121 of 1902; this J., 1903, 569.—T. F. B.

French Patents.

Millboard; Manufacture of Incombustible ——. Soc. V. E. Schneider and A. Demole. Fr. Pat. 336,436, Oct. 21, 1903.

A suitable fibrous pulp is mixed with mineral loading matter consisting of granular basic blast-furnace slag, finely powdered, together with a certain proportion of finely-powdered caustic lime. The whole is then converted into millboard, submitted to hydraulic pressure, and dried, after which the boards may be impregnated with soluble glass or coated with any suitable weather-resisting composition. —J. F. B.

Casein-cellulose Composition, and Process of Making the same. Casein Co. of America. Fr. Pat. 336,465, Nov. 6, 1903.

See U.S. Pat. 748,709 of 1904; this J., 1904, 128.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Euquinine [Quinine Ethyl Carbonate] and Salicylic Acid; Compound of ——. P. Cesaris. Boll. Chim. Farm., **43**, 11—12. Chem. Centr., 1904, **1**, 732.

On mixing together solutions of 3·96 grms. of euquinine, $CO(OC_2H_5)(OC_{20}H_{23}ON_2)$, and of 1·38 grms. of salicylic acid in about 100 grms. of absolute alcohol, crystals of a compound of the two substances separate after a few minutes. After recrystallisation from boiling alcohol, the new product melts at 195°—196° C.; it is almost insoluble in water at 15° C., soluble in 600 parts of boiling water, in 10 parts of boiling alcohol, slightly in ether, carbon bisulphide, and benzene, and easily in chloroform.—A. S.

Artemisia; Essential Oil of ——. E. Grimal. Comptes rend., 1904, **138**, 722.

From the Algerian *Artemisia herba alba*, which is a plant of some medical renown among the indigenous population, the author has extracted about 0·3 per cent. of a greenish-yellow essential oil, having a pleasant aromatic odour and a camphor-like taste. It contains lævo-camphene, eucalyptol, lævo-camphor, and the caprylic and capric esters of an undetermined terpenic alcohol.—J. T. D.

Mercury, Determination of Small Quantities of ——. T. W. Richards and S. K. Singer. XXIII., page 386.

Aldehydes, Aromatic and Fatty; Basic Reaction for ——. S. S. Sadtler. XXIII., page 387.

Aldehydes and Ketones; Determination of —— *in Essential Oils and Allied Substances.* H. E. Burgess. XXIII., page 387.

Erratum.—This Journal, 1904, page 128, column 2, in the abstract on "The Preparation and Properties of Pure Colloidal Silver," *for the words* "soloid" *and* "geloid" *read* "sol" *and* "gel" *respectively, as in the original.*

English Patents.

Hydrocarbons; Process for the Production of Highly Sulphuretted ——. J. E. W. Bengough, Vienna. Eng. Pat. 8596, April 15, 1903.

The unsaturated hydrocarbons, obtained by dry distilling the residues obtained by treating raw mineral oils with sulphuric acid, with lime, &c., give, on treatment with from 10 to 40 per cent. of sulphur chloride, a thick brown oil, containing chlorine and sulphur, and which, on boiling with a 10 per cent. solution of caustic soda, loses its chlorine, giving a sulphuretted hydrocarbon containing up to 30 per cent. of sulphur, the composition of the product depending on the fraction of the mineral oil residue employed. The product is said to be "suitable for pharmaceutical purposes." —T. F. B.

Methylene-hippuric Acid; Manufacture of ——. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 10,095, May 1, 1903.

See U.S. Pat. 743,986 of 1903; this J., 1904, 76.—T. F. B.

Trimethyl-cyclohexenonecarboxylic Acid; Manufacture of Esters of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine. Eng. Pat. 11,138, May 15, 1903.

See U.S. Pat. 743,305 of 1903; this J., 1903, 1306.—T. F. B.

Liquorice Root; Obtaining "Juice" from partly or completely dried ——. F. Evers, Düsseldorf. Eng. Pat. 1180, Jan. 16, 1904.

100 kilos. of coarsely ground liquorice root are boiled with about 300 litres of water, and the aqueous extract is pressed out. The extract is mixed with 0·25 kilo. of iron oxide and boiled down to about 100 kilos. Subsequently a quantity of sodium carbonate (about 1 kilo. of the anhydrous carbonate) sufficient to dissolve the iron compound is added, and the liquid is concentrated to any desired consistency. The iron oxide combines with the "free vegetable acids," forming compounds which are soluble in alkaline liquids. Instead of iron oxide, manganese oxide or metallic iron or manganese may be used. The "juice" so prepared is equivalent to that made from the fresh roots.—J. F. B.

United States Patents.

Aromatic Esters, and Process of Making same. E. Ritsert, Frankfort-on-Maine. U.S. Pat. 748,101, Dec. 29, 1903.

Aromatic aminocarboxylic esters are combined with aromatic sulphonic acids or their salts, thus forming the salts of the aminocarboxylic esters. For instance, *p*-amino-benzoic acid ethyl ester combines with phenol-*o*-sulphonic acid (1 mol.), or with benzene-*m*-disulphonic acid (2 mols.). The compounds or salts thus produced are soluble in water and alcohol, but insoluble in ether; they are considered to be suitable for use as anæsthetics, and are said not to give rise to injurious effects. —T. F. B.

Chloroform; Process of Making ——. A. W. Smith, Cleveland. U.S. Pat. 753,325, March 1, 1904.

Carbon tetrachloride, prepared by heating carbon bisulphide with sulphur chloride, is purified by treatment with sulphur chloride and sulphur, and distilled. It is then subjected to the action of iron and water, whereby chloroform is produced.—T. F. B.

French Patent.

Arsenic and Iron; Extracting Soluble Compounds of —— *[for Therapeutic Use]*. Chem. Werke Hausa G. m. b. H. Fr. Pat. 336,127, Oct. 19, 1903.

Natural mineral waters, containing arsenic and iron, are evaporated without access of air, and preferably whilst passing a feeble current of an indifferent gas through the liquid. If the waters contain bicarbonates, carbon dioxide should be passed through during the evaporation. The dry compound of arsenic and iron thus obtained is stated to be soluble, and to possess a high therapeutic value. The mineral waters of Levico, Austria, are said to be suitable for use as described.—E. S.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Three-Colour Photography; Sensitisers for ——. E. König. Phot. Mitt., 1904, **41**, 81.

Among sensitisers for use in the modern form of three-colour photography, where only one plate is exposed, Ethyl Red gives a good result over the green and yellow part of the spectrum up to the orange; Orthochrome T is, however, better for red; while the new dyestuff, Pinachrome, answers even better still. When incorporated with the emulsion, Orthochrome and Pinachrome give less rapid plates than when the bromide films are prepared by dipping; but this greater rapidity is not due to the presence of ammonia, because Orthochrome, used as a bath, is equally effectual in neutral solution. To prepare the bath, 1 grm. of either dyestuff is dissolved in 100 c.c. of warm alcohol, and then diluted with 500 c.c. of alcohol and 400 c.c. of water; this forms a stock solution, which may be kept indefinitely in the dark. The actual bath is composed of 4 c.c. of the solution, 2 c.c. of ammonia, and 200 c.c. of water—a quantity which is sufficient for not more than two 13 × 18 cm. plates. The plates are immersed for three or four minutes, washed well for two or three minutes, and then dried rapidly in perfect darkness. If the drying be not too slow, the plates will keep a month or more. When two ordinary plates, one of which is 10 times as sensitive as the other, are dipped in these baths, the ratio of exposure to any particular portion of the spectrum does not remain as before, but the slower plate becomes relatively more rapid. In red light, the slow plate mentioned will only require three times the exposure of the more rapid one. Nevertheless, it is not advantageous to dip slow plates for practical work, because, when exposed to mixed light, they still remain less sensitive than rapid ones.—F. H. L.

Development; Separation of ——, into Primary and Secondary Actions. J. Sterry. Phot. J., 1904, **44**, 50—57.

Development of a photographic image may be considered as consisting of two actions: the primary action, or reduction of the silver halide; and the secondary action, or intensification of the reduced portions of the image. This secondary action appears to be diminished or entirely removed by treating the plates, &c., before development, with some substance which tends to counteract the effects of the developer, *e.g.*, a dilute solution of potassium bichromate, chromic acid, &c. The effect of this treatment is not to destroy the image entirely, but the gradation of the resulting negative is entirely altered, and depends on the strength of solution used and the time of immersion. Normal gradation can as a rule be obtained, after such treatment, on much over-exposed plates.—T. F. B.

English Patents.

Agar-agar; Process of Manufacturing a Limpid Solution of —— [for Photographic Purposes]. P. Jensen, London. From M. Muetschke, Berlin. Eng. Pat. 11,625, May 21, 1903.

See Fr. Pat. 330,595 of 1903; this J., 1903, 1102.—T. F. B.

Cyanine Dyestuffs [for Sensitising Photographic Emulsions]; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine. Eng. Pat. 9598, April 28, 1903.

The dyestuffs are obtained by heating with alkali hydroxide in a suitable solvent, *e.g.*, alcohol, (1) a mixture of an alkyl halide of quinoline, or of quinoline substituted in the *m*- or *p*-position by alkyl, or alkyloxy radicles, with an alkyl halide of quinaldine, similarly substituted, or (2) a mixture of an alkyl halide of quinoline substituted as above and an alkyl halide of quinaldine. For example, 30 grms. of *p*-toluquinaldine methyl iodide and 58 grms. of *p*-toluquinoline methyl iodide, dissolved in 800 c.c. of alcohol, are heated with 5·6 grms. of potassium hydroxide. Dyestuffs obtained in this way are said to render photographic plates twice to four times as sensitive to red as quinaldine-quinoline cyanine.—T. F. B.

United States Patent.

Photographic Plate. A. A. Gurtner, Bern. U.S. Pat. 753,977, March 8, 1904.

A plate suitable for carrying out the process described in U.S. Pat. 730,454 (this J., 1903, 820) consists of two "carriers," one holding an orthochromatic film containing silver bromide, and the other holding a film containing silver chloride, and stained with Aniline Orange, thus forming a colour filter for red rays; the two films are fixed in contact by means of binding strips fastened to the "carriers."—T. F. B.

French Patent.

[Sensitive] Film Cards or Papers for Photographic Purposes; Process for Making ——. Soc. Anon. Plaques et Papiers Photographiques. A. Lumière et ses fils. Fr. Pat. 336,533, Nov. 11, 1903.

A substitute for dry plates may be prepared by "enamelling" a card or paper with a coating of gelatin, &c.; the card is then immersed in water or a dilute solution of gum, sugar, or any substance "capable of increasing or reducing the adhesive power of the enamelled surface." The sensitive film is then fixed by pressure to the card thus prepared, and can be easily removed from its support, after development, by mechanical means.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

Explosion of Nitroglycerin; Circumstances attending an —— which occurred in the Precipitating and Final Washing Houses of the Factory of the National Explosives Co., Ltd., at Upton Towans, Hayle, Cornwall, on Jan. 5, 1904. By Capt. J. H. Thomson, H.M. Chief Inspector of Explosives.

In this explosion, which was attended by loss of life, 4,200 lb. of nitroglycerin were involved. The probable cause of the explosion is considered to be the dropping of the lid of a tank into which a charge of nitroglycerin was flowing. The lids were constructed of wood, covered on the under side with lead, and, owing to their weight and shape, would give a heavy glancing blow if allowed to fall. Captain Thomson considers "that no movable article of uncovered metal other than aluminium need be present in any nitroglycerin building." As the explosion was communicated from the precipitating house to the final washing house by means of the charge of nitroglycerin running down the leaden gutter, it is recommended that the difference of level between buildings thus connected should be such as to shorten, as much as possible, the time occupied in running down a charge. Gutters should also be washed with clean water after each charge has passed down, and not more than one charge should be running to or from any one building at one time.

—G. W. McD.

Safety Explosives for Fiery Mines. Mém. des Poudres et Salpêtres, 1903–4, **12**, 7—30.

Explosives with Ammonium Nitrate as a Base.—An examination of the relative merits of paraffined paper and tinfoil of 0·03 mm. thickness as waterproof wrappers for cartridges when embedded in damp sawdust showed that, with the former, cartridges absorbed 0·19 per cent. of moisture in ten days, and 5·8 per cent. in 120 days, while with tinfoil the figures were 0·07 per cent. and 4·03 per cent. respectively. The paraffined paper cartridges could be subjected to fairly rough usage without breaking—a fact not true in the case of cartridges covered with tinfoil. Detonation in the open is transmitted much more readily between cartridges wrapped in paraffined paper than in those covered with tinfoil. The minimum quantity of fulminate necessary to detonate a 50 grm. cartridge of certain explosives is shown as under:—

	Composition.	Minimum Quantity of Fulminate.
(A)	Ammonium nitrate, 95·5 per cent. ..... Trinitronaphthalene, 4·5 per cent......	0·40 grm.
(B)	Ammonium nitrate, 90·5 per cent. ..... Collodion cotton, 9·5 per cent.	0·25 grm.
(C)	Ammonium nitrate, 88 per cent. ...... Nitroglycerin, 12 per cent.	0·20 grm.

No appreciable difference could be detected in transmission of detonation in the open in these three explosives. The addition of potassium chlorate (5 to 10 per cent.), potassium bichromate (2 per cent.), potassium permanganate (2 per cent.), barium nitrate (2 to 5 per cent.), lead nitrate (2 to 5 per cent.), and aniline nitrate (2 to 5 per cent.)

separately to these explosives, made no difference either in sensitiveness or transmission of detonation.

Explosives with Ammonium Perchlorate as a Base.—Specimens of the following composition were investigated :—(D) Ammonium perchlorate (94 per cent.), collodion cotton (6 per cent.). This compound is non-hygroscopic, does not burn in the open in thin layers, and gives results similar to explosive B, mentioned above, in the borehole, and also as regards sensitiveness to and transmission of detonation. B exploded after 9½ hours' heating at 110° C., whereas D was heated for 87 hours without exploding. (E) Ammonium perchlorate (89 per cent.), nitroglycerin (11 per cent.). This compound was heated for 30 hours at 100° C. without appreciable decomposition, but detonates by shock, and is more sensitive in every respect than D. The addition of some 40 per cent. of saltpetre to these explosives was also investigated; but in a damp atmosphere the cartridges were found to be extremely hygroscopic, owing to the formation, by double decomposition, of ammonium nitrate. Since, further, D and E produce free hydrochloric acid on explosion, they are not suitable for use in mines. Cartridges of explosive C separated in the borehole by discs of cardboard up to 9·6 mm. thick, were still found to be completely detonated, and miss-fires are to be traced chiefly to absorption of moisture by the cartridge. Explosive A, when containing 3 per cent. to 4 per cent. of moisture, would not detonate with less than 2·5 grms. of fulminate, but 1·5 grms. of fulminate was found to be sufficient when supplemented by a primer of the non-hygroscopic explosives D and E. An explosive of the following composition was investigated :—(F) Nitroglycerin (31·35 per cent.), collodion cotton (1·65 per cent.), potassium nitrate (67 per cent.) Both in the bomb and the borehole (with fulminate) the residue obtained contained from 38 to 54 per cent. of undecomposed potassium nitrate, thus pointing to very incomplete decomposition.

—G. W. McD.

Dynamite No. 0; Modification of ——. M. Lheure. Mém. des Poudres et Salpêtres, 1903–4, **12**, 46—47.

The explosive consisted of nitroglycerin (68·6 per cent.), collodion cotton (1·4 per cent.), dry wood-meal (30 per cent.). When submitted to continual exposure to damp and alternate freezing and thawing, the explosive, while slightly increasing in bulk, showed no sign of exudation of nitroglycerin. When heated continuously for 24 days at 40° C. no exudation could be detected nor any development of acid products, and the explosive was consequently authorised for manufacture.—G. W. McD.

Dynamite; Four New Types of ——. M. Lheure. Mém des Poudres et Salpêtres, 1903–4, **12**, 51—54.

The following compositions were investigated :—

——	4.	5.	6.	7.
Nitroglycerin	59·00	48·00	39·50	29·00
Collodion cotton	1·50	1·00	..	..
Sodium nitrate	25·00	36·30	43·00	50·35
Cellulose	14·00	14·00	17·00	11·00
Sodium carbonate	0·35	0·45	0·30	0·50
Ochre	0·15	0·25	0·20	0·15
Wheat flour	..	..	..	9·00

When submitted to the tests detailed in the previous abstract, hese explosives were found to be satisfactory. There were, iowever, slight traces of exudation of nitroglycerin, but iot sufficient to prevent authorisation for manufacture.

—G. W. McD.

English Patents.

itrated Cellulose; Manufacture of ——. G. J. Atkins, Tottenham. Eng. Pat. 7058, March 27, 1903.

otton-seed waste (consisting of the husk of the seed and ifts of cotton) is boiled with alkali and bleached "with a olution of a mixture of chloride and oxychloride of sodium r potassium." After purifying and drying, the bleached ellulose material is ready for nitration in the ordinary way.

—G. W. McD.

Nitrocellulose; Manufacture of ——. F. L. Nathan, J. M. Thomson, and W. T. Thomson, of Waltham Abbey. Eng. Pat. 7269, March 28, 1903.

In order to replace the water (left in nitrocellulose after washing) by alcohol, without the use of pressure and in such a manner that a very small amount of dilution of the alcohol with water takes place, the nitrocellulose is first covered with water so that practically all air is excluded. Alcohol is then quietly run down the sides of the vessel so as to form a layer on the surface of the water. A cock at the bottom of the vessel is slightly opened, so that the water slowly flows away at a rate of fall of level in the vessel of half an inch to one inch per hour. The alcohol flows in and replaces the water in the interstices of the nitrocellulose, the treatment being continued until all the water has been displaced by alcohol. When dehydration has thus been completed, the excess of alcohol is removed by pressing or centrifuging.—G. W. McD.

Nitrocellulose Gunpowder; Manufacture of a ——. O. Schmidt, Hassloch. Eng. Pat. 116, Jan. 2, 1904.

Cellulose material is ground to a paste with water under edge runners, and granulated through sieves, the grains being rounded off in a polishing cask and then dried. These grains are converted into nitrocellulose by soaking them in strong nitric acid until they swell and become transparent, after which they are immersed in strong sulphuric acid. After neutralising, purifying, and drying in the ordinary way, the powder is ready for use without the aid of solvents.—G. W. McD.

Explosive; Process of Manufacturing a Safety ——. J. P. O'Donnell, London. From C. W. Frank, Melbourne. Eng. Pat. 23,472, Oct. 29, 1903.

See Fr. Pat. 327,721 of 1902; this J., 1903, 924.—T. F. B.

United States Patents.

Nitrated Carbohydrate. A. Hough, Dover. U.S. Pat. 751,076, Feb. 2, 1904.

The claim is for a highly nitrated carbohydrate, containing about 16·5 per cent. of nitrogen, and having a constitution corresponding to the formula $C_{12}H_{12}(NO_2)_8O_{10}$. Dry finely-powdered maize starch is injected below the surface of a mixture containing 3 parts of nitric acid, 2 parts of sulphuric acid (98 per cent.), and sufficient Nordhausen sulphuric acid (containing 40 per cent. of SO_3) to "bring the nitric and sulphuric acids to 100 per cent. concentration," and leave an excess of 2—3 per cent. of free sulphuric anhydride. A further quantity of the Nordhausen acid is added during the process to maintain the strength of the nitrating liquid. The temperature is maintained at 45°—50° F. The nitrated starch is separated by filtration, and freed from lower nitro-derivatives by treatment with hot dilute ammonia. The finished explosive is an orange-coloured powder, soluble in ether-alcohol. (See also this J., 1902, 1471.)—G. W. McD.

Smokeless Powder, Rod or Grain, and Process of Making same. H. Maxim, New York. U.S. Pat. 753,994, March 8, 1904.

See Eng. Pat. 10,071 of 1899; this J., 1900, 376.—T. F. B.

Match Composition. J. A. Wendel, Milwaukee. U.S. Pat. 754,265, March 8, 1904.

The composition consists of potassium chlorate, 20 parts; antimony sulphide, 10 parts; lead nitrate, 10 parts; amorphous phosphorus, 5 parts; vegetable carbon, 5 parts; potassium bichromate, 3 parts; and glue.—G. W. McD.

French Patents.

Explosive [Slow-burning] for Fuses and the like. W. T. Unge. Fr. Pat. 336,266, Oct. 26, 1903.

For the purpose of rendering fuse powder, &c., less hygroscopic and more elastic, so that discontinuities are not present, the grains of the composition are coated with a very thin layer of a non-volatile oil or fat. In the case of black powder, 0·1—0·3 per cent. of oil or fat is said to be sufficient.

—G. W. McD.

Safety Explosive. E. Steele. Fr. Pat. 336,783, Nov. 18, 1903.

The explosive is prepared by mixing nitrophthalic acid or a nitrated mixture of resin and starch with an alkali chloride, and subjecting the mixture to a feeble gelatinisation by allowing it to fall through the vapour of wood-spirit or ether.—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Shaking and Stirring Apparatus. J. W. Brühl. Ber., 1904, **37**, 918—924.

An apparatus is described by means of which flasks carrying reflux condensers can be shaken and their contents stirred whilst they are being heated.—A. S.

French Patent.

Cream in Milk; Apparatus for Determining ——. F. Billet. Fr. Pat. 336,788, Nov. 19, 1903.

The apparatus consists of a glass cylinder having a mark about half its height, and a second mark a little above the first. The milk is added up to the lower mark, and then water up to the second. The amount of water thus added is about one fourth the volume of the milk, and causes the cream to rise more quickly. The tube is graduated between the two marks, in percentages of cream on the undiluted milk. A vertical blue strip in the side of the cylinder aids the reading of the meniscus.—W. P. S.

INORGANIC—QUALITATIVE.

Hydroxylamine Salts in Qualitative Analysis. N. Tarugi. Gaz. chim. ital., **33**, 449—454. Chem. Centr. 1904, **1**, 836—837. (Compare this J., 1904, 131.)

The author points out further defects in the method proposed by Knoevenagel and Ebler (this J., 1902, 1296). Platinum salts are not reduced to metallic platinum by an ammoniacal solution of hydroxylamine hydrochloride. In dilute solutions, no insoluble compound is produced, whilst in concentrated solutions, the precipitate formed consists of a mixture of different platinum compounds and has a composition varying with the conditions under which the precipitation is effected.—A. S.

INORGANIC—QUANTITATIVE.

Carbon Dioxide; Determination of ——, in Presence of Chlorine. M. Schlötter. Zeits. angew. Chem., 1904, **17**, 301—302.

If a gaseous mixture containing carbon dioxide and free chlorine be shaken with a solution of a hydrazine salt, the chlorine and hydrazine interact to produce hydrochloric acid and free nitrogen, the volume of the latter being half that of the original chlorine. 100 c.c. of the mixtures are collected in a Bunte burette, and after running out the water, hydrazine sulphate solution is introduced and the whole well shaken. More hydrazine solution is run in and the apparatus again shaken. This is continued until no further diminution in volume takes place. The decrease in volume having been read off, the carbon dioxide is determined. This method should be useful in the analysis of electrolytic chlorine.—E. H. T.

Mercury; Determination of Small Quantities of ——. T. W. Richards and S. K. Singer. J. Amer. Chem. Soc., 1904, **26**, 300—302.

A coil of copper wire about 1·5 mm. in diameter, previously polished and cleansed by alkali, acid and water successively, is immersed in about 15 c.c. of the solution containing the mercury, preferably in the form of nitrate. It is advantageous to take out the bulk of the mercury by one coil and to collect the last traces, which are precipitated very slowly, by the immersion of a second similar coil. The best results would probably be obtained by immersing the first coil for 4—5 hours and the second coil for 20 hours. When the precipitation is complete, the coils are washed with water and then with alcohol and dried over calcium chloride. After weighing, the coils are heated in a current of hydrogen at a temperature not much above 350° C., until the mercury is volatilised, and then weighed again.—J. F. B.

ORGANIC—QUANTITATIVE.

Starch Syrups; Examination [Analysis] of ——. A. Rössing. Zeits. öffentl. Chem., **10**, 1—7. Chem. Centr., 1904, **1**, 757.

For the determination of dextrose and dextrin in starch syrups, the following process is recommended. 50 c.c. of a solution containing 40 grms. of the sample per litre, are made up to 250 c.c., and with 25 c.c. (= 0·2 grm.) the direct cupric-reducing power is determined by Allihn's method. 50 c.c. of the original solution (= 2 grms.) are treated with 100 c.c. of a cold saturated solution of barium hydroxide, made up to 200 c.c., well shaken, and allowed to stand for two days in a closed flask at the ordinary temperature. 100 c.c. of the solution are then precipitated with sodium carbonate solution, made up to 200 c.c., filtered, and the reducing power determined with 25 or 50 c.c. of the filtrate. For inversion, Sachsse's method was found to give low results and the following procedure is recommended. 50 c.c. of the original solution are treated with 50 c.c. of water and 15 c.c. of hydrochloric acid of sp. gr. 1·19, and the mixture heated on a boiling water bath for two hours in a flask fitted with a reflux condenser. After cooling, the solution is made nearly neutral, diluted to 250 c.c., and the reducing power determined with 25 c.c. From the diminution of reducing power, *r*, before and after the treatment with baryta water, the percentage of dextrose, D, in the sample is calculated by the following formula, the decrease in the case of pure dextrose being taken as 11·7 per cent. (see this J., 1903, 886)—

$$D = \frac{100\,r}{11{\cdot}7}.$$

The total dextrose after inversion minus D gives the dextrose produced from dextrin, and this multiplied by 0·93 gives the percentage of dextrin in the sample.—A. S.

Malt; Determination of Moisture in ——, by Hoffmann's Apparatus. J. H. Schulze and G. Marienhagen. Woch. Brau., 1904, **21**, 165—166.

Owing to the occasionally anomalous behaviour of malt, when treated in Hoffmann's apparatus for the determination of its moisture (this J., 1902, 1088 and 1903, 655), the following improved procedure is prescribed:—500 c.c. of petroleum are placed in the distillation flask, 100 grms. of whole malt are added thereto and thoroughly agitated, the cooling vessel is then screwed on, filled with cold water, with an asbestos screen between the boiler and condenser, and the measuring tube is placed in position. 25 c.c. of oil of turpentine are placed in the stoppered funnel, and the thermometer is adjusted so as to clear the bottom of the boiler by 1 cm. The temperature is raised to 170° C. in 10 minutes, at first with a large flame, so that 120° C. is reached in three minutes, and subsequently with a small flame. In order to assist the circulation, the flame must not impinge on the centre of the bottom of the boiler, but must be placed to one side, immediately below the dropping funnel. A temperature of 170° C. is maintained for five minutes. The turpentine is then admitted from the funnel, and the temperature is raised to 185°—190° C. in 2—3 minutes. The distillate must be caused to flow in a continuous stream. The volume of water is read off immediately as indicated (*loc. cit.*). For pale malts the volume of water is increased by 0·2 c.c., for dark malts no correction is made, for medium malts 0·1 c.c. is added to the volume of water. For steeped barley the procedure is the same as for raw cereals (*loc. cit.*), but for green malt, after the grain has begun to sprout, the treatment is the same as for pale malt, except that 50 grms. of the sample are taken. Before use, the whole apparatus is rinsed several times with turpentine; all joints are well covered with lubricating oil.—J. F. B.

Alcohol in Dilute Solutions; Determination of ——, by Nicloux's Method. M. E. Pozzi-Escot. Bull. Assoc. Chim. Sucr. et Dist., 1904, 21, 872—876.

The determination of alcohol by the method of Nicloux (this J., 1897, 473 and 941) gives not only ethyl alcohol but aldehyde and all fermentation alcohols, and the author shows that there is doubt as to the precise stage of oxidation reached in the reaction. These results indicate that the method has only a restricted application.

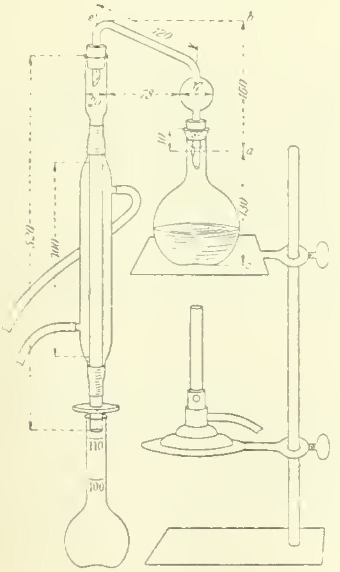
—L. J. de W.

Wheat Flour; Determination of Gliadin in —— by means of the Polariscope. H. Snyder. J. Amer. Chem. Soc., 1904, 26, 263—266.

From 85 to 90 per cent. of the total proteids of wheat flour occur in the form of gliadin and glutenin, the former predominating. Gliadin is soluble in dilute alcohol and glutenin in dilute alkalis. The specific rotatory power of gliadin, $[\alpha]_D = -92°$. The proportion of sugars and optically active non-gliadin proteids extracted by 70 per cent. alcohol is so small as not to interfere with the determination of gliadin by the polariscope. 15·97 grms. of flour are treated with 100 c.c. of 70 per cent. alcohol, and the mixture is shaken moderately at intervals of half an hour for two or three hours; the alcohol is left in contact with the flour for 12—18 hours at a temperature of about 20° C. The solution is then filtered and polarised in the 220 mm. tube. The reading on the sugar scale, when multiplied by the factor 0·2, gives the approximate percentage of gliadin nitrogen in the flour; the results correspond accurately with those of the Kjeldahl method. The results obtained indicate that wheat flour of good quality should contain about 12 per cent. of total proteids (N × 6·25) or 11 per cent. of protein (N × 5·70), of which 55—65 per cent. should be in the form of gliadin.—J. F. B.

Cocoanut Oil in Butter; New Method for Determining ——. E. Polenske. Zeits. Untersuch. Nahr. u. Genussm., 1904, 7, 273—280.

The method proposed depends upon the determination of the volatile insoluble fatty acids which distil over in the ordinary Reichert-Meissl process. The distillation must be carried out under the conditions described; the apparatus employed is shown in the illustration.



Five grms. of the filtered fat are saponified in the usual ay with 20 grms. of glycerol and 2 c.c. of 50 per cent. dium hydroxide solution. An alcoholic solution should t be used, as traces of alcohol may find their way into e filtrate. The soap is then dissolved in 90 c.c. of iled water, acidified with 50 c.c. of dilute sulphuric acid (25 c.c. of acid in 1 litre of water), a few particles of pipeclay or pumice are added, and the distillation proceeded with. The flask holds 300 c.c. The flame should be so regulated that 110 c.c. of distillate are collected in from 19 to 21 minutes, and the condenser water should have a temperature between 18° and 22° C. As soon as 110 c.c. of distillate are obtained, the receiver is removed and replaced by a 25 c.c. cylinder. Without mixing its contents, the receiver is placed in a bath of water at a temperature of 10° C., for 10 minutes, the surface of the water being about 3 mm. above the 110 c.c. mark. The insoluble fatty acids contained in the distillate collect in the neck of the flask. In the case of pure butter they solidify to form white, opaque granules, whilst with pure cocoanut oil, clear oily drops are obtained. Mixtures containing more than 10 per cent. of cocoanut oil also yield oily drops. The contents of the receiver are now mixed, passed through a filter 8 cm. in diameter, and the Reichert-Meissl value determined on the filtrate. The filter is washed three times with 15 c.c. of water, this water being also previously used for washing out the condenser, cylinder, and the receiver. The insoluble fatty acids are then dissolved by pouring three successive quantities of 15 c.c. of 90 per cent. alcohol on the filter. The alcoholic solution obtained is titrated with barium hydroxide solution, using phenolphthalein as indicator. The number of c.c. of N/10 barium hydroxide solution required is termed the "new Butter-value" of the sample of fat under examination. Thirty-one various samples of butter, having Reichert-Meissl values between 23·3 and 30·1, gave "new Butter-values" varying from 1·5 to 3·0, whilst four samples of cocoanut oil, with Reichert-Meissl values from 6·8 to 7·7, yielded "new Butter-values" from 16·8 to 17·8. A considerable number of analyses of mixtures of these two fats are also given, and it is seen from the results that butters giving Reichert-Meissl values between 23 and 27, have "new Butter-values" from 1·6 to 1·9, or, in other words, a rise of 1·0 in the former, causes the latter to increase by 0·1. With Reichert-Meissl values of 28, 29, and 30, the "new Butter-value" increases more rapidly, viz.: 2·2, 2·5, and 3·0. By taking into account the Reichert-Meissl value of the sample, a determination of the "new Butter-value" affords a simple means of detecting the presence or absence of cocoanut oil.—W. P. S.

Aldehydes and Ketones; Determination of —— in Essential Oils and Allied Substances. H. E. Burgess. Analyst, 1904, 29, 78—84.

The method adopted is that described by the author for the determination of citral in lemon oil (this J., 1901, 1176—1182); this method is found to give equally good results with most essential oils containing aldehydes or ketones, and depends on the formation of soluble sulphonates from aldehydes and ketones with neutral sodium sulphite solution. Oils containing a high percentage of aldehyde or ketone are utilised directly, whilst those, like lemon oil, containing small amounts, are subjected to fractionation (*loc. cit.*).

—T. F. B.

Aldehydes, Aromatic and Fatty; Basic Reaction for Detection and Determination of ——. S. S. Sadtler. J. Franklin Inst., 1904, 157, 231—234.

Tiemann has found (see this J., 1899, 169, 1901, 1178) that alkali is liberated by the action of sodium sulphite on an aldehyde, the reaction in the case of citral being expressed by the equation—

$$C_9H_{15}COH + 2H_2O + 2Na_2SO_3 = C_9H_{17}COH(NaSO_3)_2 + 2NaOH.$$

The author proposes to determine aldehydes by titrating the free alkali with N/2 hydrochloric acid. For the determination of citral in lemon oil, from 5 to 10 grms. of the sample are made neutral, if necessary, treated with 25 or 50 c.c. of a 20 per cent. solution of normal sodium sulphite (which has been previously heated on the water-bath), and neutralised by means of N/2 hydrochloric acid in presence of rosolic acid as indicator. The red colour due to free alkali which is produced is discharged with N/2 hydrochloric acid, and the mixture kept hot and well agitated, the titration with acid being continued as long as the red colour is re-formed. Reaction is complete in about half an hour. The reaction is also available for the determination of vanillin, piperonal, and other aldehydes. The phenolic hydroxyl of the vanillin is first neutralised with a little caustic soda, using rosolic acid as indicator, the sodium sulphite added, and the titration with N/2 hydrochloric acid performed in the hot solution. The reaction is complete and immediate with the fatty aldehydes. It will detect a dilution 1 : 1,000,000 of formaldehyde with water. The presence of acetone in wood spirit, and of acetaldehyde in grain spirit may be similarly detected. Acetone and the higher ketones also react with sodium sulphite.—J. O. B.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Mineral containing Radium in the Province of Quebec; Note on ——. J. Obalski. Eng. and Mining J., 1904, **77**, 411.

About 10 years ago the author obtained from a white-mica mine, in the province of Quebec, a specimen of cleveite weighing 375 grms. and containing 70·71 per cent. of uranium oxide. On further examination, the mineral has been found to contain an amount of radium comparable with that contained in the richest pitchblende. Rutherford found that the specimen has a radioactivity "equal to four or five," and that it contains 0·1 mgrm. of radium. Associated with this mineral was a non-coking bituminous coal, the ash of which contains 35·43 per cent. of uranium oxide.—A. S.

Platinum Black; Mechanism of the Catalytic Action of ——. R. Vondráček. Zeits. anorg. Chem., 1904 **39**, 24—40.

From experiments on the decomposition of ammonium nitrite solution in presence of platinum black, the author concludes that the reaction is a periodic one, and that a distinction must be drawn between ordinary platinum black which contains oxygen, and platinum black free from oxygen. In the first stage of the reaction, the ammonia of the ammonium nitrite is oxidised by the platinum black containing oxygen, and in the second stage the platinum black now free from oxygen effects the reduction of the nitrous acid; nitrogen is evolved in both stages of the reaction. (See also this J., 1902, 257; 1903, 1246.)—A. S.

Hydrate of Potassium Hydroxide, $KOH.2\frac{1}{2}H_2O$; A Peculiar Formation of the ——. H. Ditz. Oesterr. Chem.-Zeit., **7**, 53—54. Chem. Centr., 1904, **1**, 709.

On allowing solid caustic potash to remain in contact with purified ether containing water, well-defined crystals of the hydrate $KOH.2\frac{1}{2}H_2O$ form on the bottom of the containing vessel.—A. S.

Zinc Chloride; Specific Gravity of ——. G. P. Baxter and A. B. Lamb. Amer. Chem. J., 1904, **31**, 229—235.

Dry zinc chloride was prepared by heating the pure double zinc ammonium chloride $ZnCl_2, 3NH_4Cl$, first in a current of dry hydrochloric acid, then in nitrogen, and lastly in air. The specific gravity was determined in a modified form of pyknometer by means of toluene, in which zinc chloride is insoluble. The mean value found for the specific gravity of zinc chloride was 2·907.—T. F. B.

Calcium Carbide; New Mode of Formation of ——. H. Moissan. Comptes rend., 1904, **138**, 661—663.

While carbon will only reduce lime and form calcium carbide when the lime is melted (this J., 1904, 185), calcium will combine with finely-divided carbon at a dull red heat. Calcium chloride, fused in a graphite crucible which serves as anode, and electrolysed by a current of 10—15 ampères at 120 volts, with a graphite rod as cathode, yields metallic calcium containing a notable amount of carbide. A better electrolyte is obtained if the calcium chloride be mixed with one-fourth of its weight of calcium fluoride, and the yield of carbide is increased by adding to the bath some coarsely-powdered petroleum coke.
—J. T. D.

Metal Ammoniums; Action of Carbon Dioxide on the ——. E. Rengade. Comptes rend., 1904, **138**, 629—631.

When dry carbon dioxide is passed through sodium-ammonium or potassium-ammonium at temperatures below −50° C., the compound is rapidly whitened, with the production of sodium or potassium carbamate and evolution of hydrogen, $CO_2 + NH_3Na = NH_2CO_2Na + H$. At temperatures above −50° C. there is produced at the same time the formate of the alkali metal at the expense of the nascent hydrogen produced in the above reaction. The quantity of formate produced increases as the temperature is raised above − 50° C.—J. F. B.

Enzyme Action; Studies on ——.—I. Correlation of the Stereoisomeric α- and β-Glucosides with the corresponding Glucoses. E. F. Armstrong. Trans. Chem. Soc., 1903, **83**, 1305—1313.

By the hydrolysis of α-methylglucoside by means of maltase and of β-methylglucoside by means of emulsin, the corresponding stereoisomeric glucoses are formed, the α-compound (the ordinary crystalline glucose) having a high, and the β-compound a low rotatory power. Both α- and β-glucose are unstable in solution, and the changes which take place in a solution of glucose—slowly in simple aqueous solution, but instantaneously in the presence of a small quantity of alkali—are due to the conversion of one form into the other, until a condition of equilibrium is attained. The α- and β-glucoses have a lactonic structure and are identical with the labile α- and γ-glucoses isolated by Tanret (see this J., 1896, 365), whilst the latter's stable β-form of glucose is a mixture of the two labile modifications in the proportions in which they are in equilibrium.

Experiments on the hydrolysis of maltose by means of maltase, and of cane sugar and raffinose by means of invertase, are also described.—A. S.

Glucose; Bi-rotation of ——. R. Behrend and P. Roth. Annalen, 1904, **331**, 359—382.

By a study of the acetyl derivatives of the two modifications of glucose with a high and low optical rotation respectively, the authors confirm the conclusions arrived at by Armstrong (see preceding abstract).—A. S.

Saccharose; Combinations of —— with certain Metallic Salts. D. Gauthier. Comptes rend., 1904, **138**, 638—639.

In 1871 (J. Chem. Soc., **9**, 269) Gill described a compound of saccharose with sodium iodide to which he assigned the formula $2C_{12}H_{22}O_{11}, 3NaI. 3H_2O$. The author has prepared this compound in the same way, obtaining it in the form of prismatic crystals of a large size. His analysis, however, shows that the compound possesses the formula $C_{12}H_{22}O_{11}, NaI, 2H_2O$, thus corresponding with the analogous compounds obtained with potassium and lithium iodides. In a similar manner the author has prepared well crystallised compounds of one molecule of saccharose with one molecule of the thiocyanates (sulphocyanides) of each of the following metals: ammonium ($1·5 H_2O$), potassium ($1H_2O$), sodium ($1H_2O$), and barium ($2H_2O$).—J. F. B.

Aldehydes; General Synthesis of ——. F. Bodroux. Comptes rend., 1904, **138**, 700–701.

The author has greatly improved the yield in his synthesis of aldehydes by the reaction of ethyl orthoformate on aromatic organo-magnesium compounds, by using toluene and other hydrocarbons of the benzene series as solvents for the organo-magnesium compounds—

$$R.MgBr + C_2H_5O.CH.(OC_2H_5)_2 = C_2H_5O.MgBr + R.CH(OC_2H_5)_2$$

$$R.CH.(OC_2H_5)_2 + H_2O + HCl = R.CHO + 2C_2H_5OH + HCl.$$

The organo-magnesium compound is prepared in ethereal solution; toluene is added and the ether distilled off. To the hot liquid ethyl orthoformate is very gradually added. After half an hour, dilute hydrochloric acid is added, the upper layer decanted, washed, and dried, the toluene removed, the residue boiled with dilute sulphuric acid to destroy any acetal, and the aldehyde isolated by means of bisulphite. The following yields have been obtained :—

From	Aldehyde.	Yield per Cent. of Theory.
Benzyl chloride	Phenylacetic	55
α-Bromonaphthalene	α-Naphthoic	70
p-Dibromobenzene	*p*-Bromobenzoic	60
p-Chlorobromobenzene	*p*-Chlorobenzoic	64
Propyl bromide	Butyric	75
Isobutyl bromide	Isovaleric	66

—J. T. D.

yclohexanol [*and Ketohexamethylene*]; *Preparation of* ——. A. F. Holleman. Königl. Akad. Wiss. zu Amsterdam, 1903, 201—293. Chem. Centr., 1904, **1**, 727.

By passing a mixture of phenol vapour and excess of hydrogen over finely-divided nickel heated to 140°—160° C., the author obtained a good yield of cyclohexanol. The latter, by treatment with chromic acid mixture at a low temperature, is oxidised to ketohexamethylene.—A. S.

New Books.

Die Chemie und Technologie der Natürlichen und Künstlichen Asphalte. Ein Handbuch der gesammten Asphalt-Industrie für Fabrikanten, Chemiker, Techniker, Architekten und Ingenieure. Von Dr. Hippolyt Köhler. Friedrich Vieweg und Sohn, Braunschweig. 1904. Price M. 15.

8vo volume, containing preface, table of contents, and ubject-matter filling 417 pages and containing 191 illustrations. The following is a sketch of the contents :—Part I.—I. History, Occurrence, Properties, Formation, and Composition of the Natural and Artificial Asphaltums and Asphalts. II. Occurrence of Asphaltums. III. Views as to the Origin of Bitumens and Asphaltums. IV. The Physical and Chemical Properties, Composition, and Con-tituents of Asphaltums. V. Artificial Asphalt, its Origin, Properties, and Composition. Part II.—Natural Asphal-um, and its Use in Industry, &c. VI. Preparation of Asphalt Powder, and its Use for Mechanical Stamping. VII. Manufacture of Asphalt, Tar, &c., and its employ-ent for Molten Asphalt Work. VIII. Utilisation of Pure sphaltum for other Purposes. Part III.—Artificial sphaltum, and its Use in Industry. IX. Tars, Lacs, astics, and Cements from Artificial Asphaltum. X. and I. Manufacture and Use of Roofing Felt and Tiles, &c. II. Other Uses of Artificial Asphaltum. Part IV.—emical Investigation of Natural and Artificial Asphaltums sphalts), and the Chemico-Technical Testing of Asphalt terials.

ilinschwarz und seine Anwendung in Färberei und Zeugdruck. Von Dr. E. Noelting und Dr. A. Lehne. Zweite, völlig umgearbeitete Auflage. Julius Springer's Verlag, Berlin. 1904. Price M. 8.

o volume, containing 174 pages of subject-matter, with illustrations, the alphabetical index of subjects and hors, and four sheets of dyed specimens. The entire ject is dealt with under the following heads :—I. The mation of Aniline Black : 1. Historical ; 2. Theory of mation ; and 3. Greening of Aniline Black. II. Use Aniline Black in Calico Printing : 1. Aniline Black in vder ; 2. Formation of Aniline Black on the Fibre. Aniline Black on Wool and Silk. IV. Use of Aniline k in Dyeing. V. Investigation of the most important Materials.

Trade Report.

I.—GENERAL.

Annual Meeting of the Association of Chambers of Commerce of the United Kingdom.

At the 44th annual meeting of the Association of Chambers of Commerce, held on March 8, 9, and 10, the following were among the resolutions carried :—

Railway Rates (*Birmingham*).—1. That the trading interests of Great Britain are injuriously affected by the discrepancy between the railway rates for the carriage of goods from foreign towns to the sea, and the rates charged by railway companies in this country ; and that this injury is increased by the advantage given by our railway companies to foreign producers for the conveyance of goods from the outports to the great centres of distribution at lower rates than from the seats of home production.

2. That a memorial be addressed to the President of the Board of Trade praying that he will be pleased to receive a deputation from this Association to urge upon him the desirability of moving for the appointment of a Select Committee to inquire into the question, and to recommend some means for removing the present grievance, either by a readjustment of the railway rates, or by the development of our canals, or by both.

Railway and Canal Traffic (*Leicester*).—That in the opinion of this Association it is desirable that a special department of the Board of Trade should be appointed, with an official who shall have power to initiate inquiries into, and jurisdiction to deal with, complaints against railway and canal companies in reference to rates and conditions affecting traffic, and that a cheaper and more expeditious tribunal for dealing with such complaints on the part of traders should be substituted for the Railway Commission, the local county courts being suggested for this purpose.

Canal Development (*Manchester*).—In view of the heavy disability imposed upon the industries and commerce of the United Kingdom by the excessive cost of inland transport, and of the neglect into which the waterways of the country have fallen, this Association earnestly calls upon His Majesty's Government to take steps for the purpose of the full utilisation, the co-ordination, and the extension of British and Irish canals, either by the establishment of public canal trusts or by some other method of creating an efficient national system of cheap inland water transportation.

Minister of Commerce (*Bradford*).—That this Association expresses its satisfaction at the appointment of a departmental committee "to consider the position and duties of the Board of Trade and the Local Government Board, and to report whether any, and, if so, what alterations should be made in the constitution and status of these bodies; also whether, in the interests of administrative efficiency, any rearrangement of duties between these Departments and other Government Departments is desirable," and trusts that the deliberations of the committee will result in the organisation of a suitable Department to deal with the commercial and industrial interests of this country, such Department to be presided over by a Minister of Commerce, whose position shall be equal to that of His Majesty's Secretaries of State, as has been repeatedly urged by this Association for upwards of 30 years.

Philosophical and Scientific Apparatus for Colleges, &c. : U.S. Customs Decisions.

An exhaustive decision was rendered by the Board of General Appraisers, January 12, 1904, on a large variety of articles imported by societies or institutions incorporated solely for religious, philosophical, scientific, or literary purposes, as specified in paragraph 638 of the present Tariff Act. After noting the principal decisions of the United States courts on this subject, and the fact that many articles formerly used exclusively for scientific purposes now find extended use in trades and commerce, a review of the various provisions of all the tariffs of the United States is presented. Beginning in 1790 with the first American Congress, it was enacted that philosophical apparatus specially imported for any seminary of learning should be free of duty. The Act of 1792 continued this exemption, while the next general Act of 1816 widened the field of free importation, while the Act of 1824 extended the privilege to schools and colleges. The Acts of 1841 and 1842 enumerated the classes of articles on which no duty was to be levied, while the same broad policy was observed in all subsequent tariff acts since enacted, with exceptions only in those of 1846 and 1864, at the time of the Mexican and Civil War, when the needs of the Government were great. In 1894 the word "utensil" first appears in the law, which covers many articles not strictly scientific in character.

The Board held that a number of laboratory articles specified in the decision were free of duty when imported according to the regulations of the Treasury Department. —R. W. M.

II.—FUEL, GAS, AND LIGHT.

Gas, Coke, Tar and Ammonia Products in America in 1902.

Eng. and Mining J., March 10, 1904.

In making its annual canvass of the coal-mining and coke making industries for 1902, the United States Geological Survey has extended its inquiries in order to cover all plants producing gas and coke from coal and covering tar and ammonia. The final report will appear in "The Mineral Resources" for 1902, and the following is an abstract of some of the more important data in advance of its publication :—

In 1902 the returns from 533 companies, including the operations of 1,665 by-product coke-ovens, show that 5,015,511 tons of coal were carbonised, which yielded 30,764,625,332 cb. ft. of gas. Of this product 29,079,073,555 cb. ft. were sold, leaving 1,685,551,777 cb. ft. lost or unaccounted for. About 2,000,000 tons of the total coal carbonised were used in by-product ovens.

The aggregate value of all the products obtained from the distillation of coal in gas works or retort ovens in 1902 was 43,869,440 dols. About two-thirds of this amount, or 29,342,881 dols., represented the value of the gas produced. The value of the coke produced was 11,267,608 dols., while the tar was worth, at the works, 1,873,966 dols. Most of the ammonia produced was sold in the form of ammoniacal liquor. The total quantity sold was 49,490,609 galls., and was worth, at the works, 1,065,300 dols. In addition to this there was an actual production of 11,276,502 lb. of sulphate, which sold for 319,685 dols.

Comparatively little progress in the manufacture of chemical products from coal-tar has been made in America. The coal-tar produced in 1902 was worth at first hand 1,873,966 dols. In the fiscal year ended June 30, 1902, the coal-tar products imported into the United States were worth, at points of shipment, 7,494,340 dols. Including duty, freight, and other costs, their value in the wholesale markets of America probably amounted to about 12,000,000 dols. in all.

Coke : U.S. Customs Decision.

Feb. 5, 1904.

Coke is not free of duty under the Act of Congress approved January 15, 1903, which makes free of duty "all coal of every form and description," since coke is not coal, but a distinct article prepared therefrom.—R. W. M.

Wood Charcoal ; U.S. Customs Decision.

Feb. 29, 1904.

Wood charcoal is dutiable at 20 per cent. *ad valorem* under section 6, as "a manufactured article unenumerated," and not at 35 per cent. *ad valorem* as an "article composed of carbon," under paragraph 97.—R. W. M.

III.—TAR PRODUCTS, PETROLEUM, Etc.

Creolin Pearson : U.S. Customs Decision.

Jan. 19, 1904.

Following a decision of the United States Circuit Court, it was held that creolin pearson is dutiable at 20 per cent. *ad valorem* under paragraph 15 of the present Tariff Act, as a "preparation of coal tar not a colour or dye and not medicinal." The assessment of duty at 25 per cent. *ad valorem* as a "medicinal preparation" under paragraph 68 was overruled.—R. W. M.

Bleacher's Blue : U.S. Customs Decision.

Certain liquid blue was assessed for duty at 30 per cent. *ad valorem* as a "coal tar," under paragraph 15 of the present tariff. This action was sustained by the Board of General Appraisers. On appeal to the United States Circuit Court this decision was reversed and the claim of the importer that it was dutiable at 20 per cent. *ad valorem* under the same paragraph as a "preparation of coal tar not a colour or dye" was sustained.—R. W. M.

Petroleum Field in Russia.

Eng. and Mining J., March 17, 1904.

Explorations have been carried on for some time in the district of Berkeh, about 250 kilometres from Baku, and as they have been attended with success, active production is expected in the near future. It is intended to ship the crude oil to Baku for refining.

IV.—COLOURING MATTERS, Etc.

Indigo Crop of India.

U.S. Cons. Rep., No. 1893, *March* 5, 1904.

The season in Bengal opened unfavourably in the seven indigo-growing districts, the rainfall being very insufficient, but later good rain fell, and thenceforward conditions were favourable. The area continues to contract, the estimate for the year being 249,700 acres, compared with 255,500 acres sown last year. The exports in each of the last three years have been :—

From	1900 1.	1901 2.	1902 3.
	Cwts.	Cwts.	Cwts.
Calcutta	71,637	55,038	29,403
Madras	18,745	25,056	32,242
Bombay	5,322	3,015	2,295
Karachi	6,593	6,297	1,437

Alizarin Blue : U.S. Customs Decision.

Feb. 29, 1904.

The Board of General Appraisers held the following dyestuffs to be free of duty as "dyes derived from alizarin or from anthracene," under paragraph 469 of the present tariff :—Alizarin Blue S A E, Alizarin Blue B A, Alizarin Blue E A, Alizarin X.—R. W. M.

VII.—ACIDS, ALKALIS, Etc.

Nitrate Deposits in Tunis.

Eng. and Mining J., March 17, 1904.

What is believed to be an extensive deposit of a good quality of nitrate of soda, fit for mining, has been discovered east of Timimum, near the Feggaguira oasis. Other discoveries of equal importance have been made lately in the so-called south oasis of the Sahara in Tunt, Gurara, and Tidikelt, by military attachés. Unfortunately these deposits are remote from adequate transportation facilities that would make them of commercial value. It is intimated, however, that the completion of the Trans-Senegal Railway, now being constructed along the Zousfana river, may aid materially in developing the nitrate beds.

CRYOLITE: U.S. CUSTOMS DECISION.

Feb. 4, 1904.

Artificial cryolite, which, like the native mineral, is a fluoride of aluminium and sodium, is free of duty as "cryolite or kryolith," under paragraph 538 of the present Tariff Act. The action of the Customs authorities at Milwaukee, in assessing duty at 25 per cent. *ad valorem* under paragraph 3, as a "chemical salt," was overruled on the ground that the naming of the article in paragraph 538 is a more specific provision than the general term used in paragraph 3.—R. W. M.

BARIUM CARBIDE: U.S. CUSTOMS DECISION.

March 4, 1904.

The Board of General Appraisers held that barium carbide is dutiable at 25 per cent. *ad valorem* as a "chemical salt" under paragraph 3 of the present tariff, and not at 5·25 dols. per ton as "manufactured barytes" under paragraph 44.
—R. W. M.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

FIRE CLAY: U.S. CUSTOMS DECISION.

Feb. 1, 1904.

Fire clay in granulated form was held to be duitable at 1 dol. per ton, as "clay unwrought" under paragraph 93 of the present Tariff Act, and not at 2 dols. per ton as "clay wrought," under the same paragraph. The evidence showed that the crushing to produce granulation was only for the purpose of convenience of transportation.—R. W. M.

X.—METALLURGY.

COPPER, GOLD, AND ASBESTOS DISCOVERIES IN CANADA.

U.S. Cons. Rep., No. 1904, *March* 18, 1904.

The discovery is announced of nickeliferous copper in large quantities in Cape Breton Island. The ore body is reported to be between 270 and 280 feet wide, carries gold and silver, and contains high values in copper and gold. t is said that the property will prove to be among the argest copper mines in the world. New gold findings at oplar Creek, British Columbia, and an important discovery of asbestos in Addington County, Ontario, are also eported.

LODE-TIN; DISCOVERY OF ——, IN QUEENSLAND.

Eng. and Mining J., March 17, 1904.

In the *Australian Mining Standard*, Dec. 10, 1903, formation is given of the development of new tin deposits the vicinity of Reid's Creek, Queensland. The ore curs in veins cutting granite and slate, and, in places, is ry rich. From one vein, 9 ft. wide, material has been ken out which yielded 18 per cent. of black tin, while ether vein of still larger size also carries rich ore. veral properties are now under development, and the gher-grade ore is being transported in waggons to vinebank for crushing.

LEAD-ZINC DEPOSIT IN GERMANY.

Eng. and Mining J., March 17, 1904.

t is reported that a large deposit of lead-zinc ore has n found near Loutzen, south-west of Aachen, Germany. e deposit has been proved by boring operations, and will developed in the near future.

METALLIC MANGANESE: U.S. CUSTOMS DECISION.

Feb. 5, 1904.

Best metallic manganese without carbon, 96—98 per c t.," and valued at about 1,200 dols. per ton, is dutiable a 0 per cent. *ad valorem* as a "metal unwrought," under p graph 183 of the present tariff. The claim of the in orter for assessment of duty at 4 dols. a ton as "ferromanganese," under paragraph 122, was overruled, as an analysis showed that it was metallic manganese, and not ferromanganese.—R. W. M.

RUTILE: U.S. CUSTOMS DECISION.

Feb. 3, 1904.

Certain rutile was assessed for duty at 20 per cent. *ad valorem*, under paragraph 183 of the present tariff, as a "metallic mineral substance in a crude state." An analysis of the sample showed it to be native impure titanic oxide, and not a metal. The Board of General Appraisers sustained the claim of the importer that it was free of duty as a "crude mineral substance," under paragraph 614.
—R. W. M.

MINERAL PRODUCTION OF CANADA IN 1903.

Eng. and Mining J., March 10, 1904.

The preliminary statement of the mineral production of Canada in the year 1903, which is prepared by the Section of Mines of the Geological Survey, is as follows:—

Product.		Quantity.	Value.
METALLIC.			Dols.
Copper	Lb.	43,281,158	5,728,261
Gold	..	..	18,834,490
Iron ore (exports)	Tons	358,233	922,571
Pig iron from Canadian ore	..	42,052	707,838
Lead	Lb.	18,000,000	762,660
Nickel	„	12,505,510	5,002,204
Silver	Oz.	3,182,000	1,700,779
Zinc	Lb.	900,000	48,600
Total metallic		..	33,707,403
NON-METALLIC.			
Actinolite	Tons	550	3,108
Arsenic	..	257	15,420
Asbestos	..	31,780	891,033
Asbestic	„	10,548	13,819
Chromite	„	3,383	33,830
Coal	„	7,996,634	15,957,946
Coke	„	544,132	1,663,725
Corundum	„	No returns	..
Feldspar	„	13,228	18,666
Fireclay	„	2,317	2,505
Graphite	„	738	23,745
Grindstones	„	5,538	48,302
Gypsum	„	307,489	384,259
Limestone for flux	„	277,452	259,244
Manganese ore (exports)	„	135	1,889
Mica	..	..	159,473
Mineral pigments—			
Baryta	Tons	1,163	3,931
Ochres	„	6,226	32,440
Mineral water	..	..	100,000
Moulding sand	Tons	3,568	7,256
Natural gas	..	..	168,900
Peat	Tons	1,100	3,300
Petroleum	Bbl.	461,336	922,672
Phosphate	Tons	1,329	8,214
Pyrites	„	33,530	126,133
Salt	„	53,537	334,088
Talc	„	688	2,064
Tripolite	„	835	16,700
Total non-metallic		..	21,202,062
STRUCTURAL MATERIALS AND CLAY PRODUCTS.			
Cement, natural rock	Bbl.	92,252	75,665
„ Portland	„	627,741	1,090,842
Granite	..	..	150,000
Pottery	..	..	200,030
Sands and gravels (exports)	Tons	355,792	124,006
Sewer pipe	..	..	317,970
Slate	..	..	22,040
Terra-cotta, pressed brick, &c.	..	..	386,532
Building material, including bricks, building stone, lime, tiles, &c.	..	..	5,650,000
Total structural materials and clay products		..	8,017,045
Estimated value of mineral products not returned		..	300,000
Total, 1903		..	63,226,510

The tons used in this statement are short tons, of 2,000 lb. The average prices used in computing values of metals are: Silver, 53·45 c.; copper, 13·235 c.; nickel, 40 c.; lead, 4·237 c. The coke reported is all oven coke; gas coke is not included.

The total production of pig iron in Canada in 1903, from Canadian and imported ores, amounted to 297,885 tons, valued at 3,742,710 dols., of which it is estimated 42,052 tons, valued at 707,838 dols., should be attributed to Canadian ore, and 255,833 tons, valued at 3,034,872 dols., to the ore imported.

The value of the total mineral production reported for 18 years past has been as follows:—

	Dols.		Dols.
1886	10,221,255	1895	20,648,964
1887	11,321,331	1896	22,584,513
1888	12,518,894	1897	28,661,430
1889	14,013,913	1898	38,697,021
1890	16,763,353	1899	49,584,027
1891	18,976,616	1900	64,618,268
1892	16,628,417	1901	66,339,158
1893	20,035,082	1902	63,885,999
1894	19,931,158	1903	63,226,510

The remarkable increase in the period from 1898 to 1900, inclusive, was due to the gold discoveries in the Yukon.

The main feature presented by the mineral industry of Canada as a whole consists in the decrease in the grand total of production of a little over 1 per cent. in comparison with the figures for 1902. A comparison of the items for two years shows the reason for this falling-off. The shrinkage in the production of the Yukon placer goldfields accounts for 2,250,000 dols. of the total diminution of over 2,500,000 dols. in the gold output of the country. This is augmented by over 1,000,000 dols. decrease in the values of the output credited to others of the metallic class, pig iron, silver, lead, and nickel. To offset this the copper, iron ore, and zinc industries exhibit increases, aggregating nearly 1,500,000 dols., leaving a minus amount of a little over 2,000,000 dols., against the metallic class as a whole, equivalent to 5·8 per cent.

Advances were shown in several of the non-metallic class, notably in coal and coke, limestone, mica, salt, cement, and in some of the clay products. The total growth in all the non-metallics showing increases amounted to nearly 2,000,000 dols., the advance in the coal and coke output accounting for over 1,600,000 dols. of this. As against these non-metallic industries showing increases, decreases are exhibited in the values of the production in asbestos, natural gas, petroleum, and a number of others, aggregating about 500,000 dols., leaving a net gain in this class of somewhat under 1,500,000 dols., or a little over 5 per cent., to offset the above-mentioned falling off in the metallic class, the final difference in the grand totals for the two years amounting to nearly 660,000 dols., or a proportional decrease of about 1 per cent.

Exports.—The following table shows the chief items of minerals exported during the year:—

Product.		Quantity.	Value.
			Dols.
Arsenic	Lb.	395,573	10,583
Asbestos	Tons	31,780	891,033
Coal	„	1,954,629	5,219,860
Gold in all forms	..	..	17,566,540
Copper, fine, in ore, &c.	Lb.	37,039,175	3,702,368
„ black or coarse, &c.	„	203,701	25,226
Lead in ore, &c.	„	18,621,303	426,166
Nickel in ore, matte, &c.	„	12,699,227	1,116,099
Platinum in ore, concentrates, &c.	Oz.	283	304
Silver in ore, &c.	..	3,360,192	1,989,474
Mica	Lb.	956,244	186,020
Iron ore	Tons	368,233	922,571
Graphite, crude	Cwt.	8,235	26,230
Pyrites	Tons	21,067	59,604

The gold exported was chiefly in the form of gold dust, nuggets, and the like, or contained in ores.

ZINC SHEETS, NICKEL-PLATED: U.S. CUSTOMS DECISION.

Jan. 29, 1904.

A decision of the United States Circuit Court rendered holds that zinc in sheets, nickel-plated, is dutiable at 45 per cent. *ad valorem*, as an "article composed wholly or in part of nickel, zinc, &c.," under paragraph 193 of the present Tariff Act, and not as "zinc in sheets," at 2 cents per lb., under paragraph 192.—R. W. M.

XII.—FATS, FATTY OILS, Etc.

OLIVE OIL: U.S. CUSTOMS DECISION.

Feb. 3, 1904.

An olive oil in tins, invoiced as for machinery purposes, and which was found on analysis to contain 2·63 per cent. of free fatty acid, is dutiable at 50 cents per gallon. The oil was valued at over 60 cents per gallon, which is the limit of value at which olive oil can be entered free of duty for mechanical or manufacturing purposes.—R. W. M.

WAX; JAPAN ——.

Chem. and Druggist, March 19, 1904.

The exports of Japan wax from Japan during the 12 months ending December were as follows:—

——	1901.	1902.	1903.
Kin	4,049,300	4,216,000	3,521,400
Yen	610,000	790,000	1,064,000

NOTE.—Kin = 1·3 lb. Yen = 2*s.* 0½*d.*

COCOANUT STEARINE AND VEGETABLE TALLOW: U.S. CUSTOMS DECISION.

March 1, 1904.

Cocoanut stearine and vegetable tallow were held to be dutiable at 3½ cents per lb. as "cocoa butterine." (See this J., 1903, 832).—R. W. M.

XIII. A.—PIGMENTS, PAINTS, Etc.

PRINTING COLOUR (DRUCKFARBE): U.S. CUSTOMS DECISION.

Feb. 17, 1904.

An article of the above name consisting of powdered metallic aluminium mixed with oil and turpentine, was decided by the Board of General Appraisers to be dutiable at 30 per cent. *ad valorem* as a "paint" under paragraph 58 of the present tariff. The claim of the importer, who stated that it was used in printing cloth, that it was dutiable at 25 per cent. *ad valorem* as "ink" under paragraph 26, was overruled.—R. W. M.

XIV.—TANNING; LEATHER; GLUE, Etc.

BONE SIZE: U.S. CUSTOMS DECISION.

Feb. 5, 1904.

Following a decision of the United States Circuit Court, bone size is dutiable at 20 per cent. *ad valorem*, under section 6 of the present tariff, as a "manufactured article unenumerated," and not at 2½ cents per lb. under paragraph 23 as "glue valued at not over 10 cents per lb."
—R. W. M.

SIZING: U.S. CUSTOMS DECISIONS.

Feb. 5, 1904.

Sizing composed of ordinary and soluble starch 12·40 per cent., dextrine and soluble gum 9·04 per cent., gluten 1·77 per cent., zinc and sodium chlorides 0·77 per cent., and water 76·02 per cent., is dutiable at 25 per cent. *ad* valorem, under paragraph 3 of the present Tariff Act as a "chemical compound." Owing to the fact that this classification was not claimed by the importer in the protest, the assessment of duty at 1½ cents per lb. under paragraph 285 was affirmed.—R. W. M.

XV.—MANURES, Etc.

TANKAGE: U.S. CUSTOMS DECISION.

The Treasury Department holds that tankage, the refuse of slaughter-houses, is free of duty as a "substance used only for manure," under paragraph 569 of the present Tariff Act. The view is also expressed that the provision of this paragraph includes not only manures but substances used in combination with other materials in making manure.
—R. W. M.

XVII.—BREWING, WINES, SPIRITS, Etc.

WINE TRADE OF GERMANY.

U.S. Cons. Reps., No. 1904, *March* 18, 1904.

During 1903 Germany imported wine valued at 14,016,490 lols. and exported to the value of 5,977,132 dols. Of the otal, 6,459 cwt. came from, and 85,518 cwt. was sent to the Jnited States.

ALCOHOL PRODUCTION OF GERMANY IN 1903.

U.S. Cons. Reps., No. 1896, *March* 9, 1904.

A poor potato crop in 1902 caused a considerable curailment of the alcohol production in Germany during the eason of 1902-3, only 89,372,183 gallons being produced, is against 112,110,842 gallons in 1901-2 and 107,229,799 allons in 1900-1, so that the order of the alcohol trust to urtail the production was superfluous.

XVIII. A.—FOODS

FOOD PRODUCTS; STANDARDS OF PURITY FOR ——.

Times, March 28, 1904.

By an Act of Congress passed in 1902 the United States linister of Agriculture was authorised to establish stanards of purity for food products. This he has now done, fter taking the counsel and advice of experts and official odies. The information is issued for the guidance of the fficials of the various States and of the Courts of Justice. leat is defined as any sound, dressed, and properly preared edible part of animals in good health at the time of aughter. Fresh meat is meat from animals recently aughtered or preserved only by refrigeration. Salted, ckled, and smoked meats are unmixed meats preserved by lt, sugar, vinegar, spices, or smoke, singly or in combinan. Lard is defined as the rendered fresh fat from ughtered healthy hogs. Leaf lard is that rendered at derately high temperatures from the internal fat of the domen of the hog, excluding that adherent to the intestes. Neutral lard is lard rendered at low temperatures. ndard lard must be free from rancidity and contain not re than 1 per cent. of substances, other than fatty acids, t fat. Milk is the lacteal secretion obtained by the comte milking of one or more healthy cows, properly fed and t, excluding that obtained within 15 days before and five s after calving. Standard milk must contain not less n 12 per cent. of total solids and not less than 8·5 per t. of solids not fat, nor less than 3·25 per cent. of milk f. Skim milk is milk from which a part or all of the c am has been removed, and standard skim milk must c tain not less than 9·25 per cent. of milk solids. Cream i efined as that portion of milk, rich in butter fat, which r s to the surface of milk on standing, or is separated f n it by centrifugal force. Standard cream must contain o less than 18 per cent. of milk fat. Butter is defined as tl product obtained by gathering in any manner the fat of fr h or ripened milk or cream into a mass, which also contains a small portion of the other milk constituents, with or without salt. By two Acts of Congress passed in 1886 and 1902 butter may also contain additional colouring matter. Standard butter is butter containing not less than 82·5 per cent. of butter fat. Renovated or process butter is the product obtained by melting butter and reworking, without the addition or use of chemicals or any substances except milk, cream, or salt. Standard renovated or process butter is that containing not more than 16 per cent. of water and at least 82·5 per cent. of butter fat. Cheese is defined as the solid or ripened product obtained by coagulating the casein of milk by means of rennet or acids, with or without the addition of ripening ferments and seasoning. By Act of Congress, 1896, cheese may also contain additional colouring matter. Whole-milk or full-cream cheese is cheese made from milk from which no portion of the fat has been removed. Skim-milk cheese is cheese made from milk from which any portion of the fat has been removed. Cream cheese is cheese made from milk and cream, or milk containing not less than 6 per cent. of fat. Standard whole-milk cheese or full-cream cheese must contain in the water-free substance not less than 50 per cent. of butter fat. Whey is the product remaining after the removal of fat and casein from milk in the process of cheese-making. Kumiss is mare's or cow's milk, with or without the addition of sugar (sucrose), which has undergone alcoholic fermentation. Standards are also established for sugar and sugar products, glucose products, condiments, and beverages.

XX.—FINE CHEMICALS, Etc.

RADIUM.

Times, March 21, 1904.

At the request of the Academy of Science, the Austrian Minister of Agriculture, in order to facilitate the solution of certain important questions relating to the nature of radium, has ordered that from January 1 last until further notice no trading should be permitted in the residues from the manufacture of uranium colours at Joachimsthal, and that 10,000 kilogrammes of those residues should be reserved for purchase by the Academy and another 10,000 kilogrammes for M. Curie. These consignments are to be devoted entirely to the purpose of scientific experiment.

CAMPHOR; EXPORTS OF ——, FROM JAPAN.

Chem. and Druggist, March 18, 1904.

According to statistics which have been issued by the Board of Trade, the exports of camphor from Japan during the twelve months ending December were as follows:—

—	1901.	1902.	1903.
Kin	4,165,757	3,953,211	3,985,364
Yen	3,905,000	3,405,000	3,538,000

Note.—Kin = 1·3 lbs. Yen = 2*s*. 0⅓*d*.

CINCHONA; EXPORTS OF ——, FROM JAVA.

Chem. and Druggist, March 26, 1904.

The following table gives the exports of Cinchona from Java for the years 1899—1903:—

—	1899.	1900.	1901.	1902.	1903.
Private plantations (Amst. lbs.)	9,752,639	9,366,596	12,018,397	12,575,676	12,947,742
Government plantations (Amst. lbs.)	659,657	660,975	758,796	943,259	808,581
Total exports	10,412,296	10,027,571	12,777,193	13,518,935	13,756,323

CERIUM OXALATE AND HELIOTROPIN: U.S. CUSTOMS DECISIONS.

Feb. 5, 1904.

Cerium oxalate is dutiable at 25 per cent. *ad valorem* as a "medicinal preparation" under paragraph 68 of the present tariff, and not free of duty as "cerium" under paragraph 518. Heliotropin is dutiable at the same rate under paragraph 3, as a "chemical compound," and not free of duty as a "crude vegetable substance" under paragraph 617.—R. W. M.

HYDROQUINONE: U.S. CUSTOMS DECISION.

Feb. 10, 1904.

Chemically pure hydroquinone was assessed for duty at 25 per cent. *ad valorem*, under paragraph 68 of the present tariff act, as a "medicinal preparation." The Board of General Appraisers, following a decision of the United States Circuit Court, sustained the claim of the importers that it was dutiable at 20 per cent. *ad valorem*, as a "preparation of coal tar, not a colour or dye," under paragraph 15.—R. W. M.

PARALDEHYDE: U.S. CUSTOMS DECISION.

March 3, 1904.

The Board of General Appraisers held that paraldehyde, prepared from aldehyde by the action of a mineral acid, was dutiable at 55 cents per lb. as a "medicinal preparation in the preparation of which alcohol is used," under paragraph 67 of the present tariff act. The evidence showed that, while paraldehyde is prepared from aldehyde, the latter is obtained by the oxidation of alcohol, either directly or in the manufacture of spirits. The claims of the importer that it is dutiable at 25 per cent. as a "chemical compound" under paragraph 3, or at the same rate as a "non-alcoholic medicinal preparation" under paragraph 68 were overruled.—R. W. M.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.], "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 6239. Morison. Condensing apparatus. March 14.

,, 6437. Macgregor and Pearson. Centrifugal machine for drying peat or like material. March 16.

,, 6444. Ancel. Crushing and pulverising machine. [Belgian Appl., Oct. 7, 1903.]* March 16.

,, 6548. Brooke. Furnaces. March 17.

,, 6727. Davidson. Furnaces.* March 19.

,, 6781. Foster. Multiple effect evaporators. March 21.

,, 6800. Warwick. Grinding machines.* March 21.

,, 6823. Murphy. Furnaces. March 21.

,, 6855. Jensen (White-Mylin Furnace Co.). Furnaces.* March 21.

,, 7010. Haack, and Sührter Maschinen-Fabr. vorm. H. Hammerschmidt. Vacuum drying apparatus. March 23.

,, 7078. Reeves and Bramwell. Apparatus for filtering liquids. March 24.

,, 7187. Perrett. Filters March 25.

,, 7204. Bokelberg and Sachse. Continuous vacuum distillation of fats, oils, tars, and the like.* March 25.

,, 7210. Justice (Telluride Reduction Co.). System of and apparatus for filtering liquids. March 25.

,, 7258. Wright and Lennox. Filters. March 26.

[C.S.] 6087 (1903). Knudsen. Apparatus for liquefying air and other gaseous fluids. March 23.

,, 6599 (1903). Brownlow. Filters. March 30.

,, 8061 (1903). Mehnert and Pape. Filters. March 30.

,, 8847 (1903). Beaven. Furnaces for malt and other kilns and drying apparatus. March 30.

,, 9606 (1903). Claudel. Process and apparatus for the gasification of combustible liquids. March 23.

,, 12,984 (1903). Slama. Apparatus for the continuous distillation of hydrocarbons, fatty acids, &c., and steam superheating apparatus therefor. March 23.

,, 15,955 (1903). Grupe. Rotary driers. March 30.

,, 28,328 (1903). Knight. Filters. March 23.

,, 28,518 (1903). Moll. Process and apparatus for evaporating weak brine. March 23.

,, 1503 (1904). Rockwell. Rotary furnaces. March 23.

,, 1975 (1904). Voiry and J. de la Fresnaye et Cie. Process and apparatus for the distillation of volatile liquids. March 23.

,, 4011 (1904). Von Szathmáry. *See under* XVII.

II.—FUEL, GAS, AND LIGHT.

[A.] 6162. O'Brien. Composition for improving the illuminating power and destroying the smoke and smell of burning oils or gas. March 14.

,, 6264. Nyren. Purifying gas for the removal of sulphur or sulphur compounds therefrom. March 15.

,, 6302. Loomis and Pettibone. Manufacturing wood gas.* March 15.

,, 6303. Loomis and Pettibone. Manufacturing producer gas.* March 15.

,, 6308. Kennedy. Treatment of peat, and apparatus therefor. March 15.

,, 6314. Green and Martin. Process of consolidating peat.* March 15.

,, 6335. Thuman. Water-gas apparatus. March 15.

,, 6527. Thompson (Moore). Process and apparatus for quenching and bleaching coke.* March 17.

,, 6540. Brookes (Makeever). Means and apparatus for use in treating and enriching gas.* March 17.

,, 6719. Talbot and Mond. Gas producers. March 19

,, 6837. Wise. Liquid fuel, and the manufacture of products pertaining thereto. March 21.

,, 6860. Cutler, Cutler, and Cutler. Gas purifiers March 21.

,, 6957. Bowing. Treatment of coal and other carbonaceous materials for the production of ga and coke or other carbonised substances March 22.

,, 6959. Levis (Gen. Electric Co.). Filaments, and methods of manufacturing the same. March 22.

,, 6960. Levis (Gen. Electric Co.). Filaments, an methods of manufacturing the same. March 22

[A.] 6972. Gerard and Fiedler. Electrodes for arc lamps. March 22.

,, 6981. Kennedy. Gas producers. March 23.

,, 6999. Forster. Gas producers and like apparatus. March 23.

,, 7079. Whitworth. Gas producers. March 24.

,, 7145. Imray (Pintsch). Bunsen burners. March 24.

,, 7298. Fleming. Arc-lamp electrodes. [U.S. Appl., March 26, 1903.]* March 26.

,, 7299. Fleming. Arc-light electrodes, and method of making same. [U.S. Appl., March 26, 1903.]* March 26.

[C.S.] 6090 (1903). Burschell. Method of removing sulphuretted hydrogen from gases with simultaneous recovery of sulphur. March 23.

,, 9606 (1903). Claudel. *See under* I.

,, 10,852 (1903). Grundy. Manufacture of incandescent mantles. March 30.

,, 17,327 (1903). Von Bauer. Coke ovens. March 30.

,, 23,045 (1903). Good and Spencer. Apparatus for the purification of coal-gas. March 30.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 6302. Loomis and Pettibone. *See under* II.

,, 6554. McClelland and Risk. *See under* XII.

,, 6891. Zimpell. Saturator for the recovery of sulphate of ammonia from ammonia gases.* March 22.

,, 7204. Bokelberg and Sachse. *See under* I.

[C.S.] 10,004 (1903). Heber. *See under* XIII B.

,, 12,984 (1903). Slama. *See under* I.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 6217. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of colour lakes from sulphur dyestuffs. March 14.

,, 6225. Johnson (Badische Anilin und Soda Fabrik). Manufacture of indoxyl and its derivatives. March 14.

,, 6226. Johnson (Badische Anilin und Soda Fabrik). Manufacture of indigo white. March 14.

,, 6552. Imray (Meister, Lucius und Brüning). Manufacture of blue sulphurised dyestuffs. March 17.

,, 6741. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of nitro derivatives of certain aromatic bases. March 19.

,, 6839. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matter, and lakes therefrom. March 21.

,, 6840. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matter from *o*-chlor-*p*-toluidine and β-naphthol, and of lakes therefrom. March 21.

, 7040. Cosway and The United Alkali Co., Ltd. Manufacture of blue sulphur dyes. March 23.

, 7041. Cosway and The United Alkali Co., Ltd. Manufacture of blue-black to black sulphur dyes. March 23.

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Vice-Chairman: G. W. Slatter.

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H. R. Procter.
F. W. Richardson.
Geo. Ward.
H. A. Watson.
Thorp Whitaker.
J. B. Wilkinson.

Hon. Local Secretary and Treasurer:
T. Fairley, 17, East Parade, Leeds.

The following take office in Sept. next:—*Chairman:* H. B Procter. *Committee:* W. Ackroyd, J. E. Bedford, F. Branso B. A. Burrell, and A. Smithells.

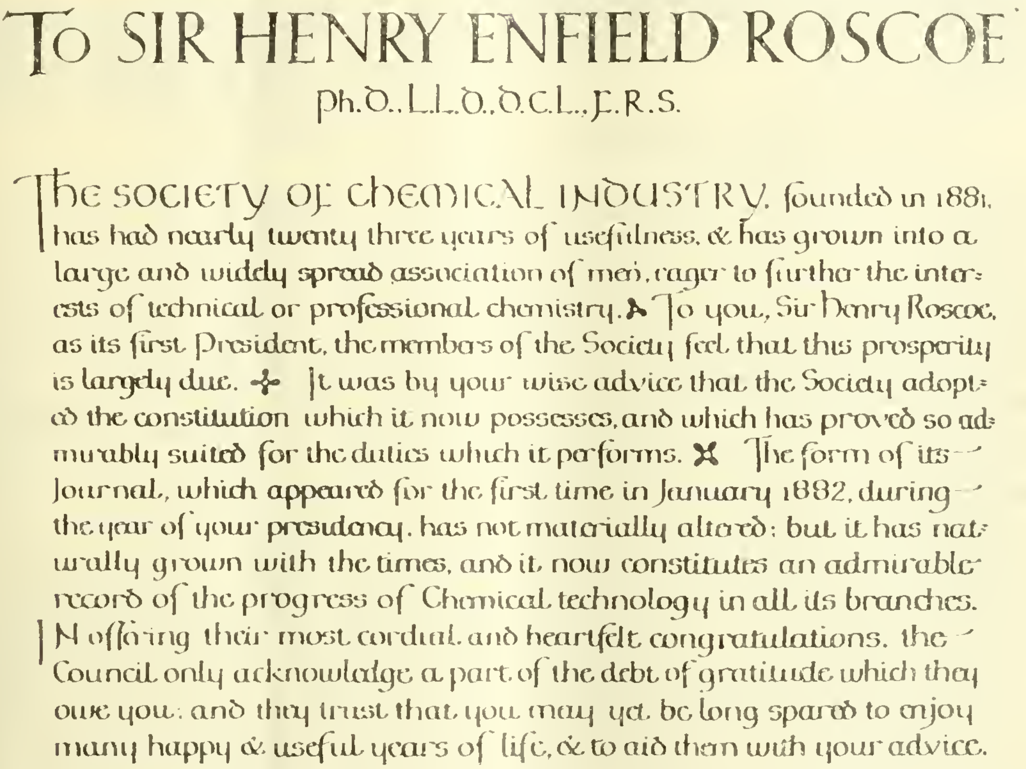
N.B.—The names in *italics* are those of members of Committee who retire from their respective offices at the end of the current sessio

Notices.

JUBILEE OF SIR HENRY ROSCOE, F.R.S.

At Owens College, Manchester, on April 22nd, the 50th anniversary of the date of Sir Henry Roscoe's graduation as Doctor of Philosophy of the University of Heidelberg was celebrated by a reception and presentation of an address from his old University, his former students, and from the universities and colleges of the United Kingdom, the Continent, and the Colonies, and from many scientific societies. The University of Heidelberg, through Dr. Thorpe, presented him with the honorary diploma of Doctor of Philosophy. Sir Michael Foster, M.P., presented the address from the University of London. Sir William Ramsay presented an address from University College, London. Dr. Thorpe also presented an address from King's College, London. The British Association, of which Sir Henry Roscoe was president in 1887, was represented by Major Macmahon, hon. secretary. Sir Michael Foster, M.P., also presented an address from the Royal Society, and Sir William Ramsay addresses from the Chemical Society and the Society of Chemical Industry.

The following is a facsimile of the text of the address presented by the Society of Chemical Industry :—



To SIR HENRY ENFIELD ROSCOE
Ph.D., LL.D., D.C.L., F.R.S.

The Society of Chemical Industry, founded in 1881, has had nearly twenty three years of usefulness, & has grown into a large and widely spread association of men, eager to further the interests of technical or professional chemistry. ❧ To you, Sir Henry Roscoe, as its first President, the members of the Society feel that this prosperity is largely due. ❧ It was by your wise advice that the Society adopted the constitution which it now possesses, and which has proved so admirably suited for the duties which it performs. ✠ The form of its Journal, which appeared for the first time in January 1882, during the year of your presidency, has not materially altered; but it has naturally grown with the times, and it now constitutes an admirable record of the progress of Chemical technology in all its branches. In offering their most cordial and heartfelt congratulations, the Council only acknowledge a part of the debt of gratitude which they owe you; and they trust that you may yet be long spared to enjoy many happy & useful years of life, & to aid them with your advice.

To this Sir Henry Roscoe replied as follows :—

Nearly a quarter of a century has passed since a number of friends interested in applied chemistry, amongst whom I remember were Messrs. Muspratt, Brock, and Carey, consulted me as to the desirability of founding a society in Lancashire having for its object the closer connection of scientific and industrial chemistry. I cordially endorsed their opinion, but suggested that if needed in the North it was also needed for the country at large. And so the Society of Chemical Industry was founded. Its success as been phenomenal, and the work which it has done and is oing is of national importance. To the President, Sir William Ramsay, to my former pupil, the indefatigable ditor of the Journal, Mr. Watson Smith, and to the embers of Council, I tender my best thanks.

NNUAL GENERAL MEETING, NEW YORK, 1904.

The Annual General Meeting will be held in New York ity on Thursday, Sept. 8th, and following days. Members ho contemplate attending are requested to communicate ith the General Secretary as soon as possible, in order at suitable travelling arrangements may be made. A vised programme appeared in the March 31st issue.

In accordance with the provisions of Rule 18 of the e-laws, notice is hereby given that those members whose mes are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Mr. Wm. H. Nichols has been nominated to the office of President under Rule 8; Dr. Edw. Divers, Prof. W. R. Eaton Hodgkinson, Mr. Max Muspratt, and Mr. T. J. Parker have been nominated Vice-Presidents under Rule 8; and Sir Wm. Ramsay has been nominated a Vice-President under Rule 11.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the ordinary members of the Council. Forms for this purpose can be obtained, on application, from the General Secretary, or from the Hon. Local Secretaries of the Canadian, New York, and Sydney Sections.

Extract from Rule 18 :—"No such nomination shall be valid unless it be signed by at least ten members of the Society who are not in arrear with their subscriptions, nor unless it be received by the General Secretary, at the Society's Office, at least one month before the date of the Annual General Meeting at which the election to which it refers takes place. Nor shall any such nomination be valid if the person nominated be ineligible for election under Rules 12 or 15. No member shall sign more than one nomination form."

THE MEDAL.

At a meeting of the Council of the Society held on March 23rd last, it was unanimously resolved to present the Society's medal for 1904 to Prof. Ira Remsen, President of the Johns Hopkins University, Baltimore, Md., U.S.A., for conspicuous services rendered by him to Applied Chemistry.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

List of Members Elected

25th APRIL 1904.

Baker, John T., Easton, Pa., U.S.A., Manufacturing Chemist.

Bean, Percy, 10, Marsden Street, Manchester, Analytical Chemist.

Brown, W. Anderson, 104, Kingston Road, Ilford, Essex, Soap Analyst.

Carhart, Dr. Cornelius, Keyport, N.J., U.S.A., Pharmacist.

Eames, Charles J., 99, Water Street, New York City, U.S.A., Consulting and Applied Chemist.

Elson, J. Hugh, Monroe Drug Co., Unionville, Mo., U.S.A., General Manager.

Haigh, B. Wilson, 4, York Street, Barnsley, Yorks., Chemical Engineer.

Hamblet, Abel Martin, c/o Oxford Paper Co., Rumford Falls, Maine, U.S.A., Chemist.

Hard, Dr. James, M.B., Cordobanes 16, City of Mexico, Mexico, Chemist and Pathologist.

Harker, Dr. George, 35, Boulevarde, Petersham, Sydney, N.S.W., Chemist.

Hart, John J., Endcliffe, Park Avenue, Ashton-on-Mersey, Cheshire, Calico Printer.

Hess, Henry W., c/o Toledo Gas Light and Coke Co., 327, South Erie Street, Toledo, Ohio, U.S.A., Chemist.

Huillard, Alphonse. Suresnes (Seine), France, Tannin Extract Manufacturer.

Jepson, John Elliott, The Star Paper Mill Co., Ltd., Feniscowles, near Blackburn, Chemist.

Johnson, G. B., 7, Church Street, Liverpool, Wholesale Chemist.

Johnson, S. Hearon, 7, Church Street, Liverpool, Wholesale Chemist.

Jones, George Poole, Park Hotel, Williamsport, Pa., U.S.A., Chemical Engineer.

Lindemann, Ottocar, 53, Victoria Street, Westminster, S.W., Managing Director (Korting Bros., Ltd.).

Lossen, Dr. Clemens F., c/o Gulf Refining Co., Port Arthur, Texas, U.S.A., Chemist.

McGill, A., 317, Queen Street, Ottawa, Canada, Analytical Chemist.

Marris, H. C., The Russian Steam Oil Mills Co., 32, Kourlandski Street, St. Petersburg, Russia, Analytical Chemist.

Pelly, Russell George, 63, Rowan Road, Brook Green, Hammersmith, W., Analytical Chemist.

Petty, Gordon N., 5, Wellington Terrace, Old Trafford, Manchester, Technical Chemist.

Portner, Edward G., Robert Portner Brewing Co., Alexandria, Va., U.S.A., Chemist.

Ralph, S. Jamieson, c/o Clemons, Marshall, and Carbert, Hunslet, Leeds, Research Chemist.

Sparke, Archibald, Public Library and Art Gallery, Bury, Lancs., Chief Librarian, &c.

Warburton, George H., 33, Kilburn Priory, West Hampstead, N.W., Analytical Chemist.

Watson, Percy, 554, Somerset Avenue, Taunton, Mass., U.S.A., Chemist and Dyer.

Weston, Thos. W., The Cocoa Works, York, Mechanical Engineer.

Woolcott, Herbert, 5, Alma Road, Highbury, N., Brewer's Chemist.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

Alexander, D. Basil W., l/o Denver; 1020, Date Street, Los Angeles, Cal., U.S.A.

Beebe, Murray C.; all communications to 2210, Farmer's Bank, Pittsburgh, Pa., U.S.A.

Brookman, F. W., l/o 6; 8, West Street, Rochdale.

Burk, W. E.; all communications to 1372, East Broadway, Louisville, Ky., U.S.A.

Darling, G. A., l/o Box 1024; P.O. Box 195, Fordsburg, Johannesburg, South Africa.

Kern, Walter P., l/o Lafayette Avenue; communications to 262, Paulison Avenue, Passaic, N.J., U.S.A.; Journals as before.

Koechl, Victor; all communications to P.O. Box 159, New York City, U.S.A.

Lowson, Dr. J. G. Flowerdew, l/o Lasswade; Polton Paper Works, Midlothian.

Ramsden, A., l/o India; York Villa, Walmersley Road, Bury, Lancashire.

Reinherz, Otto; communications to 181, Cromwell Road, London, S.W.

Richmond, Sylvester O., l/o Sheffield; Royal Victoria Yard Deptford, S.E.

Robertson, Alex. A., l/o Grassendale; Riversdale, Cressington Park, Liverpool.

Rouse, Wm., l/o John Street; King Edward Street Alexandria, Dumbartonshire.

Savage, G. M., l/o New York; Albert Toilet Soap Co. 168, McCord Street, Montreal, Canada.

Seligman, Dr. R., l/o Kensington; c/o Messrs. J. and W Seligman, Mills Building, New York City, U.S.A.

Sholes, C. A., l/o General Chemical Co.; 25, Broad Stree New York City, U.S.A., Chemical Agent.

Skinner, Hervey J., l/o Exchange Place; c/o Little an Walker, 93, Broad Street, Boston, Mass., U.S.A.

Smither, F. W., l/o Nashville; 802, Locust Street, Kansa City, Mo., U.S.A.

Stevenot, G. A., l/o William Street; c/o H. A. Metz Co 122, Hudson Street, New York City, U.S.A.

Swindells, Seth, l/o Kidsgrove; The Laurels, Scholar Gree Stoke-on-Trent.

Trantom, Dr. Wm., l/o New Brighton; retain Journals.

Vasey, T. E., l/o Montreal; retain Journals.

Walker, Henry V., l/o Clinton Street; 700, Park Plac Brooklyn, N.Y., U.S.A.

Walker, Jas. W., l/o Fernlea; Castle Park, Irvine, N.B.

Wheeler, E.; Journals to 33, Churchill Street, Oldham (Leicester, as given on April 15th).

Woolcott, G. H., l/o Croydon; 2, Carolina Terrace, Mont notte, Cork, Ireland.

Young, Chas. C., l/o New York; c/o Farbenfabriken Elberfeld Co., Charlotte, N.C., U.S.A.

MEMBER OMITTED FROM LIST.

902. Palmer, Fred. G., c/o Cotton Powder Co., Ltd., Melling, near Liverpool, Analyst.

Deaths.

Aitken, Dr. A. P., 38, Garscube Terrace, Edinburgh. April 17.

Slade, H. E., India-Rubber Works, Streatham Common, S.W. April 4.

The Commercial Intelligence Branch of the Board of Trade will be moved from 50, Parliament Street, S.W., on Saturday, 30th April, and will be opened at 73, Basinghall Street, E.C., on Monday, 2nd May.

Canadian Section.

Meeting held at Toronto, on March 25th, 1904.

PROF. W. R. LANG IN THE CHAIR.

A paper on "Perfumery" was read by Mr. A. P. Taylor and one by Mr. A. McGill on the "Experimental Treatment of Hard Waters."

ON THE DECOMPOSITION OF BENZENE AT HIGH TEMPERATURES.

BY G. W. McKEE.

In the manufacture of both coal gas and carburetted water-gas it is a matter of great practical importance that we should have a knowledge of the temperatures at which the various hydrocarbons decompose (especially those used for enriching purposes), and the extent to which the decomposition increases with increasing temperature. The most important among these reactions is the decomposition of benzene (C_6H_6). Suppose, for instance, we start with he gas oils which are higher normal paraffins, the pyrogenetic reactions are such as are indicated by the following: — Higher paraffins → lower paraffins → olefines → acetylenes → benzenes → diphenyl, &c. → naphthalene, &c. → tarry matter → carbon and hydrogen. The great value of benzene in increasing the illuminating value of gas s well known; and the nuisance that arises from the formation of solid substances like diphenyl and naphthalene, which top up both pipes and machinery, is one of the greatest bstacles in the manufacture of coal gas.

The precise nature of the above reactions becomes then f practical importance, and the experiments carried out were undertaken to throw some light, if possible, on the ansition temperatures of these substances. The apparatu sed is shown in Fig. 1.

To heat the furnace F, the rheostat R and the furnace F were joined in parallel and connected with the street circuit. The switch S was also inserted to permit of complete control of the current from the working table. The furnace was heated by means of hot platinum resistance wires embedded in its fire-brick walls It was found convenient to surround it with $\frac{3}{4}$ in. asbestos millboard, pieces of which were readily cut without disturbing the edges, by placing it between pine boards and using a saw. In assembling these into a box the edges were preserved for nailing by securing the pieces in a vice. In front of the furnace was placed a piece of asbestos with three holes, which were punched by means of a sharpened brass tube against a hardwood block. Two of these were for the inlet and outlet of the copper tube which was to carry the benzol vapour, while the third was for the introduction of a thermo couple.

The pyrometer used was a Le Chatelier made by Keiser and Schmidt, Berlin. A thermo-couple, of 50 cm. length, of platinum and platinum with 10 per cent. rhodium, was introduced into the furnace by means of a porcelain tube about $\frac{3}{8}$ in. in diameter and perforated by two holes, each about 1 mm. in diameter. To the thermo-couple were joined the copper wires in the porcelain dish D, which was kept at zero by means of melting ice. The copper wires were joined, as shown, to the pyrometer, which was provided with an auxiliary switch. The calibrations of the thermo-couple were plotted on section paper for interpolation purposes.

For vaporising the benzene the device shown at V in the right of the figure was used. An electric lamp was mounted on a block. On the same block was secured a piece of tin pipe about 4 ins. in diameter. A piece of $\frac{1}{4}$ in. asbestos was cut and rolled to fit the inside of the tin and thus prevent loss of heat by radiation. The benzene to be decomposed was placed in the pear-shaped funnel P. The stem of this funnel was so drawn out that the drops issuing from it would be very small; the supply was further capable of control by the tap on the stem of the funnel. In this way small drops of benzene were allowed to fall on the heated bottom of the flask, where they were at once vaporised and subsequently passed through the furnace, the rate being easily regulated by counting the drops.

About 6 ft. of seamless copper tubing, thin-walled, and about $\frac{1}{4}$ in. external diameter, the temper drawn by passing it slowly through a blow-pipe flame, were coiled around a prepared spool, so that a coil of about $4\frac{1}{2}$ ft. of it fitted nicely in the furnace, leaving an aperture between the coils sufficiently large to allow the tube which insulated the thermo-couple being passed through to the middle of the furnace. The ends of the copper tube passed through the holes shown in the asbestos pad which formed the door of the furnace, and were bent at right angles so as to terminate at A and B (see Fig. 1).

The distilling flask was selected so that its delivery tube fitted accurately into the copper tube at A, and the joint was further secured by means of suitable packing. The other end B, of the copper tube was provided with a short glass condenser 6 ins. in length, while an adapter of glass tubing was slipped over the end of the copper tube, and secured by means of a section of rubber tubing. The adapter passed through a stopper into a small glass vessel in which were caught the products of decomposition.

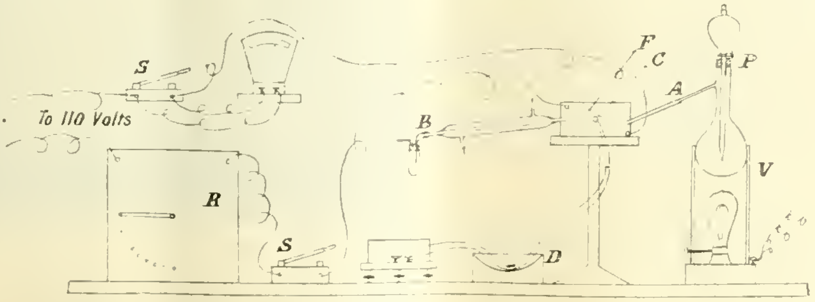


Fig. 1.

To determine whether the benzene had been decomposed or not, specific gravity determinations were made by means of a pyknometer. In all cases these were taken at 18 C., the variation of the specific gravity of benzene for a difference of one degree centigrade being very considerable.

		Per Cent.
Specific gravity of the benzol employed		0·88181
„ of products after heating to	448° C.	0·88175
„ „ „	550° C.	0·88202
„ „ „	664 C.	0·88362
„ „ „	720° C.	0·88963
„ „ „	765° C.	0·90276

These results may be expressed graphically by the following curve :—

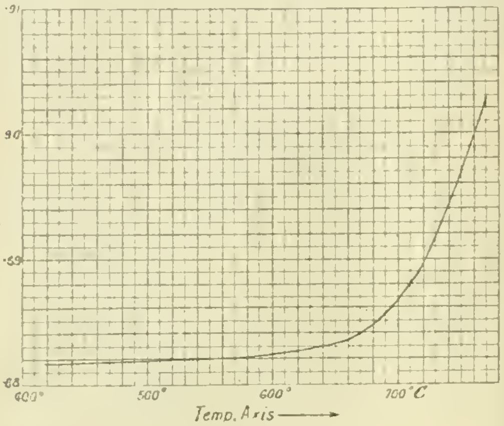


Fig. 2.

A second method of determining if decomposition had taken place was to slowly evaporate a portion of the product to dryness, and to examine the residue, if any, by the polarising microscope. The following results were obtained :—

Quantity evaporated.	Temperature to which it had been subjected in passing through Tube.	Appearance when examined by Polarising Microscope.
c.c.	° C.	
20	Not heated	No crystalline structure.
10	494	„ „
10	526	„ „
5	550	Polarisation colours scarcely visible in residue.
5	562	Crystalline residue prominent, small crystals easily distinguished.

The tube was further washed thoroughly with pure benzol, and a number of fractions taken from 544° to 550°, but it could not be said that the action became decidedly perceptible until after 550° had been passed. From that point onwards reference to the curve (Fig. 2) shows the extent to which the benzene vapours become decomposed as the temperature rises.

It would thus seem advisable, in adding enriching material to, say, a water-gas, to prevent the added material from being subjected to a temperature much greater than 700° C.

The author wishes to express his thanks to Prof. W. R. Lang of the University of Toronto, for the interest shown and the assistance rendered in this investigation.

Manchester Section.

Meeting held on Friday, February 5th, 1904.

MR. IVAN LEVINSTEIN IN THE CHAIR.

THE LUSTRE, THE TINCTORIAL PROPERTIES, AND THE STRUCTURAL ALTERATIONS WHICH RESULT FROM TREATING COTTON WITH MERCERISING AND OTHER LIQUIDS.

BY JULIUS HÜBNER AND WILLIAM J. POPE, F.R.S.

A Contribution from the Department of Pure and Applied Chemistry, Municipal School of Technology, Manchester.

During the past few years we have been occupied in investigating the action of many reagents on cotton, confining ourselves chiefly to the study of the effects produced by reagents which cause an indefinite, or but little understood, chemical change in cellulose. In a previous paper we dealt somewhat completely with the changes in the strength of yarn which result from the action of these reagents (this J., 1903, 70—77), and in the present paper we put forward the results obtained during the extension of the earlier work. The new results enable us to elucidate thoroughly the physical changes which lead to the production of a silk-like lustre on treating cotton with mercerising agents; a preliminary note on this part of the work was laid before the British Association at the Southport Meeting in September 1903.

The study of the action upon the cotton fibre of soda solutions of too great dilution for use in practical mercerisation must be considered as a necessary preliminary step to the obtaining of information as to the changes in the fibre which are produced by mercerisation.

In order to ascertain whether dilute soda solutions have any action of a chemical or morphological nature on cotton, we steeped dry hanks of twofold 50's bleached yarn in caustic soda solutions of known concentrations varying from 1° Tw. up to 80° Tw., and, after washing in cold water until all the soda was removed, dyed all the hanks, together with an untreated one for purpose of comparison, in a solution of Benzopurpurin 4 B, the amount of dyestuff used being one quarter per cent. on the weight of the hanks. After dyeing in the boiling bath for half an hour the hanks were removed, washed, and dried; they were then matched by the eye, an attempt being made to form some quantitative appreciation of the relation between the strength of the dyeings on the different hanks. This quantitative relationship, so far as it can be established in a rough preliminary test of this character, is given in Table I., in which the letter "s" signifies "stronger than," and the letter "w" means "weaker than," the repetition of the letter indicating "much greater than" or "much weaker than," as the case may be.

Assuming that, in a roughly quantitative way, the increase of strength or weakness of the dyeing is proportional to the number of repetitions of the characterising letter, it is convenient to express the results of the trial and its graphic representation in a curve as in Fig. 1.* Although we do not claim that this trial and its graphic representation by the curve have any rigidly quantitative value, yet the following points must be considered as definitely proved, namely :—

(1) Cold caustic soda solution of 1 Tw. has a considerable effect in increasing the affinity of cotton for direct dyeing colouring matters and, from 0° to about 18° Tw., the increase in affinity for the dyestuff is roughly proportional to the concentration of the soda used in the previous treatment of the cotton.

(2) Between 18° to 22° Tw. the increase in concentration of the soda has a greater effect in increasing the affinity of

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* In this curve we have plotted the concentration of the soda in Twaddell degrees, since the strength in degrees Twaddell is roughly proportional to the percentage concentration.

FIG. 3.

FIG. 6.

FIG. 4.

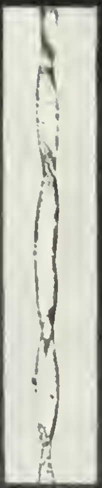

FIG. 2.

FIG. 5.

FIG. 7.

FIG 8

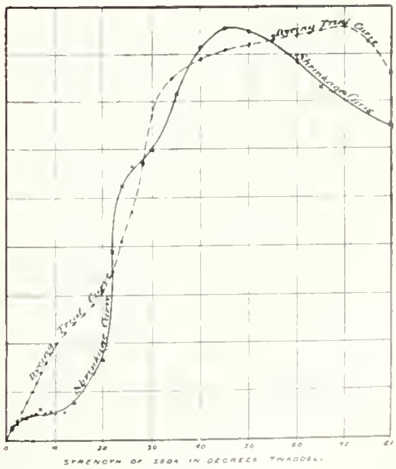

FIG. I.

In J.; Soc.; Chem.; Industry.

for paper by J. HÜBNER and W. J. POPE.

he cotton for the colour than has a corresponding increase f concentration in soda of lower strength.

(3) The effect referred to in (2) becomes greater with oda of density 22° to 26° Tw., and much greater still with oda of from 26° to 30° Tw.

(4) Above 30° Tw., however, an increase in strength of he soda exerts a less effect than before in increasing the ffinity of the cotton for the colour, so that raising the trength of the soda solution from 30° to 40° Tw., has only bout the same effect in increasing the affinity of the fibre or colour as increasing the concentration of the soda from 6° to 28° Tw. or from 28° to 30° Tw. At above 45° Tw., ncreased concentration of the soda produces but little effect n heightening the shade produced on dyeing, so that ractically the maximum increase in affinity for colour is ot by treating with soda of any concentration between 5° and 70° Tw., and an experienced eye is needed to see hat the dyeing on the hank treated with 70° Tw. soda is tronger than that on the hank treated with 55° Tw. soda.

(5) As the concentration of the soda used in mercerising s increased above 70° Tw., an actual diminution in the ffinity of the fibre for the dyestuff accompanies the increase in concentration ; thus, the hank treated with soda f 70° Tw. dyes much more strongly than does that treated vith 80° Tw. lye. This reversal of the action of the soda is f so strongly marked a character that the hank treated vith soda of 80° Tw. dyes to the same shade as that treated vith soda of 35° Tw.

TABLE I.

Hanks treated with various Strengths, stated in Twaddell degrees, of Soda Lye at 19° C., and afterwards dyed with ¼ per cent. of Benzopurpurin 4 B, calculated on the Weight of the Hanks.

° Tw.		° Tw.	° Tw.		° Tw.	° Tw.		° Tw.
1	2 s	0	14	2 s	12	45	2 s	40
2	2 s	1	16	2 s	14	30	s	45
3	2 s	2	18	2 s	16	55	s	50
4	2 s	3	20	3 s	18	60	s	55
5	2 s	4	22	4 s	20	65	s	60
6	2 s	5	24	6 s	22	70	s	65
7	2 s	6	26	6 s	24	75	3 w	70
8	2 s	7	28	10 s	26	80	7 w	75
9	2 s	8	30	10 s	28	80	equals	35
10	2 s	9	35	8 s	30			
12	2 s	10	40	3 s	35			

Since the observation is now made for the first time, that ighly concentrated caustic soda has notably less effect in ncreasing the affinity of cotton yarn for substantive colours han has a solution of less strength, it seemed desirable to epeat some of the trials.

Hanks of the same spinning as before were therefore teeped in caustic solutions of concentrations ranging from 0°—80° Tw. for 48 hours, and, after the usual exhaustive vashing and drying, were dyed with Benzopurpurin 4 B, sing one-eighth per cent. by weight of colour on the weight f the hanks ; the application of less dyestuff than in the revious tests seemed desirable in order to facilitate the ibsequent comparison of the dyed hanks.

The results tabulated below (Table II.) were thus btained, and confirm the previous conclusion that the ost concentrated soda solutions have less effect in creasing the affinity for the benzopurpurin than do those less concentration, although in the second set of trials e turning point seems to be with soda of between 65° and ° Tw., whilst in the earlier trials the turning point ppeared to lie between 70° and 75° Tw. This slight parent discrepancy might, perhaps, be attributable to e different amounts of colour used in the two sets of sts, or might possibly arise from the difficulty of preciating such slight variations of shade as are involved true reason is, however, almost certainly to be found in e circumstance, which is further discussed below, that a nk treated with a very strong lye, on washing with water, comes for a certain time impregnated with a rather re dilute and therefore more active lye. In any case fact is clear that soda of 80° Tw., when applied to ton yarn, does not increase the affinity for substantive ours to nearly the same extent as does soda of 70° Tw. ; further, the concentration of soda which produces the maximum effect in this respect appears to have a density of between 60° and 70° Tw.

TABLE II.

Yarn treated at 20° C. with Soda of various Concentrations for two days, and dyed with one-eighth per cent. by Weight of Benzopurpurin 4 B.

Soda of ° Tw.	Relative Strength of Dyeing.	Compared with Soda of Strength in ° Tw.
50........	..... 3 s	 45
55........	..... 2 s	 50
60........	..... s	 55
65........	..... s	 60
70........	..... w	 65
75........	..... w	 70
80........	..... w	 75
80........	..... equals	 55

The reversal of the action of the soda in increasing the affinity for colour during continuous increase in the concentration of the soda with which the cotton is treated, is further of interest in that it might be connected with the generally held view that cold caustic has a more powerful mercerising action than soda of the same concentration at a high temperature.

We therefore made a series of dyeing trials with hanks of the same kind of cotton as in the previous case, using caustic of 10°, 20°, 30°, 40°, and 50° Tw., steeping a hank in each solution at 20° C. and at 80° C. respectively, and keeping the solutions well stirred in the ordinary way to ensure uniform action of the caustic ; after washing until free from soda, the hanks were dried and dyed all together in a boiling solution of Benzopurpurin 4 B, using 1 per cent. of colour on the weight of the hanks. On matching the hanks the results tabulated below (Table III.) were obtained, the same roughly quantitative method of description as was previously used being adopted.

TABLE III.

Soda of ° Tw.	—	Soda of ° Tw.	Soda of ° Tw.	—	Soda of ° Tw.
10, hot	s	Untreated.	40, hot	4 s	20, cold.
10, cold	2 s	10, hot.	30, cold	5 s	40, hot.
20, hot	2 s	10, cold.	50, hot	s	30, cold.
30, hot	3 s	20, hot.	40, cold	5 s	50, hot.
20, cold	2 s	30, hot.	50, cold	5 s	40, cold.

The result of this test is a very remarkable one ; it is found that whilst caustic of 20° Tw. applied hot causes ultimately a slightly stronger dyeing than 10° Tw. soda used cold, 30° Tw. soda applied hot gives less depth to the resulting dyeing than does 20° Tw. soda used cold. The difference in action becomes accentuated as the strength of the soda is increased ; and so it is found that soda of 50° Tw. applied at 80° C. affects the hank in much the same way—so far as its affinity for colour is concerned—as 30° Tw. soda used cold.

It seems to have escaped previous observation that caustic soda in such low concentrations of lye as 1° or 2° Tw. has quite a considerable action in increasing the affinity of the cotton towards substantive dyestuffs; and this is the more remarkable in that it is frequently customary to boil yarn in caustic of 1° or 2° Tw., or even of slightly greater concentration, as a preliminary to bleaching. In order to throw further light on the question which here arises, a series of trials was made in which the same yarn as before was steeped in caustic soda of 1°, 2°, and 3° Tw., both at 20° C. and at 100° C. for 15 minutes, and, after exhaustively washing the hanks treated cold with cold water and those treated hot with boiling water, all the hanks, together with an untreated one for purposes of comparison, were dyed in the same bath with ¼ per cent. of their weight of Benzopurpurin 4 B. The results obtained on matching these hanks are stated in the appended Table IV.

TABLE IV.

Strength of Soda.	Strength of Dyeing.	Strength of Soda.
° Tw.		° Tw.
1, cold	3 s	Untreated.
2, cold	3 s	1, cold.
3, cold	3 s	2, cold.
1, hot	2 w	1, cold.
1, hot	w	Untreated.
2, hot	2 s	1, hot.
2, hot	equals	Untreated.
3, hot	s	2, hot.

The table makes it clear that the prevalent practice of boiling yarn with a 2° Tw. soda solution has no effect in increasing the affinity of the cotton for substantive colouring matters, although the same concentration of soda applied cold causes a very considerable deepening of the shade ultimately assumed by the yarn.

Many other chemical reagents are known which produce on cotton an effect superficially similar to that obtained with caustic soda, and which also give to the cotton an increased affinity for substantive colours; in order to ascertain whether a different influence is exerted on the dyeing properties by such substances when applied in solutions of different concentrations, we have made several series of trials with a number of reagents, using in each case solutions of various concentrations. Hanks of bleached cotton were steeped during the same time in solutions of different concentrations of the particular reagent, then washed, dried, and dyed in a bath containing 3 per cent. of Benzopurpurin 4 B on the weight of the hanks. The results of matching the hanks are given in the appended table (Table V.):—

TABLE V.

Barium Mercuric Iodide.

6 vols. sat. sol. to 6 vols. water	s	Untreated yarn.
6 „ „ „ 4 „ „	s	4 vols. sat. sol. and 6 vols. water.
6 „ „ „ 2 „ „	s	6 „ „ „ 4 „
Saturated solution	5 s	8 „ „ „ 2 „

Potassium Iodide.

Tw.		° Tw	° Tw.		° Tw.
2	s	Untreated yarn.	40	equals	20
			75	s	40
5	s	2	105	s	65
10	s	5	Saturated sol.	s	105
20	s	10			

Hydrochloric Acid.

° Tw.		° Tw.	° Tw.		° Tw.
5	s	Untreated yarn.	25	2 s	20
			30	s	25
10	s	5	33	s	30
15	s	10			
20	equals	15			

Zinc Chloride.

2 per cent. solution	s	Untreated yarn.
4 „ „	s	2 per cent. solution.
10 „ „	equals	4 „ „
30 „ „	2 s	10 „ „
50 „ „	2 s	30 „ „
70 „ „	5 s	50 „ „

Nitric Acid.

° Tw.		° Tw.	° Tw.		° Tw.
5	s	Untreated yarn.	65	2 s	50
			83	10 s (and yellower).	65
10	s	5			
20	2 s	10	100	5 s (and yellower).	83
35	2 s	20			
50	2 s	35			

The consideration of the above sets of dyeing trials shows that each of the reagents dealt with behaves somewhat similarly to caustic soda, so far as concerns the increase in the affinity for colour which it gives to the fibre. That is to say, as the concentration of the solution increases, the affinity of the cotton for the substantive colour also increases: in no case, however, have we been able to observe the reversing effect which is produced with soda.

The work described above having established beyond doubt that caustic of high concentration has a less effect in increasing the affinity of cotton towards substantive colours than has soda of somewhat lower concentration, it seemed desirable to ascertain whether other properties of cotton are similarly related towards the strength of soda with which yarn has been treated: that is to say, whether any other property can be discovered which increases in magnitude as the concentration of the soda increases up to a certain limit, beyond which its magnitude decreases with a further increase in the strength of the soda solution applied. We therefore made a great number of attempts to determine accurately the shrinkage which the application of soda solution causes in cotton yarn, but for a long time these attempts proved abortive: the extent of the shrinkage is so slight, especially with dilute soda solutions, that the small but unavoidable amount of stretching to which the yarn is subjected during the final washing makes the results appear very confusing. Ultimately, we found it possible to take measured lengths of yarn, steep them in caustic soda for a given time, and then to measure their lengths again by re-reeling whilst the yarn is still soaked with lye; both the reelings are effected on a small machine in which the yarn passes between two wheels, the lower, of about six inches diameter, being connected with a counting mechanism, and the upper one being merely a small but heavy cylinder, the object of which is to keep the yarn uniformly stretched during its passage between the two wheels. Hanks of 200 yards each of a bleached tightly twisted yarn were steeped in caustic soda of various concentrations during half an hour, and then re-reeled in the manner briefly described; three parallel sets of determination were made, and the mean of each set of three corresponding observations are given in the accompanying table (Table VI).

TABLE VI.

Strength of Soda.	Length of Hank after treatment.	Strength of Soda.	Length of Hank after treatment.
° Tw.	Yards.	° Tw.	Yards.
0	198·0	22	171·3
1	196·4	24	163·1
2	195·7	26	160·3
3	195·6	28	160·0
4	195·5	30	158·2
5	195·2	35	150·2
6	194·2	40	143·7
7	193·7	45	141·0
8	194·2	50	142·2
9	194·0	55	142·7
10	194·2	60	145·3
12	194·5	65	149·2
14	192·7	70	150·3
16	190·4	75	152·8
18	188·7	80	154·2
20	186·8		

In order to facilitate the comparison of these observations on the extent to which cotton yarn is shrunk by treatment with caustic soda with the results obtained in the previous dyeing trials of similarly treated yarn, it is convenient to plot the shrinkage against the strength of the soda: for this purpose the curves expressing the relation between the strength of the dyeing and the strength of the soda and between the amount of shrinkage and the strength of the soda are shown in the same figure (Fig. 1). An inspection of the table shows that the most dilute caustic soda, even of 1° Tw., exerts an appreciably greater shrinking action on the yarn than does pure water in the cold. As the concentration of the soda is increased, however, the shrinking effect is seen to increase fairly uniformly up to about 18° or 20° Tw. concentration, whilst at about 20° Tw. a sudden increase in the amount of shrinkage effected is observed to occur: as we point out below, this concentration of soda is about the same as that which shows the first appreciable action on the microscope stage upon the cotton fibre. Above 20° Tw. the extent of the shrinkage increases with the concentration at a far more rapid rate than before, and the greatest shrinking effect is obtained with soda of 45° Tw.; as the strength of the soda is increased above this concentration, the shrinkage observed diminishes continuously until the concentration of 80 Tw., the highest which we have applied, is reached.

The results now put forward find an important practical application in the action of soda of different concentrations on a technical scale. It is seen from Table VI. that the maximum shrinkage is obtained when yarn is treated with soda of about 45 Tw., but we have observed that on treating yarn with soda of 80° Tw. and obtaining the slight amount of shrinkage which is noted in the table, a further and quite considerable shrinkage takes place during the subsequent washing. This is of course only what would be expected, inasmuch as the yarn impregnated with soda of 80° Tw.—a liquid of high viscosity—when treated with water becomes impregnated with soda of greater dilution, and the degree of dilution increases as the washing proceeds. Consequently the initial shrinking effect of 80° Tw. soda on the yarn is that noted in the table, but the action which is exerted during the washing with water is, at any rate during the early stages of the washing, the action of a soda which has a much greater shrinking effect on the yarn, such for instance as soda of 50° Tw. On impregnating yarn with soda of about 50° Tw., and afterwards washing with water, no perceptible shrinking is observed to occur during the washing, the reason being that the dilution has the effect of making the soda less active than before towards the yarn, so far as shrinking action is concerned. If we, therefore, consider what will happen during the impregnation of yarn on the mercerising machine or of a cotton fabric during treatment on the stenter, it will be seen that with soda up to, say, 50° Tw. the main shrinkage will occur during impregnation with soda, whilst during the subsequent washing no additional strain will be put on the arms of the yarn mercerising machine or on the clips of the stenter. The conditions are, however, quite different when the yarn or fabric is impregnated with soda of a higher degree of concentration, say, of 75° or 80° Tw. In this case less shrinkage takes place during the actual impregnation, but, on washing afterwards with water, the yarn or fabric tends to undergo a further and considerable contraction; with the high concentration of soda, therefore, the greatest strain is exerted on the arms of the mercerising frame or on the clips of the stenter during the early stages of the washing with water. There is thus in this case a certain tendency for the yarn to tear or for the cloth to rip, which would be avoided if a more dilute soda had been employed.

In connection with the dyeing properties, it is further clear that the application of soda of 70° or 80° Tw. will have a tendency to make the yarn or fabric dye unevenly because of the more powerful action on the affinity for dyestuffs exerted by the lower concentrations of soda, which will be produced locally during washing.

On inspecting the curves given in Fig. 1 it will be seen that whilst the greatest increase in the affinity of cotton for substantive colours is contributed by the action of soda of about 70° Tw. concentration, the greatest shrinkage is observed when soda of a much lower concentration is applied, *viz.*, of 45° Tw. This is doubtless due to the operation of the cause referred to in the preceding paragraphs, *viz.*, to the fact that the treatment with soda of 80° Tw. and afterwards washing involves the action, at any rate for a short time, of soda of all lower concentrations on the ibre; this would lead to the yarn treated with soda of 80° Tw. and subsequently washed, dyeing much more trongly than would have been the case if, after immersion in the 80° Tw. soda, the whole of the soda could have been emoved from the yarn without adding water. It should, owever, be noted that on washing a yarn shrunk by the npregnation with caustic soda, some change in the length f the hank must be expected to occur quite independently f any alterations in length produced by the action of diluted soda temporarily formed; the extent of such action is still under investigation.

So far as the present trials can be interpreted, it would seem that a great deal of evidence exists indicating that the apparently increased affinity which cotton has for colouring matters after having been treated with soda is, in the main, proportional to the extent to which shrinkage has taken place. We have now in hand a series of tests intended to elucidate this matter still further; tests in which the yarn, after immersion in strong soda, is washed free from soda with alcoholic solvents under such conditions that the action of aqueous caustic soda solutions of lower concentrations can play no part. A highly special case of such proportionality between the shrinkage and the strength of the dyeing would be that in which a given length of yarn removes the same weight of dye-stuff from the bath when it is mercerised as when it is unmercerised; the greater depth of colour exhibited by the mercerised hank would here be due solely to the same weight of colour being distributed throughout a shorter length of yarn than would be the case with the unmercerised hank. We find, however, on taking two hanks of the same length and dyeing them both in separate baths of the same concentration, the one after and the other before mercerisation, that the exhaust from the mercerised hank is much paler in colour than that from the unmercerised hank; the proportionality is consequently not of the special and simple character last mentioned above.

We now turn to the microscopic examination of the changes produced in cotton by treatment with mercerising and other liquids.

The microscopic examination of cotton offers certain difficulties which arise principally from the high degree of transparency possessed by the fibre; these difficulties are greater after the cotton has been treated with mercerising agents because the apparent transparency of the fibre as it lies on the microscope stage is much greater than before the treatment. Further, if mounting agents are used in the preparation, more difficulty is experienced in the microscopic observation owing to the refractive index of the fibre approximating to that of the medium and to the consequent loss of definition. It therefore seemed desirable to apply some artificial method of increasing the microscopic definition, and resort was made to the examination of the fibres between crossed Nicol prisms, a polariser being inserted under the sub-stage condenser and an analyser being placed in the eye-piece in such a position that its principal section lay at right angles to that of the polariser. The statement has been made (compare Guttmann, Manufacture of Explosives, 1895, vol. 2, p. 59) that under these conditions ordinary cotton appears colourless, but actual experience shows that all cotton fibres show interference colours when examined microscopically between crossed Nicol prisms. The interference colours exhibited by raw cotton when examined in this way are not very brilliant; they are doubtless due to internal strain in the otherwise amorphous material of which the fibre is composed and, the strain being apparently but slight, the colours are of such a high interference order that they are not visually brilliant. In order to enhance the brilliancy of the interference colours the authors prefer to insert above the polariser, and with its principal direction at 45° to that of the polarising and analysing prisms, a mica plate of such thickness as to increase the retardation of the light passing through the preparation by one-eighth of a wave-length; this thickness of mica plate seems ordinarily to give the best results, but the most appropriate thickness for use in any particular case so as to obtain the maximum colour effect in the fibre is readily ascertained by passing a quartz wedge of the ordinary kind between the eye-piece and the preparation, and noting when the most brilliant display of colour is made by the fibres.

The microscopic examination of the cotton fibre between crossed Nicol prisms, with the interposition of a one-eighth wave-length retardation plate in the manner just described, not only facilitates the observation of the outline of the fibre, but enables the internal canal, cracks in the fibre, and internal pecularities of all kinds to be made out with great ease, the differences in thickness of various parts of the fibre being indicated by changes in the colour exhibited.

The photographs in natural colours which illustrate this paper have been made by the Sanger-Shepherd process in elliptically polarised light under the conditions of illumination described above, and the author's thanks are due to Mr. Chas. W. Gamble, Director of the Photographic Department of the Manchester Municipal School of Technology, for the able assistance which he has rendered in the preparation of these slides.

The microscopic examination of the raw cotton fibre shows it to consist of a flattened ribbon, the edges of which are somewhat thickened and usually slightly turned up; sometimes, however, the edges are turned up to such an extent that they stand at nearly right angles to the surface of the ribbon. The best drawings of the cotton fibre which have previously been published are undoubtedly those given by Walter Crum (J. Chem. Soc., 1863, p. 404); these pictures give a good idea of the general microscopic appearance of raw cotton and show the slight thickening of the edges referred to; in polarised light, however, the internal canal is distinctly visible as a flattened tube-like structure traversing the whole length of the fibre. Crum's drawings are, however, faulty in one respect, namely, that the natural twist in the fibre is not of the loose character which he depicts, but is flattened, so that the twisted fibre has rather the appearance of a ribbon which has been twisted and creased rather than that of one which has been merely twisted. It is sometimes stated that the natural twist of the cotton fibre always runs in the same direction. That this is not so is sufficiently indicated by Crum's drawings, and is also evident on the most superficial microscopic examination of the fibre; the fibre is sometimes twisted in the one direction and sometimes in the other. Further, the same fibre is generally twisted in parts to the right and in parts to the left, several changes in the direction of twist being noticeable throughout the length of a single fibre; this change in twist is of great importance in connection with the production of lustre during mercerisation, as will be pointed out below.

Fig. 2 represents the photograph of a plain or untreated cotton fibre taken in polarised light as above described, and in Fig. 3 is reproduced the same fibre photographed in natural colours.

On placing a few fibres of loose cotton on a slide under a cover glass on the microscope stage, and carefully watching the behaviour of the fibres as a drop of caustic soda placed on the slide gradually comes into contact with the fibres, no change at all is observable in the cotton until the strength of the soda used reaches 16° Tw. At this concentration, however, it is seen that the fibres untwist slightly during the two or three seconds after the soda has come into contact with them; the untwisting is very incomplete and is at an end within three seconds or so at the ordinary temperature. On increasing the strength of the soda gradually, the same kind of behaviour is observed until a concentration of 20° Tw. is reached, and here the initial untwisting, which still proceeds with great rapidity, is followed by a very slow uncoiling of the twist of the fibre; but even at this strength of soda the fibre never becomes quite unrolled. With soda of 22° Tw. bubbles of air begin to make their appearance in the internal canal, and the transparency which the liquid gives to the fibre is produced much more slowly than with lower concentrations of soda. At a concentration of 26° Tw., the initial rapid and the later slower untwisting action become confused and only one kind of uncoiling effect is distinguishable; that is to say, the fibre uncoils slowly and regularly during a period of about five seconds and the fibre is left as a somewhat flattened ribbon, which is still slightly twisted. At 28° Tw. the action of the soda is appreciably slower; the uncoiling proceeds for about 15 seconds and has the effect of removing practically all the twist from the fibres; at the same time, the becoming transparent, which apparently indicates the soaking in of the soda, proceeds much more gradually than before, and the running of the soda through the internal canal with the formation of air-bubbles is much more distinctly visible than at the lower concentrations. With soda of 30° Tw. the twist of the fibre for the first time disappears completely. With soda of 35° Tw. the untwisting still proceeds with fair rapidity, occupying about 15 seconds for completion, and after the untwisting has become practically complete, the fibre is seen to swell, the swelling being accompanied by an increase in the transparency of the fibre; the two changes are, however, quite distinct, the swelling following the untwisting. At 40° Tw. fewer air-bubbles are produced than before, and the swelling proceeds more rapidly, so that one part of the fibre is seen to be swelling whilst another part is still in the stage when untwisting is taking place. At 45° Tw. no air-bubbles are left in the canal and the latter almost completely disappears; the swelling and untwisting go on quite simultaneously and the whole action is complete in about 15 seconds. The behaviour of the fibres towards soda of 50° Tw. is similar to that towards the 55° Tw. solution, with the exception that the action is a trifle less rapid with the lye of higher concentration. With soda of 55° Tw. it is for the first time noticed that a perceptible interval elapses between the wetting of the fibre and the commencement of the uncoiling; this interval occupies about three seconds, and the subsequent action is completed in about 20 seconds. With lye of 60° Tw. no appreciable change occurs for the first eight seconds or so, and then the fibres begin to swell and to become transparent; after the swelling has occurred the fibres begin to untwist, and the uncoiling takes place very slowly and deliberately, requiring about a minute for completion. With soda of 65° or 70° Tw. the same kind of action proceeds, the swelling preceding the uncoiling and the whole action going still more slowly, so that with 70° Tw. soda evidence of action is still visible after two minutes', contact. Soda of 75° Tw. exerts no apparent action for at least a minute and takes about four minutes for completion; the air-bubbles assume irregular shapes in the internal canal, giving an impression as if the fibre had burst open. With soda of 80° Tw. concentration, the action takes a still longer time and nearly all the fibres appear as if burst or split; a photograph of one of these burst and swollen fibres is reproduced in Fig. 4.

In order to facilitate their comparison, these observations may be conveniently epitomised in a table (Table VII.).

Table VII.

Strength of Soda in ° Tw.	—
0 to 15	No apparent effect.
16 to 18	Incomplete uncoiling during about a second.
20	Initial rapid untwisting followed by sluggish ditto.
26	Rapid and slow uncoiling become one, lasting 5 seconds.
35	Untwisting followed by swelling.
40	Untwisting and swelling proceeding together.
60 to 80	Swelling precedes untwisting.

The untwisting of the cotton fibre under the influence of caustic soda has not been referred to by previous workers in this field; it has the effect, when the cotton is mercerised loose, of converting the fibre into a plain surfaced rod which is bent more or less irregularly, and which is very much matted together or entangled with other fibres. The entanglement of the fibres caused by the writhing which attends the immersion in strong soda is of course responsible for the difficulties which have made the spinning of cotton which has been mercerised loose a practical impossibility.

As a point of great importance, which we now call attention to for the first time, is to be noted that up to a concentration of about 10° Tw. the swelling action of the soda follows the untwisting, whilst at concentrations greater than 40° Tw. the reverse is the case, the untwisting following the swelling. Since the concentration of about 40° Tw. is the lowest at which an effective mercerising action for practical purposes can be effected, it follows that the production of a lustre on cotton is necessarily connected with the action of soda of such concentration as causes the untwisting of the fibre to take place, either after the swelling is at an end or simultaneously with the occurrence of the swelling. The new observation, namely, that strong caustic causes the cotton fibre to untwist, is therefore one of the determining factors in the production of a gloss during the mercerising of cotton.

Confirmation of this view, if it be correct, should be obtainable by investigating microscopically the action of hot caustic soda solutions on the fibre, because it is known that hot soda is not nearly so effective a mercerising agent as is the same concentration of soda in the cold. We therefore took a caustic soda solution of 50° Tw., which at 20° C. produces a brilliant lustre on stretched Egyptian yarn and at 90° gives a lustre which is much less marked; on steeping the fibres in this at 20° C. on the microscope stage, the appearances noted in Table VII. were observed, namely, that the fibres swell slowly and afterwards untwist; but on arranging the microscope stage so that the fibres can be examined under the influence of the soda solution at 90° C., it is seen that at the high temperature the fibres began to untwist rapidly immediately they come in contact with the hot soda, and that after this untwisting is at an end the swelling effect sets in, but not until the whole of the uncoiling is finished. It is, therefore, clear that the necessary condition for the production of a good lustre during mercerisation is that the untwisting should follow the swelling, or at least that both swelling and untwisting should proceed simultaneously; and that the inefficiency of hot as opposed to cold caustic soda in mercerising is due to the fact that with the cold caustic the swelling precedes the uncoiling, whilst with the hot caustic the untwisting takes place first.

The production of a lustre during the mercerisation of stretched yarn has been previously attributed wholly to the shrinkage and the swelling which takes place during the action of strong caustic soda; we have now shown that a new factor, namely, the untwisting of the fibres, is also a necessary one to the production of an appreciable gloss. The importance of this conclusion is such as to make further confirmatory evidence desirable before proceeding to discuss the exact way in which the untwisting is operative in giving rise to the lustre. We, therefore, examined the action of a number of other reagents on the cotton fibre, using the same kind of method of microscopic examination as in the above experiments. The results are here given.

Action of a Mixture of ten parts of Soda Lye of 28° *B and one part of Water-glass Solution of* 41° *B.*—The use of a mixed solution of water glass and caustic soda of the above composition has been patented by Meister, Lucius and Brüning (Eng. Pats. 10,784 of 1897 and 11,313 of 1897), and, as Gardner remarks (Mercerisation der Baumwolle, 1898, 44), the lustre produced by it is inferior to that obtained with caustic soda alone; the mixture hinders the shrinkage, although it increases the affinity of the yarn for colouring matters. On allowing the mixture to act upon cotton fibres on the microscope stage, it is seen that action sets in slowly, the fibres beginning to untwist rapidly after about five seconds' contact with the solution and becoming quite straight after about 20 seconds. At the same time swelling occurs, but to a far less extent than if caustic soda solution alone is used. Measurements made on a hank steeped at 20° C. and subsequently washed and dried showed that shrinkage to the extent of 17·4 per cent. was caused by the action. The hank treated with this solution in the unstretched condition showed slightly more gloss than the raw yarn, whilst a hank immersed and washed whilst stretched exhibited a distinct lustre, although far less than if strong caustic alone had been used in the treatment. Treatment with this solution thus causes untwisting and but comparatively slight swelling and shrinking; and the faulty nature of the lustre produced is traceable to the incomplete extent to which these two latter factors participate in the action.

Action of a Mixture of two parts of Soda Lye of 38° *B. with one part of Glycerin.*—The use of this mixture for mercerising purposes has been protected by the Farbenfabriken vorm. F. Bayer & Co. (D.A.Kl. 8, 10,126 of 1897), and is said to arrest the shrinkage whilst increasing the strength of the yarn; we found on immersing a hank of bleached Egyptian yarn in the mixture, and afterwards washing and drying, that a shrinkage of 13·4 per cent. took place. The yarn immersed unstretched showed a slight gloss, and a hank immersed in the stretched condition developed more lustre, although far less than if caustic soda alone had been used. Treatment of loose cotton on the microscope stage with the solution showed that the fibres at first swell very gradually with the accompaniment of but little untwisting; after two minutes' action the fibres are still seen to be swelling slowly, but the untwisting begins to proceed more rapidly. The whole action is far less marked than if ordinary soda lye is used, but after the expiration of about four minutes the fibres are seen to have assumed somewhat the appearance of cotton fibres which have been mercerised in the stretched condition; this seems to be due to the slow swelling having partly absorbed the twist in the fibre, and in such a way that traces of it still remain as ridges on the round swelled surface of the fibre.

Action of Sulphuric Acid.—Mercer found that sulphuric acid exerts an action upon cotton superficially resembling that of soda; we find that on steeping a hank of bleached Egyptian yarn in sulphuric acid of 114 Tw., and subsequently washing and drying, a shrinkage to the extent of 9·5 per cent. in length is obtained; at this concentration, however, the fibres are rapidly attacked and partly dissolved. A hank immersed stretched shows after washing a perceptible increase in lustre. The examination of the action on the microscope stage shows that the fibres rapidly untwist immediately they come in contact with the acid and at the same time swell and shorten. More rapid untwisting and dissolution is observed with concentrated sulphuric acid.

Action of Zinc Chloride Solution.—This reagent was also mentioned by Mercer as somewhat similar in its action to caustic soda. The microscopic examination of the action of a 50 per cent. solution shows that the fibres untwist very slightly at the moment of contact with the solution, but that then the uncoiling stops and does not again set in; slow swelling and shrinking are noticeable. A hank immersed loose was found, after washing and drying, to have shrunk by 2·3 per cent. and showed no lustre; a stretched hank, however, was found to have become very slightly lustrous.

Action of Syrupy Phosphoric Acid.—The shrinking action of strong phosphoric acid solution was also mentioned by Mercer. We find that no action is observable for the first minute and a half after phosphoric acid is brought into contact with the fibres on the microscope stage; the fibres then, however, begin very slowly to untwist and afterwards to swell. This action proceeds until the material goes into solution.

Action of Nitric Acid of 83° *Tw.*—Fibres treated on the microscopic stage with strong nitric acid unwind very rapidly; they swell, however, only very slowly and to a considerably less extent than with caustic soda. The shrinkage of yarn immersed loose in nitric acid of 83° Tw. amounts to 9·5 per cent. Yarn treated under tension exhibits a distinct lustre, which is, however, inferior to that produced by strong caustic, and is about the same as that obtained with the mixture of caustic soda and glycerin.

Action of Concentrated Hydrochloric Acid.—On immersion in the liquid the fibres are seen to untwist rapidly, although not so rapidly as in strong caustic soda; slight swelling and shrinkage also occur. A hank immersed loose was found to have shrunk by only 1·8 per cent. after washing and drying, but exhibited no lustre, whilst a hank immersed stretched developed a distinct lustre.

Action of Sodium Sulphide Solution.—The application of a 30 per cent. sodium sulphide solution for producing a silky lustre on stretched yarn was protected by Schneider (P.B.A., Kl. 8, 12,196 of 1896). We find that immersion in such a solution causes a shrinkage of 1·3 per cent. in the length of the hank. The yarn, immersed either stretched or unstretched, acquires lustre during the treatment, although not to anything like the same extent as when caustic soda is applied to stretched yarn. On the microscope stage the fibres are seen to untwist and to swell but slightly.

Saturated Potassium Iodide and Potassium Mercuric Iodide Solutions.—We have previously shown that saturated potassium iodide and potassium mercuric iodide solutions have a considerable action on cotton yarn; on immersing a hank in saturated potassium iodide solution it shrank by 2·3 per cent. in length, and a hank immersed stretched acquired merely a slightly increased lustre. The same slight increase in lustre was obtained on immersing a stretched hank in saturated potassium mercuric iodide. On the microscope stage no untwisting of the fibre can be observed, and only a slight swelling occurs either with potassium iodide or with potassium mercuric iodide.

Saturated Barium Mercuric Iodide Solution.—We have shown that saturated barium mercuric iodide solution causes a shrinkage and an increase in strength in cotton yarn practically equal to that produced by caustic soda of 65° Tw. (this J., 1903, 70—77). On microscopic examination, however, saturated barium mercuric iodide solution is seen to cause no untwisting at all in the fibres, although great swelling and shrinkage occur. A hank immersed stretched developed but a slight lustre. No action could be detected on treating the fibres with *formic* or *glacial acetic acid,* or with *ammonia* on the microscope stage. On inspecting the results given above it will be seen that the liquids which cause rapid untwisting, strong swelling, and considerable shrinkage, namely, caustic soda, soda with water glass, soda with glycerin, and nitric acid, are those which cause the stretched yarn to acquire considerable lustre. These three factors, in our view, are essential to the production of any considerable lustre, and it will be noted that when only two of these factors are operative no appreciable lustre is developed on the stretched yarn. Thus, sodium sulphide and hydrochloric acid cause rapid untwisting of the fibre, but only give rise to slight swelling and shrinking; treatment with these liquids leads to the production of but little lustre on the stretched yarn. Again, barium mercuric iodide solution causes great swelling and shrinking, but does not make the fibre untwist; this liquid, consequently, gives rise to the production of but little lustre on the stretched yarn. Lastly, zinc chloride, potassium iodide, and potassium mercuric iodide cause no untwisting and but slight swelling and shrinkage; their application is thus attended by the production of but very little lustre in the stretched hank. A final, but probably the most convincing of all the confirmations of the truth of the view that untwisting, swelling, and shrinkage must all co-operate for the production of a lustre in the treatment of cotton is to be found in some results which we have previously published (this J., 1903, 70—77). A hank, 66·0 cm. in length, of an unbleached Egyptian yarn, having the breaking load of 417·4 ± 2·1 grms., was immersed in caustic soda of 65° Tw., and, after washing and drying, was found to have shrunk in length to 44·8 cm. and to have increased in strength to 526·3 ± 3·8 grms. A similar hank immersed in saturated barium mercuric iodide solution, after washing and drying, had shrunk to 48·9 cm. in length, and its breaking load had increased to 526·6 ± 3·3 grms. The shrinkage and the increase in strength effected by these two solutions was, therefore, as nearly the same as could be produced during any test of a practical nature, and consequently we can state that the swelling and the shrinkage caused were identical in the two cases. The only other difference is that in the case of the caustic soda rapid untwisting of the fibre takes place, whilst with the barium mercuric iodide no such uncoiling of the fibre can be observed; consequently, a stretched hank treated with this soda solution developed a perfect lustre, whilst a stretched hank immersed in the barium mercuric iodide solution showed scarcely any increase in lustre.

The proof that the production of a lustre on treating cotton yarn with reagents whilst in the stretched condition is dependent to as great an extent upon the newly observed property of untwisting which the fibre possesses as by the previously observed factors of swelling and shrinking is completed by the above observations.

We now turn to the consideration of the purely mechanical effect which causes yarn mercerised under tension to appear lustrous. It has been remarked above that after mercerising and washing loose cotton fibres they appear as plain smooth surface rods; the internal canal is almost obliterated and the fibre is curved or bent more or less abruptly. We have, however, not been able to confirm the observation of Lange (Färberzeitung, 1898, 197) that the surface of the fibre mercerised loose exhibits many folds; the fibres after treatment show extremely regular surfaces and very few folds or creases are observable at all.

Further, the absence of the folds to which Lange refers is plain from the photographs which he himself gives in illustration of his paper. The photograph, taken in polarised light in natural colours, which we now give (Fig. 5) of the appearance of a quite typical cotton fibre which has been mercerised loose, renders quite clear the strong contrast between the appearance of a raw cotton fibre (Fig. 2), also in polarised light, and the fibre mercerised loose.

On stretching a raw cotton fibre on the microscope slide, fixing it at its two ends in a stretched condition by means of drops of wax applied at the two ends, and then watching it on the microscope stage whilst caustic soda of 65° Tw. is acting upon it, a clue is got to the true reason of the gloss produced during mercerisation. The fibre is seen to first straighten itself and then to swell under the action of the reagent, the twist remaining for the most part. After the fibre has become rounded, gelatinous and swollen by the absorption of the soda, the untwisting begins to set in. It will be remembered that we have shown above that with solutions sufficiently concentrated to effect mercerisation, the fibres first swell and afterwards or simultaneously untwist.

One part of the fibre held at the two ends is seen to become twisted owing to the untwisting of some other portion of the stretched fibre; later, another part is seen to twist, perhaps in the reverse direction to the first, owing to some other part of the fibre giving up its natural twist.

This kind of action goes on until the original and natural twist of the fibre has become more or less replaced by the second kind of twist produced by the previous unwinding. The fibre mercerised stretched thus presents the appearance of a gelatinous straight rod on which a series of pieces of corkscrew-like windings are visible; on washing the fibre and allowing it to dry, it is seen to preserve this shape. By this process the original creased or folded ribbon which constitutes the raw cotton fibre becomes converted into a straight rod of nearly circular cross section which carries on its surface, however, a series of spiral elevations; at the same time the fibre and the surfaces of the raised ridges are perfectly smooth; the rounded surfaces of these smooth ridges reflect the light which falls on them from any direction in just the same way as do the turns in a polished corkscrew, and it is to the presence of these ridges, which are absent in the original fibre or in the fibre mercerised loose, that the increased lustre of cotton yarn mercerised in the stretched condition is due. For the purpose of illustrating the appearance of these ridges on a cotton fibre mercerised in the stretched condition the photograph in natural colours of a typical fibre is given in Fig. 6; for purposes of comparision a photograph of a similar fibre taken in polarised white light is shown in Fig. 7.

Lange (*loc. cit.*) has ascribed the lustrous appearance of cotton mercerised stretched to the fibre having been subjected to tension whilst still elastic, and states that such fibres present the appearance of "rods which are fairly straight, stretched, and transparent, with—in comparison with the fibres which have been mercerised in the loose state—smooth, regular surfaces." The fibres, he remarks, have the appearance of "a smooth tube."

That our view is correct and that Lange's is not, can be easily seen on examining a mass of fibres which have been mercerised stretched, either as such or in yarn, upon the stage of a dissecting microscope under a magnification of 20 to 40 diameters, allowing the light from some powerful illuminator to fall directly upon the fibres. It will be seen that the lustre or sheen of the whole mass of fibres is not due to a reflection of light from the whole or a considerable part of the length of the individual fibres, but is due to reflection from a number of points on each fibre, that is to reflection from the sides of the ridges lying spirally on the surface of the fibre.

Again, the cross section of a cotton fibre mercerised loose is nearly circular and, if Lange is correct in his view that the stretching during mercerisation has the effect of rendering the fibre smoother and more tube-like in appearance, the cross section of the fibres mercerised under tension should be still more nearly circular; whilst if the new view which we now advance is correct, the fibre mercerised stretched should be less nearly circular in cross section than the one mercerised loose. This must be so, because amongst a number of sections many would naturally occur in which the section is cut across the ridges; in these cases the cross sections should appear roughly polygonal in outline.

We do not reproduce photographs to prove that this is actually the case, because Lange's photographs, which cannot be subject to any bias in our favour, as they were made without any knowledge of the existence of the ridges to which we refer, show very plainly the existence of these polygonal cross sections.

It is convenient to construct a rough concrete model to illustrate the efficiency of such a method of obtaining lustre on a smooth polished rod as that of raising ridges on its surface.

Fig. 8 represents a photograph of a frame, the upper part of which is filled with smooth-surfaced slightly tapering glass rods, whilst the lower part is filled with similar rods on the surface of which spiral ridges have been made by turning them before the blowpipe. It will be clear from the figure that the smooth rods—which are comparable to cotton fibres mercerised loose—are far less lustrous than the ones carrying the spirals, and which are comparable with cotton fibres mercerised in the stretched condition.

It is thus proved that the lustre exhibited by cotton fibres mercerised whilst stretched has a cause which has not hitherto been suspected.

The efficiency of the practice sometimes adopted of producing a lustre on cotton yarn or fabrics by immersing them loose in caustic soda and subsequently applying tension, is at once explicable on the basis of our results. The fibres being held in the yarn or fabric cannot untwist entirely and freely as they do when immersed loose in the caustic, each fibre being held by its contact with others in the yarn; when the yarn or fabric is afterwards stretched whilst still gelatinous from the action of the soda, the fibres are straightened and the smooth and rounded ridges which give rise to the lustre are thereby produced.

This paper practically completes our study of the physical and mechanical questions which arise in connection with the action of mercerising and similar agents on cotton. We are now occupied with the determination of the composition of the substances formed when the reagents dealt with in the paper act on cotton and also with the quantitative questions involved in the absorption of colouring matters by cotton and modified celluloses. The problem of determining the composition of the addition compounds of cellulose has been previously attacked by the ordinary methods of chemical analysis, but hitherto without great success. We have therefore devised a method in which the changes in composition of a solution are traced whilst the solution is actually acting on the fire; the composition of the liquid is determined by means of the refractometer. We hope shortly to lay the results of this further work before the Society.

Discussion.

The Chairman observed that the mercerising of cotton fibres was a Lancashire invention, and that now considerable light had been thrown upon the subject by the investigations of the authors in elucidating the various important points connected with this invention, and especially in explaining the manner in which the lustre was obtained on the fibre. They were constantly charged by politicians and the press, and by others who did not know the true state and condition of things in our districts, with inefficiency and ignorance; but when they considered the improvements which were constantly being effected in our manufactures, and the establishment of new industries as the result of inventiveness and ingenuity on the part of Englishmen, they must consider that they were not so ignorant as they had been pictured by those who knew nothing about them. He asked if it was not the highest acknowledgment of British efficiency that foreign nations were building walls of protection which have not been found high enough to prevent invention.

Dr. Ad. Liebmann desired to know whether there is a difference in lustre if the cotton was treated at ordinary temperature or a lower one. He was of opinion that a great many improvements and novelties were still possible in many directions. He had found that it was possible to form metallic combinations—true chemical compounds, and not simply the depositions of oxides on the fibre, from which he had reason to believe that finally we should make new and probably startling products. He would like to ask whether there was a difference in the lustre produced if cotton was mercerised on the stretch, or if it were allowed to shrink and be stretched afterwards? He further wished to know whether the authors had made any observations on the force necessary to prevent shrinkage and to recover shrinkage, and if they had found any difference in the force required for these two operations.

Mr. Harold Lee said the paper was most interesting, whether from a scientific or commercial point of view. They all had had their eyes opened by what they had seen and heard, and they must have been struck by the amount of hard work and patience which had been expended in the experiments placed before them. They had sufficient to take away with them, and anything he might add would be quite superfluous.

Dr. Knecht asked whether the authors had made, or intended to make, further experiments with caustic potash. It was well known that caustic potash has a very different action to caustic soda. He also asked whether, when defects had been caused by uneven mercerising, or perhaps by the cold washing when caustic sodas have been used above 50° Tw., these defects could be remedied or not? There were frequent complaints that mercerised goods were liable to uneven dyeing, and from experiments he had made he came to the conclusion that this irregularity was due to the fact that the goods had been left exposed to the air for a lengthened period, and that this exposure had brought about the formation of oxycellulose upon the surface. The explanation for this uneven dyeing as given by the authors was entirely new.

Dr. H. Levinstein said it was often stated that mercerised goods have a greater affinity for dyestuffs than unmercerised goods. He thought the deeper shades were produced with the same weight of dyestuff on mercerised goods as on unmercerised goods. It seemed to him that this should not be the case. A deeper shade of indigo was produced on mercerised than on unmercerised goods. He should like to ask if the authors had ascertained if the difference in shade of the hanks was produced merely by the colour going on quicker than in unmercerised goods.

Mr. Pope, in reply to Dr. H. Levinstein, said that his question was partly dealt with in the full paper; mercerised yarn certainly takes up a larger proportion of benzopurpurin 4 B. from a bath of given strength than does the same sample of yarn unmercerised. With respect to Dr Liebmann's question, he said that the authors were able to confirm the view that soda is a more efficient mercerising agent at low than at ordinary temperatures.

Mr. Hübner, in reply to Dr. Liebmann, said that some experiments had been made by Grosheintz with a view to ascertain the force required to prevent shrinkage. The authors are now conducting a series of trials, employing the various strengths of caustic soda solutions used in the experiments described in the paper, so as to further elucidate this important question. In reply to Dr. Knecht, he said that the only way which he could suggest for reducing the possibility of uneven dyeing of goods mercerised with soda above 50° Tw., was quick and thorough washing with boiling water. In reply to a further question, he said that it was rarely the practice for pieces impregnated with strong soda lye to be left exposed to the air for a lengthened period; if this, however, should have been the case, he thought it would be perhaps quite plausible to ascribe the uneven dyeing of such pieces partly to the absorption of water, and therefore to the corresponding action of lyes of lower concentrations on the exposed parts.

New York Section.

Meeting held at Chemists' Club, on March 25th, 1904.

DR. VIRGIL COBLENTZ IN THE CHAIR.

ANALYSES OF JALAP.

BY RUSSELL W. MOORE, M.A., M.Sc.

The determination of resin in jalap presents no special difficulties from a chemical standpoint, but in practice there are several points at which the manipulation is attended with some trouble. First is the proper sampling of the root. Various methods of cutting, splitting, and rasping were tried by me, but all were abandoned in favour of a twist drill. This tool in dry jalap produces a finely powdered sample from the interior of the root in proper condition for subsequent extraction. In immature or improperly dried samples the drill yields spiral pieces, but has so torn and broken up the root that the resin is very easily dissolved. The method of analysis is as follows: 7 to 8 grms. of the fine shavings or powder are extracted in a paper thimble in a Soxhlet apparatus with 95 per cent. alcohol for an hour. The solution contains, besides the resin, various coloured extractive bodies, which are removed by washing with water. The alcohol extract is poured into a porcelain evaporating dish of a diameter of 5 ins., containing hot water. The whole is heated on the water bath until the alcohol is driven off, and the resin separates, leaving a nearly clear solution. More water is added and the mixture filtered, care being taken to retain the resin in the dish as completely as possible. The washing with hot water is repeated twice, or until a perfectly colourless filtrate is obtained. After washing the filter thoroughly with hot water, it is dried and replaced in the paper thimble first used, from which the exhausted jalap has been removed. This is placed in the Soxhlet apparatus, connected with a tared flask, and the resin in the evaporating dish is dissolved in hot alcohol and carefully washed into the thimble with hot alcohol. The contents of the Soxhlet apparatus are then extracted for two hours, the alcohol expelled or recovered from the flasks, and the pure resin dried to constant weight in the air bath and weighed. The use of the evaporating dish is recommended, since, where a beaker is used, the masses of resin adhering to the bottom and sides often cause the cracking of the beaker as it is heated and cooled. The clearness of the filtrate is also of importance, as the evaporation of a slightly turbid filtrate yielded a noticeable amount of resin.

The above method presents no new principle, being practically the same as that of the process for preparing *resina jalapæ* in the United States Pharmacopœia, but in analysing a large number of samples, attention to the points noted above has greatly facilitated the conduct of the work.

A number of results obtained are given, to show the percentage of resin found in imported jalap. The Treasury regulations prescribe a standard of eleven per cent. of resin.

The samples analysed represent lots of doubtful quality, and of these 28 out of 98 are under the prescribed 11 per cent. standard, of which eight are over 10 per cent. There is considerable difficulty in sampling inferior lots of jalap, as the roots are not uniform in size or character, and re-samples of the same bag often show differing amounts of resin. Complaint has frequently been made that the standard for resin in jalap is too high, but from the above figures on suspicious-looking jalap there do not appear to be just grounds for such a position. The well-developed and properly dried root often runs as high as 20 per cent., as will also worm-eaten samples in which the content of resin is greater because of the consumption of the portion other than resin by the worms. The principal cause of the occurrence of inferior jalap is want of care in gathering and drying the root on the part of the producers. In no way can this be remedied more effectively than by excluding the inferior article from import and commerce.

No.	Per Cent. of Resin.	No.	Per Cent. of Resin.	No.	Per Cent. of Resin.
1	15·70	34	14·25	68	17·10
		35	15·10	69	7·40
2	21·75			70	7·50
3	15·55	36	10·20	71	14·70
4	12·16	37	20·60	72	8·10
5	14·50	38	15·60	73	6·60
6	11·83	39	13·30	74	8·70
7	22·50	40	12·5	75	11·00
8	16·41	41	15·35	76	6·60
9	23·34	42	10·20	77	11·60
10	11·34	43	11·00	78	10·70
11	17·34	44	8·40		
12	14·83	45	11·10	79	8·80
		46	15·00	80	16·40
13	12·47	47	12·80	81	13·50
14	10·12	48	12·00	82	11·00
15	10·12	49	14·40	83	9·40
16	11·75	50	11·80	84	12·70
17	14·18	51	20·50		
18	11·81	52	9·50	85	7·64
19	9·88	53	12·80	86	7·79
20	13·42	54	15·90	87	15·00
21	15·14	55	10·50	88	11·34
22	11·14	56	12·20	89	14·30
23	14·60	57	11·90		
24	14·93			90	6·14
25	11·75	58	11·60	91	8·73
26	14·67	59	12·60		
27	12·80	60	13·30	92	13·57
28	10·42	61	9·20	93	8·00
		62	9·30	94	16·00
29	13·45	63	11·60	95	9·50
30	14·30	64	7·30	96	14·78
31	14·20	65	13·80		
32	10·15	66	11·00	97	12·00
33	18·65	67	12·90	98	11·50

Maximum, 23·34 per cent.; Minimum, 6·14 per cent.; Average, 12·60 per cent.

The different lots are separated by lines.

ON THE CUPELLATION OF PLATINUM ALLOYS CONTAINING SILVER OR GOLD AND SILVER.

BY W. J. SHARWOOD.

The following notes may be of interest in connection with those recently published by H. Carmichael (this J., 1903, 1324). The experiments were made primarily to ascertain the extent to which lead is retained in the cupellation of platinum alloys, and the extent to which the platinum passes into solution during parting.

The platinum used was found to contain a little iridium; the gold was prepared by twice precipitating with sulphur dioxide, and melting with borax; the silver was prepared by reduction of the chloride, and showed no trace of copper or gold; the lead was practically silver-free, 30 grms. yielding only 0·05 mgrms. on cupellation. The metals taken were adjusted to within 0·05 mgrm., and the weighings made to 0·02 mgrm., but in tabulating the results most of the fractions have been neglected. Two parting acids were used in each case; No. 1 was made by mixing equal volumes of water and of nitric acid of sp. gr. 1·42; No. 2 from one volume of water and two of acid.

In the first series, equal weights of platinum, 100 mgrms. each, were wrapped in about 5 grms. of sheet lead, with varying amounts of silver, or silver and gold, and cupelled at a temperature suitable for gold bullion; they were left in the muffle about three minutes after apparently "finishing." After weighing they were warmed with No. 1 acid, washed, boiled with No. 2 acid, washed, dried, and weighed. No. 7 was heated to anneal the residual gold. In every case except No. 8 the weight of the final residue exceeded that of the platinum, or gold + platinum, taken.

The "loss in parting" gives the silver and lead, or silver and lead and platinum removed by the nitric acid; "lead retained" indicates the increase in weight after cupellation, neglecting absorption of silver by the cupel.

With platinum alone, or with little silver, the cupelled button is of a dull grey; slight increases in the silver give a crystalline surface; with two or more parts of silver the button closely resembles a normal silver button, but has a somewhat steely appearance, and is usually brittle if the silver is less than three times the weight of platinum.

First Series.

No.	Platinum taken. Mgrms.	Silver taken. Mgrms.	Gold taken. Mgrms.	Lead retained. Mgrms.	Loss in Parting. Mgrms.	Weight after Parting. Mgrms.	Character of Cupelled Button.	Effect of Acid on Button.
1	100	0	0	37·5	0·5	137·0	Hard, silvery	None visible.
2	100	25	0	31·0	5·5	150·5	,,	,,
3	100	50	0	26·2	8·7	167·5	Dull grey	,,
4	100	100	0	25·0	48·0	177·0	,,	Very slight.
5	100	101	48	24·0	3·0	270·0	,,	None visible.
6	100	206	48	22·0	158·0	218·0	Smooth, silvery	Slight.
7	100	206	6	10·0	280·0	42·0	,,	Powdery residue.

Second Series.

No.	Platinum taken. Mgrms.	Silver taken. Mgrms.	Gold taken. Mgrms.	Lead retained. Mgrms.	Platinum dissolved in Parting. Mgrms.	Character of Cupelled Button.	Colour of Solution.
8	100	105	0·0	11·4	30	Very crystallised and brittle	Brown.
7	100	206	6·0	10·0	63	Smooth, brittle	,,
6	100	206	48·0	22·0	0	,, ,,	Colourless.
9	100	310	0·0	10·0	64	Slightly crystallised	Brown.
10	100	427	0·0	5·0	89	Smooth and silvery	,,
11	100	470	19·4	2·0	99	,, ,,	Colourless.
12	100	1,050	167·0	(?)	100	,, ,,	,,

In the second series the amounts of platinum taken varied somewhat—the weights of platinum, silver, and gold, ranging from 300 to nearly 2,000 mgrms., 5 to 10 grms. of lead being used. The buttons were rolled out to nearly uniform thickness, and 200 to 500 mgrms. cut out for parting. For the sake of comparison all are calculated to a uniform basis of 100 mgrms. of platinum. As the final residues were less in weight than the platinum or platinum and gold taken it was assumed that all the lead and silver dissolved, and the figures under "platinum dissolved" represent the platinum or gold and platinum taken, *minus* the final weight of the annealed residue. Results 6 and 7 are also included in this series for comparison.

In Nos. 7, 8, 9, and 10 the platinum was left after parting in a very finely divided condition. On filtering the brown decanted solution very little platinum remained on the filter, but the filtrate was still brown; on standing three days a black powder separated, and the solution became almost colourless. In No. 12 the cupelled button was slightly less in weight than the platinum, silver and gold taken, the silver absorbed by the cupel doubtless exceeding the lead retained.

In No. 11, attempts were made to estimate the silver in the nitric acid solution, by titration with potassium thiocyanate. In this and in other instances when platinum was present, titration indicated more silver than was actually present; the excess of reagent consumed corresponded very closely to 4 mols. potassium thiocyanate for each atom of platinum in solution, but the end of the reaction is rendered very indefinite by the platinum.

From an examination of the tabulated results it is vident that the lead retained upon cupellation decreases, vhile the platinum dissolved by nitric acid increases, with n increase in the ratio of silver to platinum. An increase n gold, silver and platinum remaining constant, seems to lecrease the dissolving of platinum, but more extended work s necessary on these lines. The retention of lead appears o depend mainly upon the fusibility of the button, oxidaion ceasing for practical purposes when the button olidifies. This was proved by cupelling alloys similar to , 2, and 3 at higher temperatures, the cupelled buttons eighing less, but it is not thought necessary to give the esults, as these were doubtless modified by the greater bsorption of silver in the cupel under these conditions.

Nottingham Section.

Meeting held at Nottingham, on Wednesday, March 30th, 1904.

MR. J. T. WOOD IN THE CHAIR.

THE DETERMINATION OF THE IODINE ABSORPTION OF OIL OF TURPENTINE.

BY T. F. HARVEY.

Since the Wijs method of determining the iodine value of fats appears to furnish a true measure of their degree of unsaturation, it was thought that it might be of use in differentiating between pinene and limonene, the chief terpenes respectively of turpentine and lemon oil, adulteration of the latter with turpentine or rectified turpentine being a common practice a few years ago.

Theoretically, limonene should absorb 4 halogen atoms, since it contains two double linkages, while pinene containing one double linkage should absorb but 2 atoms, the respective iodine values (theory) being 372 and 186—any figures obtained in excess of these when working on the pure substances must be due to substitution. Some support was lent to this idea upon finding that three samples of American turpentine gave iodine values respectively of 166, 198, and 221, while by the same method the first 10 per cent. of distillate from six samples of lemon oil gave values varying from 334 to 349. These experiments were made in 1901, and were not proceeded with. My attention was again attracted to the matter by the figures which Archbutt gave for American turpentine in the Journal for Dec. 15, 1902, and which varied from 277·4 to 405·6 according to the time of contact allowed. Recently, with a fraction of American turpentine I obtained results which did not appear to be in agreement with these. On looking further into the matter, I find that the quantity of halogen absorbed by turpentine is governed also by the excess of solution used and by the character of the excess halogen present in the Wijs solution—*i.e.*, whether iodine or chlorine be present in addition to ICl.

In the accompanying tables are shown the different values obtained by varying (1) the time, (2) excess of Wijs' solution, (3) character of excess halogen over that required for ICl, (4) hydration of the acetic acid.

Solution A consisted of ordinary Wijs' solution containing ICl with a slight excess of iodine, 25 c.c. = 49 c.c. N/10 thiosulphate.

Solution B consisted of solution A into which a slight excess of chlorine was passed. 25 c.c. = 51·5 c.c. N/10 thiosulphate.

Solution C consisted of solution A into which a large excess of chlorine was passed till 25 c.c. = 68 c.c. N/10 thiosulphate. This was then diluted to about N/5.

The liquids used in these experiments were: (1) A fraction distilled from American turpentine between 155° and 156° C.; (2) a sample American turpentine having the following characters:—Specific gravity at 15·5° C. = 0·8676; optical rotation (100 mm.) = + 8°; refractive index at 20° C. = 1·4709; soluble in one half (or more) of its volume of 99 per cent. acetic acid; 95 per cent. distils between 154°—162° C., while the residue distilling above 170° C. was 2·7 grms. per 100 c.c.; flash-point (Abel) = 94° F.

TABLE I.

Fraction of American Turpentine, distilling 155—156° C.

—	Time of Standing.		
	5 mins.	1 hour.	3 Hours.
Solution A. Excess halogen used = 42 per cent.:—			
Trace H_2O present ……	205·7	206·0	205·5
1½ c.c. H_2O added …….	204·4	205·3	207·6
Solution B. Excess halogen used = 40 per cent.:—			
Trace H_2O present ……	227·5	228·9	229·1
1½ c.c. H_2O added …….	223·4	226·8	229·0
Solution C. Excess halogen used = 32 per cent., trace H_2O present …………..	238·2	..	253·6

TABLE II.

American Turpentine.

Excess Halogen per Cent. of Total Added.	Time of Standing.	Solution A.	Solution B.
26	1 hour	131·7	..
30	"	151·3	..
34	"	172·6	..
40	5 mins.	215·3	225·4
40	1 hour	215·1, 214·0	225·4
40	3 hours	213·9	224·7
53	1 hour	332·7	348·3
84	"	409·0	..

With regard to the titration of the experiments, it has been suggested that water should always be added before potassium iodide, so as to minimise any reversal of the reaction. In the Journal for Dec. 15, 1902, I showed that this led to incorrect results, the halogen disappearing from blank experiments in amount depending on the time of contact with the water. I also showed that this loss was not mechanical, and am now of opinion that substitution of the acetic acid occurs on dilution. This does not seem unreasonable, since halogen substitution products of the fatty acids are formed in presence of iodine and iodic acid (Richter, Vol. I., page 272), both of which must be present after diluting Wijs' solution containing excess of iodine. If this view is correct, a constant blank should be obtained by employing, instead of acetic acid, a solvent such as carbon tetrachloride, in which substitution cannot occur. This was tried, and no variation ensued upon diluting the blank with water and allowing it to stand 5, 30, and 60 minutes respectively, with frequent and violent shaking. Original solution, 15 c.c. = 27·1 c.c. N/10 thiosulphate. After 5 minutes' contact with water, 15 c.c. = 27·0 c.c. N/10 thiosulphate. After 30 minutes' contact with water, 15 c.c. = 27·0 c.c. N/10 thiosulphate. After 60 minutes' contact with water, 15 c.c. = 27·0 c.c. N/10 thiosulphate. Potassium iodide should, therefore, always be added before diluting.

DISCUSSION.

Mr. ARCHBUTT said he could confirm Mr. Harvey's statement that the amount of iodine absorbed by oil of turpentine from Wijs solution depended upon the amount of iodine in excess, as well as upon the time of contact. To measure the iodine addition value, a direct titration would probably be best, if it could be made; but for the detection of adulteration, a high iodine value was an advantage and the occurrence of substitution did not matter, provided the results were concordant. He, therefore, preferred to add a large excess of iodine. The experiments recorded in the following table, all made with the same sample of turpentine, proved that, if the time of contact and the excess of iodine were kept constant, concordant values were obtained.

Time of Contact.	Excess Iodine.		Iodine Value.
	Per Cent. of that Absorbed.	Per Cent. of Total Added.	
20 mins.	96	49	288·9
"	96	49	290·0
"	96	49	289·4
			Mean 289·4
20 mins.	103	51	301·4
"	103	51	301·0
"	103	51	301·0
			Mean 301·1
20 mins.	113	53	305·2
"	113	53	304·0
"	113	53	305·0
			Mean 304·7

The conditions of working which he recommended were, to allow 20 minutes contact, and to take care that at the end of that time the iodine left unabsorbed was at least equal to, but not more than 5 per cent. in excess of that absorbed. This might involve making one or two trial titrations, which was easily done.

Scottish Section.

Meeting held on Tuesday, February 23rd, 1904.

MR. T. L. PATTERSON IN THE CHAIR.

LINTNER'S SOLUBLE STARCH AND THE ESTIMATION OF "DIASTATIC POWER."

BY JOHN S. FORD, F.R.S.E.

1. INTRODUCTION.

During the last few years, a number of papers have been published dealing directly or indirectly with the determination of the diastatic (amylotic) activity of malts, and a conspicuous feature of these has been a disregard of previous publications, more particularly of the fundamental work of Kjeldahl (Comptes rend., Carlsberg, 1879, 109), and the important papers, by Duggan (Amer. Chem. J., **7**, 306; **8**, 211), and Wood (Amer. Chem. J., 1893, 663), on the influence of traces of impurity on diastatic action.

Many of the contradictions and differences of opinion as to matters of fact prevalent in certain of the more recent publications are, in the estimation of the writer, due to the omission of precautions indicated by Kjeldahl, Duggan, and others, and the object of this communication is to again draw attention to these, and certain other precautions which must be observed, if uniformity of results is to be attained in experiments on amylotic action. At the same time, the writer regrets that his contribution to the subject is also of a contradictory, as well as of an incomplete, nature.

In a recent paper (Woch. f. Brau., 1902, 313), Mohr says: "It is well known that the activity of diastase may be increased even ten times by the addition of mere traces of certain substances, such as asparagine, lactic acid, &c.," and results are given showing such differences. Effront* in "Les Enzymes," and elsewhere, makes somewhat similar assertions, and gives data, showing the accelerating effect of asparagine, acids, and certain salts on diastatic action. Grüss (J. Pharm., **2**, 275), and Jungk (Pharm. J. Trans., **14**, 104), make much the same observations with regard to the effects of asparagine and acids respectively. Brown and Morris (J. Chem. Soc., 1890) also state that the addition of very dilute acid stimulates the action. These views have received very general acceptance, the results of Effront in particular being frequently quoted. In the opinion of the writer, this apparently favourable effect of added acid is due, not to the acid *per se*, but to its neutralising alkaline impurities present in the solutions. Very minute traces of alkaline impurities have a powerful inhibiting effect on diastatic action, and when these are less or more neutralised by the added acid, the action approaches its normal maximum, which takes place in a neutral solution, or at least in one in which the free hydrogen or hydroxyl ions are at a minimum.

That this is the explanation seems probable from the fact that the salts, mentioned by Effront and others as accelerators, appear to be all acid ones; and it will be shown subsequently, there is in laboratory operations a source of alkaline contamination, which is generally overlooked. That the starch used by Mohr (Woch. f. Brau., 1902, 94) was really alkaline, appears likely from his results with asparagine; at 17°—18° C. he finds little difference, but at 53°—55° C. a marked increase of maltose in presence of asparagine. Now an aqueous solution of asparagine reacts much more strongly acid at 53°—55° C. than it does at the lower temperatures, thus, at the higher temperature, there being a more complete neutralisation of the alkaline impurities, diastatic action is greater. On exceeding a certain addition he found the action was retarded, this being due to the presence of an excess of acidity. Degener (Chem. Centralbl., 1897, **2**, 936) has pointed out this peculiarity of asparagine solutions (which the writer had noted independently), and he attributes it to decomposition of the complex molecule, not to hydrolysis. He has also shown that many organic acid solutions require more alkali for neutralisation (with indicators) when hot, than when cold. Malt extract solutions exhibit the same phenomenon, but n their case hydrolysis of phosphates probably plays a part.

With regard to the reaction of starch preparations, as etermined by colour indicators, this depends upon the ndicator; a solution of ordinary soluble starch, may be eutral to rosolic acid, acid to phenol-phthaleine, and lkaline to methyl orange; so in speaking of a starch as eing neutral, it is necessary to define in what sense the ord is used, and this point will be referred to again.

2. EXPERIMENTAL.

a. *Maltose Constants.*

In the determination of the copper reduction of the ccharified starch solutions, the method described by rown, Morris, and Millar (J. Chem. Soc., 1897, p. 96) was nployed, and the writer, having some specimens of carefully urified maltose, took the opportunity of verifying the values ven by them for the copper-reducing power of this sugar. e maltose used, was obtained by the fractional crystallisan of a thrice crystallised preparation made from arrowroot diastase hydrolysis. The fractions of the same rotatory wer were mixed, and portions dried over sulphuric acid, d phosphoric anhydride, in desiccators for some weeks. e specimen kept over phosphoric acid, when dried *in cuo* at 106° C. lost 5·5 per cent., that from the sulphuric d desiccator lost 5·7 per cent. *in vacuo* at 106° C., and ortion dried in a current of air at 90° C. lost 0·7 per cent. 0·4470 grm. of this, dried *in vacuo* at 106° C., weighed 0·4250 grm., which is the theoretical yield for maltose hydrate. These results confirm the observations of the above authors as to the difficulty or impossibility of obtaining a definite hydrate, by drying in a desiccator, but indicate the possibility of doing so by drying in air at 90° C. For the determination of the rotatory power, 3·285 grms. anhydrous maltose was dissolved in water, and made up to 100 cc. (*i.e.*, the volume at 15·56° C. of 99·807 grms. water in air); the solution weighed 101·096 grms., and its sp. gr. 15·6°/15·6° was 1·01295 determined, and sp. gr. 15·6/4° 1·01220 calculated; the rotation in a 2-d.m. tube was $9{\cdot}13^\circ_D$: hence $[\alpha]_{D\,\text{abs.}} = 139{\cdot}0^\circ$, a value somewhat higher than that of Brown, Morris, and Millar. From various other determinations the writer has always obtained this value for concentrations of 3 to 10 per cent., and he is inclined to think that his higher result is due to the polarimeter employed, as this instrument gives for sucrose $[\alpha]^{10\%}_{D\,\text{abs.}}$ 67·0°, a value also higher than that usually accepted. Several determinations of the solution density, at different concentrations, were in close agreement with the results of the above observers, and, as will be seen below, the copper reductions are likewise so concordant as to prove that the specimens of maltose used by these workers and the writer were equally pure.

Copper-reducing Power of Maltose, the Copper being weighed in Gooch Crucibles as CuO.

Maltose taken.	CuO found.	Equal to Maltose by Brown, Morris, and Millar's Tables.
Mgrms.	Mgrms.	Mgrms.
45·5	65·8	..
81·1	113·5	82·3
167·2	229·1	167·0
221·0	300·0	220·0
265·5	362·8	266·0
293·0	398·3	292·2
312·5	427·1	313·0

With the same maltose a few experiments were made with Kjeldahl's (Comptes rend., Carlsberg, 1895) method of reduction, by boiling in an atmosphere of hydrogen; the results were as follows for 30 c.c. Fehling:—

Maltose taken.	CuO found.	Maltose by Kjeldahl's Tables.
Mgrms.	Mgrms.	Mgrms.
39·3	64·0	39·7
82·8	129·0	82·0
130·2	198·0	129·0
183·0	273·0	183·5
195·3	290·0	196·5

The agreement here is also very close.

Experiments were made to see if simple drying of the Cu_2O precipitate, in the water oven, gave the same results as ignition to CuO. Slight divergences were invariably obtained, indicating a certain amount of oxidation of the cuprous oxide under such conditions of drying, it generally weighing from 2 — 3 mgrms. more than the amount calculated, from the CuO found, in precipitates of 0·1—0·2 grm. The difference in weight was proved not to be due to retention of water by the asbestos.

It may also be mentioned here that in the writer's experience, the reduction (by means of ignition in hydrogen) of the copper oxide to metallic copper is quite unnecessary, as with reasonable care ignition to CuO gives the same results.

b. *Soluble Starch of Various Origins, Preparation, and Properties.*

Ordinary preparations of soluble starch invariably contain phosphates, and possibly traces of organic phosphorus compounds, which are not removed by prolonged treatment with dilute alkali or acid, or washing with water. Precipitation of aqueous solutions of the starch, with alcohol, carries down the phosphates with the starch, and to-

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Effront: "Les Enzymes et leurs Applications." Paris: Carré Naud.

eliminate them anything like completely, it is necessary to throw down the starch repeatedly, from acidified solutions, with alcohol. Starch obtained thus retains acid, which cannot be washed out readily with alcohol, and to remove this, it is necessary to redissolve in water and precipitate with alcohol several times. This operation is not easy to carry out, because when the starch solution becomes free from acid or salts it forms a "milk" with alcohol, which does not separate even on long standing; addition of a very small quantity of pure potassium or sodium chloride induces flocculation, but the starch then contains traces of the added salt. Neither of these chlorides, however, has any direct effect upon diastatic action. Starch prepared thus, though practically ash free (except for the traces of added salt), when ignited with sodium carbonate and nitrate shows the presence of phosphoric acid, and the writer has not obtained from potato starch a preparation which yielded less than 0·1 per cent. P_2O_5. An attempt was made to remove the phosphorus compound from a potato soluble starch by extraction with alcohol, and ether alcohol. The original starch gave 0·17 per cent., and after six weeks treatment 0·15 per cent. P_2O_5. The starch was then found to be strongly alkaline to rosolic acid, probably owing to solution of alkali from the glass extraction cylinder, so the attempt was abandoned.

Soluble starch prepared by alcohol precipitation as described, is fairly pure, and nearly neutral, that is to say, it gives no reaction with rosolic acid or methyl orange, though usually somewhat acid to phenol-phthaleine. 10 grams equal 1 c.c. N/100 NaOH; this, though an appreciable quantity, is relatively small compared with that of ordinary preparations of Lintner's starch.

It has recently been noticed that other starches than potato, such as maize, wheat, or rice contain less of, or are more easily freed from, phosphorus compounds, and the writer has prepared from maize, specimens which are certainly a close approximation to the pure substance.

To prepare starches in this way for use in technical laboratories is out of the question, and fortunately unnecessary, and we use the ordinary Lintner's preparation; and in connection with the washing of this free from acid it must be pointed out that the usual directions, to "wash until the wash waters are free from acid," are by no means sufficient, as the starch may still be strongly acid, though the wash water is neutral. Indeed it seems to be almost impossible to remove acid from starch by washing with distilled water. Saare (Ann. Agronom., 16, 471) drew attention to this many years ago. The writer has tried several times to remove all traces of acid by prolonged washing with distilled water, but bacterial fermentation has usually interfered with the attempts; this difficulty might of course be overcome by the use of some antiseptic, which does not interfere with diastatic action, such as toluol, chloroform, oil of cloves, &c., but an attempt made thus, was not more successful. 1 kilo. of maize soluble starch was stirred for 1 hour with 7 litres of distilled water, twice a day for three weeks, toluol being added as an antiseptic. At the end of that time the starch was still strongly acid, 10 grms. equal to 8 c.c. N/100 NaOH, rosolic acid, and 18 c.c. N/100 NaOH, phenol-phthalein, as against 6 c.c. and 14 c.c. respectively at the start. There was no evidence of fermentation, so presumably the increase of acidity is due to some other cause, possibly hydrolysis of the phosphates present, along with a preferential adsorption of acid by the starch granules. This is probably the explanation, as the wash waters were slightly alkaline for the first week or so. It must, however, be explained that this starch was not obtained under the ordinary conditions, as, after digestion with hydrochloric acid, and washing until the wash waters were neutral, the acidity of the starch was determined, and a quantity of soda, rather more than equivalent, added, the mixture being shaken for some hours and allowed to stand overnight. It was then filtered and washed until the excess of alkali was removed, *i.e.*, until the washings ran through neutral, when the starch was found to be acid, and at this stage was used in the experiment just described.[*]

By using tap water—*i.e.*, water containing calcium carbonate—the acidity of the starch is neutralised, but if care be not taken an alkaline preparation is obtained, and possibly the general employment of ordinary water, for washing, accounts for so many specimens being alkaline.

In all cases after using tap water, it is advisable to rewash with distilled water until a portion of the starch dissolved in boiling neutral water, gives no reaction with rosolic acid, or is at most faintly acid to that indicator.

The various raw starches, as maize, wheat, barley, rice, arrowroot, or potato, are not equally suitable for the preparation of soluble starch, owing mainly to the difference in their rate of subsidence in water. Large grained potato and arrowroot settling rapidly, washing can be carried out expeditiously; maize does not settle so well, and wheat, barley, and rice do so even more slowly. Potato starch, owing to this property and its low price, is the usual material employed, though arrowroot, save for the price, is equally desirable. Whichever starch is used, it should first be washed with water, then with half per cent. soda, again with water, and then digested with hydrochloric acid sp. gr. 1·037 for two to three days at 40° C., or until a portion, after washing free from excess of acid, dissolves readily in boiling water, and shows no sign of gelatinised granules.

If the action of the acid be not carried far enough, the solution filters badly, rendering the determination of its copper-reducing power difficult. On the other hand, if the treatment be carried too far there is a very considerable production of amylo-dextrin. Indeed, all soluble starches prepared in the heat by acid contain this substance, and it is to its presence, and not to that of maltose or glucose, that their copper-reducing power is due. This is proved by the fact that yeast has no effect in reducing the amount of apparent maltose in solutions of the starch, and that these, on dialysis, yield, not sugars, but a body having the properties of amylo-dextrin.

Soluble starch (100 grms.) from arrowroot by Lintner's method, dissolved in water, was dialysed for two days, the dialysate concentrated and precipitated with alcohol twice, the precipitate then dissolved in water, and evaporated to remove alcohol, was made to a volume of 50·03 c.c., weighing 50·434 grms.

The solution gave a red-brown colour with iodine. 10 c.c. dried *in vacuo* at 110° C. weighed 0·1985 grm., ash 0·0015 grm. 10 c.c. reduced 0·036 grm., CuO. Rotation in 2 dm. tube = $7{\cdot}47^\circ_D$.

These results correspond to $[\alpha]_{D\ \mathrm{abs.}}$ 189°, $R_{\mathrm{abs.}}$ 14·4, which are the values given by Brown and Morris (J. Chem. Soc., 1889, 453) for amylo-dextrin.

The soluble starch used here, had the constants $[\alpha]_{D\ \mathrm{abs.}}$ 195·7, $R_{\mathrm{abs.}}$ 7·4, and is thus a mixture of 48·6 per cent. starch, and 51·4 per cent. amylo-dextrin: in this case the action of the acid had been carried rather far. With care it is easy to prepare soluble starches free from unaltered starch with R 2 to 3, or containing from 13 to 20 per cent. amylo-dextrin. By allowing the action of the acid to tak place in the cold soluble starches with R as low as 0·2 t 0·5 may be obtained, but these do not give such satisfactor solutions for ordinary manipulations as those with R 2 o thereabouts. For practical purposes of diastasimetry th presence of a slightly greater or less proportion of amylo dextrin in the starch, is of no importance, as is shown b the following results:—

1 c.c. of malt extract[*] to 70 c.c. of each solution,[†] 1 hour at 40° C., boiled, cooled, and made to 100 c.c.

	Grms. of CuO per 100 c.c.
Gelatinised starch, liquefied by diastase	0·54
" plus 5 per cent. amylo-dextrin ..	0·53
" " 10 " " ..	0·54
Soluble starch R 7..............................	0·53
Amylo-dextrin R 14·4	0·57

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[*] This is true also for preparations made by nitration, acetylation, and solution in glycerin or sodium hydroxide, unless purified by repeated precipitation.

[*] Unless otherwise mentioned, the malt extract used is alwa prepared by extracting 20 grms. finely-ground malt with 500 c distilled water for six hours at 20° C. The error of measureme of the 1 c.c. from a special pipette does not exceed ± 2 mgrms.

[†] 70 c.c. of starch solution always used in the experime throughout this paper, the strength being so arranged that t volume corresponds to 2 grms. dry starch. The action is stop by boiling, or by addition of alkali, as is expedient.

Effront, in "Les Enzymes," states that starches from ifferent sources act differently with diastase, and seems to mply that this results from some actual difference in the tarch *quâ* starch. Ling (J. Fed. Inst. Brewing, 1903, 54) also finds that soluble starches prepared in different vays give different results with diastase. There is no oubt that preparations of soluble starches do differ in ertain physical characteristics, but the writer is of opinion hat when different specimens give different maltose pro-luctions with diastase, it is not the starch which causes the ariations, but the impurities present in the specimens. 'ure starches, or rather, one should say, purified starches, hether soluble starch prepared by acid, or by gelatinisation, nd liquefaction by diastase, or in the form of properly repared "pastes," undoubtedly give similar conversions rith equal quantities of diastase under similar conditions, hat is to say, solutions of soluble starches from any source, hen equally pure will give the same maltose production hen acted upon by equal amounts of diastase.* This emark does not, of course, apply to starches when in the olid (natural) state, where the rate of dissolution by malt xtract or diastase varies greatly, nor to starches prepared om malted grains, nor to the action of diastase, under rewing conditions, in the mash tun. These are conditions hich do not come within the scope of the present paper.

The starches mentioned below were, with the exception of e barley, bought commercially, and purified by treatment ith dilute alkali and acid, being well washed and air ried. Portions (15—20 grms.) were gelatinised and quefied at 79°—80° C. with a trace of precipitated diastase, oiled when limpid, and made to 500 c.c., 1 c.c. of malt xtract was added to 70 c.c. of each solution at 40° C., ept for one hour at 40° C., solutions boiled, and made to 100 c.c. The results in all cases are corrected for reduction of starch solutions, and malt extract.

Starch Variety.	CuO per 100 c.c.†	Reaction of 10 grms. Rosolic Acid.
Arrowroot, Natal	0·53	Neutral.
Rice	0·52	0·17 c.c. N/100 NaOH.
Wheat	0·52	0·17 c.c. N/100 NaOH.
Maize	0·52	0·10 c.c. N/100 H_2SO_4.
Potato	0·54	Neutral.
Barley	0·52	0·17 c.c. N/100 NaOH.
Arrowroot, unpurified	0·47	0·30 c.c. N/100 H_2SO_4.
„ Lintner's soluble	0·54	Neutral.

† In all cases CuO per 100 c.c. is expressed as grms.

It is evident that the origin of the starch has, under these conditions, no influence on the results when the starches are purified, and it may be mentioned that O'Sullivan (J. Chem. Soc., 2, 141), in one of his earliest communications on the transformation of starch, states that though he used potato starch, he satisfied himself that various other starches gave the same results. The writer has verified O'Sullivan's statement, by conversion of "pastes," made from the first six starches in above table, with precipitated diastase at 58° C. The corrected values $[\alpha]_{D3\cdot93}$ 174°—176° and $R_{3\cdot93}$ 42—44, being very close, considering that the starches, though purified, were not "pure," and that the diastase, like most alcohol precipitated specimens, was distinctly alkaline to rosolic acid (1 grm. = 16 c.c. N/100 H_2SO_4). From the above starches soluble preparations were made by Lintner's method, and tested similarly with the results below :—

Starch.	CuO per 100 c.c.	Reaction per 10 grms.		Ash per Cent.
		Rosolic Acid.	Phenol-phthaleine.	
rrowroot (α)	0·54	Acid 0·8 c.c. N/100 NaOH	Acid 5·0 c.c. N/100 NaOH	0·10
ice	0·53	„ 3·7 „ „	„ 27·0 „ „	0·09
heat	0·50	„ 5·2 „ „	„ 27·0 „ „	0·10
aize	0·52	„ 4·6 „ „	„ 25·0 „ „	0·07
tato	0·53	„ 1·5 „ „	„ 15·0 „ „	0·15
rowroot (β)	0·54	„ 0·5 „ „	„ 5·0 „ „	0·08
„ (γ)	0·47	Alkaline 1·0 c.c. N/100 H_2SO_4	„ 10·0 „ „	0·12
tato‡	0·44	„ 2·0 „ „	..	..

‡ This starch was made from a "purest commercial farina," by gelatinisation, and liquefaction with a trace of diastase, the solution er concentration being precipitated, twice only, with alcohol. The result shows well how the impurities are carried down with the rch.

The slight differences shown above may very well be counted for by variations in the impurities, and we may ely infer that equally purified preparations of Lintner's uble starch, from starches of different origin, will give e same maltose production, with equal quantities of stase. The above preparations, though exhaustively shed with distilled water, are by no means pure, and if acidity to phenol-phthaleine be taken as due to H_2PO_4 (and there are reasons for this assumption), n it would appear that traces of acid phosphates do not erfere with diastatic action to any extent. This we ght infer, for the MH_2PO_4 dissociates in solution into + H_2PO_4', and the further dissociation of $H_2PO'_4$ to - HPO''_4 being very slight, there are few free hydrogen s present in the solution, which is thus only feebly acid. he case of the starch solution alkaline to rosolic acid, if be taken as indicating the presence of M_2HPO_4, which ociates into M_2 + HPO_4'', the HPO_4'' unites with the of the water, $HPO_4'' + HOH = H_2PO_4' + OH'$ forming less dissociated H_2PO_4', and there thus being an excess hydroxyl ions present the solution is alkaline, and vourable to diastatic action. The conditions are of se not so simple as this, but these views, in the main, probably correct, and will be referred to again. It is ous from the experiments just recorded that starches ing alkalinity to rosolic acid, even when this is mpanied by acidity to phenol-phthaleine, do not give a normal maltose production. An alkalinity in the case of arrowroot(γ),‖ equal to 0·08 mgrm. soda per 70 c.c., having retarded the action distinctly. Wood (*op. cit.*) by the direct addition of soda to his starch pastes, proved that one part per million reduced the formation of maltose from 0·74 to 0·67 grm.

Fernbach (Ann. de la Brass., 1899) states that alkaline phosphates hinder, and acid phosphates favour diastatic action; the writer's experience is in agreement with the first statement, but indicates that the favouring influence of acid phosphates is an indirect action, which will be discussed subsequently.

For the preliminary testing of starch preparations rosolic acid is a useful indicator when used as follows :—Distilled water coloured with the indicator is boiled in a platinum basin, the neutrality adjusted by the addition of N/200 acid or alkali, the starch is then added and boiled; if the solution is alkaline the starch should be repurified; if neutral, or faintly acid—say not more than 1 c.c. N/100 NaOH per 10 grms.—it may be used, other conditions being suitable. Such starches as a rule show alkalinity to methyl orange equal to 2—3 c.c. N/100 H_2SO_4 per 10 grms., but the end point is not sharp, and the value of the figure, for other obvious reasons, is somewhat doubtful. Litmus, whether as paper or solution, is useless for testing starches; indeed, the use of any colour indicators for the detection of such minute traces of hydrion or hydroxidion can only be looked

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[*] Within the limits of Kjeldahl's "Law of Proportionality," and peratures from 15° to 58° C.

[‖] This preparation was washed exclusively with "tap" water.

upon as a makeshift method employed *faute de mieux* The titration figures given in this paper are only roughly approximate, and can hardly serve as a basis for calculation.

The question of acidity to phenol-phthaleine, and the importance of avoiding certain metallic impurities in the starch preparations, will be dealt with subsequently.

c. *Influence of Various Compounds on Diastatic Action.*

Although such preparations of soluble starches as the writer had available were obviously more or less impure, be, knowing something about the nature of the impurities, thought it worth while to carry out, pending the preparation of purer specimens, certain preliminary experiments with them, the results of which are detailed below.

Influence of Lactic Acid.

Starch A, potato Lintner, 10 grms. = 2·0 c.c. N/100 H_2SO_4 rosolic acid.

Starch B, potato Lintner, 10 grms. = 1·5 c.c. N 100 NaOH rosolic acid.

1 hour, 54° C.

—	CuO per 100 c.c.	
	A.	B.
Starch solution without addition	0·58	0·74
,, ,, plus 0·1 mgrm. lactic acid ...	0·58	0·75
,, ,, ,, 0·5 ,, ,, ...	0·60	0·70
,, ,, ,, 0·75 ,, ,, ...	0·57	0·68
,, ,, ,, 1·00 ,, ,, ...	0·37	0·60

The differences here are not very great, though it is evident that there has been a slight augmentation of the action; in the case of B this is doubtful, as the experimental error may be ± 0·01. Starch A is undoubtedly an alkaline one, 10 grms. requiring 12·0 c.c. N/100 H_2SO_4 with methyl orange, the same quantity of B requiring 5·0 c.c. N/100 H_2SO_4, to produce the red colour.

At this stage in the work it was found that the flasks employed, (even though they had been well steamed before being put into use) when rinsed with distilled water, and put to drain, were of sufficiently poor glass, in most cases, as to turn neutral distilled water, added to them, distinctly alkaline to rosolic acid, at once or after a short digestion at 40° C.* This alkalinity may to some extent account for certain irregularities in our previous work, and as it is not probable that we alone are the possessors of such glass, it is no doubt another factor in influencing the general opinion as to the flavouring effect of traces of acids upon diastatic action. An examination of measuring flasks, boiling flasks, and other ordinary laboratory glass vessels showed very clearly that the warnings of Mylins and Foerster (Ber., **22**, 1902 *et seq.*), as regards the solubility of certain glasses in water, are well founded. More especially is this solubility conspicuous in ordinary test tubes, and those workers who carry out diastatic determinations after Lintner's method, in test tubes, would do well not to ignore this fact.

To some extent the action of the atmosphere in "weathering" the surface of the glass seems to be reduced by keeping the vessels full of distilled water when not in use, but the employment of Jena glass only, for all such work is advisable. For dissolving the starch the writer has for some years used pure tin beakers with satisfaction. Ostwald ("Physico-chemical Measurements") has emphasised the necessity of using special glass in conductivity determinations, and the same caution is applicable to work connected with enzyme action. It may not be amiss here, to call attention to the desirability of avoiding the use of ordinary glass tubing in condensers, more especially in those used in the Kjeldahl nitrogen estimations, where very often now, no cooling water is used, as even ordinary Jena tubing is by no means proof against "live" steam; a pure tin tube in connection with an adapter of No. 477 III. Jena glass is advantageous.

Another possible source of error, is in the filter paper used for filtering the malt extract solutions; most makes of paper yield an appreciable amount of alkaline matter to distilled water, a 12 cm. No. 595 S. & S. being equal to about 0·2 c.c. N/100 H_2SO_4 (rosolic acid). The effect of this however should be avoided, fortuitously, by the customary rejection of the first considerable portion of the filtrate necessary to avoid errors of adsorption.

The rest of the experimental work in this paper was carried out with precautions to avoid the errors indicated above. The distilled water used was obtained by distillation of ordinary tap water from a large copper vessel of about seven gallons capacity, the steam passing through a double spray trap before being condensed in a pure tin "worm" pipe, the distillate from the intermediate three gallons being collected in closed bottles.

Two starches, M and N, both potato, Lintner's, were used. Tested with colour indicators, 10 grms. of each required.

—	M.	N.
Rosolic acid, c.c. N 100 H_2SO_4	0·20	Neutral
Methyl orange, c.c. N 100 H_2SO_4	9·0	2·0
Phenol-phthaleine, c.c. N/100 NaOH	14·6	18·0

1 c.c. malt extract to 70 c.c. starch solution, 1 hr., 54° C.

—	CuO per 100 c.c.	
	M.	N.
Starch solution, without addition............	0·76	0·79
,, ,, plus 0·1 mgrm. lactic acid ...	0·77	0·79
,, ,, ,, 0·2 ,, ,, ...	0·77	0·79
,, ,, ,, 0·3 ,, ,, ...	0·78	0·78
,, ,, ,, 0·4 ,, ,, ...	0·78	0·78
,, ,, ,, 0·5 ,, ,, ...	0·75	0·77
,, ,, ,, 0·6 ,, ,, ...	0·75	0·75
,, ,, ,, 0·7 ,, ,, ...	0·73	0·74
,, ,, ,, 0·8 ,, ,, ...	0·73	0·73
,, ,, ,, 1·0 ,, ,, ...	0·72	0·64
,, ,, ,, 1·5 ,, ,, ...	0·70	0·55
,, ,, ,, 2·0 ,, ,, ...	0·62	0·45

We have here a very slight augmentation in the more alkaline M starch up to 0·4 mgrm. lactic acid per 70 c.c., at which addition the N starch showed about an equal retardation.

The same starches were then tried in a similar manner, with the addition of hydrochloric acid.

Influence of Hydrochloric Acid.

1 hour at 54° C.

1 c.c. malt extract to 70 c.c. M and N_1, and 1 c.c. half strength malt extract to N_2.

—	CuO per 100 c.c.		
	M.	N_1.	N_2.
Starch solution, without addition.......	0·80	0·88	0·42
,, ,, plus 0·018 mgrm HCl ..	..	0·88	0·44
,, ,, ,, 0·036 ,, ..	..	0·85	0·43
,, ,, ,, 0·072 ,, ..	0·84	0·85	..
,, ,, ,, 0·108 ,, ..	..	0·86	0·42
,, ,, ,, 0·144 ,, ..	0·84	0·85	..
,, ,, ,, 0·180 ,, ..	..	0·83	..
,, ,, ,, 0·216 ,, ..	0·82	0·81	0·39
,, ,, ,, 0·288 ,, ..	0·80	0·77	..
,, ,, ,, 0·365 ,, ..	..	0·60	0·32
,, ,, ,, 0·432 ,, ..	0·72	..	0·25
,, ,, ,, 0·547 ,, ..	..	0·34	0·17
,, ,, ,, 0·730 ,, ..	0·51	0·25	..

---

* The alkalinity in some cases was equal to 0·2 c.c. N 100 H_2SO_4 after 1 hour at 40° C.

1 hour at 59° C.

1 c.c. half strength extract per 70 c.c.

—	M.	N.
Starch solution, without addition............	0·38	0·42
" " plus 0·009 mgrm. HCl	..	0·41
" " " 0·018 " "	..	0·42
" " " 0·036 " "	..	0·42
" " " 0·072 " "	0·39	0·40
" " " 0·144 " "	0·38	0·38
" " " 0·216 " "	..	0·28
" " " 0·288 " "	0·39	0·25
" " " 0·365 " "	0·35	0·16
" " " 0·432 " "	0·23	..
" " " 0·547 " "	0·14	0·05
" " " 0·730 " "	0·04	..

As is to be expected, the influence of the acid is more pronounced at the higher temperature.

Influence of Alkali, &c.

Experiments were now made to determine the influence of alkali on the action, using in the first case "N" starch.

1 c.c. half strength malt extract, per 70 c.c. starch solution, 1 hour, 54° C.

	CuO per 100 c.c.
Starch solution, without addition	0·46
" " plus 0·01 mgrm. NaOH	0·45
" " " 0·02 " "	0·44
" " " 0·04 " "	0·45
" " " 0·06 " "	0·44
" " " 0·10 " "	0·44
" " " 0·20 " "	0·44
" " " 0·40 " "	0·40
" " " 0·50 " "	0·40
" " " 0·70 " "	0·38
" " " 1·00 " "	0·24

The results show that with this starch a relatively large addition of NaOH is necessary before any obvious retardation takes place, and this is at first sight contradictory to what has been said about the influence of alkali. The explanation* is however fairly evident; the starch contains a rather high proportion of acid phosphates, and the slight inhibition is due to the interaction of the NaOH and MH_2PO_4, or let us say NaH_2PO_4, giving rise to $Na_2HPO_4 + H_2O$. Now Shields (Phil. Mag., 1893, **35**, 5) has proved that Na_2HPO_4 undergoes extremely slight hydrolysis, and so retardation of the action is not to be expected until sufficient NaOH has been added to bring about some formation of Na_3PO_4, which will at once break up into $Na_2HPO_4 + NaOH$, with the result that only then does the solution become appreciably alkaline. With the starch "M" retardation was evident on the addition of 0·1 mgrm. soda, and with an alcohol precipitated maize starch (which was neutral to rosolic acid and methyl orange, gave only a doubtful indication of acidity to phenol-phthaleine, and on ignition, 5 grms., with carbonate and nitrate of sodium, showed merely a coloration with molybdic solution) the results were as under:—

1 c.c. half strength malt extract per 70 c.c. solution, 1 hour, 54° C.

	CuO per 100 c.c.
Starch solution, without addition...........	0·49
" " plus 0·02 mgrm. NaOH	0·48
" " " 0·04 " "	0·45
" " " 0·10 " "	0·32

With addition of hydrochloric acid this starch gave the following results:—

	CuO per 100 c.c.
Starch solution, without addition...........	0·49
" " plus 0·02 mgrm. HCL	0·50
" " " 0·04 " "	0·45
" " " 0·10 " "	0·40

These experiments demonstrate very clearly that extremely slight additions of alkali or acid are prejudicial to the action of diastase, the more so the purer the starch solutions.

Nature of "Acidity to Phenol-phthaleine."

The "N" starch, though containing a considerable amount of acid phosphate, can hardly be considered an acid preparation, for the dissociation of the anion H_2PO_4' to $H + HPO_4''$ is extremely slight. This is well shown by the action of the starch on sucrose, even prolonged digestion giving rise to the merest traces of invert sugar. The experiment was carried out thus: starch solutions with sucrose, equal volumes of water, with the same proportion of sucrose alone, and with the addition of 20 mgrms. of KH_2PO_4 in one case, and 0·12 mgrms. of HCl in another, were kept at 60° C. for 30 hours, then at 30° C. for 42 hours (the change of temperature being unavoidable, not intentional); the solutions were then made to a definite volume, and the invert sugar determined by copper reduction. The corrected results were as follows:—

	Grms. Invert Sugar per 100 c.c.
Starch solution plus sucrose	0·003
Water solution of sucrose	0·008
" " " plus 20 mgrm. KH_2PO_4 ..	0·011
" " " " 0·12 " HCl	0·083

The results, though not free from objection, show very clearly that the acid phosphates contribute a negligible amount of acidity to the starch solutions, and may practically be looked upon as neutral salts in this connection; still they possess what we may term a potential acidity, capable of neutralising traces of alkali, and as experiments with the direct addition of potassium dihydrogen phosphate prove that in small amounts it has little effect on diastatic action, we can understand why starch preparations showing neutrality or faint acidity to rosolic acid, and slight acidity to phenol-phthaleine, are (*cæteribus paribus*) the most suitable for use in diastatic estimations. The experiments given below serve to exemplify this action of acid phosphates.

"Potential Acidity" of Acid Phosphate.

"N" Starch. 1 hour. 54° C.

	CuO per 100 c.c.
Starch solution, without addition	0·58
" " plus 50 mgrms KH_2PO_4.....	0·57
" " " 250 " "	0·50
" " " 10 mgrms. NaOH......	0·00
" " " 10 mgrms. NaOH plus 45 mgrms. KH_2PO_4..	0·35
" " " 10 mgrms. NaOH plus 90 mgrms. KH_2PO_4..	0·50
" " " 10 mgrms. NaOH plus 135 mgrms. KH_2PO_4.	0·52

Influence of Asparagine.

Various experiments carried out with different starches proved that at 40° C., and below that temperature, the addition of asparagine has little effect on the action. The results of two sets of experiments are given here:—

	CuO per 100 c.c.*
Starch solution, without addition	0·60
" " plus 1 mgrm. asparagine	0·60
" " " 5 " "	6·59
" " " 10 " "	0·60
" " " 20 " "	0·59
" " " 40 " "	0·59
" " " 60 " "	0·58
" " " 100 " "	0·57

An experiment with "M" starch, at another time, gave somewhat similar results:—

	CuO per 100 c.c.
Starch solution, without addition	0·54
" " plus 1 mgrm. asparagine.....	0·54
" " " 5 " "	0·54
" " " 20 " "	0·55
" " " 70 " "	0·56

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* Without consideration of the more complex influence of proteid matters added in the malt extract.

* These amounts of asparagine were found to be without influence on the copper reductions.

The first trials at higher temperature were made with the starches A and B, already used in the experiments with lactic acid :—

——	54° C.		62° C.	
	A.	B.	A.	B.
Starch solution, without addition	0·58	0·72	0·25	0·55
Starch solution, plus 0·7 mgrm. asparagine....................	0·62	0·76	..	..
Starch solution, plus 35·0 mgrm. asparagine....................	0·73	0·79	0·62	0·60
Starch solution, plus 70·0 mgrm. asparagine....................	0·70	0·73	..	..

Here we see that the undoubtedly alkaline "A" starch has given a much greater maltose production in presence of 35 mgrms. asparagine at both temperatures, but we are far from finding the tenfold increase mentioned by Mohr. The less impure "B" starch shows only a slight difference, and this the writer has always found to be the case with other starches of like "purity." Another set of experiments was carried out with five starches, the "A," "B," "M," and alcohol precipitated maize, previously mentioned, and also a soluble starch obtained from Drosten, of Brussels. Effront, in "Les Enzymes" (footnote, page 237*), says that his standard starches can be obtained from this firm, so a sample was purchased, and this will be more fully described further on. Solutions of the above starches were made as usual, 1 c.c. of half strength malt extract added per 70 c.c. 1 hour. 58° C.:—

——	CuO per 100 c.c.				
	A.	B.	M.	Drosten.	Maize.
Starch solution, without addition	0·16	0·26	0·38	0·10	0·42
Starch solution, plus 15 mgrm. asparagine.....	0·40	0·35	0·45	0·37	0·34
Starch solution, plus 30 mgrm. asparagine.....	0·33	0·35	0·47	0·46	0·18
Starch solution plus 50 mgrm. asparagine.....	0·25	0·34	0·42	0·48	0·14
Starch solution, plus 75 mgrm. asparagine.....	0·34	0·26	0·38	0·44	0·11

The apparently favourable influence of asparagine is here very evident with the first four ordinary (impure) starches, but with the purer maize the effect is very different. It is to be noted, however, that this starch, without addition, has not given quite so much maltose as some of the other starches with addition of asparagine. This may be due to some unrecognised impurity, or to the effect of substances other than diastase in the malt extract, or, again, it may be due, as claimed by others, to the favouring effect of asparagine, a smaller addition of which to this starch might have augmented the action. At the same time, if we admit this possibility, even the greatest maltose production in any of the other starches, in presence of asparagine, is little greater than that in the maize without addition of this substance. A further experiment was made with another specimen of alcohol precipitated maize starch of similar purity (the other having all been used) with smaller additions of asparagine, the action being stopped at an earlier stage. 1 c.c. of malt extract was added to 70 c.c. of starch solution, and the action stopped after 20 minutes. The details are given in the subjoined table.

With these starches free from alkaline impurity, we have again no indication of an increase of action through the addition of asparagine.

The corollary from these results is, that asparagine does not augment diastatic action, and where tenfold or smaller increases are obtained, by its addition, there has been a previous restriction of the action, owing to the presence of alkaline or other impurities. It has already been shown that asparagine acts as a weak acid at higher temperatures than 40° C. and so neutralises alkalinity; and it will be shown subsequently that it also prevents the restricting effect of at least one other impurity not alkaline in its nature.

——	CuO per 100 c.c.		
	55° C.		59° C.
	"N."	Maize.	Maize.
Starch solution, without addition	0·32	0·32	0·33
" " plus 0·13 mgrm. asparagine	..	0·32	0·33
" " " 0·45 " "	..	0·32	0·33
" " " 1·0 " "	0·32	0·33	0·33
" " " 5·0 " "	0·32	0·32	0·32
" " " 10·0 " "	0·30	0·32	0·32
" " " 15·0 " "	0·29	0·31	0·31
" " " 20·0 " "	0·29	0·30	0·31
" " " 30·0 " "	0·28	0·26	0·27
" " " 50·0 " "	0·27	0·24	0·25
" " " 100·0 " "	..	..	0·19

Possible Influence of Substances, other than Amylase, added in Malt Extract.

We must not forget that though the quantity of malt extract used in these experiments is not great, still the substances in it, other than diastase, may have some influence on the results. The extract ordinarily used (20 grms. malt with 500 c.c. water) will contain *circa* 0·8 grm. solids per 100 c.c., so 1 c.c. of the full strength extract contains 8 mgrms., of which two-thirds may be carbohydrates, the remaining third, say 2·7 mgrms., consisting mainly of nitrogenous matters* and salts. On ignition 1 c.c. of the extract might yield 0·4 mgrm. ash, mostly phosphates of potash and lime. How these phosphates exist in the malt extract solution is not quite certain; the solution reacts alkaline to methyl orange, and acid to rosolic acid and phenol-phthaleine, the 1 c.c. may correspond to 0·24 c.c. N/100 H_2SO_4, 0·08 c.c. N/100 NaOH, and 0·31 c.c. N/100 NaOH, with these indicators in the order mentioned. Now a solution of dipotassium hydrogen phosphates, or let us say M_2HPO_4, even at such dilutions undergoes only a slight hydrolysis; but still, in the case of the pure salt alone, sufficient hydroxidion is present to give an alkaline reaction with rosolic acid and methyl orange, but not with the more weakly acid indicator phenol-phthaleine. Potassium dihydrogen phosphate, or say MH_2PO_4, dissociates into $M + H_2PO_4''$, and the H_2PO_4'' into $H' + HPO_4''$ slightly, there being, in the case of the pure substance alone, sufficient hydrion to react acid to phenol-phthaleine and rosolic acid, but not with methyl orange. In a mixed solution of these salts, a state of equilibrium must exist for each concentration and temperature, and we may be justified in assuming that the extract (from normal malts), as added, is practically neutral; but it is obvious that after addition to the starch solution a new condition will obtain, dependent on the altered concentration and on the nature of the impurities in the starch solution. Further, our titration figures do not represent the equilibrium existing in the malt extract before titration, but the progressive effect brought about by the addition of the alkali or acid. These remarks, along with those made in connection with the effects of the addition of acids and alkali to the starch solutions, show the futility of extending this work, or attempting to draw any general conclusions as to the nature of diastatic action, until we are in a position to use purer starch and diastase preparations.

Influences of Traces of Copper and various other Substances on Diastatic Action.

The specimen of soluble starch already mentioned as obtained from Drosten of Brussels had a slightly putrid

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[*] "L'amidon type, ainsi que la fecule type dont nous nous servons, sont en vente chez Drosten, rue de Marais, Bruxelles, et chez H. Koenig, fabricant de produits chimiques, Leipzig."

[*] The experiments of Bugarsky and Liebermann, Pflueger's Archives, 1898, 72, 51, indicate that the proteid matters added will not be without influence.

smell. It contained 19 per cent. moisture, and with colour indicators gave per 10 grms. values as below :—

Rosolic acid	3·0 c.c. N/100 H_2SO_4.
Methyl orange	10·0 „ „
Phenol-phthaleine	12·0 „ N/100 NaOH.

On ignition it left 0·28 per cent. ash, containing traces of copper. Burnt with Na_2CO_3 and KNO_3 it yielded 0·14 per cent. P_2O_5.

A comparison was made with it and the starch "M."

1 c.c. malt extract per 70 c.c. starch solution.
1 hour. 58° C.

	CuO per 100 c.c.	
	Drosten.	M.
Starch solution, alone	0·12	0·76
„ „ plus 0·04 mgrm. HCl	0·12	0·76
„ „ „ 0·08 „ „	0·12	0·78
„ „ „ 0·12 „ „	0·12	0·78
„ „ „ 0·20 „ „	0·13	0·76
„ „ „ 0·29 „ „	0·15	0·76
„ „ „ 0·36 „ „	0·18	0·70
„ „ „ 0·73 „ „	0·15	0·56

The very feeble hydrolysis in the case of Drosten's starch was mainly due to the presence of traces of copper, amounting to 0·0075 per cent. Cu. To prove that copper has a retarding effect on amylotic action, a portion of a specimen of soluble starch was shaken with distilled water, containing a drop of copper sulphate solution; it was then washed with water until the washings were free from copper. The dried starch contained 0·033 per cent. Cu. A comparison was made with this and the original specimen, as usual, one hour at 40° C.

	CuO per 100 c.c.
Ordinary starch	0·58
„ „ plus copper	0·03

The retardation is very marked. In the 70 c.c. of starch solution there would be *circa* 0·7 mgrm. copper, whereas in Drosten's the amount was only 0·16 mgrm. A further test was made, mixing the "copper starch" with the original, so as to give solutions as under :—

	CuO per 100 c.c.
Starch solution, no copper	0·82
„ „ plus 0·016 mgrm. copper	0·61
„ „ „ 0·033 „ „	0·42
„ „ „ 0·160 „ „	0·12

Mere traces of copper are thus highly prejudicial to the action. It is interesting to note that in presence of asparagine, this influence is in some way, not obvious, overcome, as Drosten's starch in the experiments with asparagine gave a normal maltose production on addition of 30—50 mgrms. per 70 c.c. of solution.

	CuO per 100 c.c.
Starch solution, without addition	0·55
„ „ plus 0·05 grm. boric acid	0·53
„ „ „ 1·00 „ potass chloride	0·59
„ „ „ 0·05 grm. potass dihydrogen phosphate	0·53
„ „ „ 0·25 grm. potass dihydrogen phosphate	0·44
„ „ „ 0·10 grm. platinum black	0·44
„ „ „ 0·07 „ β-naphthol	0·47
„ „ „ 0·30 „ phenol	0·47
„ „ „ 1·00 „ ammonium fluoride	0·44
„ „ „ 1·00 urea	0·50
„ „ „ 1 c.c. chloroform	0·53
„ „ „ 1 „ toluol	0·50
„ „ „ 3 „ ethyl alcohol	0·56
„ „ „ 3 „ glycerine	0·55
„ „ „ 0·2 c.c. hydrogen peroxide 30 per cent.	0·38
„ „ „ 0·07 c.c. oil of cloves	0·55

Mercurial salts, or at least mercuric chloride, is even more fatal to amylotic action than copper, as little as 0·001 mgrm. $HgCl_2$ reducing the action about 50 per cent. The influence of several other substances is given above. The reagents used are mostly Merck's, but no special tests were made as to the purity,* as in any case the extent of their influence will be in some degree conditioned by the impurities in the starch. The results then are only of relative value. The conditions are as usual 1 c.c. of malt extract to 70 c.c. starch solution, 1 hour, 40° C.

Kjeldahl (*op. cit.*, 1879) gives results obtained by the addition of other substances, and states that 13 mgrms. borax per 100 c.c. starch solution reduced the maltose production 40 per cent. This is no doubt due to the alkaline nature of the salt, boric acid being a feebly dissociated acid, there is slight hydrolysis giving rise to free hydroxyl ions, which inhibit the action, as the writer's results with boric acid, show that the anion and non-dissociated acid have no effect.

In connection with the hydrolysis of salts of weak acids, it is to be noted that the use of potassium cyanide as an antiseptic for the preservation of diastase solutions is not to be recommended, and it is unfortunate that Reynolds Green (Phil. Trans. B., vol. 188) in his interesting work on "The Action of Light on Diastase," employed this substance as a preservative in his experimental work. Shields (*op. cit.*) has shown that KCN in N/40 N solutions is hydrolysed to the extent of 2·4 per cent.; hence one may infer that the diastase in Green's solutions, containing 0·2 per cent. KCN, would be to some extent destroyed and abnormal, and though he carried out control experiments, it does not follow, if the hydrolysis and decomposition of the cyanide varied with the conditions of exposure to light, that the controls in all cases allowed for this. Green states that KCN had no effect upon the diastase, but this is not the experience of the writer. A malt extract was precipitated with alcohol, filtered, and the coagulum dissolved in water; two equal volumes were made to 100 c.c., one "α" with water, the other "β" with water containing 0·2 grm. potassium cyanide.† 1 c.c. of each solution was at once added to 70 c.c. of "N" starch solution one hour at 40° C. The "β" solution was kept in darkness and again tested at the expiry of 48 and 96 hours.

	CuO per 100 c.c.	
	α	β
Starch solution	0·54	0·30
„ „ plus 2 mgrm. KCN	0·43	..
„ „ „ 2 mgrm. KCN plus 45 mgrm. KH_2PO_4	0·55	..
„ „ „ 45 mgrm. KH_2PO_4	..	0·41
„ „ „ β after 48 hours	..	0·15
„ „ „ β „ 96 „	..	0·06
„ „ „ β „ 96 hours plus 45 mgrm. KH_2PO_4	..	0·13

These results indicate a slow destruction of the amylase by the cyanide, and also show that even 2 mgrms. per 70 c.c. is sufficient to considerably restrict the action of the "α" solution. The figures for CuO are corrected for the effect of the cyanide on the copper reduction. Solutions containing cyanides should of course not be used with Fehling's solution, owing to the solubility of cuprous oxide in alkaline cyanides (roughly equal to a loss of 1 mgrm. CuO per 1 mgrm. KCN). Owing to the difficulty of precipitating the cyanide in presence of starch, the above results are corrected by making this allowance. The crippling effect of KCN on diastatic action is due to alkalinity arising from hydrolysis of the salt, and not to the anion CN, nor to non-dissociated HCN, as small amounts of this acid have little influence on the action.

d. *Bearing of the above Results on the Determination of Diastatic Power.*

It is fairly obvious, from the experimental results given in this investigation, that the determination of "diastatic

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[*] With the exception of the potassium chloride and dihydrogen phosphate, which were specially purified.

[†] The cyanide was free from carbonate and cyanate, and was otherwise a very pure specimen.

power" must be carried out with various precautions, and it is probable that many of the disagreements in analysts' reports as to the "diastatic power" of malt samples, ensue, not so much from difference of methods (as has been suggested), but from a non-appreciation of the importance of these precautions and apparently, trivial details, such as—

- Time and temperature of extraction, and amount of stirring of the malt and water.
- Purity of the distilled water used for the extraction, and for dissolving the starch.
- Solubility of glass apparatus.
- Alkalinity of filter papers.
- Absence of acid and other fumes from laboratory.
- Concentration of the starch solution.
- Purity of the starch.

With regard to the first factor, the generality of malts when finely ground, give a constant "diastatic power" with six hours extraction, stirring every quarter hour. The difference between five and six hours with sufficient stirring being very slight, constant motion, stirring or shaking, for one to two hours gives the same result as six hours ordinary extraction.

The importance of the purity of the distilled water, and the influence of the next three factors has already been indicated in the beginning of this paper.

The concentration of the starch solution; it is of course well known that the reducing power of the saccharified solution must fall within the limits of Kjeldahl's "law of proportionality," that is below R. 40. It is, however, advisable to keep lower than this, say R. 30, as has been shown by Brown and Glendinning (J. Chem. Soc., 1902, 388). Apart from this, concentration exerts a slight influence according to Henri ("Lois générales de l'Action des Diastases"), and the writer has also observed this effect.

1 c.c. half strength malt extract. 1 hour, 40° C.

Starch Grms. per 70 c.c.	Maltose formed.	R.
2·82	0·245	8·7
1·41	0·234	16·6
0·70	0·216	30·8
0·35	0·184	52·6

Even if the above differences are entirely due to concentration (and it is probable the impurities in the starch play a part), it is obvious that the variations of concentration which occur in practice are negligible.

The purity of the starch is the most important factor, but as this has been so fully dealt with previously little more need be said, except that the influence of certain other factors will be conditioned by the nature of the starch, and further, as there is a tendency to an accretion of alkaline contamination during manipulation, it is advisable, for analytical purposes, to use a starch preparation containing a small amount of acid phosphates, the protective action of which has already been explained.

It is interesting to give here an example of the "diastatic power" of a malt, as determined with soluble starches bought from different dealers, and so presumably used by someone.

Starch.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.
D. P. Lintner's scale	34	33	32	30	27	20	15	6

These figures require no comment, save that they alone might serve as an apology for this communication.

3. Conclusions.

The writer hopes to extend his investigations with purer starch and diastase preparations. In the meantime his object is to call attention to the necessity of observing certain precautions in work of this nature, and he thinks his investigations (incomplete though they are) show that:—

1. Many of the extraordinary results obtained by various observers are due to a lack of recognition of the important influence of traces of impurity on the course of the action.

2. Diastatic (amylotic) action attains its maximum in neutral (in the sense that water is neutral) solution.

3. Asparagine does not augment the action, unless there has been a previous restriction. This holds also for the various salts which are said to accelerate the action.

4. The restricting influence of acids depends upon their dissociation, *i.e.*, the greater the amount of free hydrogen ions the greater the restriction; though it it possible that the anion of certain acids may have some influence.

5. Purified soluble starch, or starches, of various origins, give equal maltose productions, with equal amounts of diastase, under the conditions mentioned.

For much kindly and able assistance in the experimental and other work of this paper the writer is indebted greatly to his friend, Mr. J. M. Guthrie.

Meeting held at Glasgow on March 29th, 1904.

MR. D. J. PLAYFAIR IN THE CHAIR.

THE "IODINE VALUE" OF UNSATURATED ORGANIC COMPOUNDS.

BY HARRY INGLE, B.Sc., Ph.D.

In a recent paper read before the Scottish Section of the Society of Chemical Industry (this J., 1902, 587—595), I commenced the study of the action of the various iodine solutions which have been proposed for use in the determination of the "iodine value" upon two unsaturated substances of known constitution with special reference to the origin and nature of the free acid which has often been noticed as being formed during this reaction.

The following paper contains a record of further work in this direction, and forms an attempt to render the determination of the iodine value of use in structural organic chemistry.

Hübl, in 1884, when he proposed the use of his iodine-mercuric chloride solution for the examination of oils and fats, was of opinion that the numbers obtained by his method were a direct measure of the numbers of double linkages present in a substance. It was, however, found, on extending the examination to other unsaturated substances, that many (though doubtless unsaturated) did not absorb iodine in amount proportional to the ethylene unions present.

In the first table on page 423 some of the more important recorded iodine values given in the literature of pure or nearly pure specimens by different observers are noted.

A number of other iodine values, chiefly of the phenols and oxybenzoic acids, have been determined by Fahrion (*loc. cit.*), using Waller's solutions, but, for reasons later to be explained, the results obtained with this solution are not reliable.

Many striking divergencies between the theoretical and the observed values are to be noted in the above table, and, beyond a remark of Henriques (Chem. Rev., 1898, 121) in a footnote to one of Wijs' papers, no explanation of these differences has been given. Henriques says, in reference to the acids, crotonic, maleic, and fumaric: "Offenbar verlangt die Hüblsche Reaction einen grösseren Abstand der Doppelbindung von der Carboxylgrüppe."

The Various Solutions and the Results.

Wijs' Solution.—This was prepared according to Wijs' original instructions. Excess of chlorine was destroyed by boiling or gently warming (this J., 1902, 587). Time of action, 30 mins. to one hour.

Table of Recorded Iodine Values of Pure Unsaturated Compounds.

Substance.	Theory.	Method.	Observed Iodine Value.	Authority.
Allyl alcohol	437	Hubl	422	Lewkowitsch.*
			349	"
		Wijs	436·8	Wijs.†
Oleic acid	90	Hubl	89·5—90·5	Lewkowitsch.
		Wijs	87·6	Wijs.
Elaidic acid	90	"	90·07	"
Crotonic acid	300	Hübl	25·0—25·9	Lewkowitsch.
Fumaric acid	219	"	Nil	"
Maleic acid	219	"	"	"
Cinnamic acid	171	"	15·3—16·4	"
Erucic acid	75·15	Wijs	74·9	Wijs.
Brassidic acid	75·15	..	75·0	"
Undecylenic acid	136·6	..	133·1	"
Cholesterol	68·5	Hubl	67·3—68·1	Lewkowitsch.
Styracine	194	..	81·9—83·9	"
Oil of Turpentine	187 or 374	..	358—367	Schweitzer and Lungwitz.‡
		Waller	275—294	Fahrion.§
		Wijs	303—395	Archbutt.‖
			Average. 376·7	"

* Oils, Fats, and Waxes, 2nd Ed., p. 176. † Chem. Rev. Harz- u. Fett-Ind., 1899, 11. ‡ This J., 1895, 130. § Zeits. angew. Chem., 1901, 1225—1227. ‖ This J., 1902, 1439.

Modified Hübl's Method.—Prepared and used in the manner previously described (this J., *loc. cit.*). Time of action, 16 to 18 hours.

In most of the cases recorded the two solutions give practically the same results. One or two exceptions may be noted, namely, stilbene and ethyl cinnamate, both of which yield higher values with Wijs' solution than by the other methods.

As the reactions taking place in the preparation of the iodine chloride solution and its interaction are mostly reversible, it is found necessary to have a large excess of iodine chloride present in most cases if a correct result is to be obtained. Various writers on the subject recommend an excess of from 50 to 70 per cent. in the case of oils.

That this is the case with other substances I have abundant evidence to prove. Thus a turpentine with 28 per cent. excess by modified Hübl's method gave an iodine absorption of 352, while with 69 per cent. excess a value of 367 was obtained.

Now in Wijs' solution the iodine exists for the most part as ICl, but in Hübl's solution, the quantity of ICl per unit volume is probably considerably less since the equation—

$$HgCl_2 + 2I_2 = HgI_2 + 2ICl$$

s never complete, there always remains a considerable amount of iodine free as is shown by the colour of the solution.

With Hübl's solution therefore, a greater excess is equired than with Wijs' solution, and under any circumstances the concentration of ICl and substance per unit volume can never be so great with the former as with the latter. This is doubtless the reason why Hübl's solution is slower in action than Wijs', and also why the latter sometimes yields higher results.

Modified Waller's Solution.—This was prepared by saturating Hübl's solution with dry HCl 50 grms. to the litre (this J., *loc. cit.*). There is reason to believe that in this solution the iodine chloride exists in a state of weak combination as ICl HCl. When addition of ICl from this solution takes place this double compound has to be decomposed, and such decomposition can only take place where the attraction of the double linkage for the ICl is greater than that exerted by the HCl. Negative groups attached to double linkages lower this attraction, and consequently substances containing such "protected" double linkages either do not absorb any ICl from this solution or do so very imperfectly. The amount of such "protection" exerted over a double linkage depends upon the nature of the negative groups attached to it. If the groups be strongly negative the substance does not absorb any ICl even from Wijs' (cp. Diphenylmaleic anhydride, &c.). The modified form of Waller's solution enables one to detect even a comparatively weakly negative group or groups attached to an ethylene linkage. The table given on page 425 illustrates this.

A more detailed consideration of the matter will be given under the group headings, but in general it may be

Table of Iodine Values of Unsaturated Compounds.

Group I.

Substance and Formula.	Theoretical Iodine Value.	Method.	Observed Iodine Value.	I as Acid.	Nature of Acid.
aphthalene, $C_{10}H_8$	..	M. Hubl	Nil	..	..
tyrolene slightly impure, $C_6H_5CH = CH_2$	2I = 242·2 I = 121·1	"	227	95—109	HCl
		M. Waller	224·3	..	..
		Wijs	226·6	..	..
ilbene, $C_6H_5 - CH = CH.C_6H_5$	2I = 141·1	M. Hubl	128·2	104·7	HI and HCl
		M. Hubl and water	140·6	120·8	..
		M. Waller	0·0	..	..
		Wijs	131—138	..	..
merican turpentine pinene, $C_{10}H_{16}$, B. Pt. 156—157° C.	2I = 187 4I = 374	M. Hübl	374	190	HI
		M. Waller	242	..	..
ugenol benzoate, $C_3H_5C_6H_3(OCH_3)(OCO.C_6H_5)$	2I = 95	M. Hubl a	96	?	..
		" b	94·5	23	HCl
		Wijs	94—95·1	..	..
		M. Waller	93	..	..
oeugenol benzoate, $CH_3CH = CH - C_6H_3(OCH_3).(OCOC_6H_5)$	"	M. Hübl	94·5	66	HCl and HI
		Wijs	93	..	..
		Mod-Waller, 2 hrs.	43	..	..
		" 20 "	83	..	..
ugenol, $CH_2 = CH - CH_2C_6H_3(OCH_3)OH$	2I = 154	M. Hubl.	445	..	..
		M. Waller	151	..	..
iphenyl methane $(C_6H_5)_3CH$	..	Wijs	Nil	..	..

Group II.

Substance and Formula.	Calculated Iodine Value.	Method.	Observed Iodine Value.	I as Acid.	Nature of Acid.
Dicyanstilbene, $(C_6H_5)_2C_2(CN)_2$ Cis....	..	Wijs	Nil	..	..
Trans.	..	"	6·3	..	..
Diphenylmaleic anhydride, $(C_6H_5)_2C_2(CO)_2O$	2I = 85	M. Hubl	Nil	..	..
Aconitic acid, $CH_2(COOH).C_2H(CO_2H)_2$	2I = 145	"	"	..	..
Cinnamic acid, $C_6H_5C_2H_2.CO_2H$	2I = 174	Wijs	15·0	..	..
Ethyl cinnamate, $C_6H_5.C_2H_2.CO_2C_2H_5$	2I = 146	M. Hubl	16·0	15·5	..
		Wijs	38·0	..	..
Dicinnamoyl tartaric anhydride, $(C_6H_5C_2H_2CO_2)_2C_2H_4(CO)_2O$	..	M. Hübl	Nil	..	..
Coumarin, $-C_6H_4.C_2H_2CO_2$	2I = 176	"	"	..	..
Orthonitro cinnamic acid, $NO_2C_6H_4C_2H_2CO_2H$	..	"	"	..	..
Phenyl isocarbostyryl, $C_6H_4C_3H_2ON.C_6H_5$	2I = 118	Wijs	118	..	..
Phenyl isocarbostyryl carboxylic acid, $C_6H_4C_3HON.C_6H_5.CO_2H$	2I = 96	"	35·5	..	..
Anhydro-oxyvinyl benzoic anhydride, $O:(CH-CH-C_6H_4CO)_2O$	4I = 176	..	..	..	..
	2I = 88	Wijs	88	..	HI

Group III.

Substance and Formula.	Calculated Iodine Value.	Method.	Observed Iodine Value.	I as Acid.	Nature of Acid.
Benzalacetone, $C_6H_5CH:CH.CO.CH_3$	2I = 158	M. Hübl	161*	..	..
			128†	63	HCl
Dibenzal-acetone $(C_6H_5CH:CH.)_2CO$	4I = 226	"	109	53·5	"
	2I = 113	M. Waller	27	..	"
Benzalcinnamylidene acetone, $C_6H_5C_2H_2.CO.C_4H_4C_6H_5$	6I = 294	M. Hubl	195*	..	..
		"	184†	97	HCl
	4I = 195	Wijs	195*	..	..
		M. Waller	24†	..	..
Dicinnamylidene acetone $(C_6H_5C_4H_4)_2CO$	8I = 356	Mod. Hübl	245	..	..
	6I = 265	Wijs	235	..	..
		M. Waller	118	..	..
Benzalacetophenone, $C_6H_5.CH = CH.CO.C_6H_5$	2I = 122	M. Hubl	56	28	HCl
	I = 61	Wijs	71	..	..

Group IV.

Substance and Formula.	Calculated Iodine Value.	Method.	Observed Iodine Value.	I as Acid.	Nature of Acid.
Tolane, $C_6H_5C \vdots C.C_6H_5$	2I = 147	M. Hübl	25·5	18·3	..
	4I = 295	Wijs	85	..	..
Orthonitrophenyl propiolic acid, $NO_2C_6H_4.C \vdots C.CO_2H$	4I = 267	M. Hubl	132·5	?	..
	2I = 133·5	..	..	..	..
Orthonitrophenylacetylene, $NO_2C_6H_4C \equiv CH$	4I = 316	M. Hübl	Nil	..	..

The determinations marked * were carried out with new preparations and those marked † with older ones: the different results are probably due to the fact that the action of light or the exposure to the air had rendered the preparation impure by forming polymerised or oxidised products.

stated that, if a double linkage is attached to one negative group addition may take place slowly; if it be attached to two negative groups the addition does not take place. If several ethylene bonds are present then the unprotected groups absorb ICl from this solution, while the protected groups, if they absorb at all, do so only slowly and incompletely. Very interesting results have been obtained with the phenols, which will form the subject of a subsequent paper. Thus, eugenol, which absorbs 415 per cent. of iodine from Hübl's solution (6 I = 462) the ring taking part in the absorption, gives an iodine value of 151 (2 I = 154) with this solution, only the side chain reacting.

The Formation of Free Acid during Hübl's Reaction.—This has formed the subject of a detailed paper read by the writer as before mentioned. It is therein shown that in the case of Stilbene and Styrolene its origin it not due to substitution, but that it is produced by the action of water upon the iodochlorides.

Its character is made evident by the colour change taking place in Wijs' solution. If HI be liberated, then by interaction with the ICl in excess free iodine is formed, and the colour of the solution changes to red brown. If only HCl is formed then Wijs' merely becomes paler in shade.

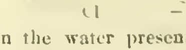
The above facts may be taken as applying in general to all substances examined.

Recent work by Walden (Ber., 1902, 2029) has thrown some light upon how the water acts upon the iodochlorides. He finds that compounds containing a tertiary carbon atom attached to a halogen atom are ionised in solution to a small extent, being, in fact, "carbonium salts" (compare the behaviour of tertiary iodides to water, A. Bauer, Ann. **220**, 158).

The presence of phenyl groups in such compounds increases their electrical dissociation (cp. Gomberg's triphenylmethylchloride and Walden, *loc. cit.*), and although of the few compounds already examined by Walden only the tertiary carbon atoms have any marked tendency to exist as ions, yet it appears likely that secondary carbon atoms may, under suitable conditions, also yield halogen compounds which are ionisable.

I am inclined, therefore, to attribute the formation of free halogen acid in Hübl's and Wijs' reaction to the ionisation and subsequent hydrolysis of the iodochlorides formed.

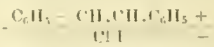
Styrolene iodochloride, for example, is probably ionised as follows:—



$$\begin{array}{c} C_6H_5-CH-CH_2I\ + \\ Cl\qquad\quad - \end{array}$$

both ions act upon the water present to form $C_6H_5CH.OH.CH_2I$ and HCl. The former is but little ionised, the latter completely, hence we get a tendency set up to change the iodochloride into the non-ionised iodohydroxyl derivative and the ionised hydrochloric acid.

Similarly stilbene iodochloride is ionised to—



$$\begin{array}{c} C_6H_5-CH.CH.C_6H_5\ + \\ Cl\,I\qquad\quad - \end{array}$$

which is in its turn hydrolysed to $C_6H_5CH.OH$ $CH.OHC_6H_5$ (non-ionisable) and HI and HCl (ionised almost completely). The HI, however, reacts with the ICl present in excess to form I_2 (non-ionised) and HCl, thus the concentration of the HCl in the solution is increased and a tendency is set up to split off the whole of the iodine from the iodochloride while by the action of mass the HCl prevents the splitting off of the whole of the chlorine ions from the iodochloride. This causes the reaction product to contain some chlorine as $C_6H_5CH.OH.CHCl.C_6H_5$ as was found by experiment (this J., 1902, 587—595).

Similar explanation may be given to the behaviour of other iodochlorides, *e.g.*, those of the eugenol benzoate and isoeugenol benzoate.

It is interesting to note that Walden finds the iodides more completely ionised than the chlorides.

Although rendered extremely probable, absolute proof that hydroxyl compounds result during the interaction of the iodine chloride solution on the water present and the unsaturated compound in the case of stilbene and styrolene was left still wanting in the paper already referred to (this J., *loc. cit.*).

The oily residue obtained after evaporating the chloroformic layer from a determination of the iodine value of stilbene by Hübl or Wijs refused to crystallise neither could a crystaline benzoate be obtained from it. It was considered to be a mixture of hydrobenzoin and isohydrobenzoin or their ethers (in the case of Hubl's solution).

A reaction which is common to both isohydrobenzoin and hydrobenzoin is their conversion into diphenyl acetic aldehyde by boiling with dilute sulphuric acid (20 per cent.).

The following experiment was carried out: 0·5 grm. stilbene dissolved in 20 c.c. of chloroform was mixed with 15 c.c. of water and then 60 c.c. of Wijs' solution added. The precipitate which at first formed was gradually dissolved on warming and the solution was coloured deep red-brown by the liberation of iodine. After standing 1½ hours it was poured into a separating funnel and water (250 c.c.) and potassium iodide and sodium thiosulphate solution added until all the iodine was reduced. The chloroform layer was run off, washed with water, and finally, the chloroform distilled off. The oily residue was mixed with 100 c.c. of water and 20 c.c. of concentrated sulphuric acid and boiled under a reflux condenser for 7 hours. The solution in the flask was then distilled in steam and the distillate (300 c.c.) which contained a nearly colourless oil shaken out with ether. On evaporation of the ethereal solution an oil was obtained which when dissolved in alcohol gave a small quantity of crystals (not examined). The oil reduced ammoniacal silver nitrate, gave a phenyl hydrazone and an oxime. It also restored the colour to magenta solution bleached by sulphur dioxide (Schiff's reaction) giving finally a very bright red-blue colour. The quantity of oil obtained did not admit of a more detailed examination, but these reactions show that it is an aldehyde and admit of no other conclusion than that the original substance was either hydrobenzoin or its isomer. Formulating the reaction we have—

$$C_6H_5 - CHOH - CHOH - C_6H_5 = (C_6H_5)_2CH.CHO + H_2O.$$

Reduction of the Iodochlorides by Potassium Iodide Solution.

In the paper already referred to I have shown that the iodochlorides of both stilbene and styrolene are reduced by the action of aqueous potassium iodide upon their alcoholic solution forming the original substance and liberating iodine. I showed also that in the determination of the iodine value of the substances correct results could only be obtained if the potassium iodide was prevented from acting upon the iodochlorides which could be done by adding water to the test solution so as to precipitate the chloroformic solution of the iodochlorides before adding the potassium iodide.* This alteration in the observed iodine value is still more marked with some other substances examined. The following table gives the iodine values obtained working in this way and for comparison those obtained by Hübl's solution and the free acid formed are likewise given.

The potassium iodide solution was allowed to stand in contact with the test 5 minutes in the experiment recorded in the last column. In all cases the blank test was mixed with the KI solution direct as there was here of course no fear of reduction.†

Errors arising from the neglect of this reduction have doubtless in the past led to the very varying results we find recorded in the literature for the iodine value of substances. This is specially to be noted in the case of the phenols the iodochlorides of which are very decomposable. The matter is still under investigation.

The results given in the above tables (pages 423—4) merit more special attention, and in the following they will be treated in greater detail.

Substance.	Theoretical Iodine Value.	Modified Hubl's Method.			Iodine Value. Mod. Waller.	Wijs' Method. Iodine Values.	
		Iodine Value.	Acid formed.				
			As I per Cent.	Nature.		Water first.	KI first.
Styrolene	242·2	227	95	HCl	224·3	226·6	172·7
Stilbene	141	128—140·6	107—120	HCl and HI	Nil	138	?
American turpentine	?	?	?	HI and HCl	242	355	253
Eugenol	2I = 154	445	?	HI	151	?	?
„ benzoate	2I = 95	94·5	23	HCl	93	95·1	93·8
Isoeugenol benzoate	2I = 95	94·5	66	HCl and HI	43	95·0	43·7
a-naphthol	2I = 177	264	187	„	120	262	195
Phenol	4I – 540	410	220	HCl	Nil	623	267
Oils, &c.	..	..	..	..	..	..	..
Tung oil	?	165	87	HI and HCl	128	164	161
Rosin, American	?	165	133	„	128	150	144

---

* With regard to the iodine value of most oils the matter is of less importance, as Harvey points out (this J., 1902, 1437). This is because the iodine chloride solutions usually employed (Hubl's and Wijs') contain sufficient water to convert the whole of the hydrolysable iodochloride into hydroxyl derivatives which are not reducible by potassium iodide. If, however, the iodochloride of the oil contains a great amount of liberated halogen (some of which has not been split off during the test) as in the case of tung oil, then the addition of potassium iodide before water has a lowering influence on the iodine values observed.

† The addition of potassium iodide solution to the blank test before the addition of water prevents any decomposition of the HOI, which is formed by the action of water upon the ICl. In the paper referred to I stated in my recapitulation of results "that in all cases it is advisable to add water to the test solution before potassium iodide, so that any iodochloride which remains unchanged may, as far as possible, be removed from the sphere of action by solution in the chloroformic layer." It is obvious that in the above statement the "blank test" is not included, as Harvey seems to think (*loc. cit.*) because in this there is no "iodochloride" present. That if water be added to the blank test first, a loss of titrable halogen does result is in accordance with my experience, even if the KI is added immediately after the water, as the following results show:—

Water added first KI immediately run in 25 c.c. Wijs = 41·0, 41·0, 41·0 c.c. Thio.

KI added first water immediately run in 25 c.c. Wijs = 41·2, 41·2, 41·2 c.c. Thio.

Water added first stood 5 mins. then KI added 25 c.c. Wijs — 38·3.

In each case 13·4 c.c. thiosulphate solution = 0·2 gr. iodine. In the actual test as the concentration of the ICl (and hence of the HOI when the water is added) is greatly reduced by absorption there will be less tendency for the HOI to decompose on the addition of water, and hence no appreciable error will result, if water be added first, from this cause.

Group I.

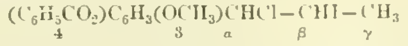
Styrolene and Stilbene.—A detailed study of the behaviour of these two substances, and the properties of the iodochlorides has already been published. They are included in the above table for completeness' sake. The reason why the theoretical values were not obtained is probably that the substances had either become oxidised by exposure to air, or had been polymerised by the action of light (Ciamician and Silber, Ber., 1902, 4129).

The loosening influence of a phenyl group attached to a carbon atom, forming one of a double linkage is well exemplified by these two substances. This loosening influence is also a protective one, as is shown by the fact that stilbene refuses to absorb iodine chloride from the modified form of Waller's solution, while styrolene which contains only one phenyl group is able to decompose this double compound ICl, HCl.

Eugenol and Isoeugenol Benzoates.—These two substances form excellent examples of this property of the phenyl group. The formulæ of the two iodochlorides are probably as follows:—Eugenol benzoate iodochloride—

$$\underset{4}{(C_6H_5CO_2)}C_6H_3\underset{3}{(OCH_3)}\underset{\alpha}{CH_2}-\underset{\beta}{CHCl}-\underset{\gamma}{CH_2I}$$

isoeugenol benzoate iodochloride—



$$\underset{4}{(C_6H_5CO_2)}C_6H_3\underset{3}{(OCH_3)}\underset{\alpha}{CHCl}-\underset{\beta}{CHI}-\underset{\gamma}{CH_3}$$

In both cases 2I are absorbed per molecule, but in the former 23 per cent. of iodine appears as haloid acid (HCl), while in the latter 66 per cent. of iodine is converted into acid (HCl and HI) by the action of the water in Hübl's solution. The loosening influence of the phenyl group in both these compounds is strengthened by the presence of the benzoyl and methoxy groups, not only is the atom attached to the substituted phenyl group (the α atom) protected, but also the β atom, *i.e.*, has its halogen atom so loosened as to be split off by the action of water as haloid acid. The amount of halogen thus split off from the β atom in each case is nearly the same, namely, 23 and 19 per cent. expressed as iodine (assuming that with isoeugenol benzoate, the whole of the chlorine is split off as HCl).

In order to further explain the iodine values of these eugenol derivatives, it was determined to endeavour to isolate the iodochlorides of the benzoates.

Eugenol Benzoate.—1·9 grm. of the substance was dissolved in acetic acid, and 150 c.c. of Wijs' solution added. After standing 2 hours the solution was poured into 500 c.c. of water in a separating funnel and shaken out with ether. The ethereal layer was treated with dilute sodium thiosulphate, and then, after well washing with water it was evaporated. A good yield of crystals was obtained which, after recrystallisation from alcohol, melted at 91° C, forming shining pearly plates. It gave all the reactions of the iodochloride, liberating iodine by heating with strong H_2SO_4. Alcoholic silver nitrate gave a white precipitate of AgCl, showing that chlorine is first split off. Potassium iodide solution added to its alcoholic solution only very slowly liberated iodine.

Halogen Determination.—0·5406 grm. of iodochloride was dissolved in 50 c.c. alcohol and 1 grm. of KOH dissolved in 2 c.c. of water added. The whole was heated in a flask in the water bath and, when the alcohol had evaporated, 50 c c. of water were added, and the heating continued for 1 hour. Then 1 grm. of silver nitrate dissolved in water was run in, and dilute nitric acid added until the dark grey precipitate was replaced by a yellowish one. The precipitate was filtered off, washed with boiling alcohol, followed by dilute nitric acid, and weighed as usual. AgCl and AgI formed 0·4386; reduced Ag in filter paper ash, 0·0171 = 0·0301 Ag_2ICl: total Ag_2ICl = 0·4688 = 37·2 per cent. I + Cl; theory for $C_{17}H_{16}O_3ICl$ = 37·4 per cent. I + Cl. The substance is, therefore, eugenol benzoate iodochloride.

Attempts to prepare the iodochloride of isoeugenol benzoate on account of its instability proved futile.

The behaviour of these two substances to modified Waller's solution has already been noticed, but a few words on the subject may not be out of place. The negatively substituted phenyl group is able to exert a greater protective influence than a simple phenol group, although it is not able to completely protect both carbon atoms of the double linkage in isoeugenol benzoate. The following table gives the iodine absorption after various lengths of time of action, using Waller's solution as modified:—

—	Eugenol Benzoate.	Isoeugenol Benzoate.
In 20 minutes	65	40·0
„ 2 hours....................	93	43·0
„ 20 „	..	83·0

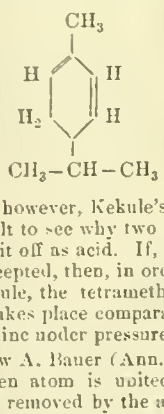
(For the reducing action of KI upon the iodochlorides, see p. 425.)

We thus see that if one of the carbon atoms of an ethylene group be attached to a strongly negative group, the latter protects, more or less, both carbon atoms from forming an addition compound.

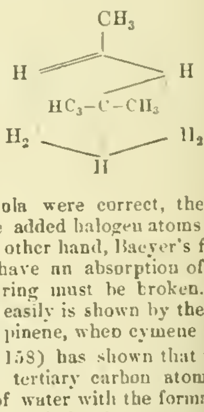
American Turpentine.—This was fractionated, and the fraction boiling between 155° and 157° taken. It probably consists of almost pure pinene. The results given in the table agree accurately with an absorption of 4I per molecule, and with the liberation of slightly over 2I as haloid acid (HI).

Schweitzer and Lungwitz' figures and those of Fahrion (*loc. cit.*) are likewise more nearly in agreement with 4I per molecule than with 2I, and the latter points out that this is better in agreement with Kekule's formula for this substance (I) than with that of Wagner-Baeyer (II.) Since the former requires an absorption of 4I, while Baeyer's formula without some intermolecular change only demands an absorption of 2I.

I.

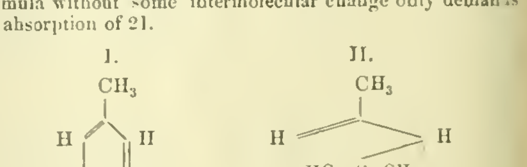


II.



If, however, Kekule's formula were correct, then it is difficult to see why two of the added halogen atoms should be split off as acid. If, on the other hand, Baeyer's formula be accepted, then, in order to have an absorption of 4I per molecule, the tetramethylene ring must be broken. That this takes place comparatively easily is shown by the action of iodine under pressure upon pinene, when cymene results.

Now A. Bauer (Ann., **220**, 158) has shown that when a halogen atom is united to a tertiary carbon atom, it is easily removed by the action of water with the formation of a tertiary alcohol. This is especially the case with the iodides (see also Walden above). If we assume that Baeyer's formula is correct then we must formulate the addition product thus—



Such a reaction would agree with observed facts. Against Baeyer's formula Fahrion further urges that Engler (Ber., **33**, 1900, 1669) shows that pinene absorbs four oxygen atoms per molecule, and hence must contain two ethylene groups. It does not however appear to the writer that in this case too a breakage of the tetramethylene ring is improbable with the formation of a similarly constituted peroxide, and he consequently does not feel justified in disputing the accepted formula of such a well-investigated substance on such meagre grounds.

The iodine values obtained by the use of modified Hübl solution and my modified form of Waller's solution with eugenol are interesting; with the former the ring takes part in the reaction, while with the latter only the side chain absorbs.

Triphenylmethane was examined because of its relationship to the very interesting triphenylmethyl of Gomberg. It behaves towards Wijs' solution as a saturated compound.

Group II.

Dicyanstilbene, cis and trans, and Diphenylmaleic Anhydride.—If we replace the two hydrogen atoms of the ethylene group in stilbene by either cyanogen or carboxy these two negative groups and the weakly negative phenyl groups are able to protect the double linkage from the attack of the halogen atoms of the iodine chloride solution (Wijs, Hübl, or Waller) and so these substances absorb no halogen. The behaviour of the two stereoisomeric dicyanstillbenes is of interest, but too great reliance should not be placed upon the results with the trans compound as it was of doubtful purity.

Aconitic acid. $CH_2 (CO_2H).C (CO_2H) : CH(CO_2H)$.—In this substance the two negative groups protect the ethylene union and hence no iodine absorption takes place.

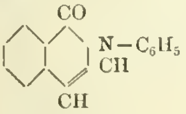
Maleic and fumaric acid contain similar groups, and hence, as Lewkowitsch has found, no iodine absorption results from their interaction with Hübl's solution.

Cinnamic Acid and its Derivatives.—Styrolene can absorb halogen even from modified Waller's solution. If we replace one of the hydrogens of the CH_2 group by carboxyl, we find that the substance resulting, cinnamic acid, has the power of absorbing only a very small amount of halogen even from Hübl's and Wijs' solution. The negative carboxyl group is capable of exerting a protective influence over the double linkage, and that, combined with the less strongly negative group phenyl, renders the substance capable of only absorbing a small amount of halogen. Cinnamic ether yields a higher iodine value with Wijs' solution than with Hübl's, probably because the concentration of the ICl in the former is greater than in the latter. The iodine value of the ether of cinnamic acid is more than that of the free acid because the introduction of the ethyl group lowers the negative character of, and hence the protection exerted by, the carboxyl group. If we render the phenyl group more negative by introducing a nitro group (as in o-nitro cinnamic acid) or an oxygen atom (as in coumarin) the protection is complete. Also if the carboxyl group be united to another acid group, as in dicinnamoyl tartaric anhydride,* the protection of the ethylene union is complete.

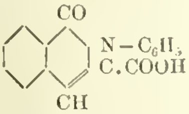
The protective influence of the negative group is here again a loosening one on any halogen that is absorbed, thus, ethyl cinnamate which absorbs 16I per cent. splits off 15·5I as acid.

The protective influence of the negative groups extends in proportion to their negative character, not only to the carbon atom to which they themselves are attached, but also to the other carbon atom of the double linkage as is shown in eugenol and isoeugenol benzoates, in cinnamic acid, and the other cinnamyl and cinnamoyl derivatives.

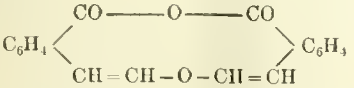
The behaviour of the three isocoumarin derivatives† is of interest, the constitutional formulæ of which are as follows:—



Isocarbostyryl.



Isocarbostyryl carboxylic acid.



o-anhydro oxyl vinyl benzoic anhydride.

In the first the CH = CH group has in direct union with it the weakly negative ring, and the weakly positive phenylimido group, hence we get absorption of halogen.

In the second, the carboxyl group neutralises in part the positive phenylimido group, and hence we do not get the full absorption. The substance behaves as a slightly more positive material than cinnamic acid.

If the formula for the third be correct it is difficult to explain the absorption of only two equivalents of halogen, instead of 4 atoms as theory requires.

Group III.

In structure the members of this group are related to styrolene, and to cinnamic acid.

Benzalacetone.—In this substance the carbonyl group has attached to it the relatively positive radical methyl, while the styryl group in virtue of the phenyl group is weakly negative. As the substance is able to absorb ICl from Hubl's solution the protective influence of the carbonyl group, manifest when in cinnamic acid, must here be neutralised by the methyl group. One of the added halogen atoms is, however, loosened, probably by the phenyl, and is split off as acid by the action of water, and as the substance does not liberate iodine from Wijs' solution that atom is chlorine. The formula of the iodochloride is probably $C_6H_5CHClCHI.CO.CH_3$. The iodochloride was isolated.

Benzalacetone Iodochloride.—One gram of the ketone was dissolved in acetic acid, and 100 c.c. of Wijs' solution added. After two hours the mixture was poured into water (250 c.c.) and the crystals which formed on standing filtered off. Recrystallised from alcohol, in which it is easily soluble, it was obtained in colourless needles, melting at 59—60° with decomposition. The alcoholic solution of the compound liberated much iodine when treated with potassium iodide solution. Silver nitrate gave first a white precipitate and then gradually a yellow one when added to its alcoholic solution, showing that chlorine was first split off. The substance was rapidly decomposed by the action of light. It was not further examined.

Dibenzalacetone.—This substance might be expected to absorb 4I per mol., but, as the table shows, actual experiment gave 2I per mol. and 1I split off as acid HCl. The oxygen of the carbonyl is evidently able to protect one styryl residue but not the other.

Benzalcinnamylidenacetone.—

$$C_5H_6-CH=CH-CO-CH=CH-CH=CH.C_6H_5$$

This substance, which does not appear to have been prepared before, was obtained by Claisen's method, namely, by the action of cinnamic aldehyde upon benzal acetone in presence of caustic soda. It was obtained as golden yellow shining needles after recrystallisation from alcohol melting at 108°. With concentrated sulphuric acid it gave a dark red colour, and was easily soluble in most organic solvents. The iodine values recorded in the table, instead of being 6I, are 4I per mol. with 2I split off as acid HCl.

Dicinnamylidene Acetone.—Here again the oxygen of the carbonyl appears to be able to protect one double linkage for instead of 8I only 6 are absorbed.

The behaviour of these derivatives of acetone to modified Waller's solution is interesting.

—	Iodine Value. Modified Waller.	Theory.
Dibenzalacetone	27	$\frac{1}{2}$I = 28·3
Benzal cinnamylideneacetone	24	$\frac{1}{2}$I = 24·2
Dicinnamylideneacetone	118	$2\frac{1}{2}$ = 111·2

The protective influence of the phenyl groups is well shown. In the last compound one of the ethylene unions is too far removed from this protection to exert itself, and hence is able to absorb 2I, and the remaining $\frac{1}{2}$I is due to the same cause as the $\frac{1}{2}$I absorbed by the other two substances, whatever that may be.

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[*] I have to thank Mr. Dakin, B.Sc., of the Yorkshire College, for this specimen.

[†] I have to thank Dr. Wm. Frew, of Perth, for these three specimens.

Benzal Acetophenone.—The absorption of nearly one I per molecule from Hübl's solution and over I from Wij's is probably due to the different concentration of the ICl in these two solutions as already mentioned.

Old specimens of all these benzal derivatives show lower iodine values than freshly prepared ones; this is probably due to either oxidation or polymerisation of these substances by the action of light (compare Ciamician and Silber's results with Stilbene, *loc. cit.*)

Group IV.

The action of ICl upon triply linked carbon atoms has been but little studied, never quantitatively. Plimpton (Chem. J., **41**, 392) obtained C_2H_2ICl by passing acetylene into a solution of ICl in HCl. McGowan (Pr. E., **9**, 589), obtained the same substance using an etherial solution of ICl. Stolz (Ber., **19**, 538) by boiling propiolic acid with an ethereal solution of ICl obtained chloriodo acrylic acid $CHI = CCl.COOH$ or $CHCl = CICO_2H$. Dichlor-di-iodo-ethane does not appear to have been prepared, but Henry (Comptes rend., **98**, 518), by the action of ICl upon C_2H_3Cl, obtained dichloroiodoethane.

As far as I am aware no attempts have been made to determine the iodine value of triply linked carbon atoms.

In the foregoing table the only acetylene derivatives examined are those in which a certain amount of protective influence is exerted by the groups attached to the two carbon atoms.

The tolane used was a slightly impure specimen obtained by the action of sodium ethylate upon stilbene dibromide. The difference in its behaviour to Hübl's and to Wijs' solution is doubtless due to the different concentration of the ICl in the two. It is interesting to note that the amount of acid formed in Hübl's solution bears nearly the same relationship to the total iodine absorption as in the case of stilbene.

That orthonitrophenylpropiolic acid absorbs exactly 2I or ICl is in accordance with Stolz's observations with propiolic acid above cited, but why *o*-nitrophenyl acetylene absorbs no halogen at all is difficult of explanation.

The Phenols.—In two or three places in this paper the iodine chloride absorptions of various phenols and phenolic derivatives have been given. The free phenols appear to behave as unsaturated cyclical ketones, whereas their benzoates react like saturated compounds.

A detailed examination of the various isomeric di- and trihydroxy benzenes and of the naphthols is in hand, and will form the subject of another paper.

Conclusion.—No general theory affords a complete explanation of all the results obtained in this research, but some help is afforded by Thiele's Theory of Partial Valencies (Annalen, **306**, 87—142) and the assumption of the tetravalency of oxygen in many of these compounds, *e.g.*, in the benzalacetones (cp. Baeyer and Villiger (Ber., 1902, 1189; Walden, Ber., 1901, 4185). The matter is, however, merely of theoretic interest, and for practical purposes the results of of the research are:—

(1) A confirmation of the conclusion arrived at in my previous paper, namely—

- (*a*) That the unsaturated compounds absorbs ICl from the various solutions.
- (*b*) That no substitution takes place during Hübl's and Wij's reaction.
- (*c*) That the acid formed is due to the action of water upon the iodochlorides.

They further show (2) that the amount of acid formed, depends probably upon the ionisation and subsequent hydrolysis of the iodochlorides by the water present. The amount of this hydrolysis is dependent upon the nature of the groups attached to the double linkage.

(3) The presence of aromatic groups, and of negative groups in an unsaturated compound attached to the ethylene union tend to lessen its attraction for iodine chloride to an extent proportionate to their negative character. The lessening of the attraction is manifest in the refusal of such substances to absorb iodine chloride from a solution containing it in weak combination with hydrochloric acid and by the increased hydrolysis of the iodochloride in Hübl's reaction.

(4) Further proof is given that the iodochlorides are reducible by the action of aqueous potassium iodide, and this reduction is thought to have been a fertile source of error in the past in the determination of the iodine value of unsaturated compounds.

(5) It is shown how by determining the iodine value of a substance by the various solutions and the amount and nature of the acid formed by the hydrolysis of the iodochloride some information may be obtained as to the probable position of the ethylene unions in the molecule.

(6) The triply linked carbon pairs seem to exert less attraction for iodine chloride than doubly linked.

I have to again thank the directors of Messrs Barry, Ostlere, and Shepherd, Ltd., for the use of their laboratory, and my assistant, Mr. Ernest Wake, for his help in carrying out the experimental work recorded in this paper.

THE ANALYSIS OF WATERS, AND THEIR CHANGES IN COMPOSITION WHEN EMPLOYED IN STEAM-RAISING.

BY R. R. TATLOCK AND R. T. THOMSON.

It would appear that, owing to the numberless more or less valuable text-books on water analysis, and the various papers on the same subject which have appeared in chemical journals, there would be little or no room for anything further to be said on this subject. But in straining after something original analysts have too often suggested the abandonment of what is of real value, in favour of what appears at first sight to be a genuine improvement, but which is in reality only superficial. This desire for something new seems to be so absorbing at the present day that we are constantly presented with crude and undigested methods of analysis, and it is to combat this spirit that, to some extent, our present paper is written. Not that we do not wish for changes for the better, but we would beware of abandoning things of real value, while at the same time we ought to go on improving our methods of analysis, accepting such modifications as are likely to be of permanent value, and relegating to their proper place such modifications in method as seem to be made solely for the sake of change.

In the present paper we intended to take a wider scope than we shall be able to take, owing mainly to lack of time to work up the subject as fully as we should have desired. We shall therefore in the first place give a few notes on certain particulars connected with the analysis of waters, and then consider the behaviour of a special variety of water when employed in a boiler for steam raising.

Temporary Hardness.—We shall in the first place deal with the determination of temporary hardness, the soap solution method for which is now rightly viewed as an unreliable and extremely empirical one. The only truly scientific method is that by titration with a standard acid, and employing some indicator to determine the end-reaction. The original indicator proposed by Hehner for this purpose was methyl orange, which was first introduced for the determination of alkali by Lunge about a quarter of a century ago. Many indicators have been brought forward to supplant it, but for its special purposes Lunge's Indicator undoubtedly still holds the field. Taking the special case of the determination of the alkalinity of water we find alizarin as one of the most recent candidates for favour, because the end-reaction is more delicate. The fatal objection to it for rapid analysis is that the solution requires to be boiled to expel carbonic acid, and it must be remembered that one boiling is not sufficient, but it must be boiled after each addition of acid to bring back the colour: and if this is not carefully and thoroughly done either a false result or an indistinct end-reaction will be obtained. Some years ago one of us showed that with lacmoid a more delicate end-reaction was obtainable (in fact quite as delicate as with alizarin), but that the great objection there also was the fact that one had to resort to boiling, exactly as in the case of alizarin. To obviate this trouble of discovering the end-reaction it is suggested to add excess of standard acid, then boil to expel carbonic acid, and titrate back with standard caustic alkali.

But this does not mend matters, as the boiling has still to be done, and we have the extra trouble of working with two standard solutions in place of one. Now, with methyl orange the great advantage is that the cold water can be titrated direct with standard acid, and although the end-reaction is not so delicate as with alizarin, yet quite as accurate a result can be obtained if the proper precautions are taken Indeed the slowness of the end-reaction of methyl orange may be almost regarded to a certain extent as a merit, as the first change in colour (especially in the titration of waters in which there are seldom such a proportion of neutral salts as would injuriously affect the end-reaction) is usually distinctly observed with, at most, 0·1 c.c. of N/10 acid. The first change ought to be taken as the end-reaction, and the intensification of the colour by further addition of acid will serve to corroborate the first impression. Working in this way we easily obtain results quite as reliable and accurate as can possibly be obtained by alizarin or any other indicator. Of course it is well to know the capabilities of all indicators, as it may happen that in certain circumstances methyl orange might not be available, and one of the others could be used in its place if the conditions under which it can be employed are known.

In titrating in this way, carbonate (or bicarbonate) of sodium, which is very often present in pit waters, would be included with the carbonates of calcium and magnesium as temporary hardness. To determine the carbonate of sodium we evaporate a measured quantity of the water to one-fourth of its original volume, filter through a dry filter, and take a measured portion of the filtrate for the determination of carbonate of sodium by standard acid.

Chlorides.—The determination of these seldom presents any difficulties, the titration with standard silver nitrate, and the employment of potassium chromate as indicator, being usually sufficient. Difficulties arise, however, when we have to deal with mossy or peaty waters and with waters containing acids or iron salts. With mossy waters, which are also sometimes acid, we have found the best mode of dealing to consist in adding some calcined magnesia to a portion (not necessarily measured) of the water, and agitating thoroughly for a few minutes. In this way, acid, if present, is neutralised, and the mossy or peaty matter is precipitated and removed from solution, while the magnesia remains practically insoluble. All that is then necessary is to filter through a dry filter, and titrate a portion of the discolorised water with standard silver nitrate solution.

Acid waters are treated with magnesia as just discribed, and so are waters containing iron, but in the latter case a few drops of hydrogen peroxide should be added in order to convert any ferrous compounds into the ferric condition. The magnesia then removes the iron wholly, and it only remains to filter the mixture and estimate the chlorides in the solution as before.

Nitrates and Nitrites.—The determination of nitrates in a water is in our opinion one of the greatest importance, at least in the case of water intended for dietetic purposes, and therefore an accurate and speedy method is of great value. We have come to the conclusion that, when properly adapted, the phenol-sulphonic acid method is decidedly the most handy and reliable. In natural waters, however, there are two ingredients which are fatal to a correct determination of nitrates, namely, organic matters, especially the brown mossy or peaty organic matter, which is so often present in the waters we are familiar with in Scotland, and the chlorides of magnesium and sodium. For the removal of organic colouring matters, such as is found in mossy waters, there is nothing superior to agitation with calcined magnesia as already described under the letermination of chlorine. We have found that when hlorine is present to the extent of 3·5 grs. per gallon (5 parts er 100,000) of chloride of sodium, only about 60 per cent. of the whole is obtained, and when 21 grs. per gallon 30 parts per 100,000) are present, only about 34 per cent. s obtained. These proportions are, however, only roughly pproximate, as we have found that the results in presence f the same proportion of chlorides are somewhat erratic. n order to obviate this adverse influence of the chlorides, lason in his book on the "Examination of Water" commends the use in the standard of the same proportion of chlorides as is present in the water being tested, so as to counterbalance their influence; but owing to the somewhat erratic effect of the chlorides we came to the conclusion that it would be more satisfactory to remove them entirely. For this purpose we have applied and adapted the method which is employed for the removal of chlorides from crude glycerine in testing the strength of that article by the bichromate method. This consists in agitating the sample with excess of silver oxide, which removes the chlorine in the form of silver chloride. When treated in this way, however, a considerable proportion of silver remained in solution, apparently as oxide, and this was deposited on evaporation of the filtrate to dryness for treatment with phenol-sulphonic acid, which soon converted the brown silver oxide into sulphate. The silver compound seemed to have the rather unexpected effect of lowering the result for nitrates, although not nearly to the same extent as, say, 3 grs. of sodium chloride per gallon. We were thus compelled to work with a limited supply of silver oxide, adding just enough to convert all the chlorides into silver chloride, this being determined by the usual volumetric method. When this was carried out the exact proportion of nitrates present was obtained, but considerable difficulty was experienced in obtaining a clear filtrate, as traces of silver chloride passed through the filter. This difficulty was also overcome by the use of a little aluminium sulphate followed by calcined magnesia. The final method adopted was therefore as follows:—100 to 200 c.c. of the water are treated with enough silver oxide, in a fine state of division, to decompose the chlorides, the proportion of which had been previously ascertained. After agitating thoroughly, a little aluminium sulphate (say about 0·1 gr.) is dissolved in the mixture, then excess of calcined magnesia is added, and the agitation continued for a minute or two. In this way the chlorides and organic matter are entirely precipitated, and are then filtered off through a dry filter, when the filtered solution will be found as free from colour as distilled water. A portion of the filtrate (50 to 100 c.c.) is now evaporated to dryness over an open water-bath, and the residue tested for nitrates by the well-known phenol-sulphonic acid method. A number of test experiments showed that in every case the whole of the nitrates, added to a water containing comparatively large proportions of chlorides and organic matter, was obtained by this method of determination.

The next point which arose for consideration was the effect of nitrites on this determination, but it was clearly shown that this was almost nil, or that their presence only slightly raised the proportion of nitrates. This fact suggested to us the idea of applying the phenol-sulphonic acid method to the determination of nitrites also, provided these could be readily converted into nitrates. The ideal reagent was soon found in hydrogen peroxide, which suits admirably for the purpose in view. To determine the nitrites, therefore, it is only necessary to remove the chlorine from, and render colourless, a quantity of the water to be tested, exactly in the manner just described. In such dilute solutions as generally occur in waters there is no danger of any nitrite being precipitated by the silver compound. A portion of the treated water is tested for nitrates, and to an equal portion there is added a little hydrogen peroxide, and the mixture evaporated to dryness. The nitrites which existed in the water are now present in the residue in the form of nitrate, and it only remains to apply the phenol-sulphonic test, then subtract the nitrates actually present in the water as such from the total nitrates now obtained, and calculate the remainder to nitrites, or to bring these compounds to nitric and nitrous nitrogen respectively. Of course it would be advisable to make certain of the presence of nitrites by one of the well-known colour tests for these compounds.

Having disposed of certain points in the analysis of water, we shall now go on to consider the second part of our subject, which is the behaviour of a special variety of water when employed in a boiler for steam-raising. The particular class of waters we refer to is the alkaline variety, or such as contain notable proportions of bicarbonate of soda, and consequently no neutral salts of calcium and magnesium. These waters are generally found at a great depth in the earth, one which we analysed being obtained from about 840 feet below the surface. The water from coal pits, for instance, often contain comparatively large proportions of bicarbonate of sodium.

In order to trace from the beginning what changes in composition occur when waters of this class are employed for steam raising, we shall first observe what takes place as the water passes through the heater. The following are analyses of boiler feed water before and after passing through the heater :—

	Grains per Gallon.	
	Before passing through Heater.	After passing through Heater.
Carbonate of calcium	11·74	3·63
Carbonate of magnesium	8·60	7·96
Carbonate of sodium	1·03	1·19
Sulphate of sodium	20·52	19·61
Nitrate of sodium	0·15	0·15
Chloride of sodium	2·73	2·69
Organic matter	0·10	0·08
Total solids	44·87	35·31
Hardness	21·98	13·10

The chief point to observe here is the result, not perhaps wholly unexpected that while no less than 70 per cent. of the carbonate of calcium in the water has been deposited while passing through the heater, only 7 per cent. of the carbonate of magnesium has been so removed. This reversal of the relative proportions of the calcium and magnesium compounds in the water appears to be largely to the advantage of the water for boiler purposes, as the hydrate or oxide of magnesium formed within the boiler is a much lighter and less compact deposit than the carbonate of calcium, and thus helps to prevent the latter from forming a scale in the boiler. This, at least, is the conclusion we draw from an examination of the deposit from such a water as this, which is in the form of a light granular powder or sludge, and which apparently does not adhere to any great extent to the boiler.

In the next place we shall go on to consider what takes place in the boiler after the water has left the heater. We do not here deal with the same water as that with which we have been showing the effect of passing through the heater, because we could not obtain the residue from the same water after concentration in the boiler, and also we thought it would be better to work upon a water which was more pronounced in its alkalinity. The following is the analysis of the water after it had passed through the feed-heater :—

	Grains per Gallon.
Carbonate of calcium	1·97
Carbonate of magnesium	4·22
Carbonate of sodium	22·26
Sulphate of sodium	12·15
Nitrate of sodium	0·10
Chloride of sodium	2·28
Organic matter	0·30
Total solids	43·28

After being used in a boiler which had been five weeks under steam, the water had the following composition :—

	Grains per Gallon.
Carbonate of sodium	949·76
Hydroxide of sodium	123·20
Sulphate of sodium	776·39
Nitrate of sodium	0·85
Chloride of sodium	136·97
Silica and alumina	0·34
Organic matter	2·20
Total solids	1989·71
Suspended matter	1094·00

It has been stated that waters containing carbonate of sodium are apt to cause priming in a boiler, but we are assured that there has not been the slightest tendency in this direction with the water under consideration. It has also been stated more recently that waters containing sulphate of sodium have also the same objectionable quality, but although we have no less than 776 grs. per gallon of this compound in the concentrated water, it is absolutely devoid of the property assigned to it. From our experience the subject of priming is a very obscure one, and the most contradictory statements have been obtained by us on this subject. It is our opinion that in the positive statements as regards priming all the conditions have not been taken into account, but that probably because carbonate of sodium or sulphate of sodium happened to be present in excessive proportion when priming took place these were credited with the defect. These facts show clearly that at present no definite conclusion can be drawn from an analysis of water as to whether it is likely to cause priming or otherwise. It will be observed in this case that 1,000 galls. of the water have been concentrated to 20 galls., or to exactly one-fiftieth of their original bulk, and at the same time 15 per cent. of the total carbonate of sodium has been converted into hydroxide. This transformation is not altogether unknown, but has been referred to by Mr. Arthur E. Leighton in his "Note on Boiler Water containing Sodium Carbonate," which appeared in the *Chemical News* for February 6th, 1903, but he does not state any theory as to the origin of the caustic alkali. From a consideration of the whole matter we think it probable that the magnesia produced from the carbonate of magnesium acts slowly as a causticising agent at the high temperature inside the boiler. To make this clear, let us take into account the suspended matter in the water of which we last gave the analysis, and which amounted to about 1,000 grs. per gallon, and had the following composition :—

	Per Cent.
Carbonate of calcium	45·76
Oxide of magnesium	14·18
Oxide of iron	4·94
Siliceous matter and clay	25·32
Carbonaceous matter, &c.	9·80
	100·00

Here, then, in the presence of about 950 grains per gallon of carbonate of sodium, we have the carbonate of magnesium entirely decomposed and converted into oxide It is now plain that there is nothing in solution which could possibly causticise carbonate of sodium, and in suspension the only possible agent is the oxide of magnesium or magnesia. We have made trials by boiling carbonate of sodium solution with calcined magnesia, but no causticising has taken place. It might naturally be anticipated, however, that the higher temperature inside the boiler would favour the action of the caustic magnesia on the carbonate of sodium. We intended to follow up this matter, but more time was required than we could devote to it, and also an apparatus which we could work under a high pressure, and from which we could allow carbonic acid to escape at intervals without allowing the temperature to fall sensibly. But in the absence of experimental proof there are certain deductions which may be drawn in support of our contention from other analyses which we now propose to lay before you. The following analysis is that of an alkaline water which was used in four different boilers :—

	Grains per Gallon.
Carbonate of calcium	4·45
Carbonate of magnesium	1·92
Carbonate of sodium	25·07
Sulphate of sodium	2·56
Chloride of sodium	7·39
Nitrate of soda	None
Organic matter	0·40
Total solids	41·79
Hardness	6·73

We have next partial analyses of the residual waters from the four boilers in which the above water was employed :—

	Grains per Gallon.			
	No. 1.	No. 2.	No. 3.	No. 4.
Carbonate of sodium	226·3	1,365·3	979·3	319·0
Hydroxide of sodium	47·6	392·0	358·4	156·8
Percentage of the carbonate of sodium causticised	21·0	28·0	32·0	39 0
Number of galls. to which 1,000 galls. of the original water had been concentrated	86½	13¼	17¼	47½

No. 1 is the concentrated water from a boiler which had been 1,100 hours under steam, and had been working at a pressure of 45 lb., or a temperature of about 274° F. The other three waters were from boilers which had been worked at a pressure of 140 lb., or a temperature of 353° F., but No. 2 had been under steam for 242 hours, No. 3 for 160 hours, and No. 4 for 74 hours.

From these data the conclusions to be drawn are obvious. First, the length of time during which the evaporation takes place does not throw any light on the greater amount of caustic alkali produced in the one case than in the other. Thus in No. 1, which was from a boiler which had been 1,100 hours under steam, only 21 per cent. of the carbonate of sodium had been causticised, or in other words 9 oz. of hydroxide of sodium had been produced from every 1,000 galls. of water; whereas in No. 4, the boiler having been only 74 hours under steam, no less than 39 per cent. of the carbonate of sodium had become causticised, or 17 oz. of hydroxide of sodium had been produced from 1,000 galls. of the water.

Second, the proportion of hydroxide of sodium formed does not appear to be influenced by the extent to which the concentration of the water is carried. This is clearly proved by a comparison of No. 2 with No. 4, because in the former case, where the concentration was from 1,000 to 13¼ galls., 12 oz. of hydroxide of sodium had been produced; while in the latter case, where the concentration was from 1,000 o 47½ galls., no less than 17 oz. of hydoxide of sodium were formed. This appears to prove the point conclusively, but it must be conceded that the results are somewhat erratic, which is not altogether surprising.

Third, the only element which has any real controlling power is the pressure. or, in other words, the temperature. n No. 1, although the evaporation had been proceeding or 1,100 hours, only 9 oz. of hydroxide of sodium had een produced per 1,000 galls. of water, whereas in No. 4 o less than 17 oz. had been produced. This is corroborated by the results of Nos. 2 and 3, but the distinction n these two cases is not quite so striking. These results, hen, although erratic to a certain extent, are on the whole ery significant, and point to the temperature as being the ntrolling factor in the greater or less production of ustic alkali from the carbonate of sodium, and the only edium which we can suggest as assisting in this decomposition is the magnesia. We should here state that the ustic alkali produced during the evaporation in the boilers hurtful to the brass fittings, and it is only in this respect at these alkaline waters have given any real trouble. We ave to thank Messrs. The Glasgow Coal Co., Ltd., for eir kindness in providing us with samples of water, and in ving us such information as would guide us in our instigation.

We thus bring to a conclusion our remarks on this bject for the present, and trust at a future time to prove disprove the theory which we have just brought forward, l also to deal further with the problems presented by ter analysis.

Yorkshire Section.

Meeting held at Leeds, on March 21st, 1904.

MR. JAS. E. BEDFORD IN THE CHAIR.

COAL WASHING.

BY W. M D. MACKEY, F.I.C.

The importance of coal washing from a national standpoint justifies any attention that the chemist can give to the subject, and one reason that, apart from the laboratory examination of coals, it has hitherto received scant attention, from the English chemist at least, lies in the fact that to control actual coal washing at the pit, more especially when a washing plant is in difficulties, which from the nature of the work often happens, necessitates working in very unpleasant surroundings, amid sludge and water black with coal dust in suspension. The separation of shale or dirt from coal will become of more and more importance as our thick seams of coal remaining to be worked become fewer. Indeed, even now many collieries only exist owing to the introduction of coal-washing plant, and as the thinner seams have to be worked, often with serious dirt partings in them, it will be found in many cases that the only possible course is to "win" these seams, using coal-cutting machinery, and sending the bulk of the seam to the washer. House and steam coal are generally cleaned by hand, that is the lumps of shale picked out by hand. "Nuts," "beans" "peas" (or "slack" containing all these, with the addition of dust), are washed, or rather are capable of being washed. Washing consists in treating coal for the removal of intermingled shale or dirt, taking advantage, for that purpose, of the difference in specific gravity between shale and coal.

There are, I understand, shales lighter than coal, but for practical purposes it may be assumed that the shale or dirt is the heavier, and as a rule a coal is easy to wash, in proportion as the shale or dirt is heavier than the coal. Water is a medium which, with proper manipulation, readily carries the coal away from the heavier shale or dirt. Dirt may be divided into three classes :—

(1) Dirt mixed with the coal proper; for example, "brasses" or pyrites.

(2) Dirt partings in the seam, *i.e.*, thin layers of shale which run laterally with the seam, and which the miner necessarily brings down with the coal.

(3) Dirt below or above the coal, which it is sometimes necessary or desirable to remove in the process of coal-getting.

"Holing" in the dirt as opposed to "holing" in the coal refers to the practice of making use of a dirt lying either at the roof or floor of the seam, or separating the seam into two or three strata, for the purpose of undermining in order to allow of the coal itself being got out, or "let down" as it is termed. In "holing" in the coal, on the other hand, several inches of the coal itself are cut away, and so rendered of small value. The difference in practice depends to some extent on the custom in the particular mine, and on the hardness of the shale compared with the coal, the men preferring, of course, to hole or undermine where it is easiest.

As to the effect on the coal. Take first "holing" in the dirt. If the dirt be carefully removed before the coal is let down, a coal clean, at any rate from added dirt, should be the result, but in practice it usually adds to the percentage of fine dirt in the coal. In the case of "holing" in the coal, the result is a large percentage of fine dust in the coal, with increased difficulties in treating the coal afterwards in the washer.

It may be presumed that all coals containing dirt or shale are capable of being washed. The question resolves itself into one of cost, and the enhanced value of the resulting washed coal. Thus, if a colliery owner loses 10 per cent. in dirt washed out, and only realises 10 per cent. enhanced price on his washed coal, he is in a worse position than if the coal had been sold unwashed. But in reality the question is one of making a marketable article of what is unsaleable, or only saleable with great difficulty. In the case of small coal frequently what unwashed would be totally wasted is made into a valuable coking smudge.

The simplest and probably the earliest form of washer was the trough, consisting of a trough or spout usually with wooden sides, and in the later forms glass slabs on the bottom to withstand the action of the water and grit.

The trough is about two feet wide, and set at a slight slope, and extending as a rule not less than 40 feet. Down this the water runs, carrying the coal, and dams set at intervals catch the dirt, and the clean coal passes on. These troughs are usually worked in pairs, one being cleaned whilst the other is at work.

The modifications of the trough form a class which we may take first. *Thus, in the "Elliot" washer, an endless belt of dams is made to travel up against the flow of water and coal, delivering the dirt at the upper end. The "Murton" consists of an endless belt of steel trays with dams attached, carrying the dirt against the flow of coal and water, and delivering it at the upper end. In the "Muscamp" the dirt is made to travel to the upper end by means of a screw (the screw in this case forming the dams), and lastly, the "Blackett" consists of a steel tube or cylinder (30 feet long, 4 feet wide) which turns as the coal and water flows from one end to the other, the tube being laid laterally at a slight slope. A screw is attached to the inside of the tube, and as the tube revolves, the dirt falling behind this screw, which forms a continuous dam, is taken to the upper end of the tube and discharged. The coal to be treated (along with part of the water) is delivered by a stationary spout running to about the middle of the tube, and the dirt gets a further washing when it passes this point by a stream of water which enters at the upper end.

To a second class belong washers of the jigger or pulsating type. This includes the German washers, the "Luhrig," the "Humboldt," the "Baum," and one at least of English make, the "Sheppard."

Washers of this type consist essentially of a grid through which water rises and falls, being actuated either by a ram or compressed air. Water and coal are led on to the upper surface of the grid at one end, and the clean coal, which is separated from the dirt by the quick upward jig of the water, is discharged with the stream of overflow water at the other. The dirt, which forms a lower layer, partly finding its way through the grid and partly being discharged into the chamber below by an opening at the further end of the grid, collects in the bottom of the chamber, and is brought out by a screw conveyor. In some cases the grid is covered with felspar, through which the dirt makes its way, and usually a washer consists of several chambers and grids for coals of different sizes, the most vigorous pulsations being given to the water for the larger sizes. In the "Baum" washer, in its latest development, all sizes are treated over one grid, and the coal sized after washing.

A third class is represented by the "Robinson" washer, which consists of a cone, into which the coal is charged at the top, and an upward current of water, which overflows at one side, carries with it the clean coal, whilst the dirt sinks and is removed by a false bottom arrangement. The separation of the coal and dirt in the washer is facilitated by moving arms or paddles.

Recently, as a fourth class, we have table washers of the gold-washing type. Of these the "Craig" is the best known in England. It consists of a steel table, on to which the coal, previously mixed with water, is led, and over which the clean coal floats and is discharged at the further end, whilst the dirt, by an ingenious back bump arrangement, is caused to travel in the opposite direction and to be discharged off the table. In this way very fine or ground coal can be washed, but the rate of washing is slow, not exceeding five tons per hour.

In choosing a type of washer one will be influenced by cost, but in connection with this it should be remembered that the accessories, bunkers, *viz.*, riddles, elevators, pumps building, &c., usually overshadow the cost of the actual washing plant. The quantity of coal to be washed is also an important factor. If over say 40 or 50 tons an hour is to be washed, I would prefer a washer of the pulsating type, which, in the German pattern at least, is expensive in the first cost. Also, if the coal is friable, a washer of the pulsating type will make least breakage. The Westphalian coal is easily broken, also the collieries are large compared with the majority of English collieries, and there one usually finds washers of this type. When say 20 to 30 tons an hour or less have to be washed, cheaper types can be economically employed, always choosing one that has the least number of moving parts exposed to the action of the water charged with grit and fine coal, as this is severe on iron or steel parts moving in it. If a coal is difficult to wash owing to the difference of specific gravity between the coal and shale being small, it is advisable to provide ample washing plant so that the washing under such circumstances is not pushed. With all sizes down to "peas" the problem is simple; but with slack containing much dust the difficulties increase, owing to the formation of slurry, *i.e.* water charged with fine coal, which separates with difficulty. Here, economy of water per ton of coal washed is of the first importance.

The water in almost all cases is pumped over and over again, and unless special precautions are taken to ensure some degree of clarification, the washing becomes unsatisfactory. I have not estimated accurately the amount of water pumped per ton of coal washed, but I consider three tons a minimum, and it may rise to 7 and 12 tons.

The washing of slack (that is coal capable of passing through say $\frac{3}{4}$-in. hole) containing much fine is a problem of increasing importance, owing to the old custom of using hand riddles in the pit disappearing. Formerly the colliers riddled the fine out before filling into the tub—the fine being left in the pit and wasted. Now the tendency is to fill the coal unriddled, and more and more fine reaches the washer. This finds its way to the well, forming sludge, which is a constant source of annoyance. It is necessary to keep it moving, as if it accumulates, say, in settling tanks, it is not only useless but a source of danger if put on the pit heap. If it is kept uniformly mixed with the other coal, in the case of coking smudge, it improves the quality of the coke for some purposes. Small dredging buckets plying in the well is one method which I have used myself with some success. Sometimes in the case of small plants the washed slack and water are both discharged on to coal in the bunkers, which is fairly effective, but entails the raising o three or four times the weight of the coal in water, unless the plant is so favourably situated that the coal and wate can gravitate to the bunkers. Many, and sometimes very elaborate, systems have been devised for dealing with th slurry difficulty, but a satisfactory solution of the proble is still wanted.

It is claimed for washers of the German pattern that the deal successfully with coal containing much dust, but i Germany I noticed that they usually prefer to riddle out th fine, say, through $\frac{3}{16}$ in. or $\frac{1}{4}$ in. before washing, and ad the fine unwashed to the washed coal. This is, as a rul impracticable in this country with slack, owing to th increasing quantity of fine in what is sent to the washery.

Turning to the laboratory examination of coal, it shoul always be insisted on that the coal reaches the laborator in the size and condition in which it is proposed to send it t the washer. The problem in the laboratory is, what degre of improvement in the coal may be expected from succes ful washing.

I give here a table showing results of the examination a coking slack of a difficult type, and though this slack h not yet been washed on the large scale, my experience the method with coal that I have actually washed, sho that it can be depended on to give indications of practic value as to the results to be expected on the large scale.

Taking 100 grammes (or more, if the coal is larg I use for the separation, potassium carbonate soluti starting with 1·25 sp. gr. (that of light coal), going up stages of ·1, the final being 1·53 sp. gr. (saturated solutio fishing out, filtering, washing quickly by suction, a determining the quantity of the portions floating at

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* This part of the paper was illustrated by diagrams.

fferent specific gravities, and also determining the per-entage of ash. The coal is quickly removed from the otassium carbonate solution and washed; and though I ave not noticed any action on the coal, in the case of, say, gnite, it is not impossible.

(100 grammes coal taken):—

—	Specific Gravity.	Grammes.	Ash.
			Per Cent.
(1)	Under 1·25	20·52	2·52
(2)	„ 1·35	50·48	4·16
(3)	„ 1·45	5·20	15·40
(4)	„ 1·53	3·07	24·74
(5)	Over 1·53	20·73	58·40
		100·00	

ortions 1, 2, and 3, together, equal 76·29 grms., containg ash 4·48 per cent. Portions 1, 2, 3, and 4, together, qual 79·27 grms., containing ash 5·27 per cent. Portions , 2, 3, 4, and 5, together, equal 100 grms., containing ash 6·27 per cent. Ash in unwashed coal, 14·90 per cent. pecific gravity of dirt (all over 1·53 sp. gr.), 2·05. 31 per ent. of the coal goes through riddle of 1 16″ hole.

It will be noticed that the ash of the different portions dded together comes to 16·27 per cent. instead of 14·9 er cent. This is owing to some extent to the ash being etermined in the coal after quick drying, which probably xpelled some of the water naturally in the coal; possibly, lso, the potassium carbonate has not been thoroughly ashed out. It should be mentioned that the sum of the ecovered coal did not come out 100, as represented, but 7·55 grms (2·45 grms. too low), and was calculated to 00.

The examination shows that this coal will, apart from the 1 per cent. fine dust, be difficult to wash, and the dirt ill be unsatisfactory, containing much combustible matter. ith most coals the ash in the dried dirt is at least 70 per nt. In this particular coal I found black coal like shale, 1·71 sp. gr., and ash 45·76 per cent., useless as a coal, it which will be very deceptive in the washing on large ale.

The following table gives the details of the examination a dirt. The sample was dried and examined uncrushed, it came from the washer:—

100 grms. taken.

Specific Gravity.	Grammes.	Ash.
		Per Cent.
Under 1·25	0·38	2·72
„ 1·35	0·42	10·31
„ 1·45	0·28	17·06
„ 1·53	0·45	24·25

king all under 1·35 sp. gr. as coal, it only amounts to per cent. loose coal left in the dirt. The dirt dried at ° C. contained 77·07 per cent. ash.

This is a good result, but it should be added that in this particular washer the water was not used twice, being run to waste, and under these circumstances a dirt very free from coal may be expected.

Discussion.

Mr. J. E. **Bedford** said that if manufacturers could get coal which was properly washed, greater efficiency would be obtained from steam boilers. As coalfields became exhausted, it was more and more necessary to be economical in the use of coal. Briquettes made of coal dust were used on some continental railways as fuel, but he was not aware that the manufacture was carried on in England to any extent.

Mr. J. W. **Cobb** commented on recent attempts to use the fine dust from coal by injecting into boiler furnaces, and asked if Mr. Mackey had seen much of this application; a serious difficulty was the carrying power of the dust. The whole process of coal washing was complicated by the fact that the variation was not in size of particle alone, nor in specific gravity alone, but in both. The sizing which preceded washing in the Lorig type was apparently a step in the right direction if the first cost of the plant was not unduly raised thereby.

Could Mr. Mackey say how far the advantage of ash diminution was lessened by increase of moisture in the washed coal? The author had been dealing exclusively with the effect of washing on ash content, but it was often the case that the primary purpose in washing was the elimination of a harmful ingredient, such as sulphur. What was the degree of success attained? Sometimes it was certainly small.

It was often said that washed coal did not give so good a coke for metallurgical purposes as unwashed. Had Mr. Mackey a decided opinion on this point?

Mr. B. A. **Burrell** asked Mr. Mackey what course he would adopt in washing coal where the mineral matter was present as finely divided clay disseminated through the mass of coal? He showed some specimens of Indian coal apparently clean and free from "dirt," but containing as much as 16 per cent. of ash in the form of clayey matter.

Mr. W. McD. **Mackey**, replying to Mr. J. E. Bedford, said that the trade in briquettes had been largely spoiled in this country owing to the use of inferior materials. In order to make them the coal must be dry, and this rather militated against the use of dust from coal washing, as it required drying.

In reply to Mr. J. W. Cobb, he said that he had not had special experience with the use of coal dust in conjunction with a steam jet. In gasworks the added water in washed coal was objected to. It should not exceed three per cent. The percentage of sulphur did not diminish in the same proportion as the ash when a coal was washed. Given the same composition, analytically, he preferred coke made from unwashed slack to that made from washed, especially for blast-furnace purposes.

Referring to the sample of Indian coal produced by Mr. Burrell, he thought it was one of the few cases in which the coal should be crushed before washing, as this was the only way in which the "dirt" could be removed.

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I.—PLANT, APPARATUS AND MACHINERY.

English Patents.

Grinding or Crushing Apparatus; Impts. in ——. T. Breakell, Wirksworth. Eng. Pat. 5782, March 12, 1903.

A stand for a mortar is combined with a pillar and arm to guide and support the handle of the pestle so that it can rotate, as well as rise and fall, inside the mortar. A spring or weight may be added to the pestle to press it against the material in the mortar.—W. H. C.

Grinding Mills. A. J. Robinson, Fremont. Eng. Pat. 514, Jan. 8, 1904.

A mill with removable grinding faces rotating in opposite directions, has a divided main shaft. One half of the mill is fixed, whilst the other can be swung on a pivot horizontally to one side, exposing the grinding faces, so that they can be easily renewed or repaired. The upper part of the outer casing is removable, whilst the lower half is so arranged that one half can be swung round with the movable part of the mill. Stops are arranged to ensure the two parts of the shaft being in line when the mill is in use. —W. H. C.

Liquefying Air and other Gaseous Fluids; Apparatus for ——. H. Knudsen, London. Eng. Pat. 6087, March 16, 1903.

The waste heat from the compressing engines and the pressure of the expanding cooling gases are utilised by means of a combination of vapour turbines and heat interchangers.—W. H. C.

Suspended Matter from Liquids: Apparatus for Removing —— by Continuous Decantation. T. R. Wollaston, Manchester. Eng. Pat. 7426, March 31, 1903.

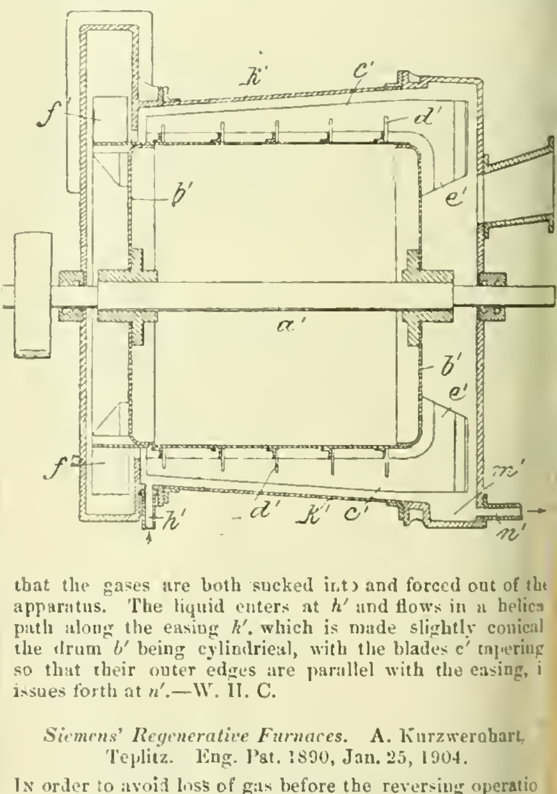
See U.S. Pat. 751,038 of 1904; this J., 1904, 246.—T. F. B.

Separating Liquid from Solid Matter; Apparatus for ——, and for Partially Drying the Solid Matter. T. Houghton and the United Alkali Co., Ltd., Liverpool. Eng. Pat. 7957, April 6, 1903.

An inclined rotating circular or annular dish is provided with a false bottom of filtering material, the space beneath which is in communication with a partially exhausted receiver. Means are provided for feeding the mixture to be separated, for drawing off the liquid, for keeping the surface of the solid from becoming impervious by means of a revolving brush, and for removing the solid by a plough. —W. H. C.

Centrifugal Apparatus for Treating Gases. E. Theisen, Baden-Baden. Eng. Pat. 8671, April 16, 1903.

An improvement on Eng. Pat. 12,693 of 1901 (this J., 1902, 904). The centrifugal blades are perforated or constructed with ribs on their rear sides, to prevent the undisturbed flow of the gases through the spaces behind the ribs, in order to obtain a more intimate contact between the gases and the liquid spray. In the Fig., which is a longitudinal section, the driving shaft a' carries the drum b' with the blades c' preferably arranged in oblique positions, and with ribs d' on their rear sides. At the gas-inlet end the blades are made with inward projections e', and at the exit with outward projections f', so that the gases are both sucked into and forced out of th apparatus. The liquid enters at h' and flows in a helica path along the casing k', which is made slightly conical the drum b' being cylindrical, with the blades c' tapering so that their outer edges are parallel with the casing, i issues forth at n'.—W. H. C.



Siemens' Regenerative Furnaces. A. Kurzwernhart, Teplitz. Eng. Pat. 1890, Jan. 25, 1904.

In order to avoid loss of gas before the reversing operatio in regenerative furnaces, the latter are provided with a ga cut-off device and an air-inlet opening capable of bein closed, these being so arranged that the gas current can l cut off and a supply of air provided, forcing the gas in tl regenerative chamber and the passage connected theret into the furnace for combustion.—E. S.

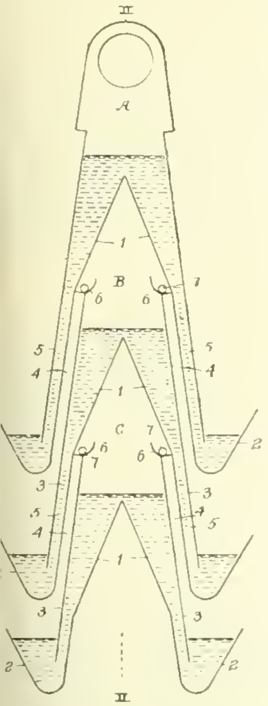
Distillation of Volatile Liquids; Process and Apparat for the ——. R. Voiry, Paris, and J. de la Fresnaye Cie., Bagnolet. Eng. Pat. 1975, Jan. 26, 1904. Und Internat. Conv., March 27, 1903.

See Fr. Pat. 330,649 of 1903; this J., 1903, 1078.—T. F.

United States Patents.

Evaporating Liquids; Process of ——. B. F. B. Sew, Skien. U.S. Pat. 752,599, Feb. 16, 1904.

Two or more inverted V-shaped portions, 1 (see figure), arranged, one over the other, each provided with pockets, nto which the lower edges of the curtain walls, 3, dip. The quid to be evaporated is fed into the pockets, 2, and drawn p into the vessels by the vacuum communicated to the vapour spaces, A, B, C, by the pipes, 7, from the pump. The solids separated fall into the pockets, 2, and are removed. The upper portion of the liquid in each chamber is under a lower pressure than the lower portion of the liquid in the pockets, consequently the solids can be removed continuously without interrupting the working. By maintaining a lower pressure in the upper vessel, the heat given out by the vapour from the lower vessels, condensing on the walls, 1, and collecting in the gutters, 6, from whence it is removed by the exhaust pipes, 7, evaporates the liquid in the vessel above. A method of combining the V-shaped chambers into a set, and for applying the principle to ordinary tubular evaporators, is given.—W. H. C.



acuum Evaporating Apparatus. C. Ordway, New York. U.S. Pat. 755,529, March 22, 1904.

FLOAT chamber is connected with both the vapour and quid spaces of the evaporating vessel, the liquid feed to hich is regulated by the height of liquid therein. This is fected by means of a float in the float chamber, attached a cord passing over a pulley and connected by a rod to lever which actuates a valve in the liquid-feed pipe. leans are provided for adjusting the float from without, d a by-pass for filling the evaporating vessel independently the float chamber.—W. H. C.

otary Kiln and Drier; Combined ——. C. A. Matcham, Allentown. U.S. Pat. 755,513, March 22, 1904.

ROTARY kiln is combined with a drier, and both are concted to a stack. A valve is provided to regulate the flow products of combustion from the kiln, and a truck to ry the connection of the flue to the drier.—W. H. C.

iln. T. Hampton, West Elizabeth. U.S. Pat. 755,655, March 29, 1904.

IRCULAR kiln with a dome has furnaces within the walls, ags" adjacent to the furnaces and a solid floor with es having inlets adjacent to the furnaces. An arrangent of flues and cross flues leads to a shaft situated ernally to the kiln.—W. H. C.

orption Apparatus; Chemical ——. H. G. Schanche, ssignor to Harrison Bros. and Co., Philadelphia. U.S. at. 755,705, March 29, 1904.

OWER is arranged with horizontal shelves from which the orbing liquid overflows at alternate sides; the ends of shelves being turned up. A plate dips into the liquid he shelves just behind the turned-up end, and reaches ly to the bottom, so that only the lower layers of the d can overflow.—W. H. C.

French Patent.

Liquid Level Indicator. Soc. l'Air Liquide (Soc. Anon pour l'Etude et l'Exploitation des Procédés G. Claude). Fr. Pat. 337,127, Nov. 21, 1903.

In order to indicate the level of a liquid in a closed vessel under pressure, a current of gas under slightly greater pressure than that in the closed vessel, is led through one branch of a T-tube. One of the other branches enters the closed vessel and dips to the bottom of the liquid in it, whilst the other is connected to one end of a U-tube filled with an appropriate liquid (or to a manometer), the other end of the U-tube being led into the gas space above the liquid in the closed vessel. The liquid in the gauge tube will be depressed in proportion to the depth of liquid in the closed vessel.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Water-Gas; Production of —— by the Dellwik-Fleischer and Strache Systems, in Theory and Practice. M. Placidi and O. Kettner. J. Gasbeleucht., 1904, **47**, 268—271.

The authors criticise the objections advanced by Strache and Jahoda against the theory of Dellwik. They consider it as proven that, during the blast period, the economy increases with the speed of the blast and with the percentage of carbon dioxide in the gas produced. If the carbon dioxide remain constant, then the greater the blast speed becomes, the greater will be the amount of heat stored up in the generator, the higher its temperature, and the shorter the blast period required. The experiments of Strache and Jahoda show conclusively, however, that during the "make" period the speed of the steam ought to be reduced as the temperature of the fuel falls. In the Dellwik process the steam supply is not regulated in this sense, and hence, towards the end of the gas-making period, much heat is lost by superheated steam passing undecomposed through the fuel, and an inferior gas is the result. In practice, therefore, whilst the Dellwik-Fleischer process marks an advance in the blast period, and the Strache process in the gas-making period, neither system, in the author's opinion, shows a completely satisfactory efficiency.—H. B.

English Patents.

Briquettes; Manufacture of —— for Fuel. J. Faucheur, Brussels. Eng. Pat. 10,416, May 7, 1903.

Gas tar is "freed from its odour," by adding to it 10 per cent. of its weight of concentrated milk of lime of sp. gr. 22° to 25° B., thoroughly mixing for 24 hours, and then removing the excess of lime by washing. 80 kilos. of tar, thus treated, are mixed with 30 kilos. of Portland cement, and then added to 1,000 kilos. of coal dust. After thorough mixing, briquettes are formed from the paste thus obtained. To free the coal dust from native sulphur or bitumens, 10 per cent. of powdered quicklime is added to it, and the mixture immersed in water. By the heat produced by the slaking of the lime, "the sulphur and bitumen fuse," "and rising to the surface of the bath," they are removed. The coal dust is then thoroughly washed with water."—L. F. G.

Liquids, Combustible; Process and Apparatus for the Gasification of ——. C. H. Claudel, Argenteuil. Eng. Pat. 9606, April 28, 1903.

See Fr. Pat. 331,372 of 1903; this J., 1903, 1122.—T. F. B.

Gas Producers; Impts. in ——. H. Boyd, Poulton-le-Fylde. Eng. Pat. 9950, May 2, 1903.

The producer, which is intended for use with bituminous fuel, is lined at its upper part with fire-brick. The lower part is not lined, but the supply of air, or air and steam, flows round it on its way to the grate, which is vertical and is situated at one side. The air is thus pre-heated, and it is stated that the casing forming the lower portion of the producer is cooled so far as to prevent the adhesion of clinker. The fuel hopper is situated centrally at the top, and the gas outlet is at one side, a depending partition screening it to such a depth that the outlet is really about mid-way down the bed of fuel. This arrangement causes the fresh fuel to be heated by radiant heat from the lower part, and the tarry, condensable matters have to pass down through a portion of the incandescent fuel, where they are decomposed.—H. B.

Carburetting by means of Naphthalene. G. P. J. Lion, Paris. Eng. Pat. 5805, March 12, 1903. Under Internat. Conv., March 14, 1902.

See Fr. Pat. 319,599 of 1902; this J., 1902, 1525.—T. F. B.

Gases; Method of Removing Sulphuretted Hydrogen from ——, with simultaneous Recovery of Sulphur. E. Burschell, London. Eng. Pat. 6090, March 16, 1903.

See U.S. Pat. 737,579 of 1903; this J., 1903, 1080.—T. F. B.

United States Patents.

Coke Quenching and "Bleaching" Apparatus. E. A. Moore, Philadelphia. U.S. Pat. 755,154, March 22, 1904.

The apparatus is built up of separable hollow transverse sections with a vestibule or extension at one end, having sides which can swing laterally, and a bottom which can swing vertically, so that it can be connected to a coke oven. The apparatus is fitted with doors at both ends, with means for supplying water to each section, and with a steam outlet.—L. F. G.

Coke; Process for Quenching and "Bleaching" ——. E. A. Moore, Philadelphia. U.S. Pat. 755,155, March 22, 1904.

"This process consists in transferring hot coke from an oven into a receptacle (see preceding abstract) from which atmospheric air is excluded, deluging the coke with water, and discharging the excess of water as rapidly as supplied." The coke is then subjected to the action of the steam generated by the quenching, the steam discharged from the receptacle, and the coke finally dried.—L. F. G.

Fuel Blocks [Briquettes]; Manufacture of Artificial ——. W. Y. Cruikshank, Assignor to N. Maley, both of Freeland. U.S. Pat. 755,278, March 22, 1904.

Slightly moist anthracite coal culm is mixed with dry powdered resin, and with asphalt rendered fluid by means of a volatile solvent, and the mixture subjected to the simultaneous action of heat and pressure, till the moisture and the solvent are volatilised, and the resin has been melted.—L. F. G.

Briquettes: Manufacture of Pit-coal or Coke ——. J. Lieb, Cologne. U.S. Pat. 756,124, March 29, 1904.

Fine coal is mixed with a small quantity of resin or other agglutinant, moistened with water, and the mass then moulded into briquettes and heated.—L. F. G.

Fuel [Briquettes]; Manufacture of Artificial ——. W. B. Thomas, Towns, Ga. U.S. Pat. 756,189, March 29, 1904.

The residuum known as "rosin-batting" is pulverised, and then mixed with a less inflammable but combustible material, such as woody refuse or fibre, and the mixture heated and moulded into shape.—L. F. G.

Briquettes [Fuel]; Process of Producing ——. J. M. Davidson, Beaumont. U.S. Pat. 756,593, April 5, 1904.

Powdered pine-wood charcoal is mixed with the high melting-point pitch obtained from pine-tar, slaked lime is added, and the mixture is heated to 250°—300 F., and moulded into blocks.—T. F. B.

Method of Combustion. C. E. Lucke, New York. U.S. Pat. 755,376, March 22, 1904.

In burning explosive gaseous mixtures, the latter are caused to flow through an opening with a greater velocity than that of the propagation of inflammation through the mixture, into a space in which the mixture may spread out and expand, the mixture being thus burned at the surface at which the velocity is equal to the rate of propagation of inflammation.—E. S.

Liquid or Gaseous Fuels; Method of Burning ——. C. E. Lucke, New York. U.S. Pat. 755,377, March 22 1904.

A gas capable of supporting combustion (such as air or oxygen) is caused to enter a pipe carrying an excess of liquid fuel over the proportion capable of being burned by the gas admitted, which latter enters on to a heated hearth or bed in the manner described in the preceding abstract. The velocity is thus reduced to the rate of propagation of the inflammation, diffusion with other gas is prevented, and the fuel is burned, at least partially, within the bed, the excess of fuel being available for burning beyond the hearth. —E. S.

Gas Producer. J. G. Sanderson, Scranton. U.S. Pat. 755,702, March 29, 1904.

The gas producer comprises a fuel chamber, the sides of which are formed of contiguous vertical water tubes provided with inlets and outlets for the water, and connected to an upper and to a lower water tank, and kept in place by bands. The fuel chamber is surrounded by a metallic sheathing, and a non-conducting jacket is placed between this and the water tubes.—L. F. G.

French Patents.

Coal; Complete Combustion of —— in Automatically Stoked Furnaces. R. Mederer. Fr. Pat. 336,946, Sept. 25, 1903.

A layer of lumpy coal placed on the grate is burnt to incandescence, and coal dust then blown on to it by a blast of hot air, the chimney draught being simultaneously cut off. After a time, communication with the chimney is again established, and coal in lumps fed in, to keep up the fire the above cycle of operations being then again repeated. The explosive combustion of the coal dust thus brought about, is said to produce a more uniform temperature and to increase the thermal efficiency.—L. F. G.

Lime and Combustible Gas; Combined Process of Manufacturing ——. The Chalk Power Gas Syndicate, Ltd Fr. Pat. 337,081, Nov. 3, 1903.

Carbonate of lime, mixed with as little fuel as possible, i burned to lime as usual, preferably with the assistance of current of steam, and with the use of as little air as possibl The gas produced, said to consist mainly of carbon dioxid is led along with the steam into a series of converters charge with incandescent fuel, whereby a kind of water-gas, said t contain but little nitrogen, is obtained. Arrangements plant are described for rendering the process continuou and for utilising the waste heat.—H. B.

Gas Producer. A. B. Duff. Fr. Pat. 337,122, Nov. 16, 1903.

The usual air blast placed in the water-sealed ash-pit of gas producer, is furnished with a hollow cylindrical to having vertical slots in the sides, and closed by a louv cap. The air issuing from the louvre top heats the fuel incandescence, whilst the blast from the vertical sl completes its combustion.—L. F. G.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Asphaltum; Investigations on ——. G. Lunge and V. Krepelka. Chem.-Zeit., 1904, 28, 177—180.

Nine different varieties of natural asphaltum, four of a ficial asphalt (prepared from petroleum pitch), and a l d and soft coal tar pitch, were treated with commercially p chloroform. The extracted bitumen was dried at 120 to expel the final traces of solvent, and then examined sp. gr., melting point, sp. gr. of a solution of given stre in chloroform, and iodine absorption. The sp. gr. determinations, in the Sprengel pyknometer at 17° C., gave the results tabulated.

For the melting-point determinations the method of Kraemer and Sarnow (this J., 1903, 291) was employed, the mean of four results being taken. (See table.)

It was considered probable that the divergent composition of the various bitumens might find expression in their effect on the sp. gr. of pure chloroform solutions. The densest petroleum asphalt—that from Wietze oil—gives the value, 1·4693, as the sp. gr. of the 6 per cent. chloroform solution, whilst in the case of the coal-tar pitches, it exceeds 1·475; but it is impossible by this means to distinguish the true natural asphaltums from the petroleum asphalts, and still less to subdivide the members of either class.

Material.	Melting Point.	Iodine Value (Hübl).	Sp. Gr. of Bitumen extracted by means of Chloroform.
Natural Asphaltums.	° C.		
Limmer	16·0	23·37	0·9877
Lobsann	25·0	23·84	1·0343
Val de Travers	28·1	26·53	1·0823
Tataros	33·6	39·71	1·0931
Bermuda	51·1	46·28	1·0861
eyssel	53·1	44·33	1·0762
Trinidad	55·2	54·10	1·0994
eleuico	90·0	46·99	1·1131
ilsonite	125·0	46·68	1·1495
Artificial Asphalts.			
alician	18·2	44·79	1·0365
Wietze	118·2	52·02	1·1269
Beaumont	69·3	46·97	1·1741
nknown	37·8	44·26	1·1075
Coal Tar Pitches.			
oft.... crude	36·1	69·34	1·2365
extracted	20·0		
ard .. crude	113·0	..	1·2741
extracted	23·0		

As an addition to the usual qualitative tests, it is stated hat petroleum spirit will give a precipitate with the chloroorm solutions of the tar pitches, but not with those of the atural asphaltums or petroleum asphalts.—C. S.

English Patents.

urpentine; Russian Oil of ——; Treatment of, and of similar Products, and of Benzine or Petroleum Spirit, for the purpose of Removing their Disagreeable Odour. E. Heber. Eng. Pat. 10,004, May 2, 1903. XIII. B., page 448.

atty Acids, Hydrocarbons, and the like; Apparatus for the Continuous Distillation of ——, and Steam Superheating Apparatus therefor. V. Sláma. Eng. Pat. 12,984, June 9, 1903. XII., page 447.

United States Patents.

ood; Apparatus for the Destructive Distillation of ——. G. O. Gilmer, New Orleans, Assignor to Illinois Investment Co., West Virginia. U.S. Pat. 677,204, June 25, 1901. Reissue No. 12,208, March 22, 1904.

LONG retort is fixed in a position slightly inclined to the rizontal, with an outlet for the products of distillation at lower end. This retort is heated from the top only, the les and bottom being protected by a brick casing, and the es are so arranged that the contents of the retort are ated "progressively"—*i.e.*, the upper end is heated much re strongly than the lower end.—T. F. B.

nzols and their Homologues; Manufacture of ——. A. Nikiforoff, Moscow. U.S. Pat. 755,309, March 22, 1904.

E Fr. Pat. 315,428 of 1901; this J., 1902, 541.—T. F. B.

Petroleum; Apparatus for Distilling ——. L. Gathmann, Washington. U.S. Pat. 755,760, March 29, 1904.

A STILL, in which the petroleum is heated under pressure, and from which the residues are continuously removed, is connected with a vaporiser, into which the oil is introduced so as to present a large surface area. The vapours are passed up a shallow inclined condenser, the top surface of which is cooled by water; "drips" are provided in the condenser to prevent the distillate from running down the upright walls, and "eduction ports" are situated at intervals along the bottom of the condenser, for the removal of different fractions of the distillate.—T. F. B.

French Patents.

Naphthalene; Process for Purifying ——. J. P. Mateu. Fr. Pat. 336,865, Nov. 21, 1903.

SEE Eng. Pat. 25,989 of 1903; this J., 1904, 182.—T. F. B.

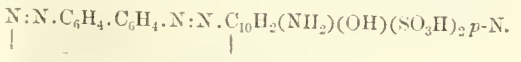
"Vaselines Industrielles" and Lubricating Mineral Oils; Manufacture of ——. P. J. Tabourin. Addition, dated Nov. 14, 1903, to Fr. Pat. 326,348, Nov. 15, 1902. (See this J., 1903, 791.)

THE emulsion of fatty acids and their calcium salts, obtained, according to the principal patent, by subjecting mineral oils to the action of calcium hypochlorite, is acidified, washed with water, and heated to 60°—80° C. with 25 per cent. of its weight of glycerin. The glycerides of fatty acids thus obtained, when mixed with about 10 per cent. of paraffin, give a product suitable for use as a lubricant.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Diazoamino-Compounds of the Aminonaphtholsulphonic Acids. L. Paul. Zeits. angew. Chem., 1904, **17**, 363—365.

IF the tetrazo-compound of tolidine be added to a solution of aminonaphtholdisulphonic acid H, 1 mol., an intermediate product is formed, which on treatment with a solution of diazotised *p*-nitraniline gives a bluish-red precipitate having the following composition:—(I.) $Cl.N{:}N.C_6H_4.C_6H_4.N{:}N.NH.C_{10}H_3(OH)(SO_3H)_2\ p\text{-}N$ ($p\text{-}N$ = diazo-*p*-nitraniline.) If this precipitate be made into a paste with a concentrated solution of sodium salicylate or sodium phenolate, decomposition occurs, and a mixture of the monazo dyestuff from *p*-nitrodiazobenzene and aminonaphtholdisulphonic acid H with the intermediate product from tetrazoditolyl and phenol or salicylic acid, is obtained, thus showing that the product (I.) is a true diazoamino-compound. When the compound (I.) is treated with a large amount of water, no nitrogen is evolved, but probably an internal condensation takes place, giving rise to the following compound:—



$$N{:}N.C_6H_4.C_6H_4.N{:}N.C_{10}H_2(NH_2)(OH)(SO_3H)_2\,p\text{-}N.$$

The sodium salt of the aminonaphtholsulphonic acid γ, when treated with tetrazoditolyl, forms only a minute quantity of an intermediate product capable of reaction. The greater part appears to form the diazoamino-compound. If β-naphtholdisulphonic acid γ be treated with tetrazoditolyl, a new intermediate product is produced which may have the following formula:—

$$Cl.N{:}N.T.N{:}N.O.C_{10}H_5(SO_3H)_2$$

On treatment with alkali the latter passes into the already known red compound.—A. B. S.

Azo Dyestuffs; Electrolytic Preparation of ——. W. Löb. XI. A., page 445.

Prussian Blue; Analysis of ——. C. Coffignier. XXIII., page 456.

ENGLISH PATENTS.

Sulpho-compounds, Organic [*Sulphonic Acids*]; *Manufacture of* ——. M. Iljinskij, Krefeld, and R. Wedekind and Co., Uerdingen. Eng. Pat. 10,242, May 5, 1903.

SEE Fr. Pat. 332,709 of 1903; this J., 1903, 1290.—T. F. B.

Indigo Dyestuffs; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst on the Maine. Eng. Pat. 11,630, May 21, 1903.

THE products obtained by heating phenylglycin or its derivatives with alkali amides (Fr. Pat. 312,763 of 1901; this J., 1902, 111) are oxidised to indigo dyestuffs by passing a current of air into a solution of the product containing an alkali nitrate; the red products formed when air alone is used for the oxidation, are not obtained by this method. —T. F. B.

Anthraquinone Series; Manufacture of Derivatives of the —— [*Anthraquinone-α-sulphonic Acids*]. H. E. Newton, London. From the Farbenfabr. vorm. F. Bayer and Co., Elberfeld. Eng. Pat. 13,808, June 20, 1903.

SEE Fr. Pat. 333,144 of 1903; this J., 1903, 1290. The sulphonic acid groups of the α-mono- and di-sulphonic acids may be replaced by heating with ammonia or with mono- or di-alkylamines.—T. F. B.

UNITED STATES PATENTS.

Anthracene Dyestuff and Process of Making same. H. Weltz, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen. U.S. Pat. 754,264, March 8, 1904.

SEE Eng. Pat. 7394 of 1903; this J., 1904, 319.—T. F. B.

Sulphur Dye [*Sulphide Dyestuff*] *and Process of Making same; Blue* ——. T. Abel, Mannheim, and A. Lüttringhaus, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen. U.S. Pat. 755,428, March 22, 1904.

SEE Eng. Pat. 19,440 of 1902; this J., 1903, 946.—T. F. B.

Alpha-Oxyanthraquinone [*Anthracene Dyestuffs*]; *Process of Making* ——. R. E. Schmidt, Elberfeld, and P. Tust, Vohwinkel, Assignors to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 755,801, March 29, 1904.

SEE Fr. Pat. 336,867 of 1903 in Fr. Pats. following.—T. F. B.

Indoxyl and Derivatives [*Indigo Dyestuffs*]; *Process of Making* ——. R. Knietsch, P. Seidel, and G. W. Meiser, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen. U.S. Pat. 756,171, March 29, 1904.

SEE Fr. Pat. 319,670 of 1902; this J., 1902, 1528.—T. F. B.

Dyestuff [*from Naphthalene*]; *Black* ——, *and Process of Making same.* R. Bohn, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen. U.S. Pat. 756,571, April 5, 1904.

SEE Fr. Pat. 328,768 of 1903; this J., 1903, 992.—T. F. B.

FRENCH PATENTS.

Anthranilic Acid and its Derivatives [*Indigo*]; *Process of Making* ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 336,907, Jan. 31, 1903.

SEE Eng. Pat. 2302 of 1903; this J., 1904, 16.—T. F. B.

Acetyldiaminophenol Sulphonic Acid; Process for Producing ——, *and a Bluish-Black* [*Azo*] *Dyestuff for Wool, susceptible to Chroming, derived therefrom.* Manuf. Lyon. Mat. Col. Fr. Pat. 337,011, Feb. 4, 1903.

SEE Eng. Pat. 3182 of 1903; this J., 1904, 56.—T. F. B.

Polyazo Dyestuffs; Production of ——, *by means of 2.4.8-Naphthylaminedisulphonic Acid.* Manuf. Lyon. Mat. Col. Fr. Pat. 337,183, Feb. 9, 1903.

SEE Eng. Pat. 3654 of 1903; this J., 1904, 56.—T. F. B.

Nitroalphylacidylaminonaphthol Sulphonic Acids, Nitroalphylaminoacidylaminonaphthol Sulphonic Acids, Aminoalphylacidylaminonaphthol Sulphonic Acids, and Aminoalphylaminoacidylaminonaphthol Sulphonic Acids; Production of ——, *and of Azo Dyestuffs derived therefrom.* Soc. pour l'Ind. Chim. à Bâle. Addition, dated Nov. 6, 1903, to Fr. Pat. 321,640, May 31, 1902.

SEE Eng. Pat. 24,936 of 1903; this J., 1904, 57.—T. F. B.

Erythrohydroxyanthraquinone, Anthrarufin, and Chrysazin; Manufacture of ——. [*Anthracene Dyestuffs.*] Soc. Anon. des Prods. F. Bayer et Cie. Fr. Pat. 336,867, Nov. 21, 1903.

ANTHRAQUINONE-α-monosulphonic acid and 1.5 and 1.8-anthraquinonedisulphonic acids are converted into erythrohydroxyanthraquinone, anthrarufin, and chrysazin respectively by heating them with water in presence of oxides or hydroxides of the alkaline earth metals.—E. F.

o-Hydroxyanthraquinones and o-Hydroxyanthraquinonesulphonic Acids; Manufacture of ——. Soc. en Commandite. R. Wedekind and Co. Fr. Pat. 336,938, Nov. 25, 1903.

THE alkali- or alkaline-earth salts of anthraquinone-*o*- or *o*-*m*-sulphonic acids are converted into the corresponding hydroxyanthraquinones by heating them under pressure with water and hydroxides of alkaline earth metals with or without addition of alkaline earth salts and of oxidising agents.—E. F.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Hyphæne Coriacea: A Palm of Madagascar yielding Textile Material. P. Claverie. Comptes rend., 1904, **138**, 768—769.

THIS palm is much used by the natives of the north-west portion of the island. Segments of the leaves are used in basket-making, and they yield a fibre, the structure and composition of which are described by the author. This fibre, however, is inferior to that of the cocoa-nut.—J. T. D.

Dyeing [*Mordanting*] *Process.* P. Heermann. Färber-Zeit., 1904, **15**, 76—78, 85—91, 108—112. (See also this J., 1903, 623, and 1904, 57.)

Basicity, "Basicity Number," and their Influence on Mordanting by Primary Metallic Mordants.—The "basicity number" of a mordant is defined as the ratio of the absolute acid content to the absolute metal content; *e.g.*, the basicity number of a stannic chloride mordant is $(4 \times 36{\cdot}45) \div 118{\cdot}5 = 1{\cdot}23$, and of a chrome mordant $Cr_2Cl_3(OH)_3$, $(3 \times 36{\cdot}45) \div (2 \times 52{\cdot}1) = 1{\cdot}05$. The experiments were undertaken to ascertain the influence of the basicity of the mordant, varied by the addition of acid or alkali to the normal solution, on the weight of mordant absorbed by the fibre. The mordants used were stannic chloride solution of 33·1 B., basic chromium chloride $Cr_2Cl_3(OH)_3$ solution of 19·2 B., basic iron sulphate solution of 31° B., and an aluminium acetate solution containing 1·5 per cent. of aluminium. In all cases, both with raw and with boiled-off silk, reduction of the basicity number (*i.e.*, the addition of alkali), resulted in considerably more mordant being absorbed than when the "normal" mordant bath was used; by increasing the basicity number (*i.e.*, by addition of acid), however, variable results were obtained; with tin and aluminium mordants, only a slight decrease from the "normal" absorption of mordant was noticed, even with addition of 5 per cent. of acid; with the iron mordant, the absorption decreased rapidly but regularly with the addition of acid, being reduced, in the case of raw silk, to one-half the normal with the addition of less than 5 per cent. of acid; while with the chromium mordant the addition of acid at once caused a very rapid drop in the absorption of mordant and further addition of acid still further reduced the absorption. In general, both with raw and with boiled-off silk, increasing or reducing the basicity number of the mordant causes a decrease or increase respectively in the amount of mordant absorbed.

The following table gives the full results obtained :—

Mordant.	Silk.	—	Increase per Cent. of "Normal" Increase.										
		Basicity No.	1·0	1·05	1·09	1·14	1·18	**1·23**	1·28	1·32	1·37	1·41	1·46
Tin (1·23) …	Raw …..	.. ..	251·6	221·7	167·1	123·4	112·1	100·0	98·3	94·3	98·6	98·7	98·4
	Boiled-off	.. ..	119·0	117·9	117·0	116·0	114·5	100·0	97·0	97·5	97·5	97·1	96·5
		Basicity No.	..	..	..	1·87	1·93	**2·00**	2·07	2·13	2·2	2·27	2·33
Iron (2·0) …	Raw …..	.. ..	..	..	..	153·3	134·5	100·0	90·4	76·7	58·6	53·9	47·6
	Boiled-off	.. ..	..	..	..	147·5	143·4	100·0	87·7	78·9	74·7	69·9	57·6
		Basicity No.	..	..	..	0·84	0·95	**1·05**	1·16	1·26	1·37	1·47	1·58
Chromium (1·05)……	Raw …..	.. ..	..	..	..	148·0	137·7	100·0	43·1	40·4	37·2	33·8	28·7
	Boiled-off	.. ..	..	..	..	132·0	125·5	100·0	48·7	39·4	34·8	33·4	32·0
		Basicity No.	..	..	..	..	6·0	**6·67**	7·33	..	8·67	..	10·0
Aluminium (6·67)……	Raw …..	Calculated on the ash	..	..	..	..	102·0	100·0	98·2	..	91·6	..	86·4
	Boiled-off	Determined directly	..	..	..	..	102·8	100·0	97·9	..	93·0	..	90·8
		Calculated on the ash	..	..	..	..	103·8	100·0	97·0	..	90·4	..	85·0

—T. F. B.

Inorganic Colloids ; Behaviour of some —— towards Fibres, and its Relation to the Theory of the Dyeing Process. W. Bilz. Nachr. Ges. Wiss. Göttingen, 1904, 1—15; Chem. Centr., 1904, 1, 1039—1040.

A colloid when converted into the gel condition has the power of taking up another colloid from its solution, with formation of "adsorption compounds." Experiments in which the gel, which serves to take up the dissolved colloid, was replaced by animal and vegetable fibres, confirmed the expectation that inorganic colloids would be taken up by the fibres. A coloured colloid is fixed with its characteristic colour; coloured inorganic substances, when converted into the colloidal condition, thus acquire the capacity of being "adsorbed." Experiments were made with colloidal solutions of selenium, tellurium, gold, vanadium pentoxide, Molybdenum blue, Tungsten blue, cadmium sulphide, arsenic and antimony sulphides, copper ferrocyanide, mercury, tin sulphide, copper hydroxide, and Molybdenum-tungsten purple. In the case of selenium, tellurium, and of gold prepared by Brunck's method (this J., 1903, 710), the fibre is dyed and the solution is more or less completely exhausted. In the other cases, also, the fibre is dyed, but the colour is not extracted from the solution to so great a degree. A colloidal solution of gold prepared by Zsigmondy's method (this J., 1902, 192) will not dye silk; a constituent of the latter (a "protective colloid") passes into solution, which prevents the gold from being deposited. The colloidal gold solution, after being boiled with silk, can no longer be precipitated by electrolytes. In several cases the dyeing of the fibres by inorganic colloids was found to be favoured by the addition of salt. Krafft (this J., 1899, 757) has shown that the substantive organic dyestuffs, especially the benzidine dyestuffs, dissolve in water as colloids. A comparison of the dyeing properties of these dyestuffs and of coloured inorganic colloids brought out the following principal differences between the two classes of compounds :—(1) The solutions of the organic dyestuffs are exhausted much more completely than those of the inorganic colloids, and the shades produced by the former are relatively much faster to washing. (2) The shades produced with inorganic colloids are not very fast to rubbing; if the coloured compounds (*e.g.*, cadmium sulphide, Prussian blue) are produced on the fibre by a two-bath process, the shades are much faster to rubbing. The points of similarity between the dyeing properties of the two classes of compounds are :—(1) The favourable effect of the addition of electrolytes. (2) The greater affinity for the colour of weighted, as compared with unweighted silk. (3) The deeper shades produced with hot solutions. (4) The retardation of the deposition of the inorganic colloids (*i.e.*, the greater uniformity of dyeing) by the addition of "protective colloids."—A. S.

English Patents.

Animal and Vegetable Fibres ; Process for Dyeing ——. H. Maun, Munich. Eng. Pat. 11,451, May 19, 1903.

See Fr. Pat. 326,010 of 1902 ; this J., 1903, 739.—T. F. B.

Hank-Dyeing Machines. E. Dittmar, Lille. Eng. Pat. 27,870, Dec. 19, 1903. Under Internat. Conv., Dec. 20, 1902.

See addition, of Dec. 20, 1902, to Fr. Pat. 315,658 of 1901 ; this J., 1903, 905.—T. F. B.

Embossed and like Effects on Woven Goods ; Rendering Permanent ——. A. Fielding, Salford. Eng. Pat. 9849, May 1, 1903.

The fabric is impregnated with a solution of viscose, dried, embossed in the usual way, and steamed to produce a coating of insoluble cellulose on the fabric. Another method consists in first coating the fabric with albumin or a similar substance, embossing, and then coating with viscose as above. (Compare Fr. Pat. 335,238 of 1903 ; this J., 1904, 15).—T. F. B.

Feathers ; Process for the Preservation of Ornamental Birds' ——. R. Wolffenstein, Berlin. Eng. Pat. 11,712, May 22, 1903.

Feathers are immersed in a 1 per cent. alcoholic solution of wax, and the alcohol evaporated.—T. F. B.

United States Patents.

Dyeing ; Apparatus for ——. P. Schirp, Barmen. U.S. Pat. 755,050, March 22, 1904.

See addition of Aug. 26, 1902, to Fr. Pat. 314,274 of 1901 ; this J., 1903, 551.—T. F. B.

Dyeing ; Apparatus for ——. J. A. Willard, Assignor to Vacuum Dyeing Machine Co., Chattanooga. U.S. Pat. 755,422, March 22, 1904.

An open dye-vat with slightly diverging sides, is provided with a perforated plate (for holding the goods) supported slightly above the bottom of the vat; a compression plate operates in the vat, above the perforated plate, and can be fixed at any distance from it. The diameter of each of these plates is approximately equal to that of the bottom of the vat. A supply pipe conveys the dye liquor to the bottom of the vat, below the perforated plate, and an exhaust pipe removes the used liquor from the top of the vat.—T. F. B.

Mercerising Apparatus. R. P. Smith and G. E. Drum, Philadelphia. U.S. Pat. 755,716, March 29, 1904.

The yarn is carried on two horizontal rows of supports, the supports of the lower row being adjustable vertically. All the supports are carried on a frame. A driving shaft, situated near the frame, is so arranged that it causes the upper set of yarn supports to rotate when the frame is lowered in the tank, the lower set of yarn supports being put in motion when the frame is raised. Gearing connects the two sets of yarn supports, so that, when necessary, both sets of supports are rotated in either position of the frame. —T. F. B.

Mercerising Yarn ; Machine for ——. P. Hahn, Niederlahnstein. U.S. Pat. 755,765, March 29, 1904.

See Fr. Pat. 325,239 of 1902 ; this J., 1903, 739.—T. F. B.

French Patents.

Dyeing Cotton Thread Several Colours ; Process for ——. Soc. anon. Teinturerie Clément-Marot. Fr. Pat. 337,027, Nov. 26, 1903.

The bobbin or cop of yarn is first dyed in the ordinary way, and then the colour is partially bleached ("stripped") by the use of a suitable bleaching agent, which again depends on the dyestuff selected. It is the circumferential surface of the bobbins, &c., which is thus bleached, the latter being rapidly passed into the bleaching vat, the liquor in which is run off when the desired point is attained. The bleached portion of the bobbins, &c., is now re-dyed another colour, the operations being repeated as many times as necessary to produce all the colours desired.—R. S.

Waterproofing Fabrics, Threads, &c. ; Composition and Apparatus for ——. V. B. Wright, W. K. Poulsom, and W. M. Mackintosh. Fr. Pat. 336,889, Nov. 23, 1903.

See Eng. Pat. 218 of 1903 ; this J., 1904, 184.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

United States Patent.

Dyeing Wood ; Process of ——. J. Brenner, Gainfarn. U.S. Pat. 755,993, March 29, 1904.

See Eng. Pat. 17,808 of 1903 ; this J., 1903, 1193.—T. F. B.

French Patents.

Multi-Coloured Effects on Dyed Paper ; Process for Producing ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 337,113, Feb. 6, 1903.

See Eng. Pat. 2809 of 1903 ; this J., 1904, 17.—T. F. B.

Dyeing Skins ; Machine for ——. P. Bruffaers. Fr. Pat. 336,992, Nov. 10, 1903.

The skins are fixed in circular trays, which are revolved by mechanism which also distributes the dye solution. The liquid runs into the trays from an upper reservoir, overflows out of the trays into a lower reservoir, and is pumped from the latter back into the upper reservoir.—R. S.

VII.—ACIDS, ALKALIS, AND SALTS.

Lead Chamber Process ; Physical Chemistry of the ——. M. Trautz. Zeits. physik. Chem., 1904, **47**, 513—610.

Complete historical and bibliographical account of research on the chamber process, with the unsolved problems arranged as queries, as follows:—1. In what way does sulphur dioxide in the Glover tower almost completely remove the nitrogen from the nitrosylsulphuric acid? 2. How is nitrosylsulphuric acid regenerated from the resulting gaseous mixture? 3. How is the sulphuric acid produced, in which this nitrosylsulphuric acid is dissolved? 4. How far can nitrosylsulphuric acid be denitrated in the chambers by variations of concentration and of temperature? Is it further denitrated in the chamber, and, if so, by what means? 5. What influence has temperature on the whole reaction? Does an optimum exist? 6. How are local variations of production and abnormalities during faulty working to be explained? 7. In what way is the greater portion of the sulphuric acid actually formed? To answer some of these questions, several sets of experiments were carried out. In the first, solutions of sulphur dioxide in water and in sulphuric acid of various strengths, with and without the addition of nitrosylsulphuric acid, $SO_2(OH)(ONO)$, were continuously shaken in an atmosphere of oxygen, and the progress of the oxidation measured by analysing samples of the liquid taken from time to time. When no nitrous compound was added, the solutions, whether in water or in acid, were oxidised extremely slowly, weeks being necessary to produce a sensible diminution of the sulphur dioxide content. On adding the nitrosyl compound to solutions in water or in acids below half-normal strength, very considerable evolution of nitrous gases occurred, and the liquid after this evolution showed but slight catalysing action. With 55 per cent. sulphuric acid, there was less evolution of gas, and the oxidation was considerably accelerated, whilst with 95 per cent. acid, though there was no gas evolution, the acceleration of the oxidation was very slight. The next set of experiments dealt with the speed of hydrolysis of nitrosylsulphuric acid. The conclusions are that nitrosylsulphuric acid at 25° C. in solution in sulphuric acid of various concentrations is hydrolysed when a stream of indifferent gas is led through, more rapidly, according as the water concentration is greater, giving off nitric oxide, with which is mixed nitrogen peroxide in proportions increasing with the concentration of the sulphuric acid. The other products are water and nitric acid, the latter in smaller proportion as the water concentration is less. Dilute solutions behave as though they were supersaturated solutions of nitric oxide. A third and very elaborate set of experiments was instituted to determine at what concentrations equilibrium is established among the various products of this hydrolysis (HNO_3, NO, NO_2, H_2O, H_2SO_4). The results, given in great detail, are summarised as follows:—Nitric oxide (NO) forms with sulphuric acid, nitric acid, and water, nitrosylsulphuric acid, and nitrogen peroxide (NO_2). The partial pressure of the latter increases, with rising concentration of sulphuric acid, to a maximum, then diminishes to practically zero, when the sulphuric acid concentration reaches 93 per cent., at which concentration nitrosyldisulphonic acid begins to be formed. The concentration of this latter increases in proportion to the decrease of that of nitrogen peroxide. The process, up to a sulphuric acid concentration of 52 per cent. is reversible for all temperatures between 22° C. and 82° C. In general, rise of temperature lessens the gaseous concentration of the nitric oxide, and rise of pressure favours the nitrogen peroxide concentration at the expense of that of the nitric oxide. A further section of the paper gives a summary of work previously published on nitrosyldisulphonic acid (this J., 1896, 622 ; 1902, 1493; 1904, 60 and 185), which the author has prepared by the reaction (aided by heat) of sulphur dioxide on a solution of nitrosylsulphuric acid in 95 per cent. sulphuric acid. This indeed forms an excellent method for preparing a pure and stable solution of nitrosyldisulphonic acid. The latter readily reacts on nitrosylsulphuric acid, giving nitric oxide and sulphuric acid. This reaction no doubt goes on in the chambers, though it is certainly not the principal reaction. Finally, while pointing out that the high reaction velocities do not allow us, with our present means of discrimination, to pronounce which of the reactions in the lead chambers plays the most important part, the author gathers together in the following scheme the various reactions, some or all of which occur:—

$$(1)\ NO + NO_2 + H_2O = 2(NO.OH).$$

$$(2)\ 2(NO.OH) + 2(HSO_3H) = \underset{\substack{\text{Nitrososulphonic acid}\\ \text{(hypothetical)}}}{2(NO.SO_3H)} + 2H_2O$$

$$= NO(SO_3H)_2 + NO + 2H_2O.$$

$$(3)\ NO(SO_3H)_2 + 2NO.OH = 3NO + 2H_2SO_4.$$

$$(4)\ 2NO + O + 2H_2SO_4 = 2(ONO.SO_3H) + H_2O.$$

$$(5)\ 2(ONO.SO_3H) + 2H_2O + NO(SO_3H)_2 = 4H_2SO_4 + 3NO.$$

$$(6)\ NO_2.SO_3H + H_2O = NO_2H + H_2SO_4.$$

—J. T. D.

Alkaline-Earth Metal Carbonates ; Decomposition of —— by Ammonium Chloride in presence of Water. H. Cantoni and G. Goguelia. Bull. Soc. Chim., 1904, **31**, 282—287.

Powdered barium carbonate, 9·87 grms., was boiled with a solution of 2·67 grms. of ammonium chloride in 500 c.c.

of water: the amounts of barium carbonate decomposed after 1½, 24, and 48 hours, were respectively 1·546, 2·138, and 2·473 grms. With 42·8 grms. of ammonium chloride in the same volume of water, 7·946 grms. of barium carbonate were decomposed after 1½ hours' boiling. The complete decomposition of 9·87 grms. of barium carbonate (shown by the clearing of the turbid liquid) was effected, when the 500 c.c. of solution contained 197·4, 53·5, and 21·4 grms. of ammonium chloride, after a few seconds', 45 minutes', and 16 hours' boiling respectively. In the cold, the action is much slower. A litre of each of three solutions of ammonium chloride was digested for 98 days at 15° C. with excess of powdered barium, strontium, and calcium carbonates, with the following results:—

Amount of NH_4Cl.	Amount decomposed in Grms. of		
	$BaCO_3$.	$SrCO_3$.	$CaCO_3$.
Grms. per litre.			
53·5	0·91745	0·17944	0·42252
53·5	0·92120	0·17830	0·42436
100	1·25512	0·25936	0·60144
100	1·25618	0·26060	0·61732
200	1·50000	0·35898	0·64800
200	1·49640	0·35890	0·64320

The authors draw attention to the bearing of these results on analytical work, especially on the separation of alkalis from alkaline earths in the usual method of analysis of silicates.—J. T. D.

Lead Carbonate. R. Salvadori. Gaz. chim. ital., **34**, 87—92; Chem. Centr., 1904, **1**, 993.

Pure lead carbonate, $PbCO_3$, prepared by precipitating lead nitrate solution with ammonium carbonate, is not altered by shaking with water at 18°, 25°, and 30° C. When boiled with water under a reflux condenser, and more slowly even at 70° C., however, it is converted into the basic carbonate, $2PbCO_3Pb(OH)_2$, whilst the water becomes faintly alkaline. The basic carbonate is also produced when the normal carbonate is boiled with N/100, N/20, and N/10 solutions of sodium sulphate or chloride and also on boiling lead chloride or sulphate with N/100, N/20, and N/10 solutions of sodium carbonate. The author concludes that the basic carbonate, $2PbCO_3Pb(OH)_2$, is a stable compound, which tends to be produced from all, even insoluble, lead salts in presence of the ions $NaCO_3$, CO_3, and OH.—A. S.

Chlorides; Transformation of Oxides and Oxy-Salts into ——. C. Matignon and F. Bourion. Comptes rend., 1904, **138**, 760—762.

By passing chlorine and vapour of sulphur chloride over heated metallic oxides or oxy-salts, the latter are converted into anhydrous chlorides. In some cases this forms the best method of preparing these chlorides. Tungstic anhydride thus gives oxychlorides WO_2Cl_2 and $WOCl_4$, chromium sesquioxide and ferric oxide give chromic and ferric chlorides, and the sulphates of barium and calcium are completely converted into the corresponding chlorides. Barium sulphate can thus be completely separated from co-precipitated ferric oxide (as the ferric chloride formed is volatile), and the amount of the latter determined.—J. T. D.

Sulphur Bromide. G. Korndoerfer. Archiv der Pharm., 1904, **242**, 156—160.

When sulphuretted hydrogen reacts on bromine in the presence of a large excess of water, hydrobromic acid and sulphur are formed, as found by Naumann, according to the equation $H_2S + 2Br = 2HBr + S$. If, however, the gas be passed into bromine merely covered with a layer of water, the containing vessel being kept cool during the reaction, a considerable amount of sulphur bromide, S_2Br_2, is produced, and forms a red oily liquid, which can be freed from dissolved hydrobromic acid by agitation with dry potassium carbonate. It is slowly decomposed by cold and rapidly by warm water.—J. O. B.

Liquid Oxygen; Preparation and Characters of Pure ——. E. Erdmann and F. Bedford. Ber., 1904., **37**, 1184—1193.

Pure oxygen was obtained by reacting with hydrogen peroxide on solid potassium bichromate in a Kipp apparatus, was dried by passing through sulphuric acid and phosphorus pentoxide, and was then passed into a flask contained in a Dewar's vacuum vessel which could be filled with liquid air. The flask was closed air-tight by a cork, through which passed two tubes—the entry tube for the oxygen and an exit tube communicating with a barometric mercury gauge and (through a T-piece) with a water aspirator. The apparatus was first thoroughly freed from air by successive evacuations and fillings with oxygen; then the flask was surrounded with liquid air, when a rapid current of oxygen could be completely liquefied. Two Kipps communicated with a common delivery-tube, the object of the second being to keep up the pressure of oxygen and prevent entry of air whilst the exhausted liquid was being removed from the first Kipp and replaced by fresh. In an hour 170 grms. of liquid oxygen are easily obtained. Analysis gave 99·8 per cent. of oxygen. The liquid has a constant boiling point at − 181·8° C. (Pure oxygen could not be obtained from potassium chlorate.) This liquid oxygen absorbs nitrogen gas with avidity; when boiling, it may be left in an open vessel exposed to air without altering in composition, but if below its boiling point it rapidly absorbs nitrogen from the air. A rapid stream of nitrogen led through liquid oxygen is readily absorbed. At − 190·5° C. and − 191·5° C. respectively, the oxygen required for saturation 380 and 460 volumes of gaseous nitrogen, or 42 and 50 per cent. of its weight. This behaviour of liquid oxygen explains why it is impossible to prepare pure oxygen by the fractional evaporation of liquid air.—J. T. D.

Liquid Air; Composition and Temperature of ——. E. Erdmann. Ber., 1904, **37**, 1193—1196.

The composition of "liquid air" is very variable. The yield from a Hampson machine working under different conditions had a temperature varying from − 194·5° to − 191° C., and contained oxygen varying from 28 to 57 per cent. The temperature at which the liquid leaves the machine is not necessarily its boiling point. In the case of a gaseous mixture, the less volatile constituent is not liquefied at its boiling point under atmospheric pressure, but at a lower temperature, corresponding to its partial pressure in the mixture; so that the oxygen in atmospheric air will not necessarily liquefy till the temperature is reduced to −195·5° C., and when it does liquefy, it will at once absorb and liquefy nitrogen.—J. T. D.

Chloric Acid; Action of Copper on ——, with or without Electrolysis;

Copper; Formation of Basic Salts of —— [Chlorate and Chloride] under the influence of Electrolysis;

Basic Cupric Chlorate; also

Chlorates of the Alkali- and Alkaline-Earth Metals; Electrolysis of —— with a Copper Anode. A. Brochet. XI. A., page 445.

Thiocyanates in presence of Salts giving Precipitates with Silver Nitrate; Determination of ——. A. Dubosc. XXIII., page 456.

Antipyrine; Application of —— in Analysis (Nitrite Reaction). C. Reichard. XXIII., page 456.

English Patents.

Phosphoric Acid; Production of ——. H. H. Lake, London. From E. H. Fallows, New York. Eng. Pat. 2284, Jan. 29, 1904.

See U.S. Pat. 751,753 of 1904; this J., 1904, 252.—T. F. B.

Brine; Evaporating Weak ——, and Apparatus therefor. E. Moll, Linden. Eng. Pat. 28,518, Dec. 28, 1903.

The weak brine is heated in a pair of boilers, the steam from which is led through coils immersed in brine in the first of a pair of large domed, closed pans, fed from the boilers. Here the evaporation is aided by exhaustion, and in a greater degree in the second pan of the pair, which is heated by a steam coil with steam that has passed through a superheater on its way from the first pan. Both pans are also heated by waste gases from the fireplaces. From the second pan the strong brine passes into directly heated open vessels, in which the salt separates.—E. S.

Gases; Process for the Separation of ——, from Gaseous Mixtures, particularly Oxygen and Nitrogen from Atmospheric Air, and Apparatus therefor. R. J. Levy, Nancy. Eng. Pat. 5649, March 11, 1903.

See Fr. Pat. 330,258 of 1903; this J., 1903, 1087.—T. F. B.

Liquefying Air and other Gaseous Fluids; Apparatus for ——. H. Knudsen. Eng. Pat. 6087, March 16, 1903. I., page 434.

United States Patents.

Sulphuric Acid; Manufacture of ——. P. G. Salom, Philadelphia. U.S. Pat. 755,247, March 22, 1904.

Sulphur dioxide gas is oxidised by bringing it into contact with water contained in a number of superposed vessels, connected electrically. A current of electricity is passed through, each vessel constituting an electrolytic cell. Means are provided for the supply to, and flow of liquid from the upper vessels to those beneath them, in order of sequence, and from the lowest vessel of the series into a suitable receptacle.—E. S.

Hydrofluoric Acid; Manufacturing ——. C. A. Doremus, New York. U.S. Pat 754,978, March 22, 1904.

Hydrofluosilicic acid, or a mixture of hydrofluosilicic acid with hydrofluoric acid, is treated with an excess of a metallic compound, thereby producing a fluoride, from which hydrofluoric acid is liberated by the action of superheated steam.—E. S.

Nitric Acid; Method of Making ——. W. Mills, London, Assignor to A. O. Granger, Cartersville. U.S. Pat. 755,378, March 22, 1904.

Substances containing lead are heated with concentrated hydrofluosilicic acid; the lead silicofluoride so formed is reacted upon by a nitrate, and the lead nitrate produced is used as a source of nitric peroxide afterwards used for nitric acid. Compare U.S. Pats. 754,667 and 754,668 of 1904; this J., 1904, 371.—E. S.

Fluorides and Silicates; Method of Making ——. W. Mills, London, Assignor to A. O. Granger, Cartersville. U.S. Pat. 755,379, March 22, 1904.

An alkali nitrate is added to a solution of lead silicofluoride, and the precipitated alkali silicofluoride is heated to obtain the fluoride; or it is mixed with "silicious material" and heated, to form a silicate. Compare the preceding abstract.—E. S.

Sodium Sulphide; Manufacturing ——. J. F. White, Buffalo, Assignor to General Chemical Co., New York. U.S. Pat. 755,201, March 22, 1904.

Nitre cake is heated in the presence of coal and salt.
—E. S.

Brine; Process of Purifying ——. W. Trantom, New Brighton. U.S. Pat. 755,415, March 22, 1904.

See Eng. Pat. 23,642 of 1902; this J., 1903, 696.—T. F. B.

Composition of Matter [Stable Hydrosulphite Body], and Process of Producing same. H. Wolf, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen. U.S. Pat. 756,759, April 5, 1904.

See Eng. Pat. 18,852 of 1900; this J., 1901, 988.—T. F. B.

French Patents.

Hydrosulphites; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 336,942, Feb. 2, 1903.

See Eng. Pat. 2204 of 1903; this J., 1903, 1347.—T. F. B.

Lime and Combustible Gas; Combined Process of Manufacturing ——. The Chalk Power Gas Syndicate, Ltd. Fr. Pat. 337,081, Nov. 3, 1903. II., page 436.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

Firebrick; Alteration of ——, by Furnace Gases. F. Firmstone. Trans. Amer. Inst. Min. Eng., New York, Oct. 1903.

A furnace, 75 ft. high and 18 ft. greatest diameter, using coke to smelt a lean magnetic ore, was lined with:—(1) blocks 14 ins. long by 6 ins. thick; (2) 2 ins. of loam; (3) one and a half brick wall of 9-in. firebrick, in English bond; (4) red brick to within 2 ins. of the iron shell; (5) 2 ins. of slag wool. The furnace was blown in in May 1902. By March 1903 the 14-in. blocks for more than 20 ft. from the top had disappeared, and a few weeks later the firebrick and the red brick had also gone, and the furnace was blown out. No unusual wear was shown in the lower part of the furnace. The 9-in. bricks between 30 and 40 ft. from the bottom were sintered together so that the joints were practically gone. The surface was glazed about $\frac{1}{16}$th to $\frac{1}{32}$nd in. thick; the fracture of the body was like bluish-grey porcelain, with nearly black spots; no deposited carbon was found. The following analyses were made:—

—	Glazed Skin.	Body of Brick.	Joint.	Brick used to Line, 1902.	Brick made, 1896.
Silica	40·23	57·63	..	55·62	56·12
Alumina	12·22	31·64	..	38·55	37·48
Iron sesquioxide	..	..	..	4·17	4·43
Iron protoxide.	11·93	3·73	6·60	..	..
Lime	10·92	0·24	..	0·24	0·36
Magnesia	4·31	0·11	..	6·24	0·29
Potash.........	9·39	2·59	2·39	0·95	0·99
Soda...........	8·43	0·51	0·79	0·29	0·23
Metallic iron ..	..	1·51	..	..	..
Zinc oxide	..	0·59	..	..	..
	97·43	98·55		100·06	99·90
Total iron......	9·28	4·41	4·62	3·10	2·92

The joints were made of a mortar of ground clay and crushed brick. The fractured brick showed spots of ferric oxide, the basis (chamotte) of the brick was white and not very fine, and the cementing clay or matrix light brown or buff. In earlier recorded cases of similar failure of bricks, disintegration by carbon deposition, through reaction of carbon monoxide on the spots of ferric oxide in the brick, seems to have been the cause, and possibly the present case is due to a similar cause, though the total disappearance of the destroyed bricks makes proof impossible. Stoppage of the furnace several times for want of coke probably led to "scaffolding," which may readily favour carbon deposition. The impregnation of the bricks with iron, shown in the analysis, is possibly effected by iron carbonyl.—J. T. D.

English Patents.

Stone, Artificial; Manufacture of ——. F. W. Howorth, London. From F. Jurschina, Würzburg. Eng. Pat. 3769, Feb. 15, 1904.

From 5 to 10 parts by volume of clay are mixed with 100 parts of sodium silicate solution of 27° to 35° B., and to the mixture is added a refractory sand, *e.g.*, granite or basalt, which has previously been mixed with 5 to 10 per cent. of its weight of well-seasoned Portland cement. The mixture is then allowed to remain at rest for some days, in order to become thoroughly uniform, and is then dried at 25° to 30° C. It is next burnt for 20 to 25 hours at 1000° to 1400° C., the temperature first being increased, and then lowered during the burning. The stone is finally allowed to cool for 24 hours in the kiln.—A. G. L.

White Cement ; Process for Manufacturing ——. E. Gogler, Podgorze, and H. Seinfeld, Cracow. Eng. Pat. 388, Jan. 6, 1904.

Lime and silicic acid are mixed, either in their natural state or after burning, with a quantity of alkali carbonate varying from one to three times the quantity of silica present. The whole is then fused at a low temperature, and the resulting product lixiviated, the lye obtained being used over again instead of fresh alkali carbonate. All the materials used should be as free as possible from iron. —A. G. L.

Concrete and the like ; Treatment of ——, *whereby the Setting of the same after Mixture may be Arrested.* J. H. Magens, Hamburg. Eng. Pat. 6247, March 18, 1903.

See Fr. Pat. 330,393 of 1903 ; this J., 1903, 1089.— T. F. B.

United States Patents.

Wood ; Vulcanised ——, *and Process of Vulcanising same.* W. Powell, Liverpool. U.S. Pat. 755,240, March 22, 1904.

See Eng. Pat. 11,235 of 1902 ; this J., 1903, 697.—T. F. B.

Wood ; Preserved ——, *and Process of Preparing same.* I. P. Lihme, Assignor to the Grasselli Chem. Co., both of Cleveland. U.S. Pat. 756,173, March 29, 1904.

Wood, *e.g.*, railway ties, is treated with a solution of zinc chloride, with the aid of both vacuum and high pressure, and is then subjected under pressure to the action of a solution of a silicate, preferably sodium silicate, whereby the exterior portions become permeated with zinc silicate. —A. G. L.

Cement-Furnace. J. Sheneman, Bronson. U.S. Pat. 755,947, March 29, 1904.

A pair of conveying and drying troughs containing the material to be burnt are placed above a rotary kiln and separated from it by an air-space, from which the air necessary for combustion is forced by means of a fan to the nozzle of the fuel-injector.—A. G. L.

X.—METALLURGY.

Blast Furnace Practice ; Hearth Area and Number of Tuyères in ——. F. L. Grammer. Trans. Amer. Inst. Min. Eng., New York, Oct. 1903.

The use of fine ores has led to the hope that by increasing the area of contact between air and fuel the output of the furnace might be increased. To do this, the number of tuyères has often been increased, but not always with favourable results. As the tuyères increase in number beyond eight, the increased friction in the narrow tubes more than compensates for the number, so that the blast-pressure may have to be increased ; for instance, with 16 tuyères a blast-pressure of about 1—2 lb. per sq. in. higher is needed than with 8 tuyères. With many tuyères, the wear is more regular, and the charge settles more evenly, than with few. A few extra tuyères are of advantage when the furnace works irregularly, and they are easily plugged with clay when not needed. In furnaces of similar dimensions and engine equipment, working under similar conditions, the number of tuyères needed is proportional to the hearth area. With a hearth of small diameter, the combustion zone extends higher than with a larger hearth, and the temperature is somewhat higher. Also the slag, metal, and coke are long in contact, and the silicon-content of the pig is likely to be high : this is usually the case in furnaces having a narrow crucible. Increasing the number of tuyères is analogous to widening the hearth, and lowers the height of the combustion zone. A wide hearth tends towards uniformity in the composition of the pig, for obvious reasons. In 30 years, the ratio of hearth area to greatest bosh-area has changed from $\frac{1}{10}$ to $\frac{3}{10}$, and the furnace capacity in cubic feet per ton of metal per 24 hours has decreased from 200—380 to 20—30. Schierz gives the relative times of exposure in the reduction zone for spiegel, foundry iron, and forge iron, as 4·53, 2·75, and 1. Gruner gives the cubic capacity of the crucible (for coke furnaces) as about 9 cb. ft. in small and 5 cb. ft. in large furnaces per ton of iron per 24 hours : modern American practice is 3 to 3½ cb. ft.—J. T. D.

Pig-Iron and Iron Castings ; Specifications for ——. R. Job. Amer. Inst. Mining Eng. (Trans.), Atlantic City, Feb. 1904.

The author describes the specifications in accordance with which pig-iron and iron castings are purchased by the Philadelphia and Reading Railway Co. The chemical and physical requirements are as follows :—Iron Castings. *Chemical :* Class I. (medium iron for engine cylinders, gears, wheel centres, smoke-stacks, &c.). The iron must be close-grained and tough ; and contain :—silicon 1·4—2 per cent. ; sulphur, not exceeding 0·085 ; manganese, not exceeding 0·7 ; and phosphorus, not exceeding 0·6 per cent. Class 2 (soft iron for small castings for general car and roadway use). Silicon, 2—2·8 per cent. ; sulphur, not exceeding 0·085 ; manganese, not exceeding 0·7 ; and phosphorus, not exceeding 0·6 per cent. Class 3 (iron for brake-shoes and other castings for frictional wear). The iron must be hard and tough ; and contain :—silicon, 2—2·5 per cent. ; sulphur, not exceeding 0·15 ; manganese, not exceeding 0·7 ; and phosphorus, not exceeding 0·7 per cent. *Physical :* The castings must be of uniform quality and of solid iron, free from physical defects and excessive shrinkage strains ; and not contaminated with sand. Castings of Classes 1 and 2 must be of grey iron throughout and easily machined. Pig-Iron. *Chemical :* Silicon, 1·5—2·5 per cent. ; manganese, 0·4—0·75 ; phosphorus, not exceeding 0·5 ; and sulphur, not exceeding 0·04 per cent. *Physical :* The material must be of uniform quality, and free from sand, dirt, slag, or other foreign matter.—A. S.

Manganese [in Iron, &c.] ; Determination of —— *by the Persulphate Method.* H. Lüdert. XXIII., page 456.

Chromium and Vanadium ; Separation of —— *[in Ferro vanadium, &c.].* P. Nicolardot. XXIII., page 457.

Titanium in Iron Ores ; Determination of ——. S. Burman. XXIII., page 457.

Available Cyanide ; Determination of ——. J. E. Clennel. XXIII., page 457.

English Patents.

Alloy ; Manufacture of a Metallic ——. T. Prescott, Huddersfield, and E. Green and Son, Ltd., Leeds. Eng. Pat. 5683, March 11, 1903.

The alloy consists chiefly of zinc and aluminium, with small proportions of iron and silicon, the composition being varied according to the degree of hardness or toughness required. The iron is first melted, the aluminium is added, and then the zinc, followed by a "silicon flux," constituted of potassium silicofluoride, calcium chloride and carbonate, sodium chloride and carbonate, and powdered glass.—E. S.

Blast Furnaces. O. S. Garretson, Buffalo. Eng. Pat. 11,297, May 18, 1903.

See U.S. Pat. 728,700 of 1903 ; this J., 1903, 747.—T. F. B.

Rotary Furnaces. W. S. Rockwell, New York. Eng. Pat. 1503, Jan. 20, 1904.

The furnace consists of two independent rotary melting chambers, elliptical in longitudinal section and circular in cross section, with contracted openings at both ends, and placed end to end in close contact with each other. The metal is melted in one chamber, whilst in the other the ingots are given a preliminary heating by the products of combustion from the first chamber. In the next series of operations the functions of the two chambers are reversed. The chambers have burner nozzles at their outer ends. Each chamber consists of two half sections hinged together, which may be opened to facilitate placing the lining, means being provided for locking such sections together when they are in place.—E. S.

Matte; Process of Converting or Bessemerising ——. O. S. Garretson, Buffalo. Eng. Pat. 11,303, May 18, 1903.

See U.S. Pat. 728,701 of 1903; this J., 1903, 747.—T. F. B.

Friable Ores; Manufacture of Briquettes from ——. H. Schulte-Steinberg, Düren. Eng. Pat. 3235, Feb. 9, 1904.

Blast-furnace slag is powdered, and subjected to the action of high-pressure steam, preferably in a rotating drum. The slag thus treated serves as binding material in making briquettes of friable ores. When it is desired that the briquettes formed should be as porous as possible, the proportion of the prepared slag used is reduced, say to 10 per cent. of the ore. Reference is made to Eng. Pat. 17,183 of 1903; this J., 1903, 1247.——E. S.

United States Patents.

Cast Iron; Process of Tempering or Hardening ——. W. Gilmour and A. Lindsay, Montreal, Assignors to C. A. Myers and H. H. Bradfield, Morrisburg. U.S. Pat. 755,763, March 29, 1904.

See Eng. Pat. 28,396 of 1902; this J., 1903, 557.—T. F. B.

Steel, &c.; Converter for Making ——. W. B. Burrow, Norfolk. U.S. Pat. 755,215, March 22, 1904.

The converter, which is operated horizontally, and is so mounted that it can be tilted, has internal ribs or corrugations occupying one-half of the inner circumference, which ribs contain horizontal and vertical tuyères discharging at right angles to each other; the former tuyères blowing towards the closed end of the converter. The tuyères are supplied from a horizontally divided wind-box on the pouring side of the vessel, having guide and deflecting plates and regulating valves. The bottom or closed end of the converter has a slag door.—E. S.

Steel; Process of Annealing ——. L. D. Davis, Erie. U.S. Pat. 755,629, March 29, 1904.

The steel is immersed in a bath of "molten metal" fusing between 1,000° and 1,500° F.; or in a bath of "molten metal in which aluminium predominates," heated to from 1,100° to 1,500° F.; or in a "bath of aluminium," heated to from 1,125° to 1,500° F.; and the steel is "gradually cooled."—E. S.

Steel Plates; Method of Locally Softening or Annealing Hardened ——. C. P. E. Schneider, Le Creuzot. U.S. Pat. 755,709, March 29, 1904.

See Eng. Pat. 19,167 of 1903; this J., 1903, 1246.—T. F. B.

Air for Blast Furnaces and Converters; Method of Extracting Moisture from ——. J. Gayley, New York. U.S. Pat. 756,110, March 29, 1904.

See Eng. Pat. 19,933 of 1903; this J., 1904, 22.—T. F. B.

Metallurgical Apparatus. G. W. Gesner, New York, Assignor to H. C. Gesner, Brooklyn. U.S. Pat. 755,867, March 29, 1904.

A vertical retort is set over a furnace the gases from which pass into a surrounding flue. In the wall between the retort and the flue a pipe coil is bedded, partly exposed to the gases of combustion, and having a terminal portion opening into the retort, composed of a combination of graphite and clay. Separate valved pipes for conveying steam and naphtha merge into a single pipe entering the coil, in which the mixture is heated and discharged into the retort. In the lower portion of the retort is a grate communicating with a chamber immediately beneath, and over the fireplace, with means of access from without. The apparatus is for the manufacture of a "hydrogen alloy" or "scale alloy."—E. S.

Ore [Gold]; Apparatus for Treating ——. T. A. Helm, Salt Lake City. U.S. Pat. 755,871, March 29, 1904.

The apparatus consists of a cylindrical tank, provided inside with radial perforated blades, extending the whole length of the tank. A circular brace-frame is arranged between the inner ends of the radial blades. An air-pipe leading into the tank, faucets to draw off the liquid, and means for rotating the tank, are also provided.—E. S.

Ores; Process of Treating [Cyaniding] ——. J. Smith, San Francisco. U.S. Pat. 755,951, March 29, 1904.

Ore containing ferrous oxide is heated in a moist, crushed state, in presence of air, whereby the ferrous oxide is rendered insoluble in the cyanide solution.—E. S.

Ores, [with] Liquids or Gases; Apparatus for Treating Solids such as ——. P. Naef, New York. U.S. Pat. 756,271, April 5, 1904.

See Eng. Pat. 17,054 of 1900; this J., 1901, 1195.—T. F. B.

Copper; Extraction of —— from Comminuted Mineral Mixtures. E. A. Le Sueur, Ottawa. U.S. Pat. 755,302, March 22, 1904.

The powdered mineral mixtures are treated with an ammoniacal solution containing a reagent capable of oxidising copper, such as a cupric compound; a portion of the total copper contents of the solution is then removed, and the partially exhausted solution is again used to dissolve fresh copper as before.—E. S.

Copper and Iron; Manufacturing Alloys of ——. J. D. Darling, Assignor to R. M. Popham, both of Philadelphia. U.S. Pat. 755,461, March 22, 1904.

A mixture of iron oxide with calcium carbide is added to a bath of molten copper; or a mixture of copper oxide and calcium carbide to a bath of molten iron.—E. S.

Plumbiferous Ores; [Vessels for] Treating ——. E. W. Engels, Düsseldorf. U.S. Pat. 755,222, March 22, 1904.

Plumbiferous ores are treated at high temperatures in vessels "composed largely of clay and carborundum, in the relative proportion of not less than 25 per cent. or more than 90 per cent. of carborundum." The clay and carborundum are conjointly used on the surfaces of the vessels exposed to be attacked by the ore, so as that they may protect one another.—E. S.

Lead Ores; Process of Desulphurising ——. A. Savelsberg, Ramsbeck. U.S. Pat. 755,598, March 22, 1904.

See Fr. Pat. 336,540 of 1903; this J., 1904, 376.—T. F. B.

Ore Bricks; Manufacture of ——. J. Koeniger, Cologne. U.S. Pat. 755,372, March 22, 1904.

See Eng. Pat. 15,437 of 1902; this J., 1903, 867.—T. F. B.

Welding Compound. R. S. Woodson, Boulder. U.S. Pat. 755,826, March 29, 1904.

Powdered silica ($93\frac{1}{3}$—97 parts) is mixed with powdered borax (3—$6\frac{2}{3}$ parts).—E. S.

Brazing Cast-Iron; Process of ——. J. E. Tichon, Assignor to T. E. Parker, both of New Bedford, and to H. F. Strout and J. C. Bassett, Boston. U.S. Pat. 756,079, March 29, 1904.

A plastic paste of "boro-boracic acid" and metallic filings is applied to the surfaces to be joined, the parts are heated, and spelter is poured on the joint, with or without the raising of the temperature and applying "boro-boracic acid."—E. S.

Brazing Compound. J. E. Tichon, Assignor to T. E. Parker, both of New Bedford, and to H. F. Strout and J. C. Bassett, Boston. U.S. Pat. 756,080, March 29, 1904.

The claims include a brazing compound containing "boro-boracic acid," with or without particles of metal, also a flux "comprising boro-boracic acid." (See preceding abstract.)—E. S.

French Patents.

Iron and Steel in a Solid, but Incandescent, State; Treatment of ——, *by means of Carbides.* E. Engels. Fr. Pat. 337,154, Nov. 28, 1903.

See Eng. Pat. 25,932 of 1903; this J., 1904, 118.—T. F. B.

Metals; Process for the Extraction of ——, the Formation of Alloys and Metallic Oxides, and the Production of High Temperatures. P. and A. Weiller. Fr. Pat. 336,989, Nov. 9, 1903.

The ores are freed from gangue and ignited with suitable reducing bodies, such as iron or carbon. To form alloys, the ores are intimately mixed with excess of the metal or metals to be introduced, and the mixture is ignited. If an oxide is to be formed, the reducing metal is to be used in smaller proportion than in the previous case. To obtain high temperatures, the body to be highly heated is bedded in "substances giving oxygen, chlorine, or sulphur, and with a reducing substance," and the mixture is then ignited.—E. S.

Antimony; Metallurgical Treatment of ——, and Apparatus therefor. F. M. E. Basse. Second Addition, dated Nov. 11, 1903, to Fr. Pat. 319,534 of March 13, 1902. (See this J., 1902, 1537; 1903, 747.)

The claim is for the use of solid fuel conjointly with that of liquid or of gaseous fuel, or of both, in the special furnace described in the main patent and in the First Addition thereto (*loc. cit.*), and also in metallurgical roasting furnaces generally.—E. S.

Zinc; Process and Apparatus for the Production of ——. J. L. Babé and A. Tricart. First Addition, dated Nov. 13, 1903, to Fr. Pat. 294,831 of Nov. 30, 1899.

The furnace supplied with a blast, described in the main patent, is replaced by a furnace in which the fumes are withdrawn by aspiration through channels in the side walls. Ore, charged into an opening in the top of the furnace (which opening is afterwards closed), descends by gravity. The air required for combustion is admitted through the fire-grate, or from the bottom of the furnace. (See U.S. Pat. 702,764 of 1902; this J., 1902, 1142.)—E. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Chloric Acid; Action of Copper on ——, with or without Electrolysis;

Copper; Formation of Basic Salts of —— [Chlorate and Chloride] under the Influence of Electrolysis;

Basic Cupric Chlorate; also

Chlorates of the Alkali- and Alkaline-Earth Metals; Electrolysis of —— with a Copper Anode. A. Brochet. Bull. Soc. Chim., 1904, **31**, 287—295.

Strong chloric acid (280 grms. per litre) attacks copper violently, a normal solution of the acid only very slowly. No gas is evolved during quiet action, cupric chloride and cupric oxide being produced. The latter dissolves in the chloric acid till the acid is completely saturated, when basic salts begin to deposit. In the cold, the metal is covered with a deposit of cuprous hydroxide, which afterwards dissolves. The electrolysis of chloric acid with a copper anode gives similar results, but more rapid action. In the cold, the anode is coated with a white deposit of cuprous chloride, but this is not perceived at 60°—80° C. Cuprous chloride itself reduces chloric acid slowly in the cold, but instantaneously when heated, forming cupric chloride and oxide. The electrolysis of chloric acid, or of potassium chlorate or cupric chlorate acidified with sulphuric acid all give identical results. The anode is attacked with great regularity. The action of copper on cupric chlorate, with or without electrolysis, results in the formation of cupric or cuprous chloride or hydroxide, or mixtures. The basic salts formed have the formula $Cu(A)_2.3Cu(OH)_2$, where Cl and ClO_3 may replace one another indefinitely in A; the amount of basic salt formed depends on the acidity of the solution. The copper dissolved from the anode is from 1·5 to 2 times that corresponding to the electrolysing current. Basic cupric chlorate, $Cu(ClO_3)_2.3Cu(OH)_2$, obtained crystallised by Bourgeois by heating the normal salt, is obtained as an amorphous product by reacting on cupric chlorate solution with cupric or alkali hydroxide. It is a greenish-blue powder, always containing a little more hydroxide than the formula indicates. The electrolysis with a copper anode of the chlorates of the alkalis and alkaline earths is similar in its procedure to that of cupric chlorate. The copper anode dissolves as cuprous ions, which are more or less rapidly converted into cupric compounds, reducing the chlorate. The basic salts, which, in the case of cupric chlorate, are deposited, are, in the case of potassium or barium chlorate, incompletely precipitated by the cathodic alkali; and the cathodic hydrogen is partly used up in reducing chlorate, and partly reduces the cupric hydroxide, and deposits copper. The black deposit formed, contains metallic copper, cupric oxide and chloride, and potassium or barium compounds as the case may be.—J. T. D.

Azo Dyestuffs; Electrolytic Preparation of ——. W. Löb. Zeits. Elektrochem., 1904, **10**, 237—238.

Azo dyestuffs can be produced electrolytically from a mixture of an aromatic amine, sodium nitrite, and a coupling component to combine with the diazo compound produced, by subjecting the same in a neutral (or occasionally alkaline) electrolyte to anodic current action at an unalterable electrode. Phenols are the best coupling components, whilst amines are quite unsuitable, giving rise to secondary reactions. The mixture of amine, sodium nitrite, and coupling component is placed in the anode compartment, which is separated by a diaphragm from the cathode compartment. The anode is preferably of platinum, and the cathode of any suitable metal. The contents of the anode compartment are agitated while the current is being passed. The strength of current, temperature, &c., vary considerably in different cases, but in no case is any artificial cooling required as in the chemical diazotising process. The following dyestuffs have been prepared:—Orange II, from sodium sulphanilate and β-naphthol; Congo Red, from benzidine and sodium naphthionate; Dianisidine Blue, from dianisidine and β-naphthol; Chrysamine G, from benzidine and sodium salicylate; and Roccelin, from sodium 1.4-naphthylaminesulphonate and β-naphthol.—A. S.

Iodoform; Electrolytic Preparation of ——, from Acetone. J. E. Teeple. XX., page 453.

English Patents.

Electric Batteries. J. Portalier, Brussels. Eng. Pat. 5891, March 13, 1903. Under Internat. Conv., Sept. 13, 1902.

See Fr. Pat. 324,851 of 1902; this J., 1903, 636.—T. F. B.

Ozone by Electricity; Apparatus for Purifying Air and Generating ——. C. Wokes and F. H. Street, both of Hull. Eng. Pat. 10,251, May 6, 1903.

An outer casing is provided internally with a series of projecting electrodes, and opposite to the internal edges of these is a similar series of electrodes mounted externally on an inner tube or shaft. The outer casing and inner tube are insulated and connected to the terminals of a source of electric current, and air or oxygen is passed through the apparatus. The apparatus may be provided with one or more additional inner tubes, each furnished with electrodes, disposed externally and internally as described above.—B. N.

United States Patents.

Sheath or Envelope for Storage Battery Plates; Protective ——. A. Meygret, Paris. U.S. Pat. 756,176, March 29, 1904.

A bath, containing a mixture of castor oil, essence of turpentine, and nitrates of cellulose, is used for coating the plates of storage batteries, thus forming an envelope or sheath of these substances on the plate.—B. N.

Sulphuric Acid; [Electrolytic] Manufacture of ——. P. G. Salom. U.S. Pat. 755,247, March 22, 1904. VII., page 442.

(*B.*)—ELECTRO-METALLURGY.

Copper Electrolysis; Relation between Arsenic and Electro-Motive Force in ——. L. W. Wickes. Amer. Inst. Mining. Eng. (Trans.), Atlantic City, Feb. 1904.

The author finds that in the electrolytic refining of copper, the arsenic passes into solution as sulphate, which then gradually undergoes hydrolysis with formation of arsenic acid. The arsenic in the latter compound is in the form of an anion and therefore cannot be deposited on the cathode and contaminate the refined copper. The known effect of the electromotive force on the amount of arsenic in the deposited copper is thus an indirect one; *i.e.*, with increased E.M.F., the time required for the deposition of a given weight of copper, and consequently also the amount of arsenic sulphate converted by hydrolysis into arsenic acid are diminished.—A. S.

Cadmium and its Alloys: Electro-Deposition of ——. S. Cowper-Coles. Electro-Chem. and Metall., 1904, **3**, 582—586.

Cadmium-silver alloys have been deposited on a commercial scale, an alloy containing a small percentage of silver having been employed for coating bright steel parts of machines, whilst domestic articles have been plated with an alloy containing 7·5 per cent. of silver. Such alloys have been found to withstand tarnishing much better than pure silver or standard silver containing 7·5 per cent. of copper. Very careful adjustment of the concentration of the solutions and the current density seems to be necessary for obtaining a definite composition of the electro-deposited alloys; and, moreover, if the bath is to be maintained for any length of time in working condition, the deposit must be of the same composition as the anode.—R. S. H.

English Patents.

Furnaces; Impts. in Electric Crucible ——. A. Reynolds, London. Eng. Pat. 11,000, May 14, 1903.

The electrical heating resistance is formed by ramming a spiral layer of material round and in contact with the walls of the crucible, the "spires" of the resistance being insulated from each other by a similar spiral layer of non-conducting refractory material, preferably the same as the material of the crucible. The resistance material, which is inert to the crucible walls at furnace temperatures, consists of plumbago, or other form of carbon, or a mixture of plumbago with the material of which the crucible is made. The furnace described is an annular one with two concentric walls, each of which has a resistance spiral, the latter being suitably connected in series or in parallel.—B. N.

Furnace; Electric Crucible ——. A. Reynolds, London. Eng. Pat. 11,001, May 14, 1903.

An iron casing, connected to one terminal of the electric supply, has a fire-brick lining, in which is bedded a plumbago crucible having a lining consisting of magnesite, or other refractory material, or a mixture of materials with or without plumbago. The crucible is in electrical connection with the outer casing, and the second electrode, vertically adjustable, is placed centrally over the crucible. A plug of plumbago, or other conducting material, in the lining, serves to start the arc and thus heat the inner lining, the latter being inert to the charge and conducting electricity at furnace temperatures, so that it forms a durable electrode. —B. N.

Melting Steel and the like in Electric Furnaces; Method of ——. A. Reynolds. Eng. Pat. 11,002, May 14, 1903.

Steel or other material is melted by forming on the surface of the charge, a slag which is chemically inert to the charge and to the electrodes. The slag is heated, and the heating maintained, by the passage of an electric current through the slag, or by an arc or arcs formed between the vertical electrodes and the slag. The latter consists of an acid silicate of lime or a basic silicate of lime or magnesia, or both metals, according to the character of the lining of the crucible, whether acid or basic.—B. N.

[*Electric*] *Furnaces for Extracting Metals and Making Carbides and similar Compounds.* Le Roy W. Stevens, and B. Timmerman, Chicago. Eng. Pat. 768, Jan. 12, 1904.

See U.S. Pat. 749,460 of 1904; this J., 1904, 192.—T. F. B.

Steel Blocks; Filling up Cavities Produced in —— *during the Process of Casting or Cooling.* J. Matzek, Mülheim-on-the-Ruhr. Eng. Pat. 912, Jan. 13, 1904.

The crust of the cooling steel-block casting is electrically fused, and the electrode is then introduced into the cavity to fuse its walls. Instead of an electrode consisting of a single carbon rod, two or more rods may be employed, so that fusion may take place at several points of the block simultaneously. Finally, molten steel is run into the cavity to unite with the steel thus fused.—E. S.

French Patents.

Antimony; Process for the Electrolytic Extraction of —— *from its Sulphuretted Ores.* J. Izart and L. Thomas. Second Addition, dated Feb. 3, 1903, to Fr. Pat. 319,449, March 10, 1902 (this Journal, 1902, 1541).

The sulphide ores of antimony or arsenic are dissolved in an alkali (potash or soda) and electrolysed, the metal being deposited with formation of an alkali sulphide. The latter may be recovered by crystallisation; or by the addition of an acid to the liquid remaining after electrolysis, the golden sulphide of antimony may be precipitated.—B. N.

Metallic Masses; Fusing ——. Hoerder Bergwerke- u. Hütten-Verein. Fr. Pat. 337,190, Nov. 30, 1903.

A gas or gaseous mixture is passed under high pressure through a tube made of a material that is a good conductor of electricity and coated with refractory non-conducting material. The end of the tube is placed against the mass to be fused, and, on passing the electric current, a "luminous electric arc" is formed, the flame produced impinging upon the mass to be melted. As the fusion proceeds, the tube is advanced.—E. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Fatty Esters; Hydrolysis and Synthesis of —— *by Platinum Black.* H. Neilson. Amer. J. Physiol., **10**, 191—200.

The platinum-black used in these experiments was washed until neutral, dried in an oven, heated for one hour at 100° C., and powdered. All the apparatus was sterilised, and the experiments were made at 38° to 40° C., except in the case of those to determine the influence of temperature. In each instance the tubes containing ethyl butyrate were placed in the incubator for 30 minutes before the introduction of the platinum-black. The ethyl butyrate solution consisted of 10·4 c.c. of that substance in 200 c.c. of distilled water with 2 c.c. of a 1 per cent. solution of thymol as an antiseptic. Five c.c. of this solution were mixed with 300 grms. of platinum-black, and the tubes placed in the incubator and shaken at regular intervals. After the required time the tubes were immersed in ice-water to stop further action, and their contents subsequently titrated with N/20 sodium hydroxide solution. Blank determinations with tubes containing only the ethyl butyrate solution were simultaneously made and the small amount of acidity in these deducted from the results of the actual tests.

Influence of Time.—The following typical results represent the amount of hydrolysis after the different times mentioned:—24 hours, 10·3 per cent.; 48 hours, 28·3; 72 hours, 37·3; 96 hours, 49·0; and 144 hours, 68·0 per cent. A slight amount of the acidity was due to acetic acid formed by oxidation of the alcohol liberated in the hydrolysis.

On comparing the action of platinum-black on ethyl butyrate with that of lipase, it was found that the hydrolysing action of the former was slower.

Influence of Concentration.—The constant factors in these experiments were :—Time, 32 hours; temperature, 40° C.; ethyl butyrate, 0·26 c.c. The following percentages of hydrolysis were observed on varying the amounts of platinum :—25 mgrms., 0·8; 50 mgrms., 1·58; 100 mgrms., 2·94; 150 mgrms., 5·0; 200 mgrms., 7·50; 250 mgrms, 9·0; 300 mgrms., 13·40; 400 mgrms., 17·0 per cent.

Influence of Temperature.—Constant factors :—Time, 24 hours; ethyl butyrate, 0·26 c.c.; platinum-black, 300 mgrms. Typical results :—0° C., 0·75 per cent.; 10° C., 2·5; 20° C., 5·1; 40° C., 12·0; and 60° C., 15·0 per cent.

Influence of Concentration of the Ethyl Butyrate.—The experiments cited show that the action of the platinum black is independent of the concentration of the ethyl butyrate, in which respect it resembles lipase.

Influence of Poisons.—In each experiment 5 c.c. of a 0.001 solution of the poison were added to the test-tube containing 0·26 c.c. of ethyl butyrate, and 300 mgrms. of platinum-black, and the whole kept at 40° to 42° C. for 24 or 48 hours. The following percentages of hydrolysis were observed as the average results of different experiments :—Water, 21·0; sodium fluoride, 18; formaldehyde, 18; chloroform, 14·5; toluene, 11·0; mercuric chloride, 11·0; silver nitrate, 9·7; salicylic acid, 5·8; phenol, 4·3; hydrocyanic acid, 1·2; and potassium cyanide, 0·0. The influence of sodium fluoride is much more pronounced in the case of lipase, whilst on the other hand hydrocyanic acid is much more destructive to the action of platinum black than to that of lipase. The action of the other poisons is very similar in both cases.

Reversibility of the Action.—A mixture of 200 c.c. of N/20 butyric acid solution and 40 c.c. of 20 per cent. alcohol with a little thymol, was thoroughly shaken with 2 grms. of platinum-black, and the liquid eventually decanted from coarser particles, and kept for 8 hours at 45° C. with occasional shaking. The contents of the flask had then a marked odour of ethyl butyrate, the presence of which was identified by distillation. A blank test made without the presence of platinum was free from ethyl butyrate. No quantitative determinations were made, but it is stated that the synthesis effected by platinum-black is not so pronounced as the hydrolysis, which is also the case with lipase.—C. A. M.

Higher Glycerides. J. B. Hannay. Proc. Chem. Soc., 1904, **20**, 58—60.

The higher glycerides, as represented by purified stearin, olive oil, linseed oil, castor oil, cotton-seed oil, rape oil, and earth-nut oil, are all capable of entering into direct combination with lead oxide, the new compounds being formed by heating the oils with excess of finely-divided litharge at 170° to 180° C. and dissolving out the product with chloroform, petroleum, or carbon tetrachloride. The substance obtained resembles wax and has no sharp melting point; it begins to soften at 120°, becomes viscous at 150° to 160°, and is quite limpid at 190° C. It commences to boil and decompose at about 280° C., the temperature varying a few degrees according to the oil used. In the case of the olein derivative, the composition may be represented by the formula $C_3H_5O_3 \vdots Pb_3(C_{18}H_{33}O_2)_3$, where the three atoms of lead are seen to replace six atoms of hydrogen, three in a molecule of glycerol, and three in molecules of oleic acid. This compound probably represents the first step in saponification by lead oxide. The oleic acid derivative, when dissolved n ether, is decomposed by cold water in the following manner :—

$$2(C_{57}H_{104}O_6,3PbO) + 3H_2O =$$
$$2(C_3H_8O_3) + 3(C_{18}H_{33}O_2)_2Pb,PbO,$$

lycerol and a basic lead oleate being thereby produced. ead glyceryl oleate and the corresponding stearate, linoleate, nd ricinoleate resemble mercury thymyl acetate in forming double compound with lead acetate. The foregoing comounds are stable and not affected by fractional precipitation, either is the lead displaced by metallic sodium, phosphoric xide, or sulphur trioxide.

Glycerol; Determination of —— in Fats. R. Fanto. XXIII., page 458.

English Patents.

Fatty Acids, Hydrocarbons, and the like; Apparatus for the Continuous Distillation of ——, and Steam Superheating Apparatus therefor. V. Sláma, Moscow. Eng. Pat. 12,984, June 9, 1903.

Fractional distillation is effected in a closed vessel containing two or more superposed communicating compartments provided with steam inlet and outlet pipes, and pipes communicating with the supply tank and steam superheating apparatus. The more volatile constituents are separated in the upper compartments. The steam superheating apparatus consists of cast iron or other hollow bodies each divided into two chambers and connected with each other. The steam passing through these chambers is superheated, whilst the substance to be distilled circulates through batteries of pipes within these chambers, and is heated to the required extent before entering the distillation apparatus. —C. A. M.

Wax; Manufacture of Artificial ——. L. A. G. Delahaye, Paris. Eng. Pat. 10,324, May 6, 1903.

See Fr. Pat. 331,714 of 1903; this J., 1903, 1138.—T. F. B.

Soap and other Commodities liable to Evaporation; Preparation of ——. R. H. F. Finlay, Belfast. Eng. Pat. 8954, April 21, 1903.

Soaps, &c., containing volatile substances, such as ammonia or naphtha, are coated with paraffin or varnish.—C. A. M.

Soap; Manufacture of ——. T. Parziale, Alexandria. Eng. Pat. 1303, Jan. 18, 1904.

A mixture of cotton-seed oil and flour is agitated with caustic soda ley until saponification is complete, and the resulting soap run into vats, where it is left until sufficiently hard.—C. A. M.

United States Patent.

Soap, and Method of Making same. G. A. Schmidt, Chicago. U.S. Pat. 755,945, March 29, 1904.

"Calcined granulated porous gritty material" is heated with "liquefied medicaments" in a closed vessel under pressure. The gritty material is then dried and mixed with "soap in liquid state"; the gritty material is "adapted to retain the medicaments out of the sphere of chemical action of the soap."—T. F. B.

French Patents.

Soaps; Process of Manufacturing Non-Caustic ——, which Develop Active Oxygen. H. Giessler and H. Bauer. Fr. Pat. 336,953, Oct. 16, 1903.

See Eng. Pat. 22,580 of 1903; this J., 1904, 327.—T. F. B.

Soaps known as "Savons de Marseille"; Manufacture of ——. L. Garbet. Fr. Pat. 337,091, Nov. 5, 1903.

In the so-called final process of "augmentation," ordinary water is replaced by an aqueous solution of lichen or similar product.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

Lead Carbonate. R. Salvadori. VII., page 441.

Prussian Blue; Analysis of ——. C. Coffignier. XXIII., page 456.

English Patents.

Paint Vehicles; Manufacture of ——. E. H. Strange and E. Graham, London. Eng. Pat. 8335, April 11, 1903.

Lime, ground to a paste with refined rosin oil, is introduced into crude rosin oil, heated to 160°—180° C., in quantity sufficient to nearly neutralise the acidity of the oil. About 5 per cent. of a manganese drier (preferably manganese resinate), ground to a paste with refined rosin oil, is then introduced at the same temperature, and finally 1 to 1·5 per cent. of litharge is added to completely neutralise the product. The whole is cooled to about 50° C., and petroleum spirit or other volatile solvent is added until the desired viscosity is attained.—T. F. B.

Carbons from Arc Lamps; Process for Utilising the Waste Ends of —— [*as Pigments*]. R. Peters, Heidelberg. Eng. Pat. 2358, Jan. 30, 1904.

See Fr. Pat. 335,795 of 1903; this J., 1904, 260.—T. F. B.

(*B.*)—RESINS, VARNISHES.

English Patents.

Resinous Substances; Synthetical Production of ——. E. R. L. Blumer, Zwickau. Eng. Pat. 6823, March 24, 1903.

Claim is made in connection with the process described in Eng. Pat. 12,880 of 1902 (this J., 1903, 705) for the use of other organic acids, *e.g.*, oxalic or formic acid in saturated solutions in formaldehyde, and of inorganic acids, *e.g.*, hydrochloric and sulphuric acids in concentrations of not less than 30 per cent., and of acid salts of inorganic acids. —C. A. M.

Turpentine; Russian Oil of, and Similar Products and Benzine or Petroleum Spirit; Treatment of ——, *for the purpose of Removing their Disagreeable Odour.* E. Heber, Bienenhof. Eng. Pat. 10,004, May 2, 1903.

The disagreeable odour of Russian, German, &c., oil of turpentine, or of petroleum spirit, may be removed by treatment with a permanganate, chromic acid, or a persulphate. The quantity required is about 5 to 10 per cent. of the weight of the distillate, using a 4 or 5 per cent. (acid or alkaline) solution of potassium permanganate. The substance to be deodorised is preferably treated with lime and distilled in steam before being subjected to the action of the oxidising agent.—T. F. B.

Waste from Wood-grinding Mills, Paper, and Cellulose Factories; Utilisation of the —— [*Linoleum*]. E. de Pass, from C. Gaertner. Eng. Pat. 27,339, Dec. 14, 1903. XIX., page 453.

(*C.*)—INDIA-RUBBER.

English Patent.

India-Rubber Tyres; Preparation for Impregnating ——. L. Leesman and M. Weinkopf, Graz. Eng. Pat. 2982, Feb. 6, 1904.

Birch tar oil (60—70 per cent.), coal-tar benzene (38—28 per cent.), and dissolved dextrin (2 per cent.) are thoroughly mixed and applied by means of a brush, to the tyres, stretched or unstretched, each successive coating being allowed to dry for a period of 24 hours.—R. L. J.

French Patents.

Rubber; Apparatus and Process for Extracting ——, *without Solvents.* N. W. Aldrich and J. F. Ryan. Fr. Pat. 337,051, Oct. 12, 1903.

See U.S. Pats. 741,257 and 741,258 of 1903; this J., 1903, 1200.—T. F. B.

Caoutchouc Substitute; Process of Manufacturing a ——. E. H. Fayolle. Addition, dated Oct. 14, 1903, to Fr. Pat. 335,584 of Sept. 26, 1903; see this J., 1904, 195.

The following improvements are now claimed:—(1) The mother liquor from which the substance separates should be kept for some days to recover a further quantity of the material. (2) If the substance separates as a thick oil, the aqueous layer is drawn off and sulphuric acid of 66° B. mixed with the oil (15 per cent. by weight of the phenol originally used). This at once produces a firm cake. (3) The kneading process may be stopped when all the moisture has been worked out. (4) The following proportions give good results:—Glycerin, 1 kilo.; 40 per cent. formaldehyde, 1 kilo.; water, ½ kilo.; phenol, 0·7—1·4 kilo.; sulphuric acid (66° B.), 1—1⅓ kilo. according to the amount of phenol, excluding the acid under (2), *vide supra*. When more than 1·4 kilo. of phenol is used, the product is pitchy.—R. L. J.

XIV.—TANNING; LEATHER, GLUE, SIZE.

Sulphuric Acid in Tanning Liquors or Extracts; Determination of ——. J. G. Parker and G. E. M. Payne. XXIII., page 457.

Tannin; Gravimetric Determination of —— *in Tanning Materials and Extracts.* J. Paessler. XXIII., page 458.

English Patents.

Adhesive Material Suitable for Use as a Glue or Size, or for Painting, Printing, or other purposes; Manufacture of ——. L. Préaubert and G. A. Thubé, Nantes. Eng. Pat. 11,028, May 14, 1903.

See Fr. Pat. 331,805 of 1903; this J., 1903, 1200.—T. F. B.

Leather; Manufacture [*Simultaneous Dyeing and Tanning*] *of* ——. P. D. Zacharias, Athens. Eng. Pat. 5305, March 6, 1903.

See Fr. Pat. 329,708 of 1903; this J., 1903, 1056.—T. F. B.

XV.—MANURES, Etc.

Basic Slag; Determination of the Phosphoric Acid Soluble in Citric Acid in ——. R. Sorge. XXIII., page 457.

French Patents.

Superphosphates; Manufacture of ——, *by means of Sodium Bisulphate.* M. Fournier. Fr. Pat. 336,872, Jan. 30, 1903.

A hot aqueous solution of sodium bisulphate is used to act upon calcium phosphate, in such proportion as to render soluble in water or in citrate solution the greater part of the phosphate, whilst giving a soft mass, easily dried and powdered. Or, powdered nitre cake is washed systematically in a series of vessels to obtain a more strongly acid solution with a residue of sodium sulphate. The acid solution is then used as in the first case.—E. S.

Manure; Apparatus for Removing Grease and Transforming Waste Materials into an Artificial ——. A. von Krottnaurer. Fr. Pat. 336,852, Nov. 20, 1903.

The apparatus includes three or more upright cylinders, opening at the bottom into a hopper having a valved opening into a chamber provided with an agitator and an outlet for the finished product. Each cylinder is separated into an upper and a lower compartment by a movable shutter, and steam is separately admitted at a regulated pressure to each lower compartment. The waste materials are charged into the cylinders, sorted according to their character: to one, waste skin or leather; to another, fragments of flesh and bones, &c., the proportion of each kind being adjusted to give a manure of the desired composition. The shutters are then opened, and the charge pass into the steam space beneath, after sufficient digestion in which, they descend by degrees into the hopper, in which they are sprayed by the injection of a suitable acid with steam. Outflow for grease and condensed water is provided from the cylinders to a trough common to all.—E. S

XVI.—SUGAR, STARCH, GUM, Etc.

Milk Sugar; Decomposition of —— by Caustic Lime. Constitution of Parasaccharin. H. Kiliani and P. Loeffler. Ber., 1904, **37**, 1196—1203.

In previous experiments the decomposition of milk sugar by caustic lime yielded mainly isosaccharin, together with a little metasaccharin. From the mother-liquors, the authors have now obtained a further yield of metasaccharin and a considerable quantity of parasaccharin. These two latter were obtained in the form of their barium double salt by sowing crystals of this salt [double barium meta- and para-sacchariuate] in the suitably treated mother-liquors. Attempts to isolate the parasaccharin in a crystalline condition were without result.

Constitution of Parasaccharin.—When barium parasacchariuate was oxidised by Ruff's process (hydrogen peroxide and ferric acetate) it was converted quantitatively into a pentose sugar, $C_5H_{10}O_4$, m. pt. 82° C., optically inactive. This sugar yielded a benzylphenylhydrazone crystallising from dilute acetone in prisms melting at 112°—114° C. Since this pentose contains only 4 atoms of oxygen, it possesses a CH_2 group, and the constitution of parasaccharinic acid is therefore represented by the formula $CH_2(OH).CH_2.C(OH)(COOH).CH(OH).CH_2OH$. —J. F. B.

Potato Starch; Comparison of the Products of the Hydrolysis of —— with those obtained from Cereal Starches. J. O'Sullivan. Proc. Chem. Soc., 1904, **20**, 65.

In this investigation it was established by six series of hydrolytic experiments on potato, Lintner's malt, barley, maize, and rice starches, with both malt extract and diastase, that the products of the hydrolysis of potato starch, as regards the percentages of maltose and dextrin, bear no quantitative relationship to those yielded by the other starches, and that therefore the products of the hydrolysis of the other starches could not be inferred from the hydrolysis of potato starch.

English Patents.

Syrup from Beets, Cane, Corn, Root Crops, or other Substances containing Saccharine Matter; Process of Obtaining ——. W. C. Salisbury and A. J. Kramper, Dakota. Eng. Pat. 26,665, Dec. 5, 1903.

See U.S. Pat. 748,314 of 1903; this J., 1904, 124.—T. F. B.

Erratum.

This J., 1903, page 373 (Eng. Pat. 22,537, Oct. 16, 1902, C. B. Duryea), the description beginning with "*This process*" and ending with "*modified starch,*" to the first semicolon, ought to have read as follows:—"The process of producing maltose consisting in providing [as the special raw material] a thin boiling or modified starch having mixed therewith a very dilute acid, cooking the mixture," and so on as *per loc. cit.*

United States Patents.

Diffusion Battery [Sugar]. A. Rak, Cesky Brod. U.S. Pat. 755,546, March 22, 1904.

The battery consists of a series of slightly conical worm-presses, the narrow end of one member communicating with the wide end of the next member, and each member erminating in a narrow juice-stopper and means for withrawing the juice. The chips, as they reach the narrow art of each press, are shovelled into the wide part of the ext one, travelling in a zig-zag course to the end of the attery.—J. F. B.

Dextrin; Manufacture of ——. G. Reynaud, Paris. U.S. Pat. 755,390, March 22, 1904.

ee Eng. Pat. 17,506 of 1902; this J., 1902, 1290.—T. F. B.

tarch; Manufacture of ——. R. Goldschmidt, Tajkovitz, d J. Hasek, Smichov. U.S. Pat. 755,479, March 22, 1904.

e Fr. Pat. 331,061 of 1903; this J., 1903, 1142.—T. F. B.

French Patents.

Molasses; Process of Obtaining —— by the direct Boiling of the Syrup. M. Kohn. Fr. Pat. 337,135, Nov. 27, 1903.

The boiled charge is cooled in the vacuum pan itself by a circulation of cold water or air; it is then discharged and treated in the centrifugals at once. For the purpose of cooling, a system of fixed coils or rotary hollow stirring bodies is supplied which, in the case of cooling by air, may be perforated in such a way that the cold air escapes through the mass of sugar.—J. F. B.

Starch and Dextrin; Process and Apparatus for Preparing Soluble ——. Calico Printers' Assoc., Ltd., W. Browning, and J. J. Barlow. Fr. Pat. 336,903, Nov. 23, 1903.

Powdered starch, previously partially dried and heated up to the desired temperature of the reaction, is treated in a rotary converter with an acid, *e.g.*, hydrochloric acid, in the state of gas, vapour, or fine spray. The acid is preferably volatilised, in known quantity, from a solution, and the vapour is introduced to the converter by means of a porcelain or glass pipe, passing through a hollow trunnion and terminating inside the vessel in the form of a swan's neck. For soluble starch a temperature of 54° C. is employed, and for dextrin a temperature of 76°—93° C. —J. F. B.

Vegetable Glue; Manufacture of Solid ——. F. Virneisel. Fr. Pat. 337,001, Nov. 16, 1903.

Starch (or other amylaceous substances) is macerated in 1 per cent. soda lye, and treated with oxidising agents (sodium peroxide, hydrogen peroxide, or alkali hypochlorite) until a product intermediate between natural starch and "soluble" starch is formed, which when neutralised, washed, and dried, dissolves readily in boiling water, and forms a thick viscous liquid.—R. L. J.

XVII.—BREWING, WINES, SPIRITS, Etc.

Amylocellulose; Enzymic Formation of ——. A. Fernbach and J. Wolff. Comptes rend., 1904, **138**, 819—821.

If a starch paste which has been liquefied at 120° C. be treated with a small quantity of an active malt extract at the ordinary temperature for such a short time (15 minutes) that no appreciable quantity of amylocellulose is formed, and if the mixture be then boiled or heated at 120° C. so as to destroy the enzymes present, this ebullition in no way interferes with the subsequent production of amylocellulose. The quantity of amylocellulose produced in 24 hours is just as great as when a similar quantity of malt extract is allowed to act for the same time without ebullition. This is the first case recorded in which an enzymic action only requires to be started in order to continue of itself, in spite of the subsequent destruction of the enzyme, with a speed and intensity proportional to the quantity of enzyme originally added to start the action. —J. F. B.

Maltase; Law of the Action of ——. Influence of the Concentration of the Maltose. E. F. Terroine. Comptes rend., 1904, **138**, 778—779.

The results of a number of experiments on the action of Taka-diastase on solutions of maltose of different strengths in 0·5 per cent. sodium fluoride solution, show that the influence of the concentration of the maltose (a) on its speed of hydrolysis (v) can be expressed by the formula: $v = k\,a/(1 + m\,a)$, where k and m are constants depending on the conditions of the experiment and of the enzyme. The same expression has been shown by Henri to hold good for the actions of invertase, emulsin, diastase, and trypsin.—T. H. P.

Maltase; Action of ——. Constancy of the Enzyme action. C. Philoche. Comptes rend., 1904, **138**, 779—781.

The author has made comparative experiments on the action of maltase (Taka-diastase) at 40° C. on solutions containing (1) 6 per cent. of maltose, (2) 4 per cent. of maltose and 2 of dextrose, and (3) 2 per cent. of maltose and 4 of dextrose. The results show that the activity of the enzyme does not vary in the first 24 hours of its action, so that, during any part of this period, the amount of maltose converted into dextrose is proportional to the mean concentration of the maltose.—T. H. P.

Top Fermentation Yeast; Fermentation Experiments with Cell Juice Expressed from ——. A. Harden and W. J. Young. Ber., 1904, **37**, 1052—1070. (Compare this J., 1900, 1127.)

The authors prepared expressed cell juice from English top fermentation beer yeast, the juice being clarified by centrifugal treatment. The average extent of the fermentation of sugar [glucose] by the juices obtained was considerably less than that found by Buchner with juices from bottom fermentation yeast. The extent of the autofermentation of the juices was very variable, but fell within the limits recorded for bottom-yeast cell juice. The fermentation due to the added sugar was frequently no more and in some cases even less, than that due to autofermentation. The total fermentation in the first 24 hours was considerably greater than with Buchner's bottom-yeast cell juices, the specific differences between the activity of the juices prepared from the two types of yeast being shown in the later stages. The fermentation when yeast-glycogen was added was considerably less than when an equivalent quantity of glucose was added. The ratio of alcohol to carbon dioxide was 0·96 (average) as against a theoretical ratio of 1·04; it was the same for autofermentation as for glucose fermentation, and was independent of the activity of the juice. The effect of dilution on the autofermentation was very slight, but the fermentation of glucose by juice diluted with three times its volume of water was reduced sometimes by nearly one-half. On the other hand, the dilution of the juice with glucose solutions had no adverse effect on the fermentative power. Determinations of the cupric-reducing power by Pavy's method showed that the quantity of reducing sugar disappearing during fermentation was considerably greater than the quantity corresponding to the alcohol and carbon dioxide produced; this apparent loss of reducing sugar amounted to 14—36 per per cent. of the total quantity present, and was generally greatest when the juice was diluted with glucose solutions. The whole of the reducing sugar so lost could, however, be recovered by inversion with 3.N-hydrochloric acid for 3 hours at 100° C. The nature of the non-reducing substance produced by the juice during fermentation has not been determined; the quantity formed was, however, found to be independent of the zymase-content of the juice.

—J. F. B.

Bottom Fermentation Yeasts; Comparative Investigation of four ——. *VI. Characters of Old Colonies on Solid Media.* H. Will. Zeits. ges Brauw., 1904, **27**, 176—181, 193—198, 210—214. (See also this J., 1899, 1039.)

The colonies sown on 10 per cent. wort-gelatin from active fermentative cells show no specific differences in their early stages. After a certain stage, long, delicate, sausage-shaped cells accumulate in the lower layers and appear at the edges, either as simple warty or manifold grape-like appendages on the underside of the colonies, growing outwards later, fan-like, in the form of "streamers." The value of the colonies from a diagnostic point of view begins with the appearance of these "streamers." The form of the "streamers" determines the future shape of the old colony; if the appendages were simple, the "streamers" are undivided, but if they were grape-like the "streamers" are manifoldly ragged. The form of the old colony also depends to some extent on the composition of the nutrient liquid and the nature of the agglutinant; it is, however, unaffected by the temperature at which growth takes place. The forms of the colonies of the four races of yeast were studied until they broke down into slime.

Anatomical Structure of Old Colonies.—The old colonies of all the races studied were constructed on the same ground-plan. In the earlier stages, the centre, corresponding to the original sowing, contains a predominating quantity of roundish and oval cells; on the lower side are the same elongated elements as compose the appendages on the underside of the edge-portions. At the later stages the central crater contains, under a surface of slime, mainly thick-walled, sausage-shaped cells. The cells which cause the characteristic form of the edge-portions of the colonies consist almost entirely of budding bands of very long, thin-walled sausage-shaped cells, which also stretch downwards like root-hairs; these cells contain much glycogen, and are often separated by cross-walls extending across the whole diameter of the cells. The top surface of the edge-portions is covered (as by bark) by a layer of compressed roundish or oval cells, characterised by great richness in fat-globules. The thick-walled elongated cells found in the central crater are quite different from the elongated cells of the edge-portions. They contain in their net-work occasional large, thick-walled, roundish, or oval cells, containing a large vacuole and rich in oil and glycogen; together with these cells are "resting cells" [chlamydospores]. These two forms are to be regarded as the mother cells of the elongated, thick-walled, mycelial threads composing the centre at advanced stages of growth; which elongated elements are identical with the cells of the second generation found in the yeast-films of old cultures in liquid media. It is therefore concluded that old colonies on solid media correspond, at all stages and in every respect, with film-formations on the surface of liquids. The differences in structure of the old colonies of the four races of yeast, depending mainly on variations in the relative numbers of their component elements, are minutely described, and correspond exactly with similar variations previously noticed in the yeast-films of cultures in liquid media.—J. F. B.

"Spring" Mashing Process; Determination of Suitable Saccharification Temperatures for the ——. M. Hartmann. Woch. Brau., 1904, **21**, 174—175.

Since every different parcel of malt is liable to require a different temperature of saccharification by the "spring" mashing process if the final degree of attenuation of the beer is to be maintained constant, it is desirable to include a determination of the necessary saccharification temperature in the laboratory analysis of the malt. Two mashing beakers are employed, one as the mash-tun and the other as the mash-copper; 50 grms. of grist are mixed with 150 c.c. of water at 35° C. in the first mashing beaker, and maintained at that temperature by means of a water-bath for half-an-hour. Before the end of that time, 100 c.c. of water are heated in the other beaker to a temperature 2° C. higher than the temperature of saccharification to be tested. The contents of the mashing beaker are then gradually added to the water in the second beaker by means of a spoon, stirring and keeping the temperature practically constant by a flame underneath; this operation can be performed in 10—12 minutes. The beaker containing the mash is then placed in a water-bath, previously heated to the desired temperature, and the contents are stirred until saccharification is complete. The mash is then boiled, cooled, made up to a weight of 450 grms., and filtered. The wort is subsequently fermented with some of the yeast of the brewery at a temperature of 25° C. for 48 hours, and the final degree of attenuation is determined. In most cases three experiments suffice to determine the saccharification temperature of a sample of malt necessary to produce the desired degree of fermentability. The following table shows the different behaviour of different types of malt when tested in the above manner.

"Spring" Saccharification Temperature.	Apparent Final Attenuation.		
	Pilsen Malt.	Munich Malt.	"Brown beer" Malt.
	Per Cent.	Per Cent.	Per Cent.
68° C.	78·9	69·2	64·0
70° C.	70·0	57·7	49·6
72° C.	63·2	49·9	42·1

—J. F. B.

Beer; Turbidities in —— caused by Tin. Dinklage. Zeits. ges Brauw., 1904, **27**, 209—210. (See also this J., 1904, 332, 333.)

Pale beer is far more liable to turbidities from contact with tin than dark beer; the previous removal of the carbon dioxide from the beer has only a very slight effect in delaying the appearance of turbidity. The production of turbidity by tin is not attributable to the presence of traces of the grey, allotropic modification of tin. Pieces of tin which have once been used to produce turbidity tend to become indifferent, unless the surface be cleansed by means of acid. Pieces of brass, tinned by various methods, all possessed the same tendency to produce turbidity.

Beer containing a piece of tin pipe was pasteurised, with a view to obtaining the substance constituting the turbidity in the form of a precipitate, free from micro-organisms.

The turbidity rapidly appeared and increased on long standing, but even after six months the milky liquid showed no signs of coagulation, either when heated or when treated in other ways, whilst the particles were so fine as to be indistinguishable under the microscope.—J. F. B.

Esters; Production of ——, in Alcoholic Fermentation. T. Bokorny. Chem.-Zeit., 1904, **28**, 301—302.

In order to determine whether the production of esters is primarily connected with alcoholic fermentation, the author investigated the fermentation of highly concentrated sugar solutions, such as were obtained by triturating solid sugars with pressed yeast. With sugar concentrations of 48 per cent. both cane sugar and glucose fermented readily, with the production of esters. With a sugar concentration of 58 per cent., glucose alone showed fermentation and a production of esters; cane sugar showed neither, owing to the inhibition of the activity of the invertase at so high a concentration. With sugars at 74 per cent. no fermentation or odour was observed in either case. When 10 grms. each of glucose, milk sugar, dextrin, egg-albumin, and peptone were mixed respectively with 15 grms. of pressed yeast, fermentation and production of esters took place only in the case of glucose, although the dextrin showed signs of fermentation, but with a rather unpleasant odour. Thus the presence of fermentable sugar is necessary for the production of esters. Hence it is concluded that the esters are normal by-products of the primary action of yeast-zymase upon fermentable sugar, and are in every way comparable with such by-products as glycerin and succinic acid. They have nothing to do with the secondary effect of the dying yeast-cells.
—J. F. B.

Wines, Natural, and Grape Stones; Determination of an Organic Phosphorus Compound in ——. J. Weirlich and G. Ortleib. Arch. der Pharm., 1904, **242**, 138—143.

Having met with a natural sweet wine from Thyra, which showed the high percentage of 0·095 of phosphoric anhydride, as compared with 0·053 per cent. in a Greek wine, and 0·02 to 0·06 in a wine from Tokay, the authors have investigated the cause of this large difference. It was found that the stones of the grapes from which the wine was prepared contained phosphorus in the form of an organic compound equivalent to 0·2854 per cent. of lecithin, extracted by ether and petroleum spirit. The extractive matter from the wine was found to yield to absolute alcohol an amount of a soluble organic phosphorus compound equivalent to 0·35 per cent. of lecithin. This wine-lecithin was also extracted by shaking out with ether and chloroform the residue obtained on distilling the wine *in vacuo*. It is found that wines strongly alcoholic, made from grapes rich in seeds, contain a much larger percentage of lecithin than those of lower alcoholic strength. Such wines also are invariably richer in nitrogen. This goes to prove that the phosphorus is present as a lecithin and not as anhydro-oxymethylenediphosphoric acid, which Posternak has shown to occur in seeds. It was found, moreover, that by disintegrating the seeds before fermentation, both the organic phosphorus and the nitrogen content of the resulting wine were slightly increased. It is to the presence of this lecithin in wines of this class that the authors attribute their recuperative value for medicinal use.—J. O. B.

Methyl, Ethyl, and Propyl Alcohols; Critical Temperatures of Solution of ——. Preparation of the Anhydrous Alcohols. L. Crismer. Bull. Soc. Chim. Belg., 1904, **18**, 18—54.

The determination of the critical temperature of solution of a suitable petroleum oil in strong alcohol affords a rapid means of measuring the proportion of water in the latter.

Ethyl Alcohol.—5 c.c. of the alcohol are placed in a graduated tube with 5 c.c. of American petroleum; the tube is closed with a rubber stopper through which a thermometer, reading to 0·1° C., is passed, the bulb being fully submerged. The mixture is warmed until it becomes homogeneous and then gradually cooled; the point at which a turbidity, due to saturation, appears is the critical temperature of solution. The critical temperature for anhydrous alcohol being, for instance, 14·8° C., the addition of 0·1 per cent. of water raises it 1·8° C. The method is therefore equivalent in delicacy to a determination of the density to five places of decimals. Anhydrous alcohol is prepared by heating commercial absolute alcohol with fresh quicklime in a closed flask. When the critical temperature has been reduced to a minimum, the alcohol is distilled off. Any traces of water which may still be present appear in the first portions of the distillate. The alcohol is anhydrous and pure when samples of 5 c.c., taken at intervals during distillation, show a constant minimum critical temperature of solution. Metallic sodium is useless for the preparation of anhydrous alcohol. Anhydrous alcohol having been obtained, a table and curve can be constructed showing the increase in the critical temperatures of solution when increasing proportions of water are added to the mixture of alcohol and petroleum. Different samples of petroleum give different results with the same alcohol, but if each sample be standardised with anhydrous alcohol, the curves showing the proportions of water are all parallel; the petroleum should be preserved in the dark. Anhydrous alcohol absorbs moisture from the air with the greatest avidity.

Methyl Alcohol.—Similar determinations can be made with methyl alcohol if a light petroleum spirit of the kind known as "gasoline" be employed. For 2 c.c. of methyl alcohol, about 5 c.c. of gasoline are necessary to give constant results. Quicklime is useless for the preparation of anhydrous methyl alcohol. The alcohol should be treated repeatedly with lumps of metallic sodium, under a reflux condenser, and should be distilled off between each treatment. In the case of methyl alcohol, any water present distils in the last fractions.

n-Propyl Alcohol.—The critical temperature of solution is determined with 3 c.c. of propyl alcohol and 3—4 c.c. of paraffin oil. The phenomena correspond closely with those observed in the case of ethyl alcohol. Anhydrous propyl alcohol is readily obtained by the use of quicklime.

From the critical temperatures of solution the author has been able to show that anhydrous ethyl alcohol is hydrated by treatment with barium oxide, owing to the formation of the ethylate, thus: $2\,C_2H_5OH + BaO = (C_2H_5O)_2Ba + H_2O$. Similarly, calcium oxide hydrates methyl alcohol. When determined with the same liquid (paraffin oil), the critical temperatures of solution for the homologous series of propyl, ethyl, and methyl alcohols increase by a constant difference of 76·2° C.—J. F. B.

Formaldehyde Vaporiser Jet for Disinfecting Pipes [*in Breweries*]. F. Heyder. XVIII. C., page 452.

English Patent.

Malting and Drying Apparatus. F. H. C. Mey, Buffalo. Eng. Pat. 25,277, Nov. 19, 1903.

A pneumatic malting drum is constructed with sectional walls. Each section can be moved and fixed nearer to or further away from the central axis of the drum. Whilst the malt is germinating, the walls may be expanded so that the grain fills the drum to its fullest capacity, but whilst the malt is being dried, the sections are consecutively moved inwards, contracting the capacity of the drum in proportion as the grain shrinks, so that the drum always remains practically full, and the heated air cannot pass through it without drying the malt.—J. F. B.

Alcohol Vapour; Prevention of Losses of ——, in Distilleries. J. S. von Szathmary, Pankota. Eng. Pat. 4011 Feb. 17, 1904.

Losses of uncondensed alcohol vapours from the discharge openings of the condenser worms during distillation are prevented by providing an auxiliary pipe branching up from the principal discharge pipe of the condenser, and leading to a second condensing worm. Both the principal discharge pipe and the auxiliary condenser are fitted at the discharging end with reducing caps, which prevent the outflow of alcohol other than in the liquid form, the vapours being retained in the auxiliary condenser until they are condensed.—J. F. B.

United States Patent.

Grain; Method of Steeping ——. V. Lapp, Lindenau, Germany. U.S. Pat. 755,144, March 22, 1904.

See Eng. Pat, 11,749 of 1903; this J., 1903, 1144.—T. F. B.

French Patent.

Wort contained in the Malt of Breweries, Distilleries, and similar Works; Process and Apparatus for the Rapid Extraction of ——. E. de Meulemeester. Fr. Pat. 336,892, Nov. 23, 1903.

See Eng. Pat. 25,582 of 1903; this J., 1904, 264.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Bakers' Yeast; Determination of the Dough-raising Power of ——, and the Influence of Baking Adjuncts on Dough Fermentation. A. Pollak. Zeits. Spiritusind., 1904, **27**, 125—126.

The only serious objection against Metzler's process (this J., 1903, 877) is that the dough employed is too dilute. In the following modification the author works as nearly as possible under the conditions employed in practice: 100 grms. of flour of known character and 2 grms. of the yeast are weighed out; at the same time 60 c.c. of distilled water at 30° C. are measured into a beaker. A preliminary dough is first made by mixing up the yeast with the water and adding a sufficient portion of the 100 grms. of flour to make a fairly fluid dough. The beaker is then placed in the thermostat at 30° C. for 30 minutes. The greater portion of the rest of the flour is spread upon a board and the prepared dough is poured on it and mixed, first with a rod and then with the hands. The beaker is then thoroughly cleaned out by adding more of the dry flour and scraping with a knife. The remainder of the flour (about 3 grms.) is used for dusting the board and removing all dough from the hands. The mixing up to this point should be done in five minutes, after which the dough is thoroughly kneaded on the board for a further five minutes and rolled into a cylindrical form. The roll of dough is dropped into a previously warmed and greased graduated measuring cylinder, and caused to occupy an ascertained volume by swinging the cylinder and levelling the surface with a wooden stamper. The cylinder is placed in the thermostat at 30° C., and the increase in volume of the dough is read off every 20 or 30 minutes, the surface being levelled each time. Curves are plotted showing the increase in volume with the time, the volumes being expressed as percentages of the original. With a given type of flour and constant method, time and temperature of manipulation, the raising power of the yeast is shown by the increase in volume after two hours. The time for which the increased volume is maintained should also be noted, together with the elasticity, nature of the porosity, and odour of the dough. The influence of baking adjuncts and yeast stimulants, such as malt extract and malt flour, can also be studied by this method.—J. F. B.

English Patents.

Chicory; Process of Preparing Dry Extract of ——. F. J. Reichert and J. J. Heydemann, London. Eng. Pat. 9133, April 22, 1903.

Chicory root is extracted with lime-water, and the clear extract evaporated to a syrupy condition, preferably *in vacuo*; the syrup is then dried and roasted. The distillates from the evaporation and drying of the extract are extracted with chloroform, and the product obtained by evaporating the chloroform solution is added to the chicory extract previous to roasting.—T. F. B.

Coffee Preparations; Manufacture of —— A. Farogó and S. Bartha, both of Buda-Pesth. Eng. Pat. 3465, Feb. 11, 1904.

A concentrated extract is made of the coffee fruit separated from the bean, that is to say, what is termed "cocoli." The latter is roasted in a closed receptacle before being extracted, and may contain a certain proportion of coffee beans.—W. P. S.

United States Patent.

Milk-Product resembling Butter; Process of Making a ——. J. H. Campbell, New York. U.S. Pat. 755,843, March 29, 1904.

An air-blast is driven through skimmed milk at a moderately low temperature, until the latter is partially concentrated. Approximately the same quantity of cream which was in the original milk is then added, and the mixture concentrated at a non-sterilising temperature to about the consistency of butter. The product is finally granulated.
—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

English Patent.

Water or Sewage; Apparatus for the Purification of ——. J. N. McClintock, Boston. Eng. Pat. 6927, March 25, 1903. Under Internat. Conv., March 25, 1902.

See U.S. Pat. 719,357 of 1903; this J., 1903, 314.—T. F. B.

(*C.*)—DISINFECTANTS.

Alcohols of the Methyl, Ethyl, Butyl, and Amyl Series; Comparative Sterilising and Antiseptic Action of ——. G. Wirgin. Zeits. Hyg., 1904, **46**, 149; through Chem.-Zeit., 1904, **28**, Rep. 85.

The alcohols were tested in aqueous solutions upon anthrax spores and *Microc. pyog. aur.* The disinfecting power increases with the molecular weight; the tertiary alcohols act, however, less powerfully than the primary and secondary alcohols of the group next below. The order of bactericidal power is as follows (downwards): 30 per cent. solution of propyl alcohol, 60 per cent. ethyl alcohol, 60 per cent. methyl alcohol, saturated solutions of isobutyl, tertiary amyl, and amyl alcohols. The above concentrations also represent the most powerful solutions of the respective alcohols as against dry spores. These solutions are more powerful than a 1 per cent. solution and rather less powerful than a 3 per cent. solution of phenol. None of the above alcohols kill spores at ordinary temperatures. All absolute alcohols and the highest concentrations of the water-soluble alcohols are almost without action on dry spores. Against moist spores, the highest concentrations are almost as powerful as the medium concentrations. The most powerful alcoholic solutions are stronger than 4 per cent. boric acid, 4 per cent. potassium chlorate, and 2 per cent. lead acetate, zinc sulphate, and copper sulphate solutions. The alcohols have a good penetrative action upon embedded spores.—J. F. B.

Formaldehyde Vaporiser Jet for Disinfecting Pipes. F. Heyder. Woch. Brau., 1904, **21**, 185.

The vaporiser jet is constructed on the principle of the gas-blowpipe. There is a narrow central pipe terminating in a fine jet and connected below with the supply of formalin solution and an outer wide pipe terminating as an annular jet around the small central jet. This outer pipe is connected with a steam supply. In use, the nozzle of the

apparatus is inserted in the pipe or other vessel to be disinfected, for which purpose an external screw thread is supplied, the central tube is connected with the formalin solution and steam is admitted to the outer tube. The formalin is thus sucked up to the nozzle and volatilised by the steam escaping there. The operation is continued until an odour of formaldehyde appears at the further end of the pipe, &c. which is being disinfected, the latter being then sealed up and left full of the vapour for about two hours.
—J. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

English Patents.

Safety Paper and Ink; Preparation of Commercial ——. J. Rowan, Ottawa. Eng. Pat. 3909, Feb. 16, 1904.

The paper is impregnated with a solution of "potassium prussiate" and ammonia, it is subsequently printed with a design in an ink containing "iron perchlorate," potassium iodide, and caustic soda incorporated in oil or varnish. These ingredients are prevented from mutual interaction by the oily medium of the ink, but when the paper is tampered with by acid or alkaline reagents a discoloration is produced. This discoloration can be intensified by mixing Magenta or manganese with the printing ink.—J. F. B.

Waste from Wood-grinding Mills, Paper and Cellulose Factories, Utilisation [Papier-maché] of the ——. E. de Pass, London. From C. Gaertner, Berlin. Eng. Pat. 27,339, Dec. 14, 1903.

The short-fibred waste from paper, cellulose, and wood-grinding mills is utilised as the plastic material for reproducing the contours of moulds. This fine pulp can be worked into the meshes of a coarsely woven fabric placed in contact with the moulds, or it can itself be allowed to lie upon the surface of the mould and the necessary rigidity imparted by a backing of long-fibred material. The waste may also be employed together with a cementing medium for the manufacture of linoleum or "lincrusta."—J. F. B.

French Patents.

Paper; Continuous Manufacture of ——, *coated on one or both sides.* P. V. Rolier. Fr. Pat. 337,199, Nov. 30, 1903.

The paper is passed in continuous length through a coating machine and thence over a drying apparatus so constructed that the coated surface is not touched until it is nearly dry; after drying, the paper is moistened and its other surface is treated in the same manner. The improved coating machine possesses a perforated cylinder, inside which a partial vacuum is maintained; means are also provided for adjusting the pressure on the brushes.—J. F. B.

Nitrocellulose and similar Substances; Compounds of ——. D. Bachrach. Fr. Pat. 337,060, Oct, 27, 1903.

See U.S. Pat. 743,422 of 1903; this J., 1903, 1304.—T. F. B.

Celluloid in Paste Form; Process for the Manufacture and Application of ——, *to the Imitation of Horn, Shell, Ivory, Mother-of-Pearl, &c.* T. Didier. Fr. Pat. 336,970, Nov. 3, 1903.

Twenty parts of celluloid, 40 parts of acetone, 40 parts of 90—95 per cent. alcohol, and 1 to 5 parts of castor oil are intimately mixed, and heated at from 20° to 60° C. for some hours, when a homogeneous paste is obtained, which can be coloured and transferred to moulds. The solvents are then allowed to evaporate, and the product is coloured to imitate horn, shell, &c.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Iodoform; Electrolytic Preparation of —— *from Acetone.* J. E. Teeple. J. Amer. Chem. Soc., 1904, **26**, 170—177.

The substitution of acetone for alcohol in the preparation of iodoform is to be recommended on account both of its cheapness and of the fact that only 6 atoms of iodine are required per molecule of iodoform produced in place of 10 atoms necessary when alcohol is used. The author's experiments show that the important factors in the electrolytic formation of iodoform from potassium iodide and acetone are: (1) Avoidance of an excessive formation of alkali in the solution. (2) Maintenance of a fairly low temperature to prevent much potassium iodate being formed. (3) Thorough stirring, so that the very dilute solution of iodine produced at the anode may always react with a very dilute solution of potassium hydroxide produced at the cathode; this is perhaps best obtained by means of a rotating anode. (4) A comparatively low anode current density to prevent formation of iodate and a high cathode density to avoid reduction of hypoiodite already formed. As regards (1), the best means of neutralising the alkali formed and that most adaptable to a continuous process is the gradual addition of iodine, which acts as follows: $2KOH + I_2 = KI + KIO + H_2O$; $3KIO + C_3H_6O = CHI_3 + KC_2H_3O_2 + 2KOH$; for every molecule of iodoform formed, 1 mol. of acetone, 1 mol. of potassium iodide, and 2 atoms of iodine should be added to the solution to bring it to its original condition, neglecting the potassium acetate, which does not reduce the yield of iodoform to a very great extent. A current yield of 94·4 per cent. of iodoform was obtained under the following conditions: 225 c.c. of water, 25 grms. of potassium iodide, and 2 c.c. of acetone were electrolysed for 65 minutes, the anode current density being 2 ampères per sq. dcm., and the cathode used being a platinum wire, the end of which dipped just below the surface of the solution; during the electrolysis, 1·56 grms. of iodine were added at intervals, so as to keep the liquid just slightly coloured. If the stirring be thorough, the anode current density may be increased to 6—8 ampères per sq. dcm., yields of 89—91 per cent. being then obtained. To determine the influence of the accumulated potassium acetate on the yield of iodoform, the following experiment was made: Electrolysis of 150 c.c. of water, 18 grms. of potassium iodide, and 2 c.c. of acetone, was first carried out under conditions similar to those given above (with addition of iodine), a current yield of 92 per cent. of iodoform being obtained. Sufficient potassium iodide and acetone were then added to restore the solution to its original condition (except for about 1 grm. of potassium acetate formed), and then 18 grms. of potassium acetate. On electrolysis, this solution gave a current yield of 80 per cent. of iodoform. So that when the potassium acetate has accumulated until it exceeds the amount of potassium iodide, and the solution contains over 12 per cent. of it, the yield is lowered by not more than 15 per cent.—T. H. P.

Cellotropin [Monobenzoylarbutin]. Pharm.-Zeit., 1904, **49**, 272.

About 22 parts of arbutin are dissolved in water, and gradually mixed, with constant agitation, with 8 to 10 parts of benzoyl chloride added in small quantities at a time, the free hydrochloric acid being neutralised each time with alkali. Benzoylarbutin is then formed as a white precipitate, which is washed, dried, and crystallised from hot water. Monobenzoylarbutin is a white, odourless, and tasteless powder, soluble in water, 1:80 at 100° C.; 1:1,300 at 15° C. The aqueous solution is neutral. M. pt. 184·5° C.
—J. O. B.

Vioform [Iodochlorohydroxyquinoline]. R. Wehrle. Suppl. z. Corr. Bl. Schweiz. Aerzte, 1903; through Pharm. Centralh., 1904, **45**, 239.

Chloro-5-hydroxy-8-quinoline is dissolved in alkali and digested with an equivalent quantity of iodine in potassium iodide solution; or an alkaline solution of a chlorohydroxyquinoline salt is mixed with the requisite amount of potassium iodide and the iodine liberated by means of chloride of lime or other suitable reagent. Iodochlorohydroxyquinoline thus obtained is a greyish-green bulky powder; it is a powerful bactericide and antiseptic, and has been used as a substitute for iodoform.—J. O. B.

Strychnine; Action of Bromine and of Iodine on ——. L. Martin. Bull. Soc. Chim., 1904, **31**, 386—391.

The action of bromine and hydrobromic acid on strychnine yields *monobromostrychnine*, $C_{21}H_{21}BrN_2O_2$; colourless needles, soluble in acidulated water or in alcohol, melting at 199° C. The iodomethylate and iodo-ethylate were prepared and analysed. If the acid solution obtained when the bromination of strychnine is just completed, be poured into a large volume of water containing more of the brominating mixture, there is obtained a yellow crystalline powder of *monobrominated monobromostrychnine hydrobromide*, $HBr.C_{21}H_{21}BrN_2O_2.Br$, which contains three differently combined bromine atoms. *Dibromostrychnine*, white crystals of similar solubilities to the mono-compound, melting at 130° C., and the hydrobromide of a brominated derivative, were also prepared. Iodic and hydrobromic acids reacting on strychnine give *hydriodide of mono-iodated mono-iodostrychnine*, from which successive treatment with acetone and ammonia removes the added iodine and the hydriodic acid, leaving *mono-iodostrychnine*, $C_{21}H_{21}IN_2O_2$, a slightly chestnut-tinted crystalline powder, melting at 188° C. *Di-iodated strychnine*, $C_{21}H_{22}N_2O_2.I_2$, is obtained by reacting with iodine and hydriodic acid on strychnine; ruby-red crystals, decomposing before fusion, which give up all their iodine on solution in acetone.—J. T. D.

Otto of Rose; Some Newly Discovered Constituents of ——. H. von Soden and W. Treff. Ber., 1904, **37**, 1094—1095.

The alcohol *nerol*, recently discovered in oils of neroli and petit-grain (this J., 1903, 228, 1100), is present in otto of rose to the extent of 5—10 per cent. It plays a most important part in the specific perfume of the otto. Otto of rose also contains about 1 per cent. of *eugenol*, identical with that from oil of cloves. By repeated fractional distillation *in vacuo* of the primary alcohols extracted from otto of rose, the authors have obtained a sesquiterpene alcohol, $C_{15}H_{26}O$, very similar to, if not identical with the *farnesol* obtained from oil of acacia flowers. This alcohol has a faint flowery perfume, somewhat resembling that of cedar-wood oil; it contains three double bonds and occurs in the otto to the extent of about 1 per cent.—J. F. B.

Terpene Compounds; Formation of ——, *in the Chlorophyll Organs of Plants.* E. Charabot and A. Hébert. Bull. Soc. Chim., 1904, **31**, 402—409.

Two lots of peppermint were grown; in one, the flowers were nipped off as they appeared, in the other they were allowed to develop. On a given date the whole were gathered, the flowers separated from the perfect plants, and the plants analysed. The results show that the deflowered plant contains more moisture, and has a greater relative development of stem than the normal plant, and that it contains both absolutely and relatively a greater amount of essential oil than the green parts of the normal plant. The proportion of combined to total menthol was also greater in the deflowered than in the green parts of the normal plant. Comparison of plants grown in sunlight and excluded from light showed that the latter retained much more water and a very much smaller proportion of essential oil than the former. From all these results it is clear that terpene compounds are elaborated under the influence of sunlight in the green or chlorophyll organs of the plant; though it is not proved that the whole of the terpene compounds in the flowers proceed from that source.
—J. T. D.

Arnisterol: the Phytosterol of Arnica Montana. T. Klobb. Comptes rend., 1904, **138**, 763—765.

From 6 kilos. of the flowers by treatment with solvents and saponification of the fatty oil obtained, a few grms. of pure *arnisterol*, $C_{28}H_{46}O_2$, were finally obtained, as rhombohedral crystals with one molecule of alcohol of crystallisation. The crystals lose their alcohol at 115°—120° C., melt at 249°—250° C., and sublime at a higher temperature. The substance dissolves in most organic solvents, but crystallises well only from alcohol. The acetone solution is dextrorotatory, and gives the colour reactions of phytosterols. The substance is quite distinct from the corresponding *anthesterol* obtained from Roman camomile, and from the other vegetable cholesterols.—J. T. D.

Safrol; Derivatives of ——, *and its Relationships to the Phenol Ethers, Eugenol, and Asarone.* H. Thoms and A. Biltz. Archiv der Pharm., 1904, **242**, 85—94.

The authors have prepared several derivatives of safrol with a view to ascertain the relations between safrol, eugenol, and asarone. By the action of nitric acid on dihydrosafrol, a mono- and a di-nitro derivative were prepared, but it was not found possible to introduce a third nitro-group, as in the case of dihydromethyleugenol. The first nitro-group entered the position (6) as in the nitration of piperonal and dihydromethyleugenol. By the action of anhydrous aluminium chloride on mononitrodihydrosafrol, the dioxymethylene group was split off and a dihydroxy-compound produced, which, on methylation, yielded mononitrodihydromethyleugenol. Anhydrous aluminium chloride is recommended as an agent for splitting off the dioxymethylene group, especially in cases where other agents are inapplicable, *e.g.*, in the presence of nitro-groups. By the action of anhydrous aluminium chloride on the mononitrodihydromethyleugenol obtained from dihydrosafrol, two isomeric compounds containing hydroxyl and methoxyl groups were produced, one melting at 52° C., and the other, containing water of crystallisation, at 78° C. The compound melting at 52° C. was ethylated and reduced to the corresponding amino-compound. The latter when oxidised yielded 1-propyl-4-methoxy-3.6-benzoquinone identical with the compound obtained by the oxidation of asarone.—A. S.

Caricari Elemi. A. Tschirch and L. Reutter. Archiv der Pharm., 1904, **242**, 117—121.

By shaking out the ethereal solution of Brazilian caricari elemi with ammonium carbonate solution, 5 per cent. of *isocarieleminic acid*, $C_{38}H_{56}O_4$, was removed. It is amorphous, and melts at 75°—76° C. Subsequent shaking out with sodium carbonate solution removes 12 per cent. of *carieleminic acid*, $C_{38}H_{56}O_4$, isomeric with the above, and 20 per cent. of *carielemisic acid*, $C_{37}H_{56}O_4$. Carielemic acid forms long white crystals: m. pt. 215° C. Carielemisic acid is amorphous and is obtained by precipitating the mother liquor, after separating the crystalline carieleminic acid with dilute acid; m. pt. 120° C. The other chief constituents are *amyrin*, $C_{30}H_{50}O$, 3 per cent.; *carieleresene*, $C_{24}H_{46}O_2$, 40 per cent.; essential oil, 3 per cent. The amyrin is identical with that isolated from other kinds of elemi, and is separable into α- and β-amyrin. The essential oil has an odour recalling turpentine, dill, and lemon. (Compare this J., 1903, 571.)—J. O. B.

Colophonia Elemi from Colophonia Mauritiana. A. Tschirch and O. Saal. Pharm. J., 1904, **72**, 467—468.

Colophonia elemi derived from *Colophonia mauritiana* from Mauritius has the following composition:—α-Isocolelemic acid, $C_{37}H_{56}O_4$, 10 per cent.; colelemic acid, $C_{39}H_{56}O_4$, 2 per cent.; β-isocolelemic acid, $C_{37}H_{56}O_4$, 8 per cent.; colamyrin, $C_{30}H_{50}O$, 25 to 30 per cent.; coleleresene $(C_{15}H_{24}O)_n$, 30 to 35 per cent.; volatile oil, 3 per cent.; with traces of bryoidin, a bitter substance, and foreign matter amounting to 10 per cent. *α-Iso-colelemic acid* was removed by shaking out the ethereal solution of the elemi with ammonium carbonate solution. It is amorphous; m. pt. 120—122° C. *Colelemic acid* and *β-iso-colelemic acid* were then removed by shaking out with sodium carbonate solution. The former is crystalline, separating from a mixture of methyl and ethyl alcohols; m. pt. 215° C. After separating this, β-isocolelemic acid was precipitated by pouring the mother liquor into acidified water. It is amorphous, m. pt. 120°. *Colamyrin* is identical with the amyrin of other elemis. It is separable into α-amyrin, m. pt. 181° C., and β-amyrin, m. pt. 192° C. The *essential oil* resembled that from carana elemi (this J., 1903, 571). Its odour was similar to a mixture of fennel, dill, and lemon oils. The major fraction distilled between 170—175° C. The residue left after steam distillation contained a small amount of bitter substance, also of a white crystalline body which was probably bryoidin, m. pt. 135·5° C. The indifferent *coleleresene* was amorphous; m. pt. 75 to 77° C.
—J. O. B.

Oil of Limes; Composition of Distilled ——, *and a New Sesquiterpene.* H. E. Burgess and Th. H. Page. Proc. Chem. Soc., 1904, **20**, 62.

The authors have isolated and identified *l*-terpineol (m. pt. 35° C.) as forming a large proportion of the oxygenated constituents of the oil. The peculiar odour of the oil which is attached to the terpineol fraction is due to an isomeric liquid terpineol of slightly lower boiling point. A new sesquiterpene of partially olefinic nature was also identified, which boils at 131° C. under a pressure of 9 mm. and at 262°—263° C. (uncorr.) under 756 mm., in the latter case, with slight decomposition; it has a sp. gr. 0·873 at 15° C. and is optically inactive; n_D is 1·4935 at 15°, and 1·4910 at 19·5° C. The sesquiterpene, for which the name "*limene*" is proposed, was characterised by the formation of a trihydrochloride (m. pt. 79°—80° C.); this was the only well-defined derivative obtained, and from it the hydrocarbon can be readily regenerated. The same sesquiterpene has been identified in hand-pressed lime oil and lemon oil, and the other oils of this series are being examined for it.

Alkaloids; Analysis [Identification] of ——, *by the Refractive Indices of their Crystals.* P. Kley. XXIII., page 458.

Pomegranate Bark, Coca Leaves, and Belladonna Leaves; Determination of Total Alkaloids in ——. E. Léger. XXIII., page 458.

Cocaine; Some New Reactions for Detection of ——. C. Reichard. XXIII., page 458.

Cinnamon Oil; Determination of Value of ——. A. Pauchand. XXIII., page 459.

French Patent.

Aldehydes; Process for Synthesising ——. G. Darzens. Fr. Pat. 337,175, Nov. 28, 1903.

Fatty or aromatic ketones are condensed by means of sodium, &c., with halogen- or amino-substituted acetic esters; the α-hydroxyacrylic esters thus obtained are saponified and decomposed by heat, or by distillation under reduced pressure, substituted acetaldehydes being obtained, which are applicable in perfumery. The reactions are as follows:—

$$\mathrm{R.R_1.CO + XCH_2COOC_2H_5 = HX + R.R_1.C:C(OH)COOC_2H_5}$$

$$\mathrm{R.R_1.C:C(OH)COOH = CO_2 + R.R_1.CH.CHO.}$$

The following aldehydes are especially claimed:—Methyl nonylacetaldehyde (from methyl nonyl ketone); *p*-methyl hydratropic aldehyde (from *p*-tolylmethyl-ketone); and α-methyl phenyl butylaldehyde (methyl benzylacetaldehyde) from methyl benzyl ketone.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Radium Effect; New ——. H. Stroud. Electrician, 1904, **52**, 958.

The author has succeeded in obtaining by means of radium rays, a photograph of the portions in relief on one side of a threepenny piece. The coin was placed directly in contact with a photographic plate, which was contained in an envelope opaque to light. A mica-covered box containing 10 mgrms. of radium bromide was placed on cardboard at a distance of 6 ins. above the photographic plate and the whole left for 10 days. On the same plate was also a medal. After development a practically perfect picture of the relief portions of the underside of the coin was obtained, but of the medal only those parts in contact with the plate could be distinguished; the other parts of the medal in relief but not in actual contact with the plate did not appear in the finished picture.—A. S.

United States Patents.

Printing Plates; Process of Making ——. B. Gisevius, Berlin. U.S. Pat. 755,225, March 22, 1904.

See Fr. Pat. 323,023 of 1902; this J., 1903, 441.—T. F. B.

Photographic Half-tone for Book-printing and Lithography; Method of ——. J. Vilim, Prague, and F. Hauser, Naefels. U.S. Pat. 755,417, March 22, 1904.

See Eng. Pat. 14,105 of 1902; this J., 1902, 1296.—T. F. B.

Colour Photograph and Process of Making same. R. W. Wood, Madison. U.S. Pat. 755,983, March 29, 1904.

Separate negatives are taken of the object to be photographed through red, green, and blue screens; positives, on glass, from these negatives are sensitised and used as plates on each of which is photographed a diffraction grating "adapted to give its appropriate colour"; a sensitised plate is exposed in succession under each of these positives, and developed. Another method consists in taking the photograph through colour screens "and through diffraction gratings associated therewith, each adapted to produce a colour corresponding to that of the screen used."—T. F. B.

French Patents.

Photographic Printing Process. L. J. B. Didier. Fr. Pat. 337,054, Oct. 22, 1903.

A bichromated gelatin film is exposed behind a negative or design, and immersed in a solution of a dyestuff of the colour desired for the picture. The coloured negative thus obtained is applied, under water, to paper or other support (preferably coated with gelatin). After a short contact, the film is removed mechanically, and a positive is obtained on the paper, which is said to contain full detail and good half-tone.—T. F. B.

Photographic Papers; Process for Preparing ——. I. Hoffsümmer. Fr. Pat. 336,873, Nov. 21, 1903.

See Eng. Pat. 25,390 of 1903; this J., 1904, 337.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

English Patents.

Explosive for Blasting, Signalling, and other purposes. A. Brock, Sutton. Eng. Pat. 10,836, May 12, 1903.

See Fr. Pat. 332,659 of 1903; this J., 1903, 1308.—T. F. B.

Safety Detonating Explosive; for use in Coal or other Fiery Mines or for General Blasting Purposes ——. W. J. Orsman, Wigan. Eng. Pat. 11,440, May 19, 1903.

The composition consists of either powdered aluminium (7 parts), ammonium nitrate (93 parts); or powdered aluminium (10 parts), ammonium nitrate (50 parts), and potassium or sodium nitrate (40 parts).—G. W. McD.

Matches; Manufacture of ——. J. H. Christensen, Copenhagen. Eng. Pat. 11,990, May 26, 1903.

In the manufacture of headless matches the match sticks are nitrated at the tips by immersion in 30 per cent. nitric acid before dipping in the igniting composition, this latter containing suitable potassium, barium, or lead compounds to neutralise the excess of nitric acid.—G. W. McD.

United States Patent.

Match Composition ——. F. E. Grimm, Utica. U.S. Pat. 755,653, March 29, 1904.

The composition consists of glue, zinc oxide, ground glass, gum benzoin, amorphous phosphorus, sulphur, lead hyposulphite, and potassium chlorate.—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

French Patent.

Photometric Apparatus. J. F. Simmance and J. Abady. Fr. Pat. 337,085, Nov. 3 1903.

See Eng. Pat. 4693 of 1903; this J., 1903, 1308.—T. F. B.

INORGANIC—QUALITATIVE.

Antipyrine; Application of —— in Analysis (Nitrite Reaction). C. Reichard. Chem.-Zeit., 1904, 28, 339—340.

The colour obtained by the addition of an acidified solution of antipyrine with a nitrite solution varies somewhat with the particular acid used, and its permanence depends on the concentration; for the most part, a solution containing not more than 0·1 per cent. of nitrite gives the best results. Rise of temperature lessens the permanence of the coloration. When either hydrochloric or sulphuric acid is used, a permanent green coloration is formed, the tint in the former case being, however, much bluer than in the latter. With oxalic acid the tint is hardly distinguishable from that with hydrochloric acid; with tartaric or acetic acid, the blue tint is intensified; and with trichloracetic acid the colour is pure deep green. The addition of strong acids or of alkalis to any of these green solutions changes the green tint to deep yellow. The reaction between antipyrine and nitrous acid is one of extreme delicacy, and affords an excellent means of detecting the latter; but owing to the variations in the tint which so readily occur, it is not to be recommended as the basis of a method of colorimetric quantitative estimation. As far as the author's experience yet goes, organic nitrites and nitro-compounds (*e.g.*, picric acid) do not behave similarly to the inorganic nitrites and nitrous acid, with antipyrine. (See also this J., 1896, 743.) —J. T. D.

INORGANIC—QUANTITATIVE.

Prussian Blue; Analysis of ——. C. Coffignier. Bull. Soc. Chim., 1904, 31, 391—396.

The author has further examined the solubility of Prussian blue in mixtures of hydrochloric acid and fatty alcohols (see this J., 1902, 1032, 1337; 1903, 472), propyl alcohol having been finally chosen as most suitable. Pure blues dissolve completely (0·5 grm. in 50 c.c. of the solvent); and on pouring the solution into water, filtering through a weighed filter, washing (this can be readily accomplished if alcohol be added to the water after the second washing), drying at 100° C., and weighing, 98·0 to 100·4, mean 99·7 per cent., of the substance taken, was recovered. The author applies this to the analysis of commercial blues. The chief of these are Wheelwrights' blue, Mineral blue, Paris blue, and Fecula blue, in which the Prussian blue is mixed respectively with barium sulphate, kaolin and barium sulphate, alumina, and starch; but other additions sometimes found are calcium carbonate and sulphate. Known mixtures of Prussian blue with these substances were treated as follows:—2 grms. were treated with 100 c.c. of the solvent, and made up, after complete solution of the blue, to 200 c.c. If the solution were clear (calcium carbonate, starch) 100 c.c. were at once taken; if not, the liquid was filtered through a dry filter, and 100 c.c. of the filtrate were precipitated by water, filtered on a tared filter, washed, dried, and the weight of blue determined. Results were very satisfactory with mixtures containing from 70 down to 3 per cent. of blue. Blues mixed with alumina dissolved much more slowly than those containing other substances. The amount of water necessary to precipitate the whole of the blue increased very rapidly as the proportion of blue in the mixture diminished. The liquid filtered from the precipitated blue was colourless or slightly greenish, and contained traces of ferric chloride, which proceeded in part from the existence of minute amounts of ferrous chloride in the blue, and in part from slight decomposition of the blue by the hydrochloric acid in the solvent.—J. T. D.

Iron in the Ferric State; Iodometric Determination of ——. R. Namias and L. Carcano. Monit. Scient., 1904, 18, 254—255.

The method of determining ferric iron by addition of potassium iodide, and titration of the liberated iodine, gave unsatisfactory results, due, in the author's opinion, to the ease with which the reverse reaction takes place, *viz.*, the oxidation of ferrous salts by iodine in presence of acids, to ferric salts. By removing the iodine from the solution by means of chloroform, however, quantitative results were obtained. The solution, oxidised with nitric acid, was evaporated to dryness, and the residue dissolved in the smallest possible quantity of hydrochloric acid, and diluted till it contained 1 to 2 per cent. of iron: it was then nearly neutralised with sodium carbonate, and concentrated hydrochloric acid, potassium iodide, and 5—10 c.c. of chloroform were added; the solution was then allowed to stand for about 12 hours, with occasional agitation, and the iodide determined by titration with standard sodium thiosulphate solution.—T. F. B.

Thiocyanates in presence of Salts giving Precipitates with Silver Nitrate; Determination of ——. A. Dubosc. Ann. Chim. anal. appl., 9, 45—46. Chem. Centr., 1904, 1, 1035.

Thiocyanates can be oxidised to sulphates quantitatively by the liquid obtained by the electrolysis of pure chloride solutions. A quantity of the thiocyanate solution sufficient to yield 0·2—0·4 grm. of barium sulphate is treated with 50 c.c. of water and 50 c.c. of a solution containing 2 grms. of barium chloride, and then 50 c.c. of the oxidising solution (containing 18—20 grms. of available chlorine per litre) are gradually added, the whole is allowed to stand for 10 minutes, 10 c.c. of hydrochloric acid are added, the liquid is boiled, and the barium sulphate filtered off. A correction must of course be made for any sulphate present in the material which is being tested. Any soluble sulphides present are first converted into insoluble sulphides and the latter filtered off.—A. S.

Manganese [in Iron, &c.]; Determination of —— by the Persulphate Method. H. Lüdert. Zeits. angew. Chem., 1904, 17, 422—423.

The following simple modification of von Knorre's method (this J., 1903, 1104) is recommended for rapid and accurate determinations in technical analysis. In the case of iron, for instance, known to contain 0·60 per cent. of manganese, 4 grms. were dissolved in 50 c.c. of boiling nitric acid (sp. gr. 1·2), and the solution diluted (without previous filtration) with about 400 c.c. of water, and treated with 40 c.c of sulphuric acid (sp. gr. 1·18) and 50 c.c. of ammonium persulphate solution (120 grms. per litre). The liquid was then vigorously boiled for 30 minutes, cooled, and treated with 15 c.c. of a recently standardised solution of hydrogen peroxide, of which 10 c.c. corresponded with 9·4 c.c. of a standard solution of potassium permanganate (1 c.c. = 0·00577 grm. of iron). As soon as the precipitate had completely dissolved, the liquid was titrated back with the permanganate solution, and the excess of hydrogen peroxide found calculated into the corresponding amount of manganese, viz., 0·62 per cent.—C. A. M.

Manganese in Presence of Iron [in Iron Ores, &c.]; Volumetric Determination of —— by Potassium Permanganate. Guyart-Volhard-Wolff Method. L. L. de Koninck. Bull. Soc. Chim. Bel., 1904, 18, 56—62.

In the determination of manganous salts in presence of ferric salts according to the equation—

$$K_2Mn_2O_8 + 3MnCl_2 + 2H_2O = 5MnO_2 + 2KCl + 4HCl$$

the author recommends that the accuracy of the process adopted, should be checked by means of manganous chloride prepared from the same permanganate solution as is used for the titration, since, according to the equation, the manganese in a certain volume of permanganate should require two-thirds of that volume for its titration. 50 c.c. of the permanganate solution are evaporated to dryness with 10 c.c. of strong hydrochloric acid, care being taken to avoid loss by spurting, and the manganous chloride produced is dissolved in dilute hydrochloric acid. The manganese in the iron ore is then titrated by the method selected [*e.g.*, Ledebur's method], a second titration being subsequently made with the addition of the manganous chloride prepared from the permanganate. From the difference between the two titrations, the real manganese value of the permanganate is readily calculated.—J. F. B.

Chromium [*in Ferrochrome, &c.*] ; *Colorimetric Determination of* ——. A. Moulin. Bull. Soc. Chim., 1904, **31**, 295—296.

The author applies Cazeneuve's reaction with diphenylcarbazide to the determination of chromium. The solutions are:—Diphenylcarbazide, 2 grms., dissolved with the aid of heat in 100 c.c. of alcohol and 10 c.c. of acetic acid, and diluted with alcohol to 200 c.c.; and a solution of chromic acid, 0·50 grm., made up to 1 litre and then again diluted tenfold. The sample (0·25 to 0·50 grm.) is dissolved, the chromium converted into chromate (for ferrochromes, boiling with hydrogen peroxide and excess of potassium hydroxide is a good method), excess of potassium hydroxide added, the solution filtered, exactly neutralised with acetic acid, and made up to 100 or 200 c.c. Into graduated test-glasses are put 2 c.c. of the diphenylcarbazide solution and 70 c.c. of water, then 0·5, 1, 1·5 c.c., and so on of the chromic acid solution, and varying amounts of the solution to be tested; after standing 20 minutes the tints are compared.—J. T. D.

Chromium and Vanadium; Separation of —— [*in Ferrovanadium, &c.*]. P. Nicolardot. Comptes rend., 1904, **138**, 810—812.

Separation of the Chromium as Chlorochromic Acid.—The substance is fused with a mixture of potassium chlorate and sodium carbonate. The iron and manganese are separated by the usual methods. The solution of alkali salts is evaporated to dryness, and the residue is fused and transferred to a small flask. The crucible is rinsed by fusing potassium chlorate in it until no coloration remains. The flask is connected with a scrubbing apparatus containing strong sulphuric acid, the gases evolved being decomposed in a dilute solution of sodium carbonate; the whole apparatus is connected with an aspirator pump. After the apparatus has been scrubbed by the passage of a current of dry air, a few drops of sulphuric acid containing a little sulphuric anhydride are admitted to the flask. When the reaction has moderated, a little more acid is introduced and dry air or hydrogen chloride is slowly aspirated through the apparatus, the flask and scrubbing vessel being finally heated at 60° C. until no more red fumes are evolved. The vanadium remains in the flask and scrubber; it is treated with alcohol and titrated with permanganate. The precipitate of chromium hydroxide is liable to contain traces of vanadium, in which case it must again be treated as above.

Separation by means of Ferric Oxide.—If the substance contain a large proportion of iron along with vanadium and chromium, it is dissolved in hydrochloric acid, and the solution is oxidised by chloric acid and evaporated on the water-bath with excess of hydrochloric acid. Under these conditions, a precipitate of ferric oxide separates out, "which contains all the metalloids," leaving the metals in solution. The ferruginous deposit should not be subjected to a higher temperature than that of the water-bath, and should be treated with a few drops of dilute alcohol in order to remove the last traces of chromium from the precipitate. The mixture is then treated with hot water, boiled with the detached precipitate in suspension, and ammonium sulphate added. All the chromium remains in solution, whilst the vanadium is removed with the ferric oxide, which is freed from vanadium first by washing with ammonia and finally by fusion with alkali salts.—J. F. B.

Titanium in Iron Ores; Determination of ——. S. Burman. Zeits. Berg.-Hütt., 1903, **51**, 743. Chem. Centr., 1904, **1**, 970.

One grm. of the finely-divided substance (or 0·5 grm. if the ore contain more than 8—10 per cent. of titanium) is heated for three-quarters of an hour in a tube of refractory glass in a current of hydrogen, then allowed to cool in the hydrogen, boiled with 8—10 c.c. of hydrochloric acid and 200 c.c. of water, and the solution filtered. The filter, without being washed, is burnt in a platinum crucible and the residue fused with 10 times its weight of sodium carbonate. The melt is treated with water and the insoluble sodium titanate filtered off and washed with water containing sodium carbonate. The residue is washed from the filter, and the paper burnt in a weighed platinum crucible. The residue washed from the filter is treated with hydrochloric acid, the titanium re-precipitated from the solution by caustic soda, filtered off, and the filter burnt in the platinum crucible containing the ash of the other paper. The contents of the crucible are fused with 10 grms. of potassium bisulphate till a clear melt is obtained, and after cooling, the latter is dissolved in 400 c.c. of water, the solution treated with about 10 grms. of alkali bisulphite, filtered, the filtrate almost neutralised with alkali, some sodium or ammonium acetate added, and the whole boiled, whereby flocculent hydrated titanic acid, $Ti(OH)_4$ is precipitated. Some platinum is dissolved during the fusion with potassium bisulphate, and is precipitated with the titanic acid, and a correction, *viz.*, the difference in weight of the crucible before and after the fusion, must be made.
—A. S.

Available Cyanide; Determination of ——. J. E. Clennell. Eng. and Mining J., 1904, **77**, 513—514.

The following method is recommended for the determination of the "solvent activity" of cyanide solutions. A quantity of pure metallic gold is dissolved in *aqua regia*, the solution evaporated, and the gold chloride dissolved in water to form a solution containing 0·5 mgrm. of gold per c.c. Into each of a number of flasks, 10 c.c. of the gold solution are introduced, the gold precipitated by a few drops of sulphurous acid solution, the excess of sulphur dioxide expelled by boiling, and the liquid made faintly alkaline by the addition of a few c.c. of sodium hydroxide solution. Equal volumes of the various solutions to be tested are run into the flasks, and the latter are agitated at intervals during 15 minutes, the undissolved gold is filtered off and washed free from cyanide, and the filter-paper and contents are dried, wrapped in lead-foil, and cupelled.
—A. S.

Sulphuric Acid in Tanning Liquors or Extracts; Determination of ——. J. G. Parker and E. E. M. Payne. Collegium, 1904, 95—96.

Ten grms. of liquid extract or liquor, or 5 grms. of finely powdered solid extract, are shaken with 90 c.c. of absolute alcohol in a stoppered cylinder, and filtered through a dry filter, the residue being washed with 90 per cent. alcohol. The filtrate and washings are acidified with 1 c.c. of concentrated hydrochloric acid, and precipitated with 2—3 c.c. of 10 per cent. solution of barium chloride. The method is accurate and is not affected by the presence of normal or acid sulphates nor of sulphites, the former being insoluble in 80 per cent. alcohol.—R. L. J.

Basic Slag; Determination of the Phosphoric Acid Soluble in Citric Acid in ——. R. Sorge. Zeits. angew. Chem., 1904, **17**, 393—397.

The author states that in the determination of phosphoric acid in basic slag, the precipitate contains the same amount of silica after "separation" of the silica by the method adopted by the German Association of Agricultural Experiment Stations (Landw. Versuchs. Stat., 1903, **59**, 312) as when the separation is omitted. It was also found that the solubility of the ammonium magnesium phosphate in ammonium citrate is considerably increased, presumably owing to the long time required for filtering. The errors due to the phosphoric acid precipitate carrying down silica and other impurities, and to the slight solubility of ammonium magnesium phosphate in ammonium citrate solution, compensate one another. The modification adopted by the Association (*loc. cit.*) can only give incorrect results, since it attempts to eliminate the *plus* error, and at the same time increases the loss of ammonium magnesium phosphate.

Böttcher's modification of the Association's method (Chem.-Zeit., 1903, **27**, 1205) and Wagner's method are also said to be open to objection. It is only in exceptional cases, with slags abnormally rich in silicate, that the *plus* error is liable to exceed the *minus* error; and in such cases it is easy to ascertain the amount of silica in the precipitate. —N. H. J. M.

Alkaline-Earth Metal Carbonates; Decomposition of —— by Ammonium Chloride in Presence of Water. H. Cantoni and G. Goguelia. VII., page 440.

Methyl, Ethyl, and Propyl Alcohols; Critical Temperatures of Solution of [Determination of Water in]——. Preparation of the Anhydrous Alcohols. L. Crismer. XVII., page 451.

ORGANIC—QUALITATIVE.

Alkaloids; Analysis [Identification] of ——, by the Refractive Indices of their Crystals. P. Kley. Zeits. anal. Chem., 1904, **43**, 160—167. (See this J., 1904, 207.)

A small crystal of the alkaloid is broken by pressure and a fragment is mounted in a drop of a medium of known refractive power. The Nicols being crossed, the stage is rotated until the crystal causes extinction, the upper Nicol is then removed, and the object is examined both in that position and in a position at right angles to it. The various media on the scale are then tried until accurate determinations of the refractive indices in the two positions have been made. The difference between the two values gives the strength of the double refraction. The crystal is positive if the refractive index of its extraordinary ray (*i.e.*, dark position between crossed Nicols and lying in the direction of the edges of the prism) be the greater, and negative if the reverse be the case. A table and graphic illustration are given of the values obtained with various alkaloids. —J. F. B.

Cocaïne; Some New Reactions for Detecting ——. C. Reichard. Chem.-Zeit., 1904, **28**, 299.

(1) When a concentrated solution of sodium nitroprusside is added drop by drop to a cold solution of cocaïne hydrochloride, a precipitate is formed immediately which appears under the microscope in the form of well-defined, reddish-coloured crystals of cocaïne nitroprusside. The crystals are dissolved on warming, and reappear on cooling; they are soluble in excess of water. A distinct reaction can be perceived in solutions containing 0·004 grm. of cocaïne hydrochloride per 1 c.c. This test serves to distinguish cocaïne from morphine. (2) If a cold, saturated solution of uranium nitrate be added drop by drop to a solution of cocaïne hydrochloride, a yellow, crystalline precipitate appears immediately. This precipitate is also soluble on heating, and appears to be soluble in water. (3) A pinch of pure titanic acid is treated with just sufficient concentrated sulphuric acid to dissolve it on heating. If a trace of solid cocaïne hydrochloride be added to the cooled solution and the mixture be warmed until the liquid assumes an oily appearance, a violet or blue coloration is gradually developed. (4) If a trace of solid cocaïne hydrochloride be ground up with a little solid potassium ethyl sulphate, and a few drops of strong sulphuric acid be added, a distinct odour of peppermint is developed on heating. (5) If solid cocaïne hydrochloride be ground up with urea, and concentrated sulphuric acid be added to the mixture, an increasing blue coloration is developed on heating strongly. Certain other organic amides give a similar reaction.—J. F. B.

ORGANIC—QUANTITATIVE.

Glycerol; Determination of —— in Fats. R. Fanto. Zeits. angew. Chem., 1904, **17**, 420—421.

Lewkowitsch (this J., 1903, 576) was unable to obtain satisfactory results by Zeisel and Fanto's method (this J., 1902, 992). The author has therefore made further experiments. He finds that it is not possible to obtain correct results by treating the fat directly with the hydriodic acid, and that it is necessary to saponify it, to separate the soap, and to take an aliquot portion of the aqueous glycerol solution for the determination:—About 10 grms. of the fat are saponified in the usual manner, the alcohol is nearly evaporated off, the soap dissolved in about 100 c.c. of hot water, and the fatty acids are separated by the addition of concentrated acetic acid The flask is then cooled and the aqueous layer separated from the solidified fatty acids, which are subsequently washed about five times with successive portions of 15 to 20 c.c. of hot water. If the fatty acids are liquid, a little hard paraffin may be advantageously added to accelerate their solidification. The aqueous layer and washings are filtered, concentrated to about 60 to 70 c.c., cooled, and diluted to 100 c.c., 5 c.c. of this solution being taken for the determination of the glycerol by the iodide method. A series of experimental determinations of glycerol in lard, butter, oils, &c., is given to show that the results thus obtained agree closely with those given by other methods.—C. A. M.

Tannin; Gravimetric Determination of —— in Tanning Materials and Extracts. J. Paessler. Collegium, 1904, 81—88, 90—95.

The author gives a detailed report on the method of tanning analysis as discussed at the meeting held by the German section of the International Association of Leather Trades Chemists at Frankfort on 25th October, 1903, together with criticisms and notes on certain details of the process where modification may in time become necessary. The following list of quantities of tanning materials, which should usually be weighed out to give the special amount of tannin in the liquor prepared for analysis (*viz.*, 0·35—0·45 grm. of tannin per 100 c.c.) has been compiled:—

	Grms.		Grms.
Algarobilla............	9	Mangrove bark	10
Canaigre	18	Mimosa bark	12
Divi-divi..............	9	Myrobalans	12
Oak bark..............	36	Quebracho wood.......	22
Oak wood	50	Rove and other galls...	12
Pine bark	32	Sumac.................	16
Garouille..............	16	Trillo..................	10
Hemlock bark	32	Valonia................	14
Chestnut wood	45	Willow bark...........	36
Knoppern	12	Used materials.........	50

Solid extracts, 5—7 grms.

Pasty extracts, sp. gr. above 1·2 or 25° Bé., 9—12 grms.

Liquid extracts, sp. gr. above 1·15, or 19° Bé., 12—18 grms.

Liquid extracts, sp. gr. below 1·15, or 19° Bé., 18—20 grms.

—R. L. J.

Pomegranate Bark, Coca Leaves, and Belladonna Leaves, Determination of Total Alkaloids in ——. E. Léger. J. Pharm. Chim., 1904, **19**, 329—337.

Pomegranate Bark.—A quantity of the finely-powdered bark, equivalent to 15 grms. of dry substance, is intimately mixed with 5 grms. of magnesia and 10 c.c. of water, and the moist powder allowed to stand for two hours in a closed flask. 150 c.c. of chloroform are then added, and the whole weighed. The mixture is then boiled for an hour under a reflux condenser, cooled, the original weight made up by the addition of chloroform, and the whole filtered 100 c.c. of filtrate (= 10 grms. of bark) are distilled, in two portions until 80 c.c. of distillate have been collected. The residue is transferred to a separator, the distilling flask being washed with two washings of 20 c.c. of neutral ether, sp. gr. 0·721, the washings being added to the chloroformic solution. The ether-chloroform solution is shaken out with 10 c.c. of N/10 hydrochloric acid and about 20 c.c. of water, and twice washed out with 30 c.c. of water. The acid extract and washings are titrated back with N/10 potassium hydroxide solution, with iodeosine as an indicator. The number of c.c. of N/10 acid thus found to be combined with the alkaloids × 0·1475 gives the percentage of total alkaloids in the bark. It is important to ensure exact neutrality of the ether employed by washing it, first with a trace of N/10 potassium hydroxide, then titrating back the free alkali with N/10 acid, using iodeosine as indicator.

Coca Leaves.—The equivalent of 25 grms. of dried powdered leaves is mixed with 5 grms. of magnesia and 15 c.c. of water, the moist powder is treated in a closed flask with 625 c.c. of ether, sp. gr. 0·721, previously saturated with water. The mixture is frequently shaken during 12 hours, then allowed to stand overnight, again shaken up, and filtered. The ether is then distilled off from 500 c.c. of filtrate, the residue taken up with 20 c.c. of neutral ether, treated with 10 c.c. of N/10 hydrochloric acid and 20 c.c. of water, the flask closed with a rubber cork, and the contents well agitated. The acid liquid is separated, the distilling flask twice washed with 25 c.c. of distilled water, these washings being used for successive shaking out of the ethereal liquid in the separator, then added to the first acid liquid. The whole of this is then filtered through a small moistened filter, which is then thoroughly washed. Sufficient water is added to bring the volume of the filtrate to 150 c.c., and the free acid is titrated back as described above; the number of c.c. combined with the alkaloids × 0·1535 gives the percentage of total alkaloids in the powder.

Belladonna Leaves.—The process is the same as that given for coca leaves. The number of c.c. of acid combined with the alkaloids × 0·1445 gives the amount of bases, as atropine, in the sample.—J. O. B.

Cinnamon Oil; Determination of Value of ——. A. Pouchand. Schweitz. Woch. Chem. Pharm., 1904, **42**, 126; through Chem.-Zeit., 1904, **28**, Rep. 80.

Ten grms. of the oil are heated on the water-bath, with constant agitation, with 20 c.c. of a 30 per cent. solution of sodium bisulphite. After the yellow mass at first produced has re-dissolved, a further quantity of 40 c.c. of the bisulphite solution is gradually added, whilst agitating and heating. After the flask containing the mixture has cooled, the liquid is transferred to a separating funnel, the flask is rinsed out twice, each time with 10 c.c. of ether, which together with another 10 c.c. are added to the liquid in the funnel. The liquid is shaken and allowed to separate, the aqueous layer is run off, the ethereal solution is collected in a tared Erlenmeyer flask, the aqueous portion is again shaken with 20 c.c. of ether, the combined ethereal solution is evaporated, and the residue is dried at 95°—100° C. and weighed.—J. F. B.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

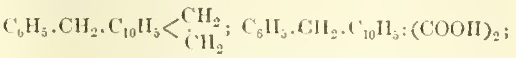
Colloids; Bibliography of the ——. A. Müller. Zeits. anorg. Chem., 1904, **39**, 121—151.

Colloidal Bodies; Mutual Influence of Dissolved ——. W. Biltz. Ber., 1904, **37**, 1095—1116.

The author deals with the preparation of colloidal solutions of various inorganic substances, and the polarity of the dissolved colloids under the influence of the electric current. Some colloids are attracted to the anode (negatively charged relatively to water) and others to the cathode (positively charged), this latter class consisting of the colloidal hydroxides of the metals. The author has found that solutions of oppositely charged colloids will precipitate each other in the form of mixed jellies ("adsorption compounds") without the addition of an electrolyte, whilst similarly charged colloids will not. For the mutually complete precipitation of oppositely charged colloids, certain definite limits of relative proportions (equivalents) are necessary. Variations on either side of the optimum proportion cause incomplete precipitation until points are reached at which no precipitation occurs. In the precipitation of the negative colloids by salts (electrolytes) of the positive colloidal hydroxides, the actions of the electrolyte and the positive colloid are superimposed.—J. F. B.

Aromatic Hydrocarbon; New —— [*Phenylacenaphthylmethane*]. C. Dziewonski and E. Dotta. Bull. Soc. Chim., 1904, **31**, 373—38:.

By heating a mixture of benzyl chloride and acenaphthene with zinc dust, or better with zinc chloride, and fractionating the product, *phenylacenaphthylmethane*, or *benzylacenaphthene*, is obtained. After several crystallisations from alcohol it forms long white silky needles, soluble in most organic solvents, and in cold sulphuric acid. It melts at 112° and boils at 340°—345° C. On oxidation it yields a mixture of *benzylnaphthalic acid* and its anhydride, which on further oxidation are converted into the corresponding *benzoyl*-compounds—



$$C_6H_5.CH_2.C_{10}H_5<\begin{matrix}CH_2\\CH_2\end{matrix};\ C_6H_5.CH_2.C_{10}H_5:(COOH)_2;$$

$$C_6H_5.CO.C_{10}H_5:(COOH)_2.$$

The imides of both these acids, and the oximes of the latter, were prepared and described.—J. T. D.

Trade Report.

I.—GENERAL.

TRANSVAAL; IMPORT TRADE OF THE —— IN 1903.

Bd. of Trade J., March 31, 1904.

Articles.	Twelve Months ended Dec., 1902.	Twelve Months ended Dec., 1903.
	£	£
Metals, and manufactures of	2,633,000	4,003,000
Leather and manufactures	628,000	735,000
Drugs and chemicals.............	420,000	500,000
Groceries and oilmen's stores (includes oils and paints)	319,000	398,000
Soap and candles..........	187,000	246,000
Arms and ammunition...........	16,000	210,000
Total of all articles.......	13,068,000	19,531,000

Of the total value of merchandise imported into the Transvaal during the year 1903, 8,006,000*l.* worth were sent *viâ* Cape Colony, 8,234,000*l.* worth *viâ* Natal, and 3,291,000*l.* worth *viâ* Delagoa Bay.

CAPE COLONY; TRADE OF ——, IN 1903.

Bd. of Trade J., March 31, 1904.

Imports into Cape Colony.

Principal and other Articles.	Year ended Dec. 31, 1902.	Year ended Dec. 31, 1903.
	£	£
Metals and metal manufactures (includes iron, lead, machinery, and hardware).................	3,088,000	4,037,000
Leather and leather manufactures	1,504,000	1,491,000
Alcoholic beverages (includes wine, beer, and spirits).........	1,005,000	580,000
Drugs and chemicals	427,000	365,000
Coal, coke, and patent fuel	398,000	295,000
Soap and candles	292,000	231,000
Earthenware and crockery.......	140,000	196,000
Paints and colours................	111,000	159,000
Cement..........................	111,000	151,000
Dynamite and blasting compounds	70,000	145,000
Oil, mineral......................	181,000	136,000
Total of all merchandise .	29,575,000	31,426,000

Exports from Cape Colony.

Principal and other Articles.	Year ended Dec. 31, 1902.	Year ended Dec. 31, 1903.
	£	£
Gold (raw)	5,915,000	11,980,000
Wool (washed, scoured, and in the grease)	1,930,000	1,818,000
Hides and skins	483,000	469,000
Copper ore........................	273,000	457,000
Total of all merchandise..	15,833,000	21,954,000

PATENTS IN CANADA.

U.S. Cons. Reps., *No.* 1913, *March* 29, 1904.

The following refers to amendments to the Patent Act passed at the last session of the Dominion Parliament:—

A patentee must commence manufacture within two years from the date of issue of his patent, otherwise it is null and void. There are some classes of patents, however, that would be difficult to manufacture in advance of the public demand. In such cases the commissioner of patents has power to place the applicants under the terms of section 7 of the Act, the effect of which would be to delay manufacture until application is made for a licence to sell the patent invention. Then, if the commissioner is satisfied there has been neglect or refusal to manufacture or sell the patent, he may grant the licence applied for. The commissioner of patents has issued a circular indicating the kinds of patents which come under section 7. They are as follows:—Patents for an art or process; patents for improvements on a patented invention, when both patents are not held by the same person; patents for certain appliances or apparatus in connection with railways, telegraph, telephone, and lighting systems, and other works usually under the control of public or large private corporations, and which appliances or apparatus cannot be installed or constructed without the consent of such corporations; and patents for inventions which are manufactured or constructed only to order and are not, according to custom, kept in stock. At present the patent office is in frequent receipt of petitions from patentees asking to come under the provisions of section 7.

SWEDEN; EXPORT TRADE OF ——, IN 1903.

Foreign Office Annual Series, No. 3123.

The exportation of matches from Sweden amounted to 1,316 tons more than in the previous year. Paper of all kinds shows a large increase—from 69,550 tons in 1902 to 82,206 tons in 1903—in fact the amount has more than doubled itself in the last four years. Wood-pulp (chemically prepared, dry) rose from 178,421 tons in 1902 to 224,573 tons in 1903. Iron ore shows an increase of from 1,719,293 to 2,827,551 tons.

Skins and hides were exported in considerably larger quantities and were valued at 5,894,000 kr. (327,440*l.*); their value in 1899 came to 3,686,000 kr. (204,700*l.*)

In regard to Swedish brandy and spirits, the exportation of which, in former years, came to from 150,000 to 200,000 litres per annum, the quantity exported last year was only 36,400 litres; it should, however, be noted that the production of these spirits is meant for home consumption.

III.—TAR PRODUCTS, PETROLEUM, Etc.

TRINITROTOLUOL: U.S. CUSTOMS DECISION.

March 16, 1904.

Trinitrotoluol was decided to be dutiable at 20 per cent. *ad valorem* as a "preparation of coal tar, not a colour or dye," under paragraph 15 of the present tariff act. The importers claimed free entry under paragraph 524, which provides, among others, for toluol, nitrotoluol, and dinitrotoluol. Since trinitrotoluol is not included in this enumeration, the assessment of duty was affirmed, as above stated.—R. W. M.

VII.—ACIDS, ALKALIS, Etc.

CHILEAN NITRATE TRADE.

Eng. and Mining J., *March* 31, 1904.

Last year the export tax, which is 56 cents per quintal, yielded the Chilean Government a revenue of 17,742,645 dols.

The exports in the year 1903 amounted to a total of 31,683,294 quintals. Prices were unusually high; 6*s.* to 7*s.* 3·5*d.* per quintal for 95 per cent. quality, and 6*s.* 6*d.* to 7*s.* 4·5*d.* for 96 per cent. alongside steamer. At these prices last year's exports had a total value of over 10,200,000*l.*, which is nearly 12 per cent. better than 1902, and the highest for some years past. At the ruling ocean freights of 12*s.* 6*d.* to 21*s.* 3*d.* per ton, the cost of shipping nitrate of soda to the distributing markets abroad reached a total of nearly 1,000,000*l.* This is less than in 1902.

The exports of nitrate of soda in the years 1902 and 1903 are given below, in quintals of 101·4 pounds.

——	1902.	1903.	Changes.
	Tons.	Tons.	Tons.
Belgium	1,277,068	1,775,457	I. 498,389
France	3,034,217	4,759,355	I. 1,725,138
Germany	7,362,216	8,488,434	I. 1,126,218
Holland	1,416,306	2,051,351	I. 635,045
Italy	1,162,662	562,123	D. 600,539
United Kingdom	1,322,445	1,606,178	I. 283,733
Miscellaneous	589,826	375,345	D. 214,476
Continent, for orders	7,924,414	5,556,511	D. 2,367,903
Total, Europe	24,089,154	25,174,754	I. 1,085,605
United States, East Coast	5,042,382	4,931,629	D. 110,753
United States, West Coast	558,457	982,646	I. 424,189
Total, United States	5,600,839	5,914,275	I. 313,436
West Indies	..	49,232	I. 49,232
South America	42,958	42,779	D. 179
Africa	113,877	90,291	D. 23,576
Australia	..	26,844	I. 26,844
Japan	440	55,881	I. 55,371
Mauritius	..	53,627	I. 53,627
Other countries	242,172	275,681	I. 33,509
Grand total	30,089,440	31,683,294	I. 1,593,854

This increase in exports was due to heavy shipments to the beet-sugar growers in Germany and France, and to purchases by powder manufacturers and others in the United States.

Tarapaca shipped 24,140,459 quintals, or over 76 per cent. of last year's total exports; Tocopilla, 4,246,929 quintals; Taltal, 1,668,263 quintals; Antofagasta, 895,352 quintals, and Caleta Coloso, 732,291 quintals. Both Tarapaca and Taltal shipped less than in 1902, but this is more than offset by the increased movement from the other ports and the initial exports from Caleta Coloso.

SULPHUR; SICILIAN ——.

Eng. and Mining J., *March* 31, 1904.

There are exported annually over 475,000 long tons of sulphur from Sicily. A feature is the heavy accumulation of stocks in Sicily, amounting, on Dec. 31, 1903, to 361,220 tons.

By far the largest consumer is the United States, which takes annually nearly one-third of the Sicilian exports. In 1903 that country received 155,996 long tons, of which 121,845 tons were best unmixed seconds, consumed principally by sulphite pulp manufacturers, and 34,151 tons taken by acid manufacturers and others. During recent years the high prices asked for brimstone have encouraged greatly the consumption of the cheaper pyrites sulphur. In 1993 imported and domestic pyrites furnished nearly 60 per cent. of the entire sulphur used in the

Destination.	1902.	1903.	Changes.
	Tons.	Tons.	Tons.
Austria	19,086	17,926	D. 1,160
Belgium	12,323	15,233	I. 2,910
France	67,249	74,372	I. 7,123
Germany	25,906	32,553	I. 6,647
Greece and Turkey	20,548	22,133	I. 1,585
Holland	8,648	5,157	D. 3,491
Italy	45,603	45,572	D. 31
Russia	17,295	15,068	D. 2,227
Scandinavia	24,918	28,292	I. 3,374
Spain and Portugal	12,863	18,163	I. 5,300
United Kingdom	25,477	19,210	D. 6,267
United States	168,919	155,996	D. 12,923
*Other countries	18,434	25,833	I. 7,349
Total	467,319	475,508	I. 8,189

* In 1903: Australia, 4,756 tons; Canada, 808; East Indies, 3,182; North and South Africa, 9,393; South America, 2,357; Switzerland, Roumania, Bulgaria, Malta, Egypt, Syria, and Asia, 5,337: total, 25,833 tons.

United States, whereas in 1896, the first year of the Sicilian compact, the proportion was less than 50 per cent. During this period consumers have been obliged to pay from 5 dols. to 6 dols. and more for crude brimstone.

The Sicilian brimstone export trade is shown in the foregoing table in long tons.

The increase in exports in 1903 is comparatively small when we consider the heavy falling off in the American and British purchases.

Following are the selling prices per long ton, f.o.b. shipping ports in Sicily :—

Quality of Sulphur.	High.		Low.		Average for Year.	
	s.	d.	s.	d.	s.	d.
Best unmixed seconds, bulk	83	9	80	9	82	6
Best unmixed seconds, ground, bags	89	6	87	6	88	3
Best unmixed thirds, bulk	79	9	78	0	79	2
Current thirds, bulk	79	0	76	9	77	9
Refined block, bulk	88	6	85	9	87	5
Refined roll, bags	94	9	92	9	93	10
Refined roll, casks	100	0	96	9	98	6
Refined roll, usual size sticks, cases	103	9	101	9	102	11
Refined roll, small sticks, cases	106	6	103	9	104	9
Sublimed flowers, pure, bags	108	6	103	6	106	2
Sublimed flowers, current, bags	99	9	97	0	98	5
Sublimed flowers, commercial, bags	94	9	92	3	93	3

Compared with 1902, these prices show a substantial increase, excepting crude seconds, which are fractionally less, owing partly to the introduction in the market of ground seconds, and also to the improved quality of best thirds. Prospects for lower prices are not favourable.

THE POTASH SYNDICATE.

Eng. and Mining J., March 31, 1904.

After nearly 25 years of successful operation the German Potash Syndicate is threatened with dissolution. The older members will not acquiesce in a reduction of their quotas of production—for the purpose, apparently, of suppressing the modern works. Nor will the members sanction the purchase by the syndicate, as is contemplated, of the mines optioned in 1902 by Americans.

The syndicate was founded in 1879, after 22 years of competition and limited consumption. In 1879 the output of crude potash salts amounted to only 768,971 metric tons, but 23 years later, in 1902, it had increased to 3,250,835 tons. Simultaneously, prices have improved, as a result of the growing consumption which has been encouraged by systematic propaganda among agriculturists. At the same time the industry has been consolidated by the periodical renewal and revision, for a term of years, of the agreement. The last compact was signed June 30, 1901, and expires on December 31, 1904. The number of works represented by the Verkaufs Syndikat has been gradually increased, and now amounts to 27, or 10 more than were officially recognised prior to the invasion of the American fertiliser combinations, in 1902.

LIQUID AIR ; TRANSPORTATION OF ——.

U.S. Cons. Reps., No. 1913, *March* 29, 1904.

An experiment for the purpose of testing the durability of liquid air has been made between Berlin and Geneva. For the further growth of this industry the question of how far liquid air can be transported without serious loss by evaporation is a vital one.

Two quarts of liquid air were delivered to the railroad at Berlin, packed in a special manner for transportation to Geneva. The shipment arrived in Geneva in five days, and after a further delay of half a day it was delivered to the chemical laboratory of the University of Geneva. The glass vessel in which the liquid air was sent still contained one-fourth of a quart thereof, which was at once experimented with.

It is stated that this was the longest distance over which liquid air has been transported, and the result was encouraging to make larger shipments, where the loss would be relatively less.

BARIUM SULPHIDE : U.S. CUSTOMS DECISION.

March 16, 1904.

Barium sulphide was held to be properly dutiable at 35 per cent. *ad valorem* as a "chemical salt," under paragraph 3 of the present tariff.—R. W. M.

BORAX GLASS : U.S. CUSTOMS DECISION.

March 23, 1904.

It was decided that borax glass is dutiable at 5 cents per lb. as "borax," under paragraph 11 of the present Tariff Act. The claim of the importer was that it was dutiable as "borate of soda containing over 36 per cent. of anhydrous boracic acid." The testimony showed that it was simply anhydrous borax, and was used as a flux in metallurgical operations in the same manner as borax. While recognising the fact that the most common form of borax contains 10 mols. of water, it was also noted that there are other varieties also known to trade and commerce, of which borax glass is one, differing from the others only in the absence of water of crystallization. The term "borax" being more specific than "borate of soda," was therefore held to correctly describe borax glass.—R. W. M.

X.—*METALLURGY.*

CHROMIC IRON ORE IN CUBA.

U.S. Cons. Reps., No. 1906, *March* 21, 1904.

An extensive and rich deposit of chromic iron ore has been found on the coast of Cuba, 30 miles from Baracoa. It aggregates from 8 to 12 ft. in thickness. It is said that the freight rates by water will permit of its transportation.

XII.—*FATS, FATTY OILS, Etc.*

COTTON-SEED ; UTILISATION OF INDIAN ——.

"Agricultural Ledger," 1903, *No.* 9. (*See also this J.,* 1904, 279.)

The export of cotton-seed from India increased from 43,485 cwts. in 1899—1900 to 3,974,000 cwts. in 1902—1903. The seed at average Indian prices can be profitably exported when the price of cotton-seed oil in England is 20*l.* or more per ton.

Egyptian cotton-seed commands a higher price, as it contains a larger percentage of oil and has no adherent "fuzz." The Indian cake is about 10*s.* per ton cheaper at Hull than the Egyptian.

The quantities of oil seeds exported from India during 1901–2 and 1902–3 were as follows :—

Kind of Seed.	1901-2.	1902-3.
	Cwts.	Cwts.
Linseed	7,328,000	6,328,000
Rape-seed	6,925,000	3,927,000
Sesamum	2,447,000	3,733,000
Cotton-seed	2,036,000	3,974,000
Poppy-seed	934,000	966,000
Earth nuts	1,085,000	1,036,000

These exports are considered more profitable than if oil industries were fully established in India, because the cakes obtained are worth much less in India than in Europe. In the larger villages of India excellent cakes are prepared from seeds capable of easier manipulation. Hydraulic press mills capable of treating cotton-seed have, however, now been established at Lahore and elsewhere.

The Director of Agriculture has investigated 100 indigenous and exotic varieties. The comparative values are shown by tables giving the number of seeds per tola, and the percentage quantities of oil and crude fibre contained in the seeds. Some samples of American and Egyptian seed contain 10 per cent. more oil than any Indian seed and average at least 5 per cent. more.

COPRA EXPORTS FROM SAMOA.

Foreign Office Annual Series, No. 3132.

Copra, at present the only important Samoan export, was subject to a serious decline in price at the beginning of the year, as the value in Samoa is now only 9*l.* 15*s.* per long ton f.o.b. steamer, when, last year, it was eagerly sought for at 14*l*; trade suffers accordingly. The Sydney market absorbs Samoan copra to the extent of 3,000 to 4,000 tons yearly. The total quantity of Samoan-made copra shipped from Western Samoa during 1903 has been 7,000 tons, worth, at say 10*l.* per ton, 70,000*l.* There is no export duty.

The value of copra exported was as follows:—1899, 90,000*l.*; 1900, 46,000*l.*; 1901, 35,000*l.*; 1902, 94,000*l.*; 1903, 70,000*l.*

The quantity of copra made yearly in Western Samoa ranges from 5,000 to 8,000 tons, of which, say, two-thirds are supplied by the natives, the rest coming from the plantations of the Deutsche Handels und Plantagen Gesellschaft. This article is not likely at present to have its yield increased. Tutuila produces yearly about 500 tons, now purchased by the United States Government from the natives at fixed rates, and then resold by sealed tenders. In 1902 they obtained from the agent of a Hamburg firm 12*l.* to 13*l.* per ton, delivered in the Government sheds.

Soap from the Castor Bean.

U.S. Cons. Reps., No. 1907, *March* 22, 1904.

Parties in the State of Durango are interested in processes or machinery for the making of soap from the castor bean. The plant (*Ricinus communis*, also known in Spanish countries as *Palma cristi*) grows extremely well there, very speedily coming in places to be as high as a small tree, and produces in abundance. A great deal of common soap is made in the "Laguna district" of Durango and Coahuila, the great cotton district of Mexico, especially by one large factory. The cotton seed is used for this purpose, but the soap produced for common use hereabouts, not being perfumed, has a very bad odour. Some time since a large experiment was undertaken with a view to extracting the oil of the castor bean, and also for making soap from it if possible, but failed, and the plant has lain idle for several years.

XVI.—SUGAR, STARCH, Etc.

Sugar Production of Germany.

Bd. of Trade J., March 31, 1904.

According to statistics published in the *Reichsanzeiger*, the quantity of raw sugar produced in Germany during the period from 1st September, 1903, to 28th February last, being the first six months of the 1903–4 sugar campaign, was 1,625,299 metric tons, as compared with 1,461,944 metric tons during the corresponding months of 1902–3. The quantity of refined sugar produced decreased from 777,763 metric tons during the six months September, 1902, to February, 1903, to 753,477 metric tons during the six months September, 1903, to February, 1904.

The total quantity of beets used during the first half of the present campaign was 12,706,527 metric tons, as compared with 11,255,958 metric tons during the corresponding months of 1902–3.

Sugar Production of Italy.

Bd. of Trade J., March 31, 1904.

According to statistics published in the *Bolletino delle Finanze*, the production of sugar by the 33 sugar refineries of Italy during the year 1902–3 was 954,091 quintals, of the value of 64,115,038 lire. These figures exceed those of 1901–2 by 211,102 quintals, and 1,416,343 lire respectively.

XVII.—BREWING, WINES, SPIRITS, Etc.

Clarifying Powders: U.S. Customs Decisions.

March 24, 1904.

A mixture, which on analysis was shown to contain 39·13 per cent. of tannin, 5·35 per cent. of mineral matter, with the balance non-tannin organic matter, was decided to be dutiable at 50 cents per lb., as "tannin," under paragraph 1 of the present tariff. The evidence showed that it was a mixture and not a definite chemical compound, as claimed by the importer, and that the tannin was the component material of chief value.—R. W. M.

XVIII. B.—SANITATION.

Sewage; Treatment of ——.

The Commissioners appointed to inquire and report upon the methods of treating and disposing of sewage have issued a third volume of their fourth report, consisting of a copiously illustrated folio Blue book of 316 pages, the whole of which is devoted to reports by Dr. Houston on bacteriological investigations, with special reference to the contamination of shell-fish. The following results are stated as general inferences, which are, perhaps, warranted "on a broad and common-sense view of the whole investigation":—(*a*) That a water which, from the bacteriologist's point of view, would be considered very impure, may, after filtration, although still containing an appreciable number of bacteria seemingly of intestinal derivation, be used for domestic purposes without any very definite or detectable harm resulting. (*b*) That the water of a tidal river grossly polluted in its lower estuarial reaches may, after a flow of some 25 miles, become so far purified by sedimentation, dilution, and the operation presumably of bactericidal agencies, as to become seemingly as little objectionable, or in some respects less objectionable, bacteriologically, than certain of our public water supplies. (*c*) That the deposition in the sea of chemically precipitated sludge in enormous quantities, if carried out under proper conditions, need not result necessarily in the production of nuisance or serious pollution of the surrounding water, and that such deposition may be thought of as an economical and seemingly not unsatisfactory means of disposing of this material. Conclusion (*a*) is somewhat modified by an appended note setting forth that, in the opinion of the writer, who holds rather a contrary view, it in no way implies that impure waters, even after careful filtration, are necessarily uniformly safe for potable purposes. The question to be dealt with in the report concerns the facts elicted during the period of observation, and these seem to indicate the danger of hastily condemning waters and other materials without a wider knowledge of comparative bacteriology, and of the correlation of bacteriology and epidemiology, than is at present available. Perhaps it may be said, in other words, that the results so far obtained are only contributions towards the attainment of a final decision on the questions which are involved.

XX.—FINE CHEMICALS, Etc.

Thorium; Occurrence of —— in Ceylon.

Imp. Inst. J., March 31, 1904, 13.

Specimens of minerals, supposed to be monazite and uraninite, sent from Ceylon, have proved to be thorite, a silicate of thorium, containing 66 per cent. of thorium oxide, and a new mineral, which it is proposed to name "thorianite." The latter contains 75 per cent. of thorium oxide, with small quantities of cerium, uranium, and lead oxides. Thorianite is richer in thorium than any mineral at present known, is strongly radio-active, and may prove to be a source of radium. The Imperial Institute expects shortly to receive further specimens and information as to the occurrence of these minerals in Ceylon.

Hexamethylenetetramine: U.S. Customs Decision.

March 22, 1904.

Duty was assessed on this article at 55 cents per lb. unde paragraph 67 of the present Tariff Act, as a "medicina preparation in the preparation of which alcohol is used." The importers claimed that it was dutiable either as a "chemical compound," under paragraph 3, at 25 per cent *ad val.*, or as a "manufactured article unenumerated," unde section 6. As no conclusive evidence was offered to show that alcohol had not been used, the assessment of duty a above was sustained.—R. W. M.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.], "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 7452. Grätzel. Catalytic processes and apparatus therefor. March 29.

„ 7462. Griffith. Method of and apparatus for purifying water or other liquid. March 29.

„ 7649. Harvey. Crucible furnaces. March 31.

„ 7667. Butler. *See under* XVIII. A.

„ 7694. Holland. Cupola [U.S. Appl., April 3, 1903]*. March 31.

„ 7739. Hoffbaur. Drying apparatus. March 31.

„ 8080. Hutchinson. Method of determining vapour pressure of liquids above and below boiling point. April 8.

„ 8359. Westaway. Machinery for drying granulated fat and substance in a like condition. April 12

„ 8481. Sagasser. Apparatus for purifying liquids by centrifugal force * April 13.

„ 8600. Beeman. Mixing, churning, concentrating, or drying semi-liquid or viscous materials, and apparatus therefor. April 20.

„ 8605. Webb. *See under* X.

[C.S.] 6925 (1903). de Marchéville. Hydro-extractors. April 7.

„ 7128 (1903). Kirkland and Cooke. Utilising waste heat in brick and other kilns. April 7.

„ 7860 (1903). Raynaud. Manufacture of solidified liquids and of a material therefor. April 7.

„ 10,053 (1903). Smithson. Packing for acid towers and condensers. April 13.

„ 10,498 (1903). Reeb. Filters. April 20.

„ 11,632 (1903). Lang. Utilising the heat of chemical reaction for heating fluid. April 13.

„ 12,195 (1903). Jones. Furnaces. April 7.

„ 3165 (1904). Suzuki. Piled vacuum evaporating apparatus. April 7.

„ 4575 (1903). Ellis (Maschinenfabr. Grevenbroich). Filtering apparatus. April 7.

„ 4602 (1904). Thompson (Hanrahan). Drying kilns. April 20.

II.—FUEL, GAS, AND LIGHT.

[A.] 7347. Thwaite. Process and apparatus for generating combustible gas from hydrocarbonaceous and other solid fuel. March 28.

„ 7481. Kuess. *See under* III.

„ 7592. Radcliffe. Gas generators and the manufacture of gas. March 30.

„ 7668. Wien and Miniz. Incandescence mantles for gas and like illuminants, and process of manufacturing same. March 31.

„ 7767. Hamilton. Gas producers. April 2.

„ 7793. Phillips. Method of enriching hydrocarbons and the like. April 2.

„ 7930. Grossmann. Manufacture of coal gas. April 6.

„ 7959. Woodall and Duckham. Carbonisation of coal, and apparatus therefor. April 6.

[A.] 7979. Boutillier. Gas producers for poor gas free from tarry matters. [Fr. Appl., April 7, 1903.]* April 6.

„ 8144. Nyren. Enriching gas, and apparatus therefor. April 9.

„ 8322. Twombly. Self-heating hydrocarbon gas generator.* April 11.

„ 8325. Buhlmann. Process of manufacturing incandescent mantles.* April 11.

„ 8492. Hodge. Gas purifier and grids. April 13.

„ 8640. Redman. Apparatus for purifying gas. April 15.

„ 8659. Ashby. Gas-making retorts. April 15.

„ 8738 McIlquham. Gas-producing plant. April 16.

„ 8827. Tonkin and Puplett. Manufacture of producer gas, and apparatus used therein. April 16.

[C.S.] 7490 (1903). Landriset. Process for the purification of acetylene gas. April 7.

„ 7871 (1903). Gregor, Agglament, Ltd., Yeo, and Forester. Manufacture of artificial fuel. April 13.

„ 9818 (1903). Rowe and Bickerton. Gas producers. April 20.

„ 10,624 (1903). Pearson. *See under* VII.

„ 11,561 (1903). Lion. Carburetting air by means of naphthalene and generating naphthalene vapour in connection with lamps for lighting purposes. April 7.

„ 13,206 (1903). Jas. Apparatus for producing combustible gas from volatile liquid hydrocarbons. April 13.

„ 13,222 (1903). Jas. Apparatus for the purification of gas. April 13.

„ 14,335 (1903). Bridson. Generation of gas from petroleum oils. April 7.

„ 25,763 (1903). Hovine and Breuille. Manufacture of producer gas, &c. April 7.

„ 1887 (1904). Hoffman and Clark. Artificial fuel. April 7.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 7481. Kuess. Process for solidifying petroleum and other mineral oils for their application as fuel. [Appl. in Tunis, Nov. 6, 1903].* March 28.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 7363. Imray (Soc. Chem. Ind. in Basle). Manufacture of amidothiophenyl derivatives and dyestuffs therefrom. March 28.

„ 7398. Johnson (Badische Anilin und Soda Fabrik). Manufacture of alizarine. March 28.

„ 7692. Newton (Bayer and Co.). Manufacture of anthracene dyestuffs suitable for dyeing and printing. March 31.

„ 7725. Abel (Act.-Ges. f. Anilinfabr.) Manufacture of new sulphurised dyestuffs. March 31.

„ 7863. Lake (Oehler). Manufacture of mono-azo dyes. April 5.

„ 7953. Newton (Bayer and Co.). *See under* XIII. A.

„ 8282. Newton (Bayer and Co.). Manufacture of new anthraquinone derivatives. April 11.

[C.S.] 8503 (1903). Iljinskij and R. Wedekind and Co. Manufacture of halogen derivatives of oxyanthraquinones, April 20.

„ 11,003 (1903). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new green sulphurised colouring matters. April 13.

„ 12,099 (1903). Newton (Bayer and Co.). Manufacture of anthracene derivatives. April 20.

[C.S.] 12,298 (1903). Imray (Soc. Anon. Mat. Col. et Prod. Chim. de St. Denis). Manufacture of sulphurised dyestuffs. April 20.

,, 12,681 (1903). Johnson (Badische Anilin und Soda Fabrik). Manufacture of soluble compounds or salts of basic colouring matters. April 13.

,, 12,879 (1903). Ellis (Chem. Fabr. Sandoz). Manufacture of blue sulphur dyes. April 7.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 7360. Bartelt. Apparatus for preparing bleaching liquor. March 28.

,, 7475. Stables (Eyres and Sons). Waterproof fabrics. March 29.

,, 7745. Pope and Hübner. Engraved bowls or rollers for producing reflected finish on textile fabrics, paper, or other lamellar materials. April 2.

,, 7780. Lendrum. Scouring, milling, and dyeing of fabrics and other analogous materials. April 2.

,, 8084. Parkinson. Method of producing light waterproof cloths for garments. April 8.

,, 8107. Ostersetzer. Finishing woven and other textile fabrics printed with patterns in metal powder.* April 8.

,, 8288. Johnson (Badische Anilin und Soda Fabrik). Production of blue to blue black shades on wool. April 11.

,, 8409. Gruschwitz and Herminghaus. Jigger dyeing machines. April 12.

,, 8433. Serkowski. The waterproofing of materials such as fabrics, tissues, paper, &c. April 12.

,, 8531. Palmer. Figuring or shading velvet.* April 13.

,, 8545. Cross. Treatment of cotton hulls to obtain useful products therefrom. April 13.

,, 8551. Möller-Holtkamp. Manufacture of size for cotton yarn. April 14.

,, 8570. Partridge. Machines for dyeing yarn and slubbing. April 14.

,, 8813. Mandleberg. Manufacture of waterproof fabrics. April 16.

[C.S.] 6731 (1903). Lake (Mattei). Apparatus for dyeing sliver and other textile fibres. April 7.

,, 7206 (1903). Maunsell - Smyth. Process for colouring, decorating and treating paper and like substances, fabrics, and other materials. April 7.

,, 8635 (1903). Wiley. Method of and apparatus for waterproofing garments. April 20.

,, 8636 (1903). Wiley. Method of and apparatus for applying certain waterproofing agents to textile fabrics and garments. April 20.

,, 10,035 (1903). Rawson and Lodge. Machine for dyeing, scouring, bleaching or treating with liquids, textile fibres in the form of cops, cheeses, &c., with or without perforated broaches or tubes. April 20.

,, 13,116 (1903). Imray (Meister, Lucius, und Brüning). Printing fabrics with indigo. April 20.

,, 27,483 (1903). Keefer. Method of printing yarns or threads. April 7.

,, 1502 (1904). Rowland. Aniline dyeing compound. April 20.

,, 1596 (1904). Détré. Tubes for holding yarns or threads during dyeing, bleaching, mordanting, and like operations. April 7.

,, 4610 (1904). Willard. Apparatus for dyeing raw stock, wool, &c. April 7.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

[C.S.] 7206 (1903). Maunsell-Smyth. *See under* V.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 7397. Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable dry hydrosulphites. March 28.

,, 7452. Grätzel. *See under* I.

,, 8377. Leslie. Apparatus for the manufacture of carbonic acid gas. April 12.

[C.S.] 8819. (1903). Trivick. Process for the manufacture of dry sulphates of the alkali metals, and the products thereof. April 20.

,, 10,053 (1903). Smithson. *See under* I.

,, 10,356 (1903). Hills and Lane. Production of pure or nearly pure hydrogen. April 7.

,, 10,624 (1903). Pearson. Manufacture of lime and fuel gas. April 20.

,, 14,831 (1903). Glogner. Treating graphite for the separation of impurities therefrom. April 7.

,, 2541 (1904). Hegeler and Heinz. Glover tower process. April 7.

,, 4409 (1904). Feely. Slaked lime and process of preparing the same. April 7.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 8440. Richardson. Process of and apparatus for manufacturing glass articles.* April 12.

,, 8602. Fleming. Manufacture of pottery ware. April 14.

[C.S.] 4501 (1904). Hays. Working of glass. April 20.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 7343. Nusch (Westdeuts. Thomas-Phosphat Werke). Manufacture of an artificial floor covering. March 28.

,, 7385. Potter. Treatment of concrete. March 28.

,, 7736. Spatz. Manufacture of fireproof stone, stoneware, and mortar. March 31.

,, 8413. Latham. Utilising old plaster casts and other hydrated sulphate of lime and apparatus therefor. April 12.

,, 8504. Glossop. Manufacture of artificial stone. April 13.

,, 8542. Goddard. Asphaltic-mosaic flooring or paving composition.* April 13.

,, 8619. Goldsmith. Machine for applying colours glazing-matter, &c., on tiles, bricks, and similar articles. April 14.

[C.S.] 7128 (1903). Kirkland and Cooke. *See under* I.

,, 1617 (1904). Crew. Brick kilns. April 7.

,, 4409 (1904). Feely. *See under* VII.

,, 4606 (1904). Liebold. Manufacture of cement. April 7.

,, 5985 (1904). Frydenlund. Manufacture of tiles or other glazed articles from slate or slate refuse. April 20.

,, 6007 (1904). Steger. Manufacture of artificial stone blocks or bricks. April 20.

X.—METALLURGY.

[A.] 7344. Simpson and Batt. Treatment, dressing, and separation of mineral matters. March 28.

,, 7367. Simmersbach. Process and apparatus for smelting ores, more particularly iron ores. March 28.

[A.] 7412. Beckett. Removing molten slag from open hearth furnaces. March 28.

„ 7426. Izzett. Regenerative gas furnaces for melting steel, &c. March 29.

„ 7478. Rouse and Cohn. Manufacture of briquettes from powdered iron ore or iron wastes, or from iron sand or mixtures thereof for reduction in furnaces. March 29.

„ 7602. Defays. Reverberatory furnaces. March 30.

„ 7658. Kunicke. Precipitating boxes for gold or other metal bearing solutions. March 31.

„ 7935. Minnis. Method and apparatus for galvanising iron and steel sheets. April 6.

„ 7936. Traubel and Schultze. Process of disintegrating or granulating blast furnace or similar slag. April 6.

„ 7981. Mercadier. Manufacture of spongy or porous lead and of articles therefrom. [Fr. Appl., April 7, 1903].* April 6.

„ 8026. King. Removal of furnace slag and utilisation of the heat thereof. April 7.

„ 8102. Sulman and Kirkpatrick-Picard. Recovery of mercury from its ores and compounds. April 8.

„ 8216. Gin. *See under* XI.

„ 8311. Kurzwernhart. Siemens regenerative furnaces.* April 11.

„ 8605. Webb. Apparatus for extracting liquid from finely crushed minerals or the like. April 14.

„ 8677. Hyatt. Gold extraction. April 15.

„ 8683. Meadows. Apparatus for the manufacture of metallic alloys. April 15.

„ 8817. Malzac. Process for desulphurising by the damp method nickel, copper, zinc, and other ores, and hydroxidating their metals with a view to their extraction. [Fr. Appl., May 6, 1903].* April 16.

[C.S.] 12,186 (1903). Gührs and Gührs. Treatment of metallic zinc. April 7.

„ 13,033 (1903). Glinsky. Protection of metallic surfaces from oxidation and from the action of liquids, steam, and air. April 7.

„ 4263 (1904). Swindell (Johnston). Process of coating metal objects. April 7.

„ 4973 (1904). Trezel and Montby. Alloy for and process of soldering and brazing aluminium and its alloys. April 7.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 8188. Taylor. Electrical insulation. April 9.

„ 8216. Gin. Electric furnace for converting pig iron into steel.* April 9.

„ 8686. Delafon. Galvanic battery. April 15.

[C.S.] 15,317 (1903). Collis, Collis, and Head. Construction of apparatus for the electro-deposition of metals. April 20.

„ 28,805 (1903). Schneider. Electric furnaces. April 13.

„ 3790 (1904). Keller. Electric furnaces. April 7.

„ 5921 (1904). Soc. Anon. l'Ind. Verrière et ses Dérivés. Electric melting furnaces. April 20.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 8104. Burdon (Pierard). Manufacture of tapers, wax vestas, candles, and the like. April 8.

„ 8233. Nicloux. Material for saponifying fats, and method for obtaining it. [Fr. Appl., Oct. 14, 1903.]* April 9.

„ 8304. Nicloux. Method of separating from castor oil seeds or the like a material for saponifying fats or oils. April 11.

„ 8359. Westaway. *See under* I.

[C.S.] 8588 (1903). Breda. Process of separating liquid constituents from fats and waxes. April 20.

„ 12,159 (1903). Mapleton. Butter substitute. April 13.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

[A.] 7953. Newton (Bayer and Co.). Manufacture of new colour lakes. April 6.

„ 8082. MacIvor and Burnett. Manufacture of white lead. April 8.

„ 8800. Raynes and Raynes. Coloured marking inks for marking linen, cotton, and silk fabrics and the like. April 16.

(*B.*)—Resins, Varnishes.

[C.S.] 14,554 (1903). Terrisse. Treatment of gums and resins and the preparation of varnishes. April 20.

(*C.*)—India-Rubber.

[A.] 7795. Karavodine. Treatment and utilisation of waste vulcanised rubber and ebonite. [Fr. Appl., July 25, 1903.]* April 2.

„ 8691. Az. Treatment of vulcanised caoutchouc. April 15.

[C.S.] 14,001 (1903). Pensa. Substance similar to rubber and process of manufacturing same. April 20.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

[A.] 7761. Taylor. Treatment and finish of leather. April 2.

„ 8368. Russell. Adhesive compound or cement. April 12.

„ 8551. Möller-Holtkamp. *See under* V.

„ 8788. Faucheux and Boissière. Process for the manufacture of gelatine and glue.* April 16.

XV.—MANURES, Etc.

[A.] 7841. Sangster. Ammoniacal and phosphatic fertilisers. April 5.

[C.S.] 8931 (1903). Cross and Dunbar. Combination of organic and inorganic materials and substances for manuring and fertilising agricultural and horticultural soil, &c. April 20.

„ 26,150 (1903). Horteloup. *See under* XIX.

XVI.—SUGAR, STARCH, GUM, Etc.

[A.] 7560. Sharp. Starches March 30.

„ 8544. Cross. Manufacture of a crystalline sugar. April 13.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 7329. Dewar. Malting and apparatus therefor.* March 28.

„ 8461. Street and Street. Purification or filtration of liquid refuse discharged from distilleries, breweries, paper works and other places.* April 13.

[C.S.] 8766 (1903). Harvey. Means for aërating beer or the like. April 13.

„ 3682 (1904). Lapp. Process for providing iron vessels, such as those in which beer is prepared or stored, with a protective coating, more particularly applicable to pasteurising vessels. April 20.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—Foods.

[A.] 7594. Thorp. Preservation of food products. March 30.

,, 7631. Ohlsson. Method of sterilising food products and the like. March 31.

,, 7667. Butler. Production of milk in the dry condition known as milk powder, applicable also to the treatment of analogous matter for reducing it to a dry or powdered condition. March 31.

,, 7895. Braga. Manufacture of extract of meat.* April 5.

,, 7896. Braga. Manufacture of extract of meat.* April 5.

,, 7955. Graham. Flour, &c., and bread and other foods made therefrom. April 6.

,, 8129. Fürst. Dietetic food preparation. April 8.

,, 8167. Wrigley and Chapman. Manufacture of custard powder. April 9.

[C.S.] 12,159 (1903). Mapleton. *See under* XII.

,, 15,606 (1903). Thompson (Act.-Ges. f. Chem. Ind.). Nutritive substance. April 7.

,, 26,150 (1903). Horteloup. *See under* XIX.

,, 3682 (1904). Lapp. *See under* XVII.

(*B.*)—Sanitation; Water Purification.

[A.] 7383. Porion. Process and apparatus for disinfecting sewage and like waters.* March 28.

,, 8461. Street and Street. *See under* XVII.

[C.S.] 14,258 (1903). Eichen. Purification of sewage. April 7.

(*C.*)—Disinfectants.

[A.] 8415. Lake (F. Stearns and Co.). Antiseptic compound, and process for manufacturing same.* April 12.

[C.S.] 27,889 (1903). Raetz. Process of solidying such liquid compounds of phenol or cresol and soap which are soluble in water and form emulsions, intensifying at the same time their antiseptic properties. April 7.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 7819. Ortmann. Manufacture of celluloid or like compositions. April 2.

,, 7885. Elias. Process of paper manufacture. April 5.

,, 8298. Fell (Bigelow). Pulp washing and filtering machine.* April 11.

,, 8433. Serkowski. *See under* V.

,, 8461. Street and Street. *See under* XVII.

[C.S.] 7341 (1903). Lederer. Manufacture of variously shaped industrial objects from cellulose compounds. April 7.

,, 10,243 (1903). Balston and Briggs. Manufacture of soluble acetylised cellulose derivatives. April 13.

[C.S.] 26,150 (1903). Horteloup. Treatment of furze to obtain a food for cattle, paper pulp, and an ammonium salt which may be used as a manure. April 7.

,, 5126 (1904). Voigt. *See under* XXII.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 7534. Hamel. Manufacture of concentrated formic acid from formates. March 30.

,, 7875. Johnson (Koepp and Co.). Manufacture of formates. April 5.

,, 7954. Newton (Bayer and Co.). Manufacture of a new pharmaceutical product. April 6.

,, 8302. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of derivatives of barbituric acid. April 11.

,, 8543. Abel (Act.-Ges. f. Anilinfabr). Manufacture of derivatives of barbituric acid. April 13.

[C.S.] 8095 (1903). Ritsert. Manufacture of medical anæsthetic compounds. April 7.

,, 11,137 (1903). Imray. (Meister, Lucius, and Bruning). Manufacture of derivatives of cyclohexane and cyclohexene. April 7.

,, 12,282 (1903). Zimmerman (Chem. Fabr. Schering). Manufacture of products useful in therapeutics. April 13.

,, 12,773 (1903). Johnson (Kalle and Co.). Manufacture of colloidal products containing bismuth oxide. April 13.

,, 12,798 (1903). Langheld. Therapeutic products. April 13.

,, 13,889 (1903). Howorth (Knoll and Co.). Manufacture of certain new cotarnin salts. April 7.

,, 14,430 (1903). Newton (Bayer and Co.). Manufacture of the monoformyl derivative of 1·3-dimethyl - 4·5 - diamido - 2 6 - dioxypyrimidine. April 13.

,, 26,089 (1903). Verley and Givaudan. Manufacture of ionone. April 20.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 7490. Rusher and Baudinet. Explosive.* March 29.

,, 7511. Selwig. Nitrating fibrous matter. March 29.

,, 7893. Wetter (J. D. Riedel). Sulphur compounds and priming compositions suitable for the manufacture of matches. April 5.

,, 8041. Mikolajczak. Manufacturing dinitroglycerine and dinitroglycerine explosives and powder.* April 7.

,, 8678. Tulloch. Manufacture of a high explosive. April 15.

[C.S.] 8278 (1903). Thomson and Thomson. Manufacture of nitrocellulose and apparatus therefor. April 13.

,, 15,268 (1903). Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture of matches. April 13.

,, 5126 (1904). Voigt. Process of manufacturing nitrated cellulose. April 20.

* * *

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Notices.

ANNUAL GENERAL MEETING, NEW YORK, 1904.

The Annual General Meeting will be held in New York City on Thursday, Sept. 8th, and following days. Members who propose to attend the meeting are requested to inform the General Secretary, as soon as possible, by what steamer they will travel. Each boat will be met on arrival at New York by a representative of the Reception Committee, with a list of apartments, at various prices, which have been reserved for the Society. The same system will be observed at all the other cities visited by the special train. A revised programme appeared in the March 31st issue.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Mr. Wm. H. Nichols has been nominated to the office of President under Rule 8; Dr. Edw. Divers, Prof. W. R. Eaton Hodgkinson, Mr. Max Muspratt, and Mr. T. J. Parker have been nominated Vice-Presidents under Rule 8; and Sir Wm. Ramsay has been nominated a Vice-President under Rule 11.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the ordinary members of the Council. Forms for this purpose can be obtained, on application, from the General Secretary, or from the Hon. Local Secretaries of the Canadian, New York, and Sydney Sections.

Extract from Rule 18:—"No such nomination shall be valid unless it be signed by at least ten members of the Society who are not in arrear with their subscriptions, nor unless it be received by the General Secretary, at the Society's Office, at least one month before the date of the Annual General Meeting at which the election to which it refers takes place. Nor shall any such nomination be valid if the person nominated be ineligible for election under Rules 12 or 15. No member shall sign more than one nomination form."

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

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1889. Hecht, Jos. L., Bettendorf Metal Wheel Co., Davenport, Iowa, U.S.A., Analytical Chemist.

Deaths.

Preston, R., Grasmere, Whitefield, near Manchester. March 30.

Stanning, John, Broadfield, Leyland, Preston. March 5.

London Section.

Meeting held at Burlington House, on Monday, April 11th, 1904.

MR. WALTER F. REID IN THE CHAIR.

THE VOLATILISATION OF LEAD OXIDE FROM LEAD GLAZES INTO THE ATMOSPHERE OF A CHINA GLOST SAGGAR, AND ITS EFFECT UPON THE LEADLESS GLAZE WARE IN THE SAME SAGGAR.

BY W. THOMASON, F.I.C.

Concurrently with the agitation against the use of raw lead in china and earthenware glazing operations, there have been made by most potters more or less serious attempts at the production of a suitable glaze for the above purposes containing no lead oxide whatever, and still more extensive experiments for the substitution of raw lead by fritted lead in one or other of its forms. With the composition and solubility of these glazes I do not propose to deal in this paper, but wish to direct your attention to the important part the volatilisation of lead oxide from even fritted glazes may play in the production of the smooth surface so necessary in the above wares. Most makers entering upon the manufacture of leadless glazed goods have met with initial successes, and have been encouraged to pursue the matter further, with the result in many cases that the bulk experiments have not been so successful as the earlier trials, though absolutely no changes may have been made in the composition of the glaze and body worked upon. These disappointing results have been somewhat vaguely ascribed to the fact that lead oxide in the glost oven has been transferred on firing during the earlier trials from the lead-glazed walls of the saggar, and from the stilts upon which the vessels are placed in the saggar to the surface of the leadless-glazed ware operated upon, but no measure of this transference has, up to now, been attempted. This would be a sufficient explanation if it could be shown that the actual absorption of lead oxide by a leadless glaze from a lead-glaze surface near to it, amounts to more than a few decimal points per cent., and it is with the extent to which such absorption may go on that I wish to deal in this paper.

To obtain any quantitative reading of the lead gathered in process of firing under the above conditions, it is necessary first of all to ascertain the ratio of glaze to bisque, since when fired the two cannot be separated, and consequently the analyses have to be made upon the mixture of these two bodies.

In the first experiment, china saucers were selected as being capable of accurate weighing, and yet fairly representing flat ware. These were carefully dried, weighed, dipped into a leadless glaze, and again dried and weighed, with the result as shown in Table A, which also indicates the effect of firing upon the weights. The saggars and stilts in this experiment were washed with a lead glaze containing about 30 per cent. of lead oxide, of which the whole is fritted. Referring to Table A, we find the most noticeable feature is an actual gain in weight on firing in every instance, and that the increases are fairly regular. There has therefore been an appreciable absorption of some material which might be an alkaline oxide, boric acid, or more probably lead oxide. But the actual increase is more than is apparent, for the unfired glaze in question contains as one of its constituents raw china clay, which sustains a loss of 11 per cent. due to combined water on ignition.

The glaze contains 28·7 per cent. of raw china clay, which at 11 per cent. combined water would lose 3·16 per cent. on total glaze when fired; and, therefore, the actual accumulation of lead, or other oxide, amounts by direct weighing of the ware to the apparent increase in weight plus 3·16 per cent. on the glaze alone.

Table A.

Leadless-glazed Saucers in Saggar washed with Lead Glaze.

Saucer.	Weight of Biscuit.	Biscuit dipped and dried.	Biscuit Glost fired.
No.	Grms.	Grms.	Grms.
1	114·12	121·85	122·15
2	110·13	121·60	121·86
3	103·95	113·35	113·60
4	107·02	117·40	117·67
5	103·35	112·75	112·87
6	112·98	122·60	122·87
7	108·34	119·15	119·30
8	112·79	120·50	120·62
9	107·42	Broken in Dipping House	
10	110·45	118·25	118·40
11	113·35	123·30	123·52
12	120·96	130·10	130·40
Totals (excluding No. 9)	1,217·44	1,320·85	1,323·26

Excluding No. 9 we have the following totals:—Biscuit, 1217·44 grms. Biscuit glazed but unfired, 1320·85 grms. Therefore, glaze equals 103·41 grms. Weight of glazed ware after firing equals 1323·26 grms. Therefore, increase of weight during firing equals 2·41 grms., equals 2·33 per cent. of the glaze alone.

From Table A we find on 11 saucers 103·41 grms. of dry glaze were used. The increase on weight on firing amounts to 2·41 grms. – 2·33 per cent. on glaze alone. Loss of combined water sustained by the glaze = 3·16 per cent. Total foreign matter accumulated is therefore 5·49 per cent. The saucers were now crushed, and examined for lead oxide on the average sample. Analysis showed 0·56, 0·50 = 0·53 per cent. lead oxide on glazed biscuit. Calculating from Table A, we find that on the glaze alone this increase is equal to 6·78 per cent. It is, however, practically impossible in a factory where most of the glazes contain lead to produce an entirely lead-free glaze, owing to the same frit kilns and mills being employed for glazes of both kinds. Consequently the leadless glaze was examined for lead oxide, and found to contain it to the extent of 0·25 per cent. The actual accumulation of lead oxide in kiln is therefore by analysis 6·78 per cent. – 0·25 per cent. = 6·53 per cent. The gain was found to be, by direct weighing, 5·49 per cent. The absorption may therefore attain to a sufficiently high figure to have a very appreciable effect upon the surface of the glaze.

The above figures, while substantially confirming each other, make it possible that an exchange of oxides has taken place, and a small quantity of alkaline oxides, or boric acid, has been transferred to the lead-glazed saggar. On the other hand, the variation between the results obtained by different methods may be merely experimental, and, as the quantity of glaze worked upon is necessarily small, this is a not unlikely explanation.

Having dealt with saucers representing flat, it was thought necessary to repeat the trial on cups representing hollow ware. The process was the same as before, so far as the dipping, weighing, and firing are concerned; but a blank series of experiments was carried on in which a saggar was washed out with the same glaze as that in which the ware was dipped. This was done because it appeared possible that not all of the water might be capable of removal from the dipped bisque by drying; for the borax frit used in the glaze, when finely ground, becomes partially hydrated, and the water thus held might not be completely removed at the temperature to which it was convenient to raise the ware in drying. Tables B and C represent the weights, &c., of the cups in question.

TABLE B.

Leadless-glazed Cups in Saggar washed with Lead Glaze, as in Table A.

Cup.	Weight of Biscuit.	Biscuit dipped and dried.	Biscuit Glost fired.
No.	Grms.	Grms.	Grms.
1	103·170	109·160	109·169
2	85·128	91·089	91·110
3	94·531	100·389	100·465
4	102·790	108·282	108·357
5	100·689	107·334	107·364
6	102·237	108·382	108·425
7	103·624	110·932	110·922
8	102·692	109·327	109·445
9	100·040	106·216	106·233
10	99·040	105·737	105·760
11	104·529	111·144	111·245
12	108·587	114·439	114·454
Total...	1207·057	1282·431	1282·949

Therefore, glaze on biscuit equals 75·374. Increase of weight during firing equals 0·518. Increase of weight upon glaze alone equals 0·69 per cent.

In Table B we find a similar result of firing upon the weights of the ware as in Table A, though different in degree, and No. 7 is an exception in actually losing weight—this is due, in all probability, to the accidental removal of glaze during setting. On the cups 75·374 grms. of glaze were used. Actual increase in weight, 0·518. Increase, 0·69 per cent. on the glaze alone.

TABLE C.

Leadless-glazed Cups in Saggar washed with Leadless Glaze.

Cup.	Weight of Biscuit.	Biscuit dipped and dried.	Biscuit Glost fired.
No.	Grms.	Grms.	Grms.
1	83·319	89·301	89·060
2	92·122	97·782	97·540
3	97·760	104·422	104·139
4	97·431	103·313	103·72
5	103·535	109·390	109·134
6	103·564	109·650	109·380
7	94·869	101·424	101·152
8	101·885	107·671	107·415
9	89·725	96·382	96·090
10	88·829	95·117	94·854
11	107·619	114·339	114·053
12	104·027	111·055	110·745
Total...	1164·685	1239·826	1236·634

Therefore, glaze unfired on biscuit equals 75·141 grms. Decrease during firing equals 3·192 grms. Decrease equals 4·25 per cent. on glaze alone.

In Table C 75·141 grms. of glaze were used. Actual loss in weight, 3·192 per cent. Decrease, 4·25 per cent. Total accumulation of lead, or other oxides, 0·69 + 4·25 per cent. = 4·94 per cent.

Examining the powdered cups for lead oxide, it was found to exist in the ware to the extent of 0·37 per cent. Consulting Table B, we find this to be equal to 6·33 per cent. of the glaze alone. The leadless glaze here worked upon contained 0·67 per cent. adventitious lead oxide; therefore actual gain in lead oxide equals 5·66 per cent. We thus have two sets of figures corroborating each other as before, and establishing that, under certain conditions, transmission of lead oxide does take place from the walls of the saggar to the ware in the saggar, and that such transmission goes on to an extent which may easily account for early successes experienced by many manufacturers, and their less successful results in bulk; for it is the custom to use the scrapings from the ware in washing out the saggars, and these scrapings, consisting at first of a lead glaze, as more and more leadless ware is used will become correspondingly reduced in lead oxide.

The figures quoted above scarcely establish whether there is, or is not, a corresponding transmission of alkaline oxides or boric acid from the ware to the walls of the saggar, as they are necessarily not accurate to within several decimal points per cent., by reason of the low ratio of glaze to glazed ware—but so far as they do so, they point to the probability of this being the case. For the purpose of this paper, however, it does not much matter whether an exchange does or does not take place; since in either event it is obvious that the glaze on the ware becomes very considerably modified in its composition, and that the tendency will be for it to develop some of the well-known qualities of leaded glaze. To ascertain the probable experimental error, the ware as per Table C was crushed, and an average sample examined for lead oxide.

Lead oxide in this sample, 0·05 per cent. on body and glaze; 0·82 per cent. on glaze alone. Examination of the glaze before firing showed 0·67 per cent. Consequently the errors in analysis do not amount to more than 0·15 per cent. in this case, and probably the figures for lead accumulation, as shown by analysis, are not further from the truth than this.

It has been pointed out that lead oxide can be found in the glaze of some of the leadless-glazed wares on the market; but while there may be instances of makers thus wrongly describing their goods, it is more probable that the lead oxide is derived from the frit kilns in preparation of the glaze, or by the above-mentioned transference in firing.

In advancing the 5—6 per cent. lead oxide which a leadless glaze may gather in firing as an explanation of some of the successes experienced by the manufacturers in their earlier attempts at this work, and their less marked success in bulk, I do not mean it to be inferred that this accumulation of lead oxide is necessary for the production of first-class leadless-glazed ware—in point of fact, there is not much to choose between the cups of Tables "B" and "C," but it is evident that the presence of lead vapour may have a steadying effect on a leadless glaze, and such glaze may come to the necessary brightness at a fire just not sufficient to develop the surface in leadless-washed saggars.

Leadless-glazed wares, fired in leadless-washed saggars, are being produced by many firms at present, but for the most part there is either a somewhat lower standard of selection set than if lead glazes are used, or an extra price is charged if the lead-glaze standard be maintained.

The presence of so high a percentage of 0·67 per cent. of lead oxide in a glaze intended to be leadless may appear anomalous to some, but, as I have explained earlier, it is almost impossible, in a factory where lead is largely used, to make a wholly leadless glaze without duplicating the grinding plant and frit kilns; and, recognising this difficulty, for purposes of exemption under special rules for earthenware and china trades, the Government considers a glaze leadless if not more than 1 per cent. of lead oxide be present in the dried material.

THE PREPARATION OF LEAD GLAZES OF LOW SOLUBILITY, AND SOME POINTS TO BE OBSERVED IN THE PROCESS.

BY W. THOMASON, F.I.C.

The fritting of lead in the manufacture of lead glazes is one of the oldest, and, under certain conditions, it may also be one of the best, methods of preventing plumbism amongst the workers in these glazes. So far as this country is concerned, however, up to 1898 the mere act of fritting had been looked upon as all that could be done in the matter, and no regard had been taken of the composition of the frit. The act of fritting was probably in itself not without a good effect upon the health of the workers; since the vitrified lead oxide (as monosilicate for the most part) was less dusty when dried on the ware than was the white lead for which it was substituted, and was consequently less liable to be taken into the system by breathing. Here, however, its utility ended, for when it did gain access to the stomach, through neglect of the ordinary dictates of cleanliness on the part of the workers, or through defective ventilating and cleaning of the dipping house, &c., by some of the manufacturers, its solubility in the gastric juice proceeded with almost as great rapidity as did that of white lead, and cases of plumbism have occurred in factories where none but fritted lead of this composition was employed.

Up to 1898 the use of fritted or raw glazes was optional to the manufacturers, but in that year the Home Office commissioned Drs. Oliver and Thorpe to inquire into the best means of checking the growth in the number of cases of lead poisoning which were yearly occurring in the industry, and the results of the enquiry are embodied in the Blue Book of 1899 (C. 9207). The Commission visited the principal English and Continental potteries, and the trend of the report was in favour of stricter preventive measures in the shape of age limits, medical examination of females (in which sex the disease was relatively high in this country), suspension of workers suspected of the disease, greater cleanliness in such parts of the factory as employed lead oxide, the more extensive use of ventilating fans, &c. These regulations, while beneficial in themselves, and largely suggested by the manufacturers, are not in any way chemical, and have therefore little interest for this Society.

The Commission further reported upon the form in which lead oxide was employed in various continental works, and its effect upon the percentage of plumbism amongst the workers, and found that the practice of fritting was distinctly in the direction of safety to the workers, though no official register of the cases of lead poisoning is kept on the Continent, as is the case in this country. In the Continental works, the lead when fritted was for the most part lead bisilicate—a harder and more insoluble form than any in considerable use in this country at the time; though a few months previous to the issue of the report Messrs. Doulton and Co., Lambeth, had arrived at a similar conclusion as to the low poisoning effects of glazes made with this bisilicate compared with raw lead, or monosilicate glazes, and had succeeded in making most of their glazes with this harder material. But the advisers to the Home Office did not consider the results by means of bisilicate to be, as regards solubility, so good as a further chemical study would produce, and in this opinion they were justified; for by adopting a glass proposed by Dr. Thorpe, a glaze containing 22 per cent. of lead oxide could be produced, having an almost inappreciable solubility. A low solubility is, however, not the only property which a glaze should possess. A glaze, particularly a lead glaze, must contain certain proportions of raw material, such as china clay, Cornish stone, &c., if it is to work satisfactorily in the dipping tub, and no amount of grinding will produce precisely the same effect upon a frit as does the presence of a proportion of such raw material in the prevention of settlement from the slop.

The 22 per cent. frit would have made practically all the earthenware and china glazes in use in North Staffordshire district too much fritted, or would have sent up heir melting point, whilst for majolica purposes, it was mpracticable on account of its composition, *i.e.*, its low ead content. Consequently, Dr. Thorpe did not press his formula, but proceeded to show that by maintaining a certain ratio between all the bases of the frit, calculated to lead oxide, and all the acids calculated to silica, low olubilities must result. The weakness of such a broad tatement was that no limit was put to the proportion in which the silica might be replaced by boric acid. Dr. Thorpe did not examine any frit containing more than per cent boric acid, whereas it would be possible for us t Lambeth to include this acid to the extent of over 0 per cent. in the frit, if it were thought necessary to do o, and still preserve the ratio as proposed by Dr. Thorpe. The ratio as finally proposed by Dr. Thorpe was that all ases thus calculated should not exceed 1·45 : 1·00 as compared to the acids calculated to silicic acid, yet, at a meeting of the Royal Institution previously the same observer had announced that 2·00 : 1·00 would be a safe ratio. This alteration meant much to the manufacturers, since it made a more acid and, consequently, more infusible frit necessary, and, in addition, tended to further limit the lead oxide in the frit, and therefore in the finished glaze. It meant even more than this, for, under the original figures of 2·00 : 1·00, the most regularly used Continental frit would have been available for English potters, *viz.*, lead bisilicate; but under the latter ratio this was excluded from the frits which would fall within the Home Office requirements. On the 1·45 : 1·00 ratio Dr. Thorpe recommended to the Home Office that after a certain period all glazes should have a solubility not exceeding 2 per cent. lead oxide when treated in a certain manner with hydrochloric acid, of the average acidity of gastric juice, *i.e.*, 0·25 per cent. The frits capable of producing such glazes were shown to range in lead oxide from 16 per cent. to 44 per cent.

There are, however, majolica colours which cannot be produced by so low a lead content as even the 44 per cent., and consequently by the adoption of this frit such glazes would have been excluded from use.

Probably the most serious objection to the 2 per cent. standard is, that in it are included glazes of all classes, from majolica to earthenware and china, which glazes differ fundamentally in their melting points and lead contents.

Obviously, therefore, the standard (whatever may have been practicable to makers of earthenware and china) was out of the question for majolica, and this has been partially recognised, although the proposal, if it had become law in its original form, would have included glazes of all melting points.

Negotiations proceeded between the Home Office and the potters, and the following objections were raised to the 2 per cent. standard:—(1) English potters are being asked to accept conditions never before employed by any potters in the world. (2) On the Continent, lead bisilicate has been found to prevent plumbism, so there would appear to be no good reason why English potters should accept a harder and more inconvenient frit. (3) That lead bisilicate, while producing a non-poisonous glaze would give with most earthenware and china glazes a solubility, if not over 2 per cent., at least so near to that figure as to make it unsafe for the potters to accept the standard. (4) That the solubility of the frit might vary considerably with its degree of fineness.

In connection with the objection No. 4, figures were adduced by the representatives of the potters upon work done by Messrs. Jackson and Rich to show that the same glaze might, in different degrees of subdivision, yield anything from 1·5 per cent. to 17·5 per cent. lead oxide, to 0·25 per cent. hydrochloric acid.

The negotiations, unfortunately, were productive of no good result, and the matter was referred to arbitration, the manufacturers refusing to accept any standard of solubility whatever, and withdrawing their previous offer to frit the lead in all their glazes without accepting a fixed standard, and the Home Office relying on the 2 per cent. standard as advocated by Dr. Thorpe.

The arbitration award has now been made, and by it all manufacturers who conform to a 5 per cent. standard of solubility are exempted from liability should a worker acquire lead poisoning in a factory where the proper rules of cleanliness are observed by the manufacturer; while such makers as do not accept this standard must accept liability for damage to the health of the worker on lines similar to the Workmen's Compensation Act, with liability for the first fortnight during which the worker is incapacitated.

The foregoing *résumé* of the proceedings between 1898 and the present date, while probably unnecessary for many here to-night, has been thought desirable for pointing the importance of the following figures, in which glazes made by lead bisilicate are considered.

Government Method of Testing the Solubility of a Glaze.—A portion of the dried glaze is shaken with one thousand times its weight of 0·25 per cent. hydrochloric acid at 15° C. for a period of one hour; allowed to settle for one hour and filtered. The lead in the filtrate is then estimated, and returned as the solubility of the glaze in question.

The method is open to criticism, particularly as to its temperature and the time of contact of acid and glaze, but it appears to give in practice a good ratio of solubilities of various glazes. Previous to the issue of the Government method, Messrs. Doulton and Co. had used 0·20 per cent. hydrochloric acid at 37·7° C. as representing more nearly the composition and temperature of gastric juice; but inasmuch as to work at ordinary temperatures is more convenient than at the temperature of the human body, the Government method was adopted, and this was further necessary to obtain concordant results with other workers.

The frit used at Lambeth is lead bisilicate, and the reasons for selecting this compound as the most suitable for general purposes are the following:—(1) It contains only two materials, both of which can be obtained almost chemically pure. (5) It is known to be fairly insoluble in acids, and is yet capable of being conveniently run down in a frit kiln, and will thence flow into water, leaving the bottom of the kiln clean. (3) Its theoretical composition is 65 per cent. lead oxide, and 35 per cent. silica, consequently it can be used in the preparation of glazes of high lead content. The compound is made by intimately mixing red lead, or litharge, and dry flint in the easily calculated proportions, transferring to a frit kiln, and when completely vitrified, and fluid throughout, running off into water, which breaks up the glass into small portions.

The most important points in the preparation are the intimate mixing of the materials, and their complete combination in the kiln; since, if either be defective, a high solubility will result. The resulting frit is not, strictly speaking, lead bisilicate; for analysis of the glass, as run from the kiln, shows the following proportions:—

——	By Analysis.	By Theory.
	Per Cent.	Per Cent.
Lead oxide	61·71	65·02
Alumina	1·00	..
Silica	36·88	34·98
Totals	99·56	100·00

It is therefore evident that the frit has gathered some alumina and silica from the hearth of the kiln. From the composition of the fireclay bottom of the kiln, and the amount of alumina taken up, it also follows that some lead oxide has been lost by volatilisation. The composition of the frit is about one-third of the distance between lead bisilicate and trisilicate, and the loss of lead oxide is about equally accounted for by absorption from the bed of the kiln and by volatilisation.

The above figures are confirmed by analysis of lead bisilicate from two North Staffordshire houses, and may be taken to represent very closely the average composition of commercial bisilicate. This frit is referred to as bisilicate in the following figures. The glaze is now prepared by grinding the lead frit with a borax frit and some raw material, preferably china clay or Cornish stone, which assist to prevent its settlement in the dipping tub.

One of the points raised by the manufacturers in opposing the Home Office standard was that great increases of solubility might be caused by excessive grinding of the glaze. These figures were obtained from the researches of Messrs. Jackson and Rich, who, as stated before, found that solubilities of 1·5 per cent. to 17·5 per cent. could be obtained from a frit, according to its fineness. For their purpose these gentlemen elutriated the frit and examined the finest and coarsest particles, but what they did not show, so far as I am aware, was the proportion in which these extremely fine particles would be produced in practical grinding. This is most important, since, if in very small quantities, their solubility, though high, might have very little effect on the solubility of the glaze as a whole. The following experiments show that the glaze, as wet-ground in different mills, is not capable of any such variation in solubility.

Glaze contains 14 per cent. total lead oxide.

Series A.

Mill running with one-half its normal load.

	Soluble Lead Oxide, per Cent.
Ground 9 hours	1·64*
„ 18 „	2·26

* Easily passes 160-mesh, and is in condition for dipping.

Series B.

Mill running with its full load.

	Soluble Lead Oxide, per Cent.	
Ground 9 hours	0·90	
„ 18 „	1·20	
„ 27 „	1·36 1·44	mean 1·40*
„ 36 „	1·51 1·55	mean 1·53

* Easily passes 160-mesh.

The above figures were obtained by grinding the glaze in an ordinary granite mill, and show that the first day's grinding is the most productive of soluble lead oxide, and that the subsequent days are of successively diminishing effects. Series A and B represent the effect of prolonged grinding in mills of a particular class, but, so that no error could be made, the experiment was repeated with a grinding cylinder of the Alsing pattern, and the results are stated in Series C.

Series C.

Glaze contains 14 per cent. total lead oxide. Ground in Alsing cylinder.

	Soluble Lead Oxide, per Cent.	
Ground 6 hours	0·88	
„ 12 „	1·05	
„ 18 „	1·29	
„ 24 „	1·45 1·53	mean 1·49†

† Pass 160 lawn.

Thus substantially confirming Series A and B.

The figures given above are from a glaze which has since been discarded as having an insufficient lead content for our purpose at Lambeth, but the ratios will stand. While these figures show that Messrs. Jackson and Rich's contention, however theoretically accurate it may be, has not the practical bearing which may be read into it; they, nevertheless, prove that some considerable effect is produced, and that it would not be safe to work so near the standard of solubility as a manufacturer would be doing if he used the average continental proportions, and the usual continental frit.

Dr. Thorpe contended that, though under no rules, the continental makers were conforming to the 2 per cent. standard, and while this would be mainly true, there certainly would be occasions on which they would be exceeding the limit.

Another point in the examination of the glazes for solubility, is that the first hour removes by far the greater proportion of the soluble lead oxide, and that subsequent shaking has less considerable effect, as witness the following figures:—

	Lead Oxide. Per Cent.
One hour shaken, one hour standing:—	
Glaze A	1·64
Glaze B	2·26
Two hours shaken, two hours standing:—	
Glaze A	1·91
Glaze B	2·52

Messrs. Jackson and Rich have found similar effects from continued shaking with acid, and ascribe the cessation of chemical action to a film of silica which the acid separates from the lead contained in the glaze. They find that the same frit in the presence of pebbles does not similarly lose in solubility on shaking; and that a frit which has become insoluble when washed with caustic soda, again becomes partially soluble in acid. Their point that the silica is the cause of the reduction in speed of solubility is therefore supported, but not entirely established, as the pebbles may be rubbing down the frit, thus producing more soluble particles, and the action of the caustic soda may result in surface decomposition of the frit, and not in merely removal of silica from the surface.

Dr. Thorpe has opposed their contention by assuming that the frit which they worked upon was wanting in homogeneity, and that what at first dissolved was in reality a more basic frit present in the mass worked upon. He supports his argument by showing that in seven frits which he examined, the basic oxides passing into solution do not bear the same ratio to each other as existed in the original frit worked upon, this proving what was presumed to be a simple glass, to be, in reality, a mixture of glasses of different solubility. The net result is, that starting from such a frit as commercial bisilicate, it is possible to get, within the limits of practical grinding, variations in solubility of a glaze amounting to from 25 per cent. to 35 per cent. of its normal solubility, but that such variations as anticipated by Messrs. Jackson and Rich are quite impossible. That more serious differences are possible under other conditions will be shown later on.

The bulk of the lead glazes used in the Lambeth Works are coloured, and have a low melting point. They therefore contain more lead oxide than do the earthenware and china glazes in North Staffordshire; and however possible or impossible it may be to adopt a more insoluble frit than bisilicate for earthenware and china, it is quite impossible to do so for majolica, &c.; since the more insoluble frits, in many instances, contain less lead oxide than do our finished glazes, and yet I consider that at Lambeth we are working with as little lead oxide as is compatible with good results, and reasonable losses in process. For the past three or four years we have used all our lead fritted as bisilicate in two of our departments, and during that period have produced thousands of gallons of majolica glazes ranging from 2·5 per cent. to 3·0 per cent. of soluble lead oxide. The results are satisfactory, though certain details of dipping and firing had to be mastered. Up to somewhat less than two years ago there still remained a department in which all the glazes were fritted, but of no definite solubility, *i.e.*, old glazes containing 60 to 70 per cent. of lead oxide, of which most was soluble, and of such glazes many are still in use elsewhere. To obtain exemption under the then provisional 5 per cent. standard, it was necessary for a change to be made in this department, and in doing so an unexpected source of variation in solubility came to light. The same frits were in use as in the departments already conforming to the 5 per cent. standard, and the mills for the final wet grinding were of the same pattern; there was a difference, however, in the treatment of the frits before being introduced into the mill for the final grinding. In this new department the frits were dry-ground into a fine flour in a cylinder, whereas in the other instances the dry grinding was not carried beyond a coarse meal. The glazes prepared under these conditions did not yield the customary 2·5 per cent. to 3 per cent., but as high as 7·0 per cent. to 7·5 per cent. The increase might have been due to several causes: (1) Lead oxide, accidentally present in the borax frit which is supposed to be leadless; (2) Imperfectly prepared bisilicate; (3) Different treatment of the frit in the dry state. The borax frit on analysis accounted for 0·70 per cent of soluble lead oxide. The bisilicate was normal in composition, and well fused, and, further, during the period in which high solubilities were being obtained in one department, the customary 2·5 per cent. to 3·0 per cent. was ruling in the other two, although the frits were from the same batch.

Accordingly the frit was less finely dry-ground, and the solubility at once fell to 4·40 per cent. and 4·52 per cent. in different samples.

The rougher dry grinding had occasioned a drop of more than half the difference in solubility between the glazes used in the different departments; consequently, the rough grinding was made rougher, and the frit merely reduced to pass a 12-mesh sieve. The glazes immediately fell in solubility to 2·8 per cent. and 3·02 per cent. in two different samples. This brought all departments into line, and within the 5 per cent. limit of solubility when ground to pass the 160 lawn. The glazes contain about 30 per cent. of lead oxide, but by using a very coarsely-crushed frit, and carefully watching the grinding, it has been found possible to produce a glaze containing 55 per cent. of lead oxide of solubility of about 3 per cent. to 3·5 per cent.

It appears to me that the unlooked-for effect of dry grinding considerably supports the theory of solubility being more influenced by the surface exposed to the solvent, than to irregularity of composition; nevertheless, the contention that the solubility may be much influenced by wet grinding is not supported by these results. I believe the dissimilarity between two glazes of the same composition, but prepared, one largely by dry grinding, and the other almost entirely by wet, can only be accounted for by the different shapes which the small particles of frit assume in the processes; those in the dry-ground glaze being angular, and those in the water-ground essentially rounded and consequently exposing the smallest surface to the solvent in proportion to their mass.

The experiments referred to in this paper cover a period of four years, and represent tons of material; and it is the fact that they are the result of actual manufacturing experience, and not merely laboratory trials, which has prompted me to bring them before you.

Table showing the effect of fine dry grinding of Lead Frit as a preliminary to the final wet grinding. In all cases the particles pass a lawn of 160 *meshes to the linear inch.*

State of Frit when introduced into Mill for wet grinding.	Lead Oxide contained in Glaze.	Lead Oxide soluble in 0·25 per Cent. HCl.	Percentage soluble of the Lead Oxide present.
	Per Cent.	Per Cent.	Per Cent.
Finely dry-ground	30—32	7·0—7·5	23·4
Coarsely dry-ground.......	30—32	4·40—4·52	14·4
Crushed to pass a No. 12 sieve.	30—32	2·8—3·02	9·3
Extremely coarse, having all fine dust removed by sieving.	55	3·0—3·5	5·9

There is no doubt but that for purposes such as those at Lambeth, it is possible to produce glazes, either colourless or coloured, for which a 5 per cent. standard of solubility affords margin for an occasional slight variation in the composition of frits, and of fineness of grinding. This statement is made on the evidence of about two hundred observations of solubility, none of which have exceeded the 5 per cent. limit, except under the conditions of dry grinding above alluded to. To ensure success, it is, however, essential that that the condition of the frit kiln be considered, and that a good stock of lead frit be prepared before going on to make the borax frit, or *vice versâ*. Failing this, the solubility will rise from one of two causes:—(1) Slight residues of lead frit always remain in kiln, and these are taken up by the following borax frit, and rendered soluble, making their way into the glaze through the borax frit. (2) Residues of borax frit remain, which increase the basicity of the lead frit, and make it more soluble. The use of lead bisilicate is described above, but it will occur to many chemists that lead sulphide or sulphate might have been used instead of the fritted lead with complete immunity from poisoning. As a matter of fact, lead sulphide is occasionally used in potteries, but the results are not such as to make it a sufficient substitute for white lead in high-class work—the sulphur is the difficulty, as lead sulphide in the presence of a limited amount of air may produce metallic lead. Lead sulphate is not, of course, liable to this trouble, but it is not so insoluble in dilute hydrochloric acid.

Before finally deciding upon what form of lead to use at Lambeth we had adopted provisionally the bisilicate, and realising that it was to an extent soluble, the following attempts to reduce its solubility were made:—

(1) The amount of lead soluble from the frit being known, a portion of the calcium oxide of the glaze equivalent to the amount of lead soluble, was introduced as

sulphate with the idea of rendering insoluble the small quantities of lead which would otherwise pass into solution. The results were disappointing, as no decrease in solubility was discernible.

(2) As lead sulphate is less soluble in dilute sulphuric acid than in water, in another case the whole of the calcium was introduced as sulphate. The result was again imperceptible.

Precipitated lead sulphate was now examined for solubility, and found to be at least as soluble as the bisilicate, a fact which explains the non-success of the experiments above. It would appear, therefore, that in factories where lead of a not more soluble character than bisilicate is used, there is no proper reason for the administration of dilute sulphuric acid to the workers as a safeguard against plumbism.

During the period in which the wholly fritted lead glazes have been in use at the Lambeth works there has been no case of lead poisoning, and the workers as a whole feel an improvement in health, particularly in the case of one man who is a very susceptible subject.

Some makers who have attempted to use fritted lead as a substitute for white lead, find the tendency to be towards a rise in melting point, and consequently a somewhat egg-shell surface. I believe that such effects are merely the result of silicious matter taken up in the preparation of the frit from the bed of kiln—that, in fact, the theoretical composition of the frit has been taken in calculating and not the actual composition as determined by analysis.

There are here for your inspection, examples of majolica semi-transparent enamels, opaque enamels, and under-glaze painted tiles, &c. On each is marked the solubility of the glaze employed.

Cost of Fritted as compared with Raw Lead Glazes.—There is of course more labour and time spent in the preparation of the former glazes, but, on the other hand, the cost of materials is somewhat less than where raw white lead is used. For instance, the price of white lead is at present 18*l.* 10*s.* per ton. The price of red lead is 14*l.* 15*s.* per ton. Therefore the PbO costs in white lead 4·3*s.* per unit per ton, and the PbO costs in red lead 3·0*s.* per unit per ton. Further, the fritting tends to the use of a lower percentage of lead oxide—for an excess of lead frit means settlement in the dipping tub, and this remark applies especially to soft enamels and majolica glazes. Consequently borax and lime are used to replace the lead, and are introduced in the form of a soft and easily prepared frit, thus further reducing the cost of materials.

Our experience at Lambeth is that it is possible to make fritted majolica glazes at practically the same cost as the older raw lead glazes.

DISCUSSION.

Mr. BERTRAM BLOUNT questioned whether all these regulations had been necessary. It seemed to him that great excitement and interest had been aroused by what was, after all, a small matter. The worker of course must be protected from anything which could do him harm, if it was controllable without undue expenditure, but he feared that, in the eagerness which the Government showed to safeguard the worker, they had hedged him in with needless restrictions. The manufacturers seemed to have accepted the situation loyally, and they had brought the matter to a point where they had as far as possible no restrictions such as would hamper their trade. As far as he had followed this controversy, it amounted to this, that the manufacturers had decided to accept the use of fritted lead—he thought unnecessarily; but having accepted that, they objected a little, which was not surprising, to the requirement that this fritted lead should have a certain standard solubility. Originally the solubility was very vaguely defined; it was that the material should be soluble to the extent of only 2 per cent. of lead oxide, but no definition was given as to the fineness of the frit—a point which had been brought out by many, and which Mr. Thomason had shown to be important, although not so important as some had supposed. The point on which Dr. Thorpe probably relied was that for practical purposes the glaze was always ground to a fineness suitable for dipping, so that it might go through a 160-mesh sieve. But that was not sufficient, for it was possible to have a material which could just scrape through a sieve of that fineness, which would contain numerous coarse particles as well as floury particles. The proportion of particles which would just scrape through was not important; it was the flour which was important, and, unless some more exact definition of fineness were given, no standard of solubility could be set up. Supposing the glaze were prepared of the requisite fineness and insolubility, it had yet to be shown that the workers would suffer any particular harm by absorbing moderate quantities of it, and the direction of safety to the worker lay in the greater cleanliness of the works and the workers, and the general precautions in carrying out operations rather than in any particular rule. If manufacturers decided that they could better prepare their ware with a glaze containing an amount of soluble lead precisely defined, he thought the body of opinion of chemists and technologists should be on their side. It seemed to him that until that was done, an unsatisfactory situation would exist, and manufacturers might be more or less harassed and perhaps not quite fairly treated. The knowledge which a Government inquiry certainly should have at its disposal might be actually misleading unless conference with the manufacturers was held in a more liberal spirit than appeared to have been exhibited in this case.

The CHAIRMAN said the volatilisation of lead in furnaces was well known, and a French process called "posage par volatilisation" was based on the method of lining the saggar with a paste of red lead, and putting the ware inside without any contact whatever with the glaze. The method was published by Brogniart in 1844, and some of our old Chelsea ware was made in the same way. The pieces to be glazed were burned alternately with lead-glazed ware in the same saggar. After using a lead-glazed ware the same saggar was employed for burning biscuit figures, and on the surface of the biscuit a very fine glaze was produced, which was called a "spitting"; such a glaze was almost unobtainable by the actual immersion of the figures in a solution. The author had rendered great service, however, in getting the actual figures as to what occurred; for he (the speaker) had not been able to find in the literature on the subject any definite statement of the actual amount of this volatilisation. The knowledge of the old potters was carried down from father to son; they got certain results, but as to the exact quantities of the ingredients used they had not the slightest knowledge and very often could not reproduce them. The difficulties to which Mr. Blount had alluded with regard to fixing the composition of the ingredients which some manufacturer should use were very great. On the one side there was a Government department doing its best for the workers, the manufacturers, and the public, but he thought they ough to consult manufacturers more than they did. In Germany there was quite a different state of affairs. Each trade had a guild, and the Government never introduced any important measure without consulting the guild, the consequence being that they worked hand in hand. Perhaps there was no necessity to have these restrictions, because the manufacturers did what they could do to get rid of the difficulties. Here there was the Employers' Liability Act which was most unfair to employers. Damages occasioned to the workers by the operations they carried out were no always due to a fault of the employer, but he had to pay everything, and that seriously hampered industrial enterprise. In Germany, the compensation paid to a workman injured in the course of his employment—and all employments were subject to some risk—was made good from three sources: first, a fund to which the workmen themselves had to contribute; secondly, the general taxation of the country; thirdly, the employer. This principle wa extended to all industries, and he thought it was a subjec the Society might take some action upon later on. Th pottery industry was an instance where it was particularl hard on the employers. It was a trade where the profit were not unduly great, and through the carelessness of th employees the employer might be saddled with a ver heavy liability. As every trade was carried on for th benefit of the whole community, there was no reaso why a portion of the damages should not be paid by th community as a whole. It was particularly unfair when employers were pinned hand and foot by Government restrictions which they could not fight as individuals, though they might be perfectly well aware that, as in this case, there were most complicated questions which could not be solved by a few tests made in a laboratory; the long experience of the manufacturer should be consulted. In Germany, he believed, there were very great restrictions as to the use of vessels containing lead glaze soluble in dilute acids, and the police regulations prohibited altogether the use of any vessel for culinary purposes which contained glaze or enamel in which the lead was soluble. In some enamels lead was prohibited altogether. He had not heard, however, of any regulations which prevented the German manufacturers making such ware and selling it to us. Here was another point where the Government might step in with great advantage and test the cheap enamelled goods that came from abroad and were sold very largely in this country. There again came in the trade question whether such competitors who sent over things which might be prohibited in their own country were not working much more cheaply than our manufacturers possibly could. He thought that the fact of the solubility of glaze ground dry being greater than that of the same glaze if ground wet might possibly be due to the particles being finer when ground dry, because the same particles might be ground over and over again when dry, but when suspended in water they did not come under the same amount of attrition. He quite agreed that passing through a sieve of 160-mesh was no test at all of fineness; only careful levigation would be a sufficient indication, and that was very difficult to carry out.

Mr. **Thomason** in reply said the fineness of the glaze as produced by dry grinding and subsequent wet grinding was in all probability the cause of the extreme solubility. The matter of volatilisation from the red lead of the saggar added to the unglazed article placed inside the saggar was rather different from the point he referred to in the first paper. In one instance the glaze was lead oxide, in the other a silicate or rather a silico-borate. It was the fact that volatilisation occurred even from fritted lead as distinct from raw lead which led him to prepare the first paper. There was considerable communication between the Home Office and potters before any standard of solubility was decided upon, and it was upon the margin which should be left in the hands of the potter that the atter finally came to grief. It was quite obvious that, hile in most instances 2·5 or 3 per cent. would be sufficient or most majolica purposes, there were cases in which the ame glaze would exceed that point. The German method f estimating the value of the ware by the fact of its ielding or not yielding lead oxide in an acetic acid solution as a very much less drastic one than those in which the laze was in a very fine state of subdivision, in spite of the ifference in the strength of the acid—it was, he believed, ne per cent. acetic acid. Considering the surface exposed the action, the British method was much more searching an the German.

ACTION OF CERTAIN SOLUTIONS UPON ALUMINIUM AND ZINC.

BY WATSON SMITH.

I will first give the results of some experiments as to e action of certain acids and alkalis on aluminium and nc.

Phosphoric Acid and Sulphuric Acid.—Phosphoric acid, ncentrated or dilute, attacks aluminium strongly with olution of hydrogen.

Winteler (Die Aluminium Industrie, 1903, 21) states at concentrated phosphoric acid acts like concentrated suluric acid on aluminium, in the former case phosphorus, the latter sulphur, being separated. I have observed ther separation of phosphorus nor of sulphur in such es. Dammer, Bd. III., p. 86, mentions in the case of phuric acid that sulphur dioxide is formed during the cess of solution. This I can confirm.

With zinc, phosphoric acid solution yields zinc phosphate and phosphide (Dammer, II., 458), I find, with evolution of hydrogen gas.

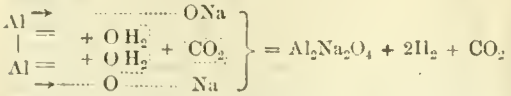
Organic Acids.—It has been stated that organic acids, dilute and cold, are without action on aluminium. Dammer (Bd. III., 86–87) states that even in presence of sodium chloride, acetic acid of 4 per cent. strength and citric acid of 1 per cent. strength showed no action after many days' contact. Only after 14 hours' boiling in a 4 per cent. acetic acid solution in presence of sodium chloride, did a sheet of aluminium of 1 square metre superficies, and 24·743 grm. weight, lose 47 mgrms. Roscoe and Schorlemmer, Vol. II., 545, state that organic acids attack aluminium only slightly, but it dissolves in them with ease in presence of chlorides, such, *e.g.*, as common salt. They draw the conclusion that it cannot therefore be used for plating cooking utensils. Winteler is silent on this subject. I tested this matter, and found that the action of acetic acid, dilute or fairly strong, is but slight, but on adding common salt and heating, greater action springs up, provided the acid be fairly strong. I should incline, according to appearances in my own experiments, to accept Dammer's figures and definition here, and hence would say that aluminium is not quite suitable for some cooking utensils, whilst it is for others.

Nitric Acid.—Winteler (p. 21) writes, "Nitric acid appears on superficial observation, to have absolutely no action on pure aluminium." Dammer (Vol. III., p. 86) says, "It is not attacked by nitric acid hot or cold," quoting Deville, Heeren and Buff. Roscoe and Schorlemmer (Vol. II., 545) write, "Concentrated as well as dilute nitric acid is almost without action on the metal." This latter statement is nearest the truth; that alone given from Dammer, *loc. cit.*, is partially false. According to my own experiments the case stands thus: Cold nitric acid, whether concentrated or dilute, is practically without action on aluminium at ordinary temperatures. But on raising the temperature to near the boiling point, fairly vigorous action is set up with liberation of nitrous fumes. If the liquid be now cooled, the action subsides and at about 50° C. or somewhat over, ceases. If aluminium dust or powder be used, the action, on heating, becomes very vigorous, and the temperature thereby rises further. Still, even then, on cooling the action greatly subsides. Besides nitrous fumes, ammonia in one case was also formed. This was proved by removing some of the clear acid liquid, and heating with caustic soda in excess.

Ammonia.—Winteler, *loc. cit.*, p. 21, says that ammonia solutions act slowly upon aluminium with formation of the hydroxide. Dammer also states that ammonia acts slowly. I find that a hot and strong ammonia solution acts on aluminium with generation of hydrogen and formation of aluminium hydrate. On raising such an ammonia solution to boiling, ammonia is evolved with appearance of effervescence, and this may have caused previous observers to overlook the possibility of admixed hydrogen. If the evolved gases be passed through water, bubbles of the hydrogen will be perceived and may be easily collected and tested.

Action on Zinc.—The action of a hot, almost boiling solution of ammonia was now tried on zinc cuttings. Slight but perceptible evolution of hydrogen was proved. If zinc dust be employed, the evolution is considerably greater. But whereas in the case of zinc the zinc hydrate formed, readily separates from the metal and falls in the solution, it was found that in the case of aluminium the hydrate adheres firmly and forms a coat, thus protecting the metal from further action.

Aluminium and Sodium Carbonate.—If aluminium dust be warmed with normal sodium carbonate solution, decomposition of the latter sets in with such violence that the contents of the vessel soon froth over. The effervescence is due to escape of a mixture of carbon dioxide and hydrogen. The action is very vigorous even with aluminium foil or sheet. In the reaction it may be said that in presence of the alkali carbonate the tendency of aluminium to unite with the hydroxyl of the water is so strong as to cause displacement and expulsion of hydrogen, and almost simultaneously—*in statu nascendi,* the alumina hydrate half-formed attacks the sodium carbonate, liberating carbon dioxide and uniting with soda to form sodium aluminate. The reaction cannot then be represented by an ordinary equation, and thus a special device is required—



$$\left.\begin{array}{l} Al \rightarrow \cdots\cdots ONa \\ \ \ | = \ \ + OH_2 + CO_2 \\ Al = \ \ + OH_2 \\ \rightarrow \cdots O \cdots Na \end{array}\right\} = Al_2Na_2O_4 + 2H_2 + CO_2$$

If now the liquid be filtered from excess of aluminium powder or foil, and carbon dioxide be passed through the clear liquid (sodium aluminate), a copious precipitate of aluminium hydrate is obtained, sodium carbonate being re-formed—

$$Al_2Na_2O_4 + CO_2 + 3H_2O = Na_2CO_3 + Al_2(OH)_6.$$

We thus see that on heating, aluminium expels the carbon dioxide from an aqueous solution of sodium carbonate, also decomposing water to form sodium aluminate, whilst in the cold, carbon dioxide decomposes sodium aluminate solution, precipitating aluminium hydrate and re-forming sodium carbonate. Thus in a hot solution the elements of aluminium hydrate in the nascent state can decompose sodium carbonate, expelling the carbon dioxide and combining with the soda. It was natural next that the attempt should be made to utilise aluminium hydrate, freshly precipitated and washed, for this same purpose. But I found that even on boiling such aluminium hydrate with sodium carbonate not the slighest reaction occurred. This clearly proves that it is only the nascent aluminium hydrate that will effect the decomposition referred to.

Zinc and Sodium Carbonate.—The contrast in the action of aluminium and zinc is shown by the fact that boiling sodium carbonate solution simply dissolves and oxidises aluminium with decomposition of water and liberation of hydrogen; also sodium carbonate is decomposed with liberation of carbon dioxide and union of soda to form sodium aluminate, which remains in solution, whilst with zinc a boiling sodium carbonate solution causes oxidation of the metal at the expense of water hydrogen being evolved, but any basic zinc carbonate or even hydrate, if formed, is decomposed in the boiling solution with formation of insoluble zinc oxide left along with residual metallic zinc. In other words, a boiling sodium carbonate solution simply converts metallic zinc into zinc oxide with escape of hydrogen.

But according to Gmelin, Wöhler showed that by the action of sodium carbonate solution on zinc a basic "zincosodic carbonate" is formed, which dissolves, and probably has the composition $Zn<\substack{NaCO_3\\ONa}$ hydrogen escaping. Wöhler states that he obtained octahedral crystals of this compound. On attempting to repeat this experiment I have entirely failed to obtain any solution containing dissolved zinc. I can confirm the evolution of hydrogen in the action of hot sodium carbonate solution on zinc, but on prolonging this action I gradually accumulated a white deposit, chiefly consisting of zinc oxide, and the filtrate from this contained no zinc. If Wöhler's compound be formed, it must be by the slow action of a cold solution; if attempted hot, and "zinc-sodic carbonate" for an instant be formed, it must be instantaneously decomposed again as follows:—$Zn<\substack{CO_3Na\\ONa} = ZnO + Na_2CO_3$. Wackenroder has shown that zinc oxide remains invulnerable when boiled with a sodium carbonate solution.

Aluminium and Ammonium Phosphate.—A weight of 4·7955 grms. of thin aluminium plate was placed in a solution composed of 100 c.c. of phosphoric acid (sp. gr. 1·275), rendered faintly alkaline by addition of ammonia. The whole was then heated till the liquid boiled, and ebullition continued till ammonia was no longer evolved. After this treatment, during which it was observed that the metal was greatly suffering, a white substance was plentifully formed. The aluminium was then gently wiped, after first washing in water, and weighed. It had lost no less than 0·9815 grm., that is 20·47 per cent. of its original weight. Evidently, then, aluminium is not the metal for vessels in which to heat ammonium phosphate solutions. The next question was, Which is the attacking constituent, the phosphoric acid or the ammonia? Ammonium phosphate solution, on boiling, suffers decomposition, ammonia being rapidly liberated. In this decomposition, of course, both phosphoric acid and ammonia at the moment of liberation may be regarded as *in statu nascendi.* It would seem tolerably certain that in the case of the hot ammonium phosphate the action on the aluminium is as follows:—Nascent ammonia in presence of steam acts as do the fixed alkalis, water being decomposed and aluminium hydrate being produced, with evolution of hydrogen. This aluminium hydrate then falls an easy prey to phosphoric acid, aluminium phosphate being formed.

Zinc with hot (boiling) ammonium phosphate solution yields hydrogen gas which comes off with the ammonia evolved.

Ammonium Arseniate and Aluminium.—The action of hot or warm ammonium arseniate solution on aluminium is very pronounced, hydrogen with arseniuretted hydrogen being copiously evolved.

Ammonium Arseniate and Zinc.—In the case of zinc a similar action to the foregoing occurs, but less freely.

Sodium Chloride and Aluminium.—The action on aluminium in the form of powder or foil, of hot and moderately strong solution of sodium chloride was now tried. The metal was attacked with evolution of hydrogen, the solution becoming alkaline. It was found that the *rationale* of this reaction is as follows:—Aluminium in the presence of sodium chloride attacks the water, setting hydrogen free. Aluminium hydrate is thus formed, and almost instantaneously attacking the sodium chloride, yields basic aluminium chloride and some free sodium hydrate. It is already known that organic acids which attack aluminium only slightly, dissolve it to quite an appreciable extent if sodium chloride and similar chlorides be present. It is clear, therefore, that aluminium is not quite suitable as a material for cooking utensils. 15·714 grms. of aluminium foil were heated for four days in a solution of sodium chloride (0·759 grm. of NaCl in 125 c.c., 6·072 grms. per litre). The loss of weight was only 0·002 grm. But the metal became also coated, and this coating protected it from further action. Such formation of an adherent protective coating is an important practical point, for it was found on removing the piece of aluminium from the solution and heating it in a fresh and even stronger sodium chloride solution, that it was but very slowly attacked. Hence, for some culinary purposes, and with suitable precautions, aluminium might prove useful. (See this J., 1899, 149.)

Sodium Chloride and Zinc.—But the action of sodium chloride on aluminium is very trifling compared with this action on zinc. 15·692 grms. of zinc foil were heated for about two weeks at about 80° C., in a dilute solution of sodium chloride (0·749 grm. in 125 c.c. or 5·992 grms. per litre). The loss of weight was 0·684, or the zinc in this period lost 4·36 per cent. of its weight. The precipitate formed on the zinc separated easily, and fell to the bottom of the containing vessel leaving the metal clean, and of course ready for renewed attack. But since solutions of sodium chloride so dilute could act as stated on aluminium and zinc, the question suggested itself that possibly water at 100° C., or thereabouts, might even act on these metals.

Distilled or Pure Water and Aluminium and Zinc.—On experiment, it was found that distilled water at 80° C. acted very slightly on aluminium after several days digestion, whereas zinc was considerably affected. Here, again, too, the hydrate formed at the surface of the zinc separated very easily and settled down in the liquid. With the aluminium a slight coating was formed, both adherent and protective. (See this J., 1899, 279.)

Hot Water and Aluminium.—As is well known, a very small quantity of an alkali hydrate in water will cause very considerable action on the metal. Having some suspicion that the soft glass of the test tubes I had been using for some of the experiments might contribute a small quantity of alkali to boiling water, I applied the following test. Distilled water was heated to incipient ebullition in a platinum dish with aluminium powder. Very slight action thus took place. But when the same powder was transferred to a test-tube and heated, quite a vigorous evolution of hydrogen was observed.

Hot Water and Zinc.—The action of boiling or almost boiling water on zinc dust in a test tube was such as to generate hydrogen enough to collect and test. The action was considerably less than on aluminium. In a platinum dish it was very slight indeed.

Sodium and Potassium Nitrate and Aluminium.—Aluminium powder with an aqueous solution of potassium or sodium nitrate heated to 100° C. in platinum, gave rise to a faint evolution of hydrogen gas, whereas the same mixture transferred to an ordinary soft glass test tube and boiled, showed vigorous action, and a considerable evolution of gas. In the experiment with the test tube about 20 c.c. of liquid were generally used. So 20 c.c. of distilled water were evaporated in the same test tube three times over (about 60 c.c. in all). Time of action on the glass, was about one hour. The alkali thus extracted from the glass was found to be equivalent to 0·0015 grm. NaOH; or 0·025 grm. per litre. (For an interesting and analogous case of the influence of the alkalinity of glass, see Lindet, this J., 1904, 330; bottom of col. 1.) A sodium nitrate solution heated to boiling (or rather, incipient ebullition) with aluminium powder in a test tube, after a time invariably and quite suddenly set up a vigorous effervescent action through evolution of hydrogen, and formation also of ammonia which was largely evolved.

As at most very slight action could be obtained in platinum, it was thought that incipient action must have been started by the alkalinity of the test tube, and this alkalinity once induced and becoming active, is continually increased, as follows—

$$NaNO_3 + \left\{\begin{array}{l} 6H_2O \\ 3H_2O + 3Al = 3Al(OH)_3 + 3H_2O + NaOH + \\ H_2O \qquad\qquad\qquad\qquad NH_3 + H;\ \text{or}, \end{array}\right.$$

$$2(NaNO_3) + 20H_2O + 3Al_2 = $$
$$3[Al_2(OH)_6] + 6H_2O + 2NaOH + 2NH_3 + H_2.$$

In this action we have two sources of alkalinity, the nitrate of soda and the walls of the test tube, and both continually increase, and so give rise to ever increased reducing action in presence of the aluminium on the sodium nitrate, and thus the way is prepared to a final tempestuous evolution of ammonia and hydrogen, with proportionately greater increments of alkali.

Sodium and Potassium Nitrate and Zinc.—Action similar to that on aluminium, only much less vigorous.

Petroleum Products and Aluminium.—It may be interesting to note here that Charitschkow has observed with regard to the action of petroleum products on aluminium, that in this respect aluminium is superior to copper and fully equal to iron. (See this J., 1896, 443.)

Practical Applications of the Foregoing Facts, &c.—I. From my experiments with nitric acid, the great value of pure aluminium as offering such resistance to the action of nitric acid, below a temperature of 50° C., or thereabouts (not over 50° C. to 55° C.) forced itself upon me, and I would suggest that for transport of nitric acid, not glass carboys or even earthenware vessels be used, but box-shaped vessels composed of pure sheet aluminium, protected by enclosure in wood (this J., 1903, 1352). It seems to me also that storage vessels in the nitric acid factory, would be most conveniently made of pure sheet aluminium. (See Guttmann, this J., 1898, 313.)

II. If aluminium could be produced cheaply enough, it were certainly better suited than zinc for cisterns in which to store water for household purposes and in the construction of receptacles to catch and run off rain water. It would last far better than zinc. Brackish water would rapidly act on zinc, whilst aluminium would prove ery resistant. (See Norton, this J., 1897, 465; 1899, 497.)

III. As a material for cooking vessels and culinary purposes, discrimination and caution are required. Aluminium kettles and teapots are largely offered for sale. I fear, however, in the latter case (teapots) when carbonate of soda" is added to get the "tea to draw" as the old people say, that the drawing power would soon extend from the tea to the teapot itself! (See this J., 1896, 118; 1899, 587.)

I have much pleasure in acknowledging here the very intelligent help received from my assistant, Mr. Albert Shonk.

Discussion.

Mr. Oscar Guttmann said that he was the first to mention the use of aluminium in that room some years ago. He believed he suggested it to the Royal Gunpowder Factory, where they now used aluminium extensively for nitric acid and nitroglycerin. He thought there would be some difficulty in constructing storage tanks of aluminium, and boxes lined with aluminium in which nitric acid could be safely carried, *e.g.*, to India. Although aluminium had been successfully soldered recently, he did not think the composition of the solder was the same as the metal, and though the aluminium might stand, the solder would not. Another difficulty has been that rivets would not always do. Centrifugal machines were made for separating the waste acids from guncotton, the baskets of which were constructed of aluminium, but it was found that the centrifugal force drove the rivets into the aluminium, the holes became oval and the basket began to leak. In order to make a vessel out of aluminium, three rows of rivets had to be provided which weakened the construction and was expensive. There were a number of mechanical and other difficulties in the way of using aluminium for such purposes as Mr. Watson Smith had suggested. On the other hand, for long lines of gutters for conveying nitroglycerin and mixed acids it was very extensively used already.

Mr. Blount said aluminium soldered very badly, but the difficulty could be overcome by autogenously soldering.

The Chairman said that there was one observation in the paper which, if not absolutely novel, was new to most of those present, namely that they could use a test-tube as one of the reagents in a test. He agreed with Mr. Guttmann about the difficulty of getting a box-shaped vessel as recommended by Mr. Watson Smith for the conveyance of nitric acid, but when the difficulty of getting a good joint was surmounted, it was not the best form of vessel for conveying liquids.

SESSION 1903—1904.

Monday, June 6, 1904 —

Mr. J. K. H. Inglis. "The Loss of Nitre in the Chamber Process."

Mr. A. Marshall. "Acetone: Its Manufacture and Purification."

Scottish Section.

ERRATA.

LINTNER'S SOLUBLE STARCH AND THE ESTIMATION OF DIASTATIC POWER.

BY JOHN S. FORD, F.R.S.E.

(This Journal, 1904, 414—422.)

Page 414, col. 2, bottom line, and 15 up; page 421, col. 1, line 25 from top; and page 422, col. 2, line 7 from top: for "amylotic" read "amylolytic."

Page 416, col. 1, last line: asterisk (and corresponding footnote) should be after "phosphates," page 415, col. 2, line 5 from bottom.

Page 419, col. 2, line 37, for "*exteribus*" read "*ceteris*."

Yorkshire Section.

Meeting held at Bradford, on April 18th, 1904.

MR. JAS. E. BEDFORD IN THE CHAIR.

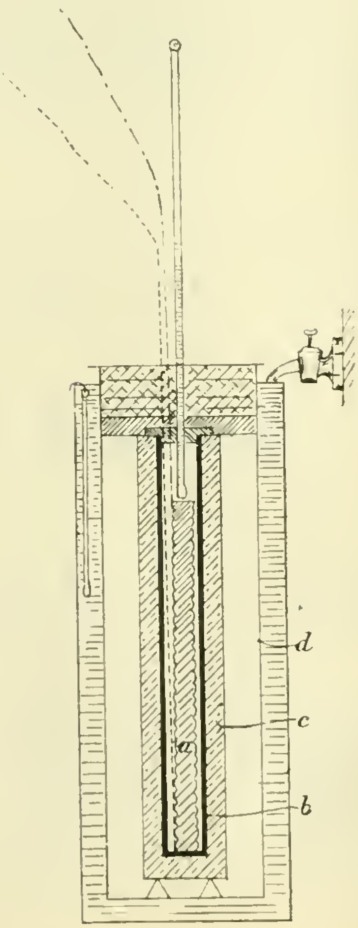
NOTE ON THE RELATIVE EFFICIENCY OF HEAT-INSULATING MEDIA.

II.—STEAM PIPE COVERINGS.

BY S. H. DAVIES, M.Sc.

This work was begun with the object of finding a suitable covering for pipes conveying highly superheated steam. A very high temperature has therefore been maintained throughout the experiments. In most cases the temperature of the steam pipe was raised to about 250° C. (482° F.). If steam of 90 lb. pressure is used, this is equivalent to a "superheat" of 150° F.

The first method of experimenting which suggested itself was to cover considerable lengths of pipe with the material, supply a regulated quantity of superheated steam, collect and weigh the quantity of water condensed in unit time. To carry this out with any degree of accuracy is, however, extremely difficult. To supply steam at a uniform pressure and superheated to a uniform temperature for a considerable period is almost impossible. If this difficulty is evaded by supplying the same steam to a number of parallel pipes covered with different materials, it is difficult to insure that the supply to each pipe is uniform. I therefore abandoned this in favour of an electrical method of heating. The loss of heat was determined by simply observing the quantity of electrical energy which must be supplied to the apparatus and transformed into heat in order to maintain a uniform temperature. I am greatly indebted to Prof. Stroud, of Yorkshire College, for his suggestions regarding this part of the work.



The heater consisted of a coil of fine platinoid wire wound round a porcelain core (*a*) (see diagram). This was placed in a wrought-iron steam pipe (*b*) 2 inches in diameter, 2 feet in length, closed at one end by a blank end of iron welded into the pipe of the same thickness as the wall of the pipe. The heater was immersed in melted paraffin wax to insure a uniform temperature throughout the length of the pipe. The sides and closed end of the pipe were then surrounded by the lagging or insulating material (*c*); the open end was covered with a wooden lid, perforated with holes for a thermometer and wires to convey the current to the heating coil. The steam pipe and its fittings were placed vertically in a wide tin cylinder (*d*), and the top covered with a closely fitting wooden lid and with several layers of hair felt. The loss of heat from the top end of the pipe was thus reduced to a negligible quantity.

The outer cylinder was immersed in running water to secure a uniform temperature, and therefore uniform conditions for radiation from the free surface of the material.

The coil of wire on the heater was connected with the factory current, regulated by the introduction of a rheostat of incandescent lamps placed parallel with each other and in series with the heater. An ammeter was included in the circuit. A current of 3 to 4 ampères was passed through the heater until the temperature rose to about 250° C., and then the current was regulated by means of the rheostat until a constant temperature was obtained in the pipe. In every case this high temperature was maintained in the steam pipe over-night, so that any moisture present in the covering might be expelled. An opportunity was thus given of observing any charring or disintegration of the material which might take place. The apparatus then remained under close observation, and when a constant temperature had been observed for half an hour, the temperature and flow of current were recorded.

The results of these experiments are shown in Table I. Round the insulating material a few coils of thin platinoid wire were wrapped, forming a resistance thermometer for recording the temperature on the outer surface (not shown in diagram). The wire formed one arm of a Wheatstone bridge, in parallel with an equal length of wire immersed in an oil bath, which was heated or cooled until equilibrium was established, and the temperature then recorded (column (*d*)).

It will be seen that the results are not directly comparable, owing to the different thicknesses of material supplied by the maker. Except in the case of plastic coverings, this is, however, a matter of theoretical interest, the practical question being, What loss of heat do we obtain from steam pipes covered by the materials just as they are supplied by the makers? The figures given in column (*g*) supply an answer, giving the loss of heat per hour calculated for a difference of 250° C. between the steam pipe and the water jacket.

For comparison an experiment carried out with the bare steam pipe is added, and it will be seen that, with the best covering, 77 to 78 per cent. of the heat transmitted by the bare pipe is retained, while with the worst covering examined only 21 per cent. is retained.

Pasquay states ("Wärmeschutz in Dampfbetrieb," 1895) that by using the best protective coating, in the most favourable case, about 80 to 85 per cent. of the loss whic occurs from a naked steam pipe may be avoided—a figur which corresponds closely with my results.

It will be noticed that there is a group of very efficien coverings, including magnesia sectional (thick), slag wool sectional, and remanit. Secondly, comes a grou of fairly efficient non-conductors, including the various mic preparations. Thirdly, there is a group which has abo half the efficiency of the first-named, including certai asbestos rope coverings, plastic slagwool and the Lero mixture. The list concludes with coverings which cannot l described as non-conductors.

TABLE I.

Experimental Data.

(*a*) Description of Covering.	(*b*) Mean Thickness.	(*c*) Temperatures. Inside Pipe.	(*d*) Surface of Lagging.	(*e*) Cold-Water Jacket.	(*f*) Current required to keep Temperature constant.	(*g*) Calories lost per Hour per 250° C. difference between the sides.*	Remarks.
	Ins.	° C.	° C.	° C.	Amps.	Cals.	
1. Magnesia sectional, *thick*	$1\frac{1}{2}$	253	51	14·5	2·05	55	
2. Slag wool sectional	$1\frac{7}{16}$	236·7	49	15·7	2·05	60	A thin layer of powdery material formed on the hot surface by disintegration of the fibre.
3. Remanit (waste silk rope)	$\frac{3}{4}$	249·5	50	13	2·1	60	The fibre is charred for $\frac{1}{8}$ in. depth. This is about the limit of temperature at which remanit can be used.
4. Mica, sectional, *double*	2	254·5	52	17·5	2·15	61	
5. Morley's composite	$1\frac{3}{4}$	220	50	21	2·0	63	It consists of slag wool surrounded by layers of hair felt and compressed fibre, covered with painted canvas.
6. Mica flexible, *thick*	2	248	53	13	2·25	68	
7. Mica sectional, *single*	$\frac{7}{8}$	251·5	61	17·5	2·35	74	
8. Mica flexible, *thin*	$1\frac{1}{2}$	247	64	14	2·35	74	
9. Magnesia sectional, *thin*	$\frac{31}{32}$	230	66	12	2·4	83	
10. Remanit and slag wool	$1\frac{1}{2}$	240·5	[67]	23	2·5	90	The cotton-fibre bag containing slag wool charred, and the contents were scattered.
11. Asbestos board and hair felt	1	233	65	17·5	2·5	91	Hair felt badly charred.
12. Asbestos rope filled with magnesia	$\frac{15}{16}$	253	71	12	3·0	118	The filling is contained in canvas surrounded by woven asbestos; the canvas is charred, and the filling escapes.
13. Asbestos cloth, ribbed	$1\frac{3}{16}$	251	75	15	3·0	120	
14. Asbestos rope filled with slag wool	$\frac{3}{4}$	248·5	75	15·2	3·0	121	Behaves like No. 12.
15. Leroy mixture, *thick*	$1\frac{1}{4}$	254	[77]	11	3·15	128	
16. Asbestos cloth containing sections filled with magnesia	$1\frac{3}{16}$	247·5	[76]	14·7	3·1	130	
17. Plastic slag wool covered with black pitch	$1\frac{1}{3}$	255	78	11·5	3·2	132	
18. Asbestos rope filled with asbestos fibre	$1\frac{1}{3}$	250	[79]	13·5	2·95	142	Owing to scarcity of material this result was obtained with 18 ins. of asbestos rope, plus 7 ins. of magnesia sectional covering, but the result has been calculated for a complete covering of asbestos rope.
19. Leroy mixture, *thin*	$\frac{17}{32}$	254	[80]	18·7	3·37	151	
20. Creswell's plastic asbestos, No. 1	1	230·5	85	23	3·25	160	
21. " " " No. 2	1	240	89	23·5	3·35	163	
22. Leroy asbestos, plastic	1	230	89·5	24	3·4	176	
23. Bennett-Lawes' plastic	1	212	87	22	3·4	191	
24. Bare pipe	..	177	..	18	3·45	242	

NOTE.—Figures in brackets are interpolated, not experimental figures.

* The last column is calculated as follows:—Calories lost $= C^2Rs\frac{0{\cdot}2387}{1000}$. The resistance of the heater = 14·6 ohms. Calories lost per hour per difference of 250° between the sides $= C^2 \times 14{\cdot}6 \times 60 \times 60 \times \frac{0{\cdot}2387}{1000} \times \frac{250}{(c)^\circ - (e)^\circ}$. The probable experimental error does not exceed 4 per cent. of the calculated heat losses.

In this connection it may be noted that while asbestos ibre may be necessary as a binding material, or asbestos loth may be used to carry a filling, asbestos itself is not good insulating material. Bergmehl also appears to have een over-estimated in this respect.

From the data recorded in Table I., it is possible to alculate, with some approach to accuracy, a coefficient of onductivity for the pipe coverings. (See Table II.) This oefficient expresses the number of calories lost per hour, er square metre of area, by transmission through 1 metre f the insulating medium, with a difference of temperature 1° C. between the sides. Let Q = loss of heat recorded alories per hour); r_1 = half the outside diameter of the pe in cm.; r_2 half the outside diameter of the lagging in n.; l = length of pipe in cm. (instead of considering e closed end of the tube separately, it is treated as an ldition to the length of the tube); t_1 = temperature inside pe; t_2 = temperature on the surface of the lagging. hen the coefficient of conductivity—

$$K = \frac{Q.\log_\epsilon\left(\frac{r_2}{r_1}\right).100}{2\pi l.(t_1 - t_2)}$$

This assumes that the conductivity of the iron pipe is infinitely great compared with the conductivity of the lagging—an assumption which does not introduce any appreciable error.

In certain classes of work the weight of the covering is important; details of the actual weight of covering on the 2-ft. length of pipe, as well as the weight per cubic foot, will be found in Table III.

I have not found it possible to prepare a table of costs, but in this connection it is obvious that an extra capital outlay on a good insulator may lead to very important economies in the fuel required for steam-raising.

In a factory with which I am acquainted, the total area of pipes employed in the distribution of steam from the boiler house to all parts of the factory is 730 square metres. At the moderate computation of 3 kilos. of steam condensed per square metre of naked pipe per hour, the condensation would amount to 2,190 kilos. of water per hour, if the pipes were uncovered, representing a loss of 2,750 tons of coal per annum. Nearly 80 per cent. of this loss may be avoided by the use of an efficient covering.

Table II.

Coefficients of Conductivity.

Covering.*	Calories per sq. m. per hour.
1. Remanit	0·039
2. Magnesia sectional, thick	0·054
3. Slag wool sectional	0·057
4. Morley's composite	0·068
5. Mica sectional, double	0·072
6. Asbestos board and hair felt	0·073
7. Mica flexible, thick	0·081
8. Asbestos rope filled with slag wool	0·091
9. Asbestos rope filled with magnesia	0·092
10. Remanit and slag wool	0·094
11. Asbestos cloth, ribbed	0·113
12. Leroy mixture, thick	0·129
13. Asbestos rope filled with asbestos fibre	0·133
14. Asbestos cloth containing sections filled with magnesia	0·133
15. Cresswell's plastic asbestos, No. 1	0·142
16. " " " No. 2	0·148
17. Plastic slag wool, covered with black pitch	0·151
18. Leroy asbestos plastic	0·161
19. Bennett-Lawes' plastic	0·181

* See note to Table III.

With the increasing tendency to use high-pressure steam and superheated steam, the importance of selecting a good insulating medium is greatly enhanced. In the factory referred to above I have made a number of observations regarding the amount of condensed moisture present in the steam at different points. In each case steam has been travelling at a fair rate past the point at which the test has been made. A large calorimeter was used, made of tin-plate surrounded by hair-felt and wood, and provided with a lid of similar material and a disc stirrer. About 100 kilos. of cold water were used, and from 10 to 12 kilos. of steam condensed. The rise in temperature was about 60° C. Starting with superheated steam from the boiler house at about 90 lb. pressure and a temperature of about 550° F., I have recorded from 0 to 12 per cent. of condensed moisture in the steam at distances of 140 to 460 ft. A mean of 11 satisfactory experiments gave 6·2 per cent. of condensed moisture. The distributing pipes were covered, but not in a very efficient manner.

Table III.

Density of Materials.

Description of Covering.	Length.		Thickness.	Outside Diameter.	Weight in Grms. covering Sides and one End of Pipe.	Weight per Cb. Ft. in Lb.
	Ft.	In.	In.	In.		
1. Remanit	2	3	⅜	4⅛	710	11
2. Asbestos cloth and hair felt	2	1	1	4¾	1030	14
3. Remanit and slag wool	2	1¼	1½	5¾	2060	16
4. Magnesia sectional, *thick*.	2	1½	1½	5⅝	2050	17
5. Morley composite covering	2	1½	1¼	5⅞	3150	20
6. Leroy mixture, thick	2	1	1¼	4⅝	1925	21
7. Asbestos rope filled with magnesia	2	1	15/16	4¼	1570	24
8. Asbestos cloth and magnesia	2	1⅝	1 5/16	5	2540	25
9. Asbestos cloth, ribbed	2	1¾	1 3/16	4⅞	2570	28
10. Slag wool, sectional	2	1⅛	1 7/16	5¼	3230	28
11. Asbestos rope filled with slag wool	2	1	¾	4¼	1870	31
12. Mica flexible, *thick*	2	1½	2	6¾	6020	32
13. Creswell's asbestos, plastic, No. 2	2	1	1	4¾	2550	36
14. Mica sectional, double	2	2	2	6⅝	7800	41
15. Creswell's asbestos, plastic, No. 1	2	1	1	4⅝	2950	42
16. Bennett-Lawes' plastic	2	1	1	4⅝	2990	42
17. Asbestos rope filled with asbestos fibre	1	6 *only*	1⅛	4½	2620	45
18. Leroy's asbestos, plastic	2	1	1	4⅞	3300	47
19. Plastic slag wool	2	0	1½	5⅜	6450	56

Note.—In cases where two different thicknesses of material have been experimented with, the results are only given with the *thicker* covering.

During a period when the steam was not superheated, other conditions remaining the same, a mean of 12 satisfactory tests gave 13·5 per cent. of condensed moisture. This may serve as a further illustration of the extraordinary loss of energy resulting from the condensation of steam during its distribution in any large factory, and the great importance of securing an adequate covering for the distributing mains.

Discussion.

Mr. G. W. Slatter inquired which was the best covering in the opinion of the author, taking into consideration the cost as well as the other qualities of the covering. Which was the best method of protecting steam pipes exposed out of doors from the weather?

Mr. Ward inquired whether the amount of air contained in the cover had not a considerable effect on its efficiency.

The Chairman stated that he had been in the habit of covering the pipes at his factory with a mixture of clay, waste flax (known locally as "Shivvy-dan,"), cow-hair, &c., worked up into a paste and applied as plastic covering, finishing with a coat of pitch. This covering was cheap and durable.

Mr. Thorp Whitaker said he had had a large experience with steam-pipe covering, and had covered many miles of piping in Bradford dyeworks with magnesia sectional covering. Unfortunately, like most covers, this was liable to be damaged when pipes were taken down and their position altered, and he had found it advisable to coat the magnesia covering with a mixture such as Mr. Bedford had described, finishing with two coatings of pitch or boiled tar. This formed a weather-proof covering, and the pipes covered in this manner could be taken down and replaced without the covering tumbling to pieces.

Mr. Davies, in reply, stated that he was not prepared to recommend one cover as being superior to all others. He had found difficulties in ascertaining the cost of material, these costs appearing to be somewhat elastic. Wherever steam pipes were covered it was advisable to finish off the cover with a coat of canvas and paint, whether for indoor or outdoor use. In reply to Mr. Ward, the amount of air present in a covering was of great importance, and the best covering consisted of a mass of minute air cells, separated by walls of non-conducting material. Unfortunately, the difficulty was to discover a material which was non-conducting, and stable at the high temperatures employed, and which would permanently retain a light, porous texture. With regard to the covering the chairman employed, he was quite unable to recommend it, and he considered that it would prove very inefficient compare with the coverings of which he had spoken.

THE AMOUNT OF COCOA BUTTER CONTAINED IN THE COCOA BEAN.

BY S. H. DAVIES, M.Sc., AND B. G. MCLELLAN, A.I.C.

The physical and chemical constants of cocoa butter hav been exhaustively dealt with by Lewkowitsch (this J 1899, 556), but so far as I am aware no communicatio regarding the percentage of cocoa butter in the bean ha been made to this Society. The matter is one of som importance to food analysts who are called upon to stat the amount of pure cocoa present in samples of commerci chocolate. It might be supposed that the amount of t chief constituent of such a well-known substance h already been determined with great accuracy, but this not the case.

On examining a section of the cotyledons, or ker (known commercially as cocoa-nibs) under the microsco it will be found to consist of cells, some of which a coloured, and others contain crystals of fat associated w very small starch granules and albuminoid substanc These cells are not permeable to fat solvents, and it necessary to disrupt them by mechanical means before t cell contents can come in contact with the solvents.

It is probably owing to this fact, that all the ol estimations of the percentage of fat in cocoa nibs a too low.

Our work is entirely concerned with the percentage of cocoa butter in the roasted nibs, this being the only value of commercial importance.

Ridenour (Amer. J. Pharm., 1895, 202) has given values which vary from 37 to 50 per cent. for different varieties of bean, which are certainly too low.

The most reliable determinations are those by Heisch (Analyst, 1, 142) and Zipperer (Untersuchungen uber Kakao, &c., 1887). They are given in Table I.

TABLE I.

Percentage of Cocoa Butter in Roasted Cocoa Nibs.

——	Heisch.	Zipperer.
Caracas	48·4	49·24
Puerto Cabello	..	48·4
Trinidad (inferior)	49·4	48·14
Surinam	54·4	49·88
Arriba	..	50·07
Guayaquil	49·8	52·09
Grenada	45·6	..
Port au Prince	..	46·9
Bahia	50·3	..
Cuba	45·3	..
Para	54·0	..
Mean	49·65	49·24

Our determinations range over two years, and represent samples taken from bulk lots on the London market, with the exception of the Jamaica cocoas; these came direct from the island.

The beans were roasted fully, but with careful precautions against burning; they were then broken and winnowed, to remove all the husk, and the nibs very finely ground on stones in a small mill. The resulting pasty mass was cooled quickly to prevent any separation of butter, and the mass of cocoa carefully sampled by taking scrapings from different parts of the block. Two grams of this sample are exhausted in a Soxhlet extractor with petroleum ether. The latter has been subjected to fractional distillation, and the fraction boiling between 40° and 50° C. is used for the extraction. The treatment with petroleum ether lasts overnight. After distilling off the ether, the residue is heated for four hours at 95° C., cooled, and weighed. Petroleum ether will be found more satisfactory than ether for this purpose. Ether extracts theobromine and some of the colouring matter of the cocoa in addition to the fat.

An experiment was made to determine the extent to which an alteration in roasting affected the proportion of fat.

TABLE II.

Roasted Cocoa-Nibs (Trinidad).

——	Moisture.	Fat.
Very high roast	3·0	54·0
„ low „	3·8	52·7

We conclude that the small variations in our roasting would not appreciably affect the comparisons given in our next table. The individual tests, and the mean for each country, are given in Table III. This gives a general mean of 54·44 per cent., or 5 per cent. higher than Heisch's and Zipperer's results.

In the case of the Jamaica cocoas, the exact history of which was known, it was possible to observe the effect of *fermentation* of the cocoa bean on the fat contents. These figures are shown in Table III. As might have been expected, prolonged fermentation results in the loss of some of the carbohydrate and albuminoid constituents of the bean, leaving a substance richer in fat.

We agree with the earlier observers that there is not sufficient variation in the percentage of fat in different kinds of bean to enable the country of origin to be established from this determination. Probably the percentage varies chiefly with the richness of the soil and with the method of curing adopted, and is not dependent upon the locality.

TABLE III.

ECUADOR.		VENEZUELA.		DUTCH GUIANA.	BRAZIL.		AFRICAN.
Arriba.	Other Varieties.	East of Caracas.	West of Caracas.	Surinam.	Para (Amazon).	Bahia.	West Coast.
56·70	50·95	52·28	53·10	55·17	55·80	55·58	54·85
53·03	54·09	54·27	54·65	57·55	55·33	55·87	54·03
54·68	52·50	50·45	55·15		54·22	52·35	52·43
56·32	53·75	50·15	54·08		55·57	53·50	52·15
52·55	53·07	49·47	51·01		53·24		54·22
		51·95	52·12		53·92		54·52
		51·93	54·06		56·56		55·39
		50·12	52·13		55·20		54·10
			52·38				55·07
			51·82				55·00
Mean .. 54·66	52·87	51·33	53·05	56·36	54·98	54·33	54·18

WEST INDIES.								CEYLON.
Trinidad.	Grenada.	Dominica.	Santo Domingo.	Jamaica.				
			Samana.	Un-fermented.	Mildly Fermented.	Fully Fermented.	Highly Fermented.	
55·27	55·15	55·55	54·25	54·80	58·55	56·89	59·08	54·57
54·89	52·28	55·17	56·10	53·75	58·88	57·00	59·44	52·25
53·29	55·02	57·32	55·10	53·83	53·92	57·56	58·35	57·61
54·97	55·03	54·87	56·20	55·21	53·92	58·75	58·83	48·65
55·58	54·92	53·31	55·24	54·14	53·50	57·63	56·87	50·32
55·43	54·66	55·65		54·87	57·74	57·97	57·90	54·15
55·15	58·59	55·28		56·29	57·92	56·93	57·20	56·55
52·65	56·56	55·31		53·45	57·89	56·08	59·35	52·09
	56·14	53·58		55·80	57·46		57·22	51·65
	54·54	55·25			55·98		57·44	54·43
		54·88			56·11		57·18	52·12
		54·14			56·15		59·25	52·45
					57·50			56·73
					58·72			
ean.. 54·57	55·3	55·03	55·38	54·68	56·73	57·35	58·23	53·36
					Mean .... 56·75			

GENERAL MEAN, 54·44 per cent.

Discussion.

Dr. Chaplin inquired what time was necessary for the full extraction of the cocoa butter; he also wished to know whether the introduction of fats other than cocoa butter was permissible in commercial chocolates.

Mr. G. Ward asked whether cocoa butter extracted from beans from different countries was uniform in constitution.

Mr. Dixon inquired whether there was any great difference in the amount of extract obtained by using ethyl ether as compared with petroleum ether.

Mr. Davies, in reply, stated that they had usually started the extraction in the afternoon and allowed it to proceed for an hour or so; then the packet of cocoa stood in Petroleum Ether overnight, and the exhaustion was continued for two or three hours the next day. With regard to the constitution of chocolate, it was illegal to use other fat to replace cocoa butter in many European countries, but in England the constitution of chocolate has never been legally defined, and it would be possible to use any foodstuffs in the preparation of chocolate. He expected that the addition of other fats would be forbidden in the future in England. He had not elaborately examined the cocoa butters from different countries to see if they had the same chemical constitution, but the physical characteristics of the taste, odour, melting point, &c., were the same, and he had no reason to suppose that there was any difference in the chemical constitutions. Ethyl ether appeared to extract from 0·2 to 0·5 per cent. more material from the cocoa bean than petroleum ether.

Obituary.

DR. ANDREW PEEBLES AITKEN,

Professor of Chemistry and Toxicology in the Royal (Dick) Veterinary College, Edinburgh; Member of the Society of Chemical Industry.

Dr. A. P. Aitken was a native of Edinburgh, and was educated in the Edinburgh University, where he took the degree of Master of Arts in 1867, of Bachelor of Science in the department of Physical Science in 1871, and finally of Doctor of Science in the department of Chemistry in 1873. He then studied at Heidelberg, and on his return to Edinburgh was appointed assistant to Professor Crum Brown and Demonstrator of Practical Chemistry in Edinburgh University. His final appointment was to the Professorship of Chemistry in the Dick Veterinary College in 1875. He died on Sunday, April 17th, at his residence in Edinburgh.

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United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3e).

I.—PLANT, APPARATUS AND MACHINERY.

Superheated Steam for Petroleum Borings. W. Szaynok. Naphta, 1904, **12**, 17—19.

Most of the existing engines in use in the Boryslaw (Galicia) district have insufficient heating space in the boilers to satisfactorily deal with the task of boring the deep wells now required. By introducing superheaters in the boiler smoke boxes, however, the author finds the increased efficiency of the dry steam reduces the consumption of fuel by about 15 per cent. At the same time there is practically no condensation in the live steam pipe, and the use of superheated steam in the atomiser diminish the consumption for this purpose. The best results with superheater are obtained when the effect of this apparat is to reduce the temperature of the effluent flue gases 273° C., this being the point at which the maximum weig of gas can pass through the smoke stack.—C. S.

English Patents.

Hydro-extractors. M. de Marchéville, Paris. Eng. P 6925, March 25, 1903.

See Addition, of May 13, 1902, to Fr. Pat. 291,015 of 1 this J., 1903, 355.—T. F. B.

Filtering Apparatus. R. E. Ellis, London. From Maschinenfabrik Grevenbroich, Grevenbroich. Eng. Pat. 4575, Feb. 24, 1904.

Hollow arms are provided with perforated pipes depending from them and penetrating the filtering medium. When the latter has become clogged, water is forced through the arms, which are rotated, and the filter is thus cleansed. Means are provided for carrying off the muddy wash water and for injecting water under the porous floor of the filter. —W. H. C.

Rotary Driers. D. Grupe, Davenport. Eng. Pat. 15,955, July 18, 1903.

The horizontal rotary drier with internal steam flues, described in U.S. Pat. 659,299 of 1900, is fitted with a steam chamber at the outlet end into which the ends of the steam flues are fixed, and this steam chamber is provided with a special drain trap and outlet, as well as steam inlet; the chamber rotates with the drier. At the other end, the steam flues pass through holes in a perforated plate forming one portion of an end chamber, and are connected beyond this plate together in groups of two or more, by small steam chambers provided with cleaning doors opposite the steam flues. In this way the contraction and expansion of the steam flues does not interfere with the working. The drier is supported on rollers, and suitable feed and discharge openings are provided.—W. H. C.

Vacuum Evaporating Apparatus; Piled ——. T. Suzuki, Sunamura. Eng. Pat. 3165, Feb. 9, 1904.

Each evaporating pan is constructed of several superposed segments or "drums," with suitable heating coils. At the top there is a rotating distributing coil, and between the segments are arranged overflow valves, operated from without. The liquid to be evaporated flows from segment to segment in each pan, whereby very rapid and economical evaporation is effected.—W. H. C.

Freezing of "Liquid Gases" on the Discharge thereof from Storage Vessels; Method and Apparatus for Preventing ——. L. von Orth, Berlin. Eng. Pat. 4694, Feb. 25, 1904.

The outlet pipe from the storage vessel has a spiral opening, so that the issuing liquefied gas impinges on the walls of an outer tube of larger bore. This tube has ribs on its outer side, and is surrounded by a casing, "through which a heating liquid medium is made to flow" in a "serpentine direction." The liquefied gas is only heated after it has begun to expand.—W. H. C.

French Patents.

Forcing and Drawing off Liquids, Inflammable, or those which evolve Explosive Gases; Process for ——. C. Martini and H. Hüneke. Fr. Pat. 337,733, Feb. 28, 1903.

See Eng. Pat. 4233 of 1903; this J., 1904, 14.—T. F. B.

Furnace. J. Ritz. Fr. Pat. 337,770, Dec. 16, 1903.

See Eng. Pat. 27,613 of 1903; this J., 1904, 363.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

ron Carbonylferrocyanide; a Constituent of Spent Oxide. M. Stoecker. VII., page 488.

ulphur; Determination of —— *in Calcium Carbide.* H. Lidholm. XXIII., page 504.

English Patents.

Coke Ovens. T. von Bauer, Berlin. Eng. Pat. 17,327, Aug. 10, 1903.

y a special arrangement of flues and air channels, and by acing the return-gas channels below the gas-distributing annels, the same ovens can be operated for either "direct indirect production," and for hand or mechanical charging. pecial plugs are provided for altering the distribution of gas. Steam can be injected into the gas flues to clear them of deposits, and is also injected through the coking coal to increase the yield of tar and ammonia.—W. H. C.

Solidified Liquids [Hydrocarbons, Alcohols]; Manufacture of ——*, and of a Material therefor.* E. Raynaud, Spy. Eng. Pat. 7860, April 4, 1903.

Liquids, such as hydrocarbons or alcohols, may be solidified by the addition of 0·4 to 10 per cent. (according to the degree of hardness desired) of a mixture of sodium silicate and saponified fat, which may be made by saponifying "cocoa-butter" with caustic soda, and adding four to five times the weight of sodium silicate. This mixture should be heated with the liquid to be solidified at about 40° C., with stirring.—T. F. B.

Fuel [Briquettes]; Artificial ——. E. J. Hoffman and W. J. Clark, Chicago. Eng. Pat. 1887, Jan. 25, 1904.

The fuel is made by intimately mixing 92 per cent. of coal dust or crushed coal, 3½ per per cent. of crude petroleum, 2½ per cent. of rosin, and 2 per cent. of soda ash, the last three ingredients being first melted together; the mass is then formed into briquettes.—L. F. G.

House or other Refuse; Process of Treating —— *for Converting it into Substances of Commercial Utility [Fuel Briquettes].* T. G. Charlton. Eng. Pat. 16,304, July 24, 1903. XVIII. B., page 500.

Gas from Petroleum Oils; Generation of —— *for General Purposes, particularly for Use with Burners for Steam Generation and like purposes.* E. R. Bridson, Nottingham. Eng. Pat. 14,335, June 27, 1903.

Oil is pumped through a vaporising coil, which surrounds a burner, the latter being fed with a portion of the vapour from the coil. The supplies of oil to the coil and vapour to the burner are controlled automatically by diaphragm valves. The apparatus is put in operation by burning some spirit in a gutter surrounding the vaporising burner, and pumping oil into the coil by means of a hand pump. The main portion of the vapour generated, is led to the motor or other place of consumption.—H. B.

Coal Gas; Apparatus for the Purification of ——. R. Good, Croydon, and S. Spencer, London. Eng. Pat. 23,045, Oct. 24, 1903.

A hydraulic main, of the form described in Eng. Pat. 7258 of 1886, is fitted longitudinally and transversely with horizontal tiers of pipes, open at each end to the atmosphere, for inducing the more rapid condensation of the tar, &c., within the main. The outlet for the tar and liquor is provided with regulating and cleaning devices. A washer of the kind referred to in Eng. Pat. 2317 of 1881, is constructed with similarly arranged condensing pipes, and other modifications of details are introduced.—H. B.

Gases; Apparatus for Producing a Mixture of —— *or of Gas and Air for Illuminating Purposes.* H. H. Lake, London. From Selas Ges., Berlin. Eng. Pat. 5088, March 4, 1903.

See Fr. Pat. 333,033 of 1903; this J., 1903, 1287.—T. F. B.

Acetylene Gas; Process for the Purification of ——. A. Landriset, Gampel. Eng. Pat. 7490, March 31, 1903.

See Fr. Pat. 330,180 of 1903; this J., 1903, 1080.—T. F. B.

Carburetting Air by Means of Naphthalene, and Generating Naphthalene Vapour in connection with Lamps for Lighting Purposes. G. P. J. Lion, Paris. Eng. Pat. 11,561, May 21, 1903. Under Internat. Conv., May 21, 1902.

See Fr. Pat. 321,495 of 1902; this J., 1903, 205.—T. F. B.

Producer Gas and the like; Manufacture of ——. E. Hovine and H. Breuillé, Paris. Eng. Pat. 25,763, Nov. 25, 1903.

See Fr. Pat. 336,786 of 1903; this J., 1904, 365.—T. F. B.

Mantles; Manufacture of Incandescent ——. F. B. Grundy, Richmond. Eng. Pat. 10,852, May 13, 1903.

The filaments of which "artificial silk" is composed are twisted together in a manner similar to that in which cotton yarn is twisted to produce knitting cotton, and the two-ply or three-ply cord thus formed is knitted into fabrics as usual. The latter are then impregnated with a solution containing 10—20 per cent. of the usual oxides, dried, treated with ammonia gas or soaked in a strong solution of ammonia, dried, and burned off.—H. B.

French Patents.

Gas from Pulverised Combustibles; Process and Apparatus for Producing ——. G. Marconnet. Fr. Pat. 337,514, Dec. 8, 1903.

Pulverised fuel is allowed to fall down a vertical conduit, the lower end of which opens into an ash-box. The particles of fuel are burned during their fall, by means of suitable burners, the ash being collected in the box beneath, whilst the gas is led off to the motor or other apparatus in which it is to be used. In the apparatus described, the fuel conduit or shoot, constructed of refractory material, is of rectangular cross-section, and the walls are perforated with series of orifices serving to admit air and gas respectively, and to maintain the flames required for burning the fuel during its fall. Parallel passages supply the air and gas to the orifices, and the whole is surrounded by a body of coke. The gas, produced by the combustion of the powdered fuel, on issuing from the lower end of the shoot, is led up through the surrounding coke, whereby any accompanying dust is removed.—H. B.

Pyrophoric Alloys for Use in Igniting and Illuminating. C. Auer von Welsbach. Fr. Pat. 337,320, Oct. 31, 1903.

Pyrophoric alloys are prepared by fusing together one or more of the rare-earth metals (lanthanum, cerium, &c.) and iron, the best results having been obtained on adding 30 per cent. of iron. The iron may be wholly or partly replaced by nickel or cobalt. On rubbing such an alloy with a file or the like, brilliant sparks are emitted, which are capable of igniting, with certainty and almost immediately, a mixture of air and combustible gas. The alloys may be used for illumination, or for the ignition of gases.—H. B.

Mantles; Manufacture of Incandescence ——. F. Haan, A. Krausz, and Z. Sziklai. Fr. Pat. 337,475, Nov. 12, 1903.

Mantles are made as usual from a solution composed of water, 1,000 parts; thorium nitrate, 300—500 parts; cerium nitrate, 2—4; cobalt nitrate, 0·5; ammonium nitrate, 1; aluminium nitrate, 0·5; lead nitrate, 1; "tartar," 1; and 0·5 to 1 part of "nitrate of sepia or of mother-of-pearl, that is, of the salts formed by dissolving these substances in nitric acid."—H. B.

Mantles; Manufacture of Incandescence ——. G. H. Maisch. Fr. Pat. 337,371, Nov. 17, 1903.

See U.S. Pat. 712,562; this J., 1902, 1527.—H. B.

Incandescence Filaments for Electric Lighting; Manufacture of ——. Siemens and Halske A.-G. Fr. Pat. 337,608, Dec. 12, 1903.

Incandescence filaments are made from tantalum or niobium by drawing or rolling the metal into fine tubes, filled or not with conductors of the first or second class. —H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum Borings; Superheated Steam for ——. W. Szaynok. I., page 482.

Petroleum; Determining Impurities [Water] in Boryslaw (Galicia) ——. M. Wielezynski. XXIII., page 504.

United States Patent.

Still for Crude Bituminous Material. H. W. Ash, Cambridge, Assignor to Warren Bros. Co., Charleston. U.S. Pat. 757,387, April 12, 1904.

An upright still is heated directly by a furnace below it, and also by the furnace gases, which are led into a chamber surrounding the sides of the still. The products of combustion of the furnace pass from this chamber to a blower, whence they are forced through the material which is being distilled.—T. F. B.

French Patent.

Greases [Lubricants], Plasters, and Waterproofing Compositions [Paints]; Process of Making ——. J. Girard and P. J. Tabourin. Fr. Pat. 337,753, Dec. 15, 1903.

Ozokerite is employed in the manufacture of lubricants (*e.g.*, mixed with naphtha); in making waterproof paints (*e.g.*, mixed with paraffin wax, petroleum residue, and colouring matters); and for similar purposes.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

o-Tolidine; Constitution of ——. G. Schultz, G. Rohde, and F. Vicari. Ber., 1904, **37**, 1401—1402.

The diaminoditolyl (*o*-tolidine) prepared from *o*-nitrotoluene is generally regarded as having the constitution $[4.3](NH_2)(CH_3)C_6H_3.C_6H_3(CH_3)(NH_2)[3.4]$, both on account of its method of preparation and its behaviour, which is analogous to that of benzidine (di-*p*-diaminodiphenyl), but no complete proof of the correctness of this formula has hitherto been found. This proof is now supplied by the authors, who have found that the hydrocarbon prepared from *o*-tolidine by means of its hydrazine compound is identical with the hydrocarbon—

$$[3](CH_3).C_6H_4.C_6H_4(CH_3)[3],$$

obtained by treating *m*-iodotoluene with sodium.—A. S.

Indole from Indoxyl; Preparation of ——. D. Vorländer and O. Apelt. Ber., 1904, **37**, 1134—1135.

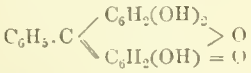
Indoxylic acid and indoxyl are readily reduced to indole by reduction in alkaline solution, either with sodium amalgam or with caustic alkali and zinc dust. The yields are satisfactory.—E. F.

Amino- and Aminohydroxy-diphenylamines. R. Gnehm and G. Weber. J. prakt. Chem., 1904, **69**, 223—244.

Dimethyl-*p*-diaminodiphenylamine is prepared either by oxidation of dimethyl-*p*-phenylenediamine with aniline and reduction of the indamine so obtained, or by condensation of dimethyl-*p*-phenylenediamine with *p*-aminophenol. It yield no dyestuff if heated alone with sulphur, but if heated wit sulphur in presence of phenol, sulphuretted hydrogen i evolved and a sulphide dyestuff is obtained which dye cotton in yellow shades. Dimethyltriaminodiphenylami is prepared by reducing the indamine obtained from th oxidation of dimethyl-*p*-phenylenediamine with 1 mol. o *m*-phenylenediamine. On melting with sulphur and pheno this substance yields a sulphide dyestuff which dyes cotto in dark greenish-black shades. Dimethyl-*p*-diamino-*m* hydroxydiphenylamine is obtained by condensing dimethy *p*-phenylenediamine with resorcinol. With nitrous acid yields a nitrosamine which is transformed by hydrochlori acid into the *p*-nitroso compound. This latter reacts wit amines and phenols to form oxazine dyestuffs. Those pr duced with diphenylamine, β-naphthol, and dimethyl-*n* aminophenol are blue in shade. With formaldehyde, dimethy *p*-amino-*m*-hydroxydiphenylamine forms either dimethyl-, amino-*m*-hydroxybenzyl alcohol or the diphenylmetha compound, $CH_2[C_6H_3(OH).NH.C_6H_4N(CH_3)_2]_2$, accordi to the proportions used. On oxidation with tertiary amin the latter gives triphenylmethane dyestuffs. On melti dimethyl-*p*-amino-*m*-hydroxydiphenylamine with sodi sulphide and sulphur, a sulphide dyestuff is formed whi dyes cotton in green to greenish-blue shades. *p*-Dimethylamino-7-hydroxynaphthalene is obtained from dimethyl-*p*-phenylenediamine and 2.7-dihydroxynaphthalene.—E. F.

Hydroxyquinone; Condensation of —— with Aldehydes. C. Liebermann and S. Lindenbaum. Ber., 1904, 37, 1171—1180.

One mol. of benzaldehyde condenses with 2 mols. of hydroxyquinone in presence of concentrated sulphuric acid to form a triphenylmethane dyestuff of the constitution—



$$C_6H_5.C\begin{cases}C_6H_2(OH)_2\\ \quad\quad\quad\quad\quad > O\\ C_6H_2(OH)=O\end{cases}$$

which dyes intensely on basic mordants, reddish-orange on alumina and greyish-violet on iron oxide, not very fast to light. An analogous dyestuff is obtained if the benzaldehyde be replaced by acetaldehyde. The properties of the product are very similar, but the dyeings produced by it are redder in shade than those from the benzaldehyde derivative. With formaldehyde no dyestuff is produced, the product obtained being hexahydroxydiphenylmethane. With pyrogallol and phloroglucinol, benzaldehyde reacts under the same conditions in equimolecular proportions, yielding colourless compounds possessing no dyeing properties.—E. F.

Benzimidazoles, and Dyestuffs derived therefrom. O. Kym. Ber., 1904, 37, 1070—1074.

A triaminobenzimidazole derivative, *p*-amino-*a*-phenyl-N-*p*-aminophenol-*m*-aminobenzimidazole, is best obtained by partially reducing *o-p*-dinitro-*p′*-aminodiphenylamine to o-*p′*-diamino-*p*-nitrodiphenylamine, heating this with *p*-nitrobenzoyl chloride, thus forming *p*-nitro-*a*-phenyl-N-*p*-nitrobenzoylaminophenyl-*m*-nitrobenzimidazole and subsequently reducing. The base, when diazotised and coupled ith other compounds, yields dyestuffs which have less ffinity for cotton and dye in redder shades than those erived from diaminobenzimidazole derivatives.—E. F.

riphenylmethane Dyestuffs; Colour Bases of ——. A. Baeyer and V. Villiger. Ber., 1904, 37, 1183—1184.

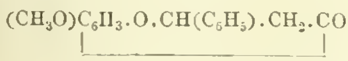
N treatment with alkali, Aniline Blue forms the corre-ponding phenylimide, $C_{37}H_{29}N_3$, which is black. On rinding with caustic soda solution, Parafuchsin yields a olymer of the corresponding imide, which can be recrystalsed from xylene and which differs from the carbinol in ing extremely insoluble and difficult to crystallise. Its mpirical formula is $C_{19}H_{17}N_3$. In the case of New Fuchsin e monomolecular quinone-imide is formed and is already own as Homolka's base.—E. F.

Hydroxyflavonol; Synthesis of ——. S. v. Kostanecki and M. L. Stoppani. Ber., 1904, 37, 1180—1182.

AEONOL is condensed with benzaldehyde to form 2′-droxy-4′-methoxychalkone, according to the equation—

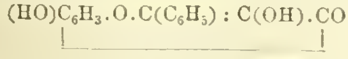
$$C_6H_3(OCH_3)OH.(COCH_3)[1:3:4] + C_6H_5.CHO =$$
$$C_6H_3(OCH_3)OH(CO.CH:CH.C_6H_5) + H_2O.$$

boiling with alcohol and sulphuric acid, this is converted o 3-methoxyflavanone—



$$(CH_3O)\underbrace{C_6H_3.O.CH(C_6H_5).CH_2.CO}$$

ich is converted by amyl nitrite and hydrochloric acid o an isonitroso compound, which, on boiling with dilute phuric acid, forms 3-methoxyflavonol. This is saponified hydriodic acid to 3-hydroxyflavonol—



$$(HO)\underbrace{C_6H_3.O.C(C_6H_5):C(OH).CO}$$

ch dyes in pale yellow shades on alumina mordants. —E. F.

Orsellinic Acid; Constitution of ——. F. Henrich. Ber., 1904, 37, 1406—1415.

By treating 1 mol. of orsellinic acid ethyl ester dissolved in caustic soda solution with a solution of diazobenzene chloride prepared from 2 mols. of aniline, benzene-disazo-orsellinic acid ethyl ester, $(C_6H_5N_2)_2:C_6(CH_3)(OH)_2(COOC_2H_5)$, is produced, m. pt. 186° C., easily soluble in cold benzene and toluene and in hot petroleum naphtha (ligroïn), alcohol, and glacial acetic acid. This disazo compound was reduced with stannous chloride and hydrochloric acid, and the reduction product heated with concentrated hydrochloric acid for five hours at 160° C. The diamine obtained was identical with diamino-orcinol, $C_6H(CH_3)(OH)_2(NH_2)_2[1.3.5.2.4]$, and consequently orsellinic acid must have the constitution $C_6H_2(CH_3)(OH)_2(COOH)[1.3.5.6]$. This view was confirmed by a determination of the dissociation-constant of the acid. Ostwald has shown that the electric conductivity of an acid is increased considerably if it contain a hydroxyl group ortho to the carboxyl group, and to a much greater degree if there are two hydroxyl groups ortho to the carboxyl group. The dissociation-constant of orsellinic acid is 0·0127, but that of the so-called *p*-orsellinic acid is 4·1; hence the true formula for orsellinic acid is that given above, whilst the constitution of *p*-orsellinic acid must be $C_6H_2(CH_3)(OH)_2(COOH)[1.3.5.4]$.—A. S.

Amino-Orsellinic Acid Ethyl Ester; Derivatives of ——. Formation of Litmus Dyestuffs. F. Henrich and K. Dorschky. Ber., 1904, 37, 1416—1424.

It has been previously shown (this J., 1897, 529; 1902, 1450) that by the oxidation of β-amino-orcinol in alkaline solution, a mixture of dyestuffs is produced, of which those insoluble in alcohol greatly resemble the dyestuffs of litmus insoluble in alcohol. The authors have now subjected the amino-orsellinic acid, $C_6H(CH_3)(NH_2)(OH)_2COOH[1.6.3.5.2]$, corresponding to β-amino-orcinol, to oxidation in alkaline solution. A well-cooled solution of 1 mol. of the hydrochloride of amino-orsellinic acid ethyl ester was treated with 2 mols. of potassium hydroxide dissolved in a small quantity of water. The mixture oxidises rapidly in the air and becomes coloured red with a vivid fluorescence. After 48 hours, the mixture was acidified, and the reddish-brown precipitate filtered off. The product crystallises from acetic ester mostly in orange-coloured needles, with an intense blue lustre, but occasionally also in greenish scales. It is easily soluble in warm glacial acetic acid and alcohol and in cold benzene; its alcoholic solution is fluorescent. The dyestuff greatly resembles those discovered by Weselski, and proved to be phenoxazine derivatives (this J., 1890, 489, 600). If more than 2 mols. of alkali be used and the solution be not cooled. the carboxyl group is split off, and non-fluorescent dyestuffs are obtained similar to those obtained by the oxidation of amino-orcinol. The authors consider it probable that the two classes of dyestuffs present in litmus, *viz.*, (1) fluorescent dyestuffs soluble in alcohol, and (2) non-fluorescent dyestuffs insoluble in alcohol, are produced from erythro esters of orsellinic acid in a similar manner to the formation of the dyestuffs from orsellinic acid ethyl ester as already described.—A. S.

English Patents.

Basic Colouring Matters; Manufacture of Soluble Compounds or Salts of —— [for Soaps, Varnish, &c.]. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen. Eng. Pat. 12,681, June 5, 1903.

Soluble compounds, suitable for colouring soap, wax, varnish, or printing ink, are obtained by the action of alkalis or alkaline salts, on the insoluble compounds of basic dyestuffs and the higher fatty acids. For example. 20 parts of caustic soda lye (containing 35 per cent. of sodium hydroxide) are added to a mixture of 100 parts of oleic acid and 30 parts of the free base of Benzyl Violet, at 100° C. To prepare a coloured varnish, 500 parts of "printer's varnish" are added to the above mixture previous to the addition of the alkali.—T. F. B.

Sulphurised Colouring Matters [*Sulphide Dyestuffs*]; *Manufacture of Green* ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabrikation, Berlin. Eng. Pat. 11,003, May 14, 1903.

See Fr. Pat. 332,101 of 1903; this J., 1903, 1192.—T. F. B.

Sulphur Dyes [*Sulphide Dyestuffs*]: *Manufacture of Blue* ——. G. B. Ellis, London. From Chem. Fabr. vorm. Sandoz, Basle. Eng. Pat. 12,879, June 8, 1903.

See Fr. Pat. 332,560 of 1903; this J., 1903, 1241.—T. F. B.

United States Patents.

1.5 - *Nitroanthraquinone Sulphonic Acid* [*Anthracene Dyestuff*]. R. E. Schmidt, Elberfeld, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 757,057, April 12, 1904.

See Fr. Pat. 334,576 of 1903; this J., 1904, 57.—T. F. B.

1.8 - *Nitroanthraquinone Sulphonic Acid* [*Anthracene Dyestuffs*]. R. E. Schmidt, Elberfeld, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 757,058, April 12, 1904.

See Fr. Pat. 334,576 of 1903; this J., 1904. 57.—T. F. B.

Lake; Blue Red —— [*from Azo Dyestuff*], *and Process of Making same*. G. Gullbransson, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine. U.S. Pat. 757,109, April 12, 1904.

See Eng. Pat. 23,830 of 1902; this J., 1903, 1055.—T. F. B.

Oxidising Organic Compounds. M. Moest, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine. U.S. Pat. 757,136, April 12, 1904.

See Eng. Pat. 19,178 of 1902; this J., 1903, 945.—T. F. B.

French Patents.

Indigo; Process for Making ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 337,634, Feb. 26, 1903.

See Eng. Pat. 4538 of 1903; this J., 1904, 16.—T. F. B.

[*Sulphide*] *Dyestuffs; Production of Brown* ——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 337,316, Oct. 26, 1903.

Dyestuffs dyeing unmordanted cotton in various shades of brown, from a dyebath containing an alkali sulphide, are obtained by heating a mixture of an alkylated *m*-aminophenol or one of its substitution products, with an aromatic amine or phenol, or their substitution products, in presence of sulphur.—A. B. S.

Aminothioalphyl Derivatives and Azo Sulphide Dyestuffs derived therefrom; Production of New ——. [*Sulphide Dyestuffs.*] Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 337,329, Nov. 5, 1903.

If dinitrophenylthiocyanate, which is obtained by heating a mixture of dichlorobenzene, alcohol, and potassium thiocyanate, be partially reduced with ammonium sulphide, a red crystalline powder is formed consisting of aminonitrothiophenyl. In a similar manner, dinitrophenylthiocarbamide and other dinitrophenyl-thio derivatives, and also those derived from trinitrochlorobenzene, dinitrochlorobenzene sulphonic acid and other similar substances, can be converted into nitroamino-thio derivatives. These derivatives can be diazotised and combined with amines, phenols, &c. to form azo dyestuffs. All these azo dyestuffs contain at least one atom of sulphur, which can be converted by an alkaline reducing agent into a sulphydric group, which causes the dyestuff to dissolve in alkalis even if it contain no carboxylic or sulphonic groups. The dyestuffs of this class which are soluble in water, dye wool and silk from an acid bath. The others dye unmordanted cotton from an alkaline bath containing an alkali sulphide, in the same manner as the usual sulphide dyestuffs.

—A. B. S.

Tetrazo Dyestuffs; Production of New Substantive —— Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 337,449, Dec. 5 1903.

See Eng. Pat. 27,630 of 1903; this J., 1904, 249.—T. F. B

Dyestuffs suitable for Sensitising Purposes; Process fo Preparing ——. Soc. Anon. Prod. F. Bayer et Cie Fr. Pat. 337,704, Nov. 16, 1903.

See U.S. Pat. 752,323 of 1904; this J., 1904, 337. Homologues of quinaldine, such as toluquinaldines or bromo quinaldine, may be used instead of quinaldine, and sulphuni esters, such as the ethyl esters of ethyl-, benzene-, o toluene-sulphonic acid, may replace the diethyl sulphate o the principal patent: other dialkyl sulphates give simila compounds to that obtained by using diethyl sulphate.

—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Aniline Black on Wool; Colour Reserves for —— Pokorny. Bull. Soc. Ind. Mulhouse, Procès-verbau 1903, 205.

Woollen tissues, after being successively washed, soape treated with sodium bisulphite, passed (in such a manne as to remain immersed for 15 seconds) through a bath com posed of 22 litres of bleaching powder solution at 4° B 18 litres of hydrochloric acid at 4° B., and 240 litres water, and then washed and dried, are padded two three times in a solution containing, in 30 litres, 4,0 grms. of aniline hydrochloride, 1,500 grms. of sodiu chlorate, and 2,600 grms. of potassium ferrocyanide. The are then dried and printed with dyestuffs, such as Pate Blue V, Uranin, Thioflavine, Rhodamine 6 G and B ext (1 part), admixed with potassium thiocyanate (2 parts zinc oxide (5 parts) made into a paste with water (5 part and starch thickening (20 parts), with or without sodiu acetate in addition. The black is developed, in the u printed parts of the tissues, by wrapping the latter damped cotton tissues and steaming them for 15 minut The tissues are finally washed and soaped.—E. B.

Discharges with Potassium Chromate and Oxalate Vat Blues. M. Prud'homme. Rev. Gen. Mat. C 1904, **8**, 97—98.

Instead of adding oxalic acid to the sulphuric acid ba a good result is obtained in many cases by adding potassi oxalate to the printing pastes and then passing thro a sulphuric acid bath containing 150 grms. of acid litre. This method does not give good results in the c of yellow discharges with Chrome Yellow. The best res are obtained by printing the yellow paste without oxalate, then passing through a solution containing 100—150 grms sulphuric acid and 10 grms. of oxalic acid per litre.

—A. B.

Prussian Blue Discharge on Turkey-red. E. Bontem Bull. Soc. Ind. Mulhouse, 1903, **73**, 349.

Potassium ferricyanide is heated on the water-bath caustic soda-lye at a temperature of 50°—56° C., the solu obtained being cooled and poured into water in w British gum and starch are suspended. The thick mixture thus produced is printed upon a tissue dyed Turkey-red, which is thereupon passed through a Mat Platt steam-ageing apparatus, the tissue being afterw treated with sulphuric acid at 6° B., to which about 50 g of ferrous sulphate per litre is added.—E. B.

Prussian Blue Discharge on Turkey-red. (Report o preceding paper.) H. Schmid. Bull. Soc. Ind. Mulh 1903, **73**, 350.

As the function of the alkali ferricyanide, employe Bontemps (see preceding article), is not to remove Alizarin from the Turkey-red colour-lake, and as this is converted by the soda lye into an alkali ferrocyani is preferable to employ the latter in the discharge-mi t the outset. Moreover, the iron salt may be omitted from ie sulphuric acid bath, all the elements essential for the roduction of the blue being introduced into the printing iixture employed. This may be accomplished by adding mixture of ferric nitrate and glycerin to caustic soda-lye nd then adding the amount of alkali ferrocyanide necessary o combine with the iron present. The solution thus prouced, after being thickened, is printed and steamed as in ie process described by Bontemps, the Prussian blue being ormed during the subsequent treatment with acid. By dding to the discharge mixture sodium plumbite, and hroming the tissues after passing them through the acid, green discharge may be obtained. It is possible thus to btain green and blue discharge colours of the same brightess and shade as those produced in the older bleaching owder and the newer alkali (indigo) discharge styles.

—E. B.

ydrosulphite NF; Employment of —— in Clearing Whites in Calico Printing. O. F. Alliston. Bull. Soc. Ind. Mulhouse, 1903, **73**, 346—348.

HE "whites" of cotton tissues printed with insoluble zo dyestuffs cannot be efficiently cleared with bleaching owder solution without injury to the dyestuffs. They may, owever, be cleared by means of "hydrosulphite N F," the ondensation product of sodium hydrosulphite and formldehyde (Eng. Pat. 5867 of 1903; this J., 1904, 369), he tissues being, to this end, passed through gum-water ontaining, per litre, 10—15 grms. of this compound, and hen being dried and steamed for 3—5 minutes. The mployment of the compound in question is especially dvantageous in the case of two-colour prints of Paraitraniline Red and an Azo Black produced from either of ie brands, S or D P, of Azophor Black, inasmuch as both lacks satisfactorily withstand the clearing operation with , while they are considerably acted upon by bleaching owder. T. Stricker, who, at the request of the Industrial ociety of Mulhouse, has made experiments on the subject, ates that the action of the hydrosulphite compound in earing "whites" stained with azo dyestuffs is very effecve. He finds ordinary sodium hydrosulphite too unstable be employed in a similar manner for the same purpose.

—E. B.

Brightening Silk and Cotton. C. Knapstein. Färber-Zeit., 1904, **15**, 101—104.

r treating silk, after dyeing, with a dilute solution of osphoric acid, a better gloss is obtained than when citric tartaric acid is used. Phosphoric acid may also be used vantageously, with pure olive oil, for brightening black s. In the softening process, the addition of a little taric acid to the alum bath, previous to adding alkali, ances the gloss of the product. Vegetable silk is ghtened, after dyeing, by immersion in a cold on lukerm soap bath (containing 5—8 per cent. of soap on the ight of material used) and subsequent treatment with ute acid; phosphoric acid is found to give better results n sulphuric acid.—T. F. B.

Titanium Salts as Laboratory Reagents. E. Knecht. XXIII., page 503.

English Patents.

eing, Bleaching, Mordanting, and like operations; Tubes or holding Yarns or Threads during ——. L. Détré, eims. Eng. Pat. 4596, Feb. 24, 1904. Under Internat. onv., July 10, 1903.

prevent the uneven dyeing of yarn in the form of cops obbins, the yarn is wound on a tube the central portion vhich is perforated. This tube is fitted with a diaphragm er at the middle or at one end, which causes the dye or to pass through the central part of the bobbin.

—A. B. S.

ing Raw Stock, Wool, and similar Materials; Apparaus for ——. J. A. Willard, Chattanooga. Eng. Pat. 610, Feb. 24, 1904. Under Internat. Conv., May 21, 903.

S U.S. Pat. 755,422 of 1904; this J., 1904, 439.—T. F. B.

Printing Yarns or Threads; Method of ——. W. B. Keefer, Philadelphia. Eng. Pat. 27,483, Dec. 15, 1903.

The threads from a number of spools pass through an arrangement which spreads them out in one plane and then over a rectangular "table." The latter is in the form of a square prism; it can be rotated on a horizontal axis and has a series of continuous grooves running round the four rectangular faces. The threads lie in these grooves, and whilst there are printed in the desired colours by one or more printing rollers which pass over the upper surface of the table and are supplied with colour from colour boxes, &c. When one portion is printed, the "table" makes a quarter revolution and the next portion is similarly treated, whilst the lower face of the "table" is cleaned by means of a rotating brush held in position by means of a spring. The "table" then makes another quarter revolution, and so on. After printing, the yarn is led into the steaming and colour-fixing apparatus. The printing rollers move transversely to the threads.—A. B. S.

Intaglio Printing Forms on Cylindrical Surfaces; Method of Producing ——. H. H. Lake, London. From G. F. and J. W. McIndoe, Boston. Eng. Pat. 4207, Feb. 19, 1904.

A piece of embossed fabric, &c., a representation of which is desired on the cylinder, is coated with a solution of starch or other glutinous material, and dried by heat and pressure. An acid-resisting adhesive substance is now applied to the raised parts only of the fabric, by a light treatment with a roller. A metal cylinder is then passed over the prepared fabric, etched by means of a suitable acid, and the acid resisting coating removed from the unetched portions.

—T. F. B.

United States Patents.

Dyeing Textile Fabrics; Machine for ——. C. L. Rothwell-Jackson and E. W. Hunt, Bolton. U.S. Pat. 757,055, April 12, 1904.

See Eng. Pat. 7872 of 1903; this J., 1903, 904.—T. F. B.

Waterproofing Tissues. T. Luthringer, Lyons. U.S. Pat. 757,326, April 12, 1904.

See Fr. Pat. 321,479 of 1902; this J., 1903, 296.—T. F. B.

French Patents.

Chemical Products [Compounds of Hydrosulphites with Aldehydes]; New Series of ——. L. Descamps. Fr. Pat. 337,530, Feb. 23, 1903.

See Eng. Pat. 19,446 of 1903; this J., 1903, 1345.—T. F. B.

Discharging; Process of ——. Soc. Anon. Prod. F. Bayer et Cie. Fr. Pat. 337,574, Dec 10, 1903.

Complete discharges, even with sulphide dyestuffs, may be obtained by the use of chromium compounds, such as chrome alum, chromic acid, &c. For example, the dyed fabric may be printed with a paste containing about 15 per cent. of tartaric acid, 5·5 per cent. of sodium ferrocyanide, 20 per cent. of sodium chlorate, and 1 per cent. of chrome alum, together with starch, kaolin, &c. Or the goods may be first immersed in a 1 per cent. chrome alum solution, and then printed with a paste containing oxidising agents.

—T. F. B.

Fabrics; Process for Printing ——. W. B. Keefer. Fr. Pat. 337,744, Dec. 15, 1903.

See Eng. Pat. 27,483 of 1903; preceding these.—T. F. B.

Finishing of Tulle and Analogous Tissues; Continuous Arrangement for ——. Soc. Bouffier et Pravaz Fils. Fr. Pat. 337,483, Nov. 23, 1903.

The material passes from an opening and stretching arrangement into one or more vats containing the finishing liquid, and then between revolving brushes, which rub the liquid into the material and remove the excess. From the last it passes into a drying chamber, and is finally passed over calendering rollers to complete the drying.—A. B. S.

Oil for Oiling Fibres; Preparation from Petroleum or other Mineral Oils of an ——. V. J. Kuess. Fr. Pat. 337,714, Dec. 11, 1903.

Petroleum or other mineral oil (100 parts) is mixed with animal fat (15 parts) and rosin oil (10 parts). 14 parts of caustic soda solution (containing 4 parts of alkali hydroxide) are added, and then 1 part of hydrochloric acid is stirred in, and the whole heated and added to a hot solution of 1 part of lichen or other cryptogamous substance in 300 parts of water.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

English Patent.

Colouring, Decorating, and Treating Paper, Fabrics, and other Materials; Apparatus for ——. G. H. Maunsell-Smyth, Exideuil sur Vienne. Eng. Pat. 7206, March 27, 1903.

The liquid or dye to be applied to the material is forced into a closed vessel, under pressure, in the form of a fine cloud or spray. The material, which may be previously moistened with a mordant if required, is passed through this vessel, and so receives the required colour, &c., on its surface, after which it is dried.—A. B. S.

VII.—ACIDS, ALKALIS, AND SALTS.

Sulphuric Acid Manufacture; Meyer's Tangential System for ——. E. Hartmann and F. Benker. Z. angew. Chem., 1904, **17**, 554—558.

In Meyer's latest publication, he gives the yield of his two-chamber system of 1,650 cb. m. as equal to that of a three-chamber oblong system of double the capacity, and as he puts the yield of his system at 5 kilos. of sulphuric acid per cb. m. per 24 hours, equivalent to 7·4 kilos. of chamber acid of sp. gr. 1·58, the corresponding figures for the older system must be 2·5 and 3·7 respectively. Such chambers are possibly found, but a modern set of chambers on the old system will give a yield of 6 to 7, or even over 7·4 kilos., of chamber acid; and where that is not the case, there is something wrong either with the chambers (which are built too low and too wide) or with the draught, the burners, the construction of the Glover or Gay Lussac, or the co-ordination of the various parts of the system. In comparing the two systems as to cheapness of production, Meyer's system requires less lead, but its construction costs more both in lead-working and in framework, and it occupies the ground it covers less economically. Repairs are effected in the old chambers much more easily and with much less stoppage to the process than in the case of Meyer's chambers; and especially the position of the outlet pipe (which, perhaps, more frequently requires repair than any other part of the apparatus) in Meyer's system renders repairs to it almost impossible without a complete stoppage of work. In regard to yield, the modern narrow and high chambers have done away with the "dead space," and the circulation of the gases according to Abraham's law, coupled with their forward progress, secures that the gases entering the Gay Lussac contain, practically, no sulphur dioxide, and are of the right composition for effective absorption. Apparently, the Abraham circulation exists in the circular chambers too, and interferes somewhat with the tangential circulation, with the result that reaction is not completed when the second chamber is reached; this would appear to be the reason for the insertion, in Meyer's latest systems, of a very complex arrangement of condensing tubes between the last chamber and the Gay Lussac. On the whole, the authors consider the old oblong form of construction—with modern dimensions—to be preferable, in point of cost, ease of working and repair, and yield, to the tangential chambers.—J. T. D.

Oxidation of Sulphurous Acid; Influence of Hydriodic Acid on the ——. A. Berg. Comptes rend., 1904, **138**, 907—909.

Hydriodic acid either retards or accelerates the oxidation of sulphurous acid in solution by air, according to its concentration, and for a particular strength of sulphurous acid, there is a certain proportion of hydriodic acid the presence of which exerts no influence on the oxidation. For solutions containing about 1 per cent. of sulphur dioxide, this critical strength of hydriodic acid is approximately 3 per cent. Manganous and ferrous chlorides, and also the soluble iodides of the metals, likewise hasten the oxidation of sulphurous acid. Potassium bromide and chloride are without action, whilst hydrochloric acid delays the oxidation, and in large proportion prevents it.—T. H. P.

Silica and Fused Alkali Carbonates; Reaction between ——. N. M. von Wittorf. Z. anorg. Chem., 1904, **39**, 187—196.

When two molecules of sodium carbonate are fused with one of silica, the latter does not expel an equivalent quantity of carbon dioxide, but the reaction is found to be reversible. If the partial pressure of gaseous carbon dioxide be kept low, *viz.*, at 0·07 atmosphere, about 20 per cent. of the carbonate remains undecomposed at 1,300°, and about 34·5 per cent. at 870° C. Similarly, with one molecule each of potassium carbonate and silica, 10 per cent. of carbonate escapes conversion at 1,300° and 19 per cent. at 870° C. On the other hand, the formation of silicate is greatly repressed by presence of much gaseous carbon dioxide; thus, on raising its partial pressure from 0·07 atm. to 1 atm., the melt (in the case of sodium carbonate) takes up 13 per cent. of carbon dioxide at the expense of silica. From a study of the five alkali metals it is shown that the affinity of the oxides for carbon dioxide at high temperatures rises with the atomic weight, whence the amount of silicate obtainable from carbonate follows the reverse order.
—W. A. C.

Sodium Sulphite; Spontaneous Oxidation of ——*, in Air.* A. and L. Lumière and Seyewetz. Phot. Mitt., 1904, **41** 101—104 and 117—120.

The authors find that dry anhydrous sodium sulphite doe not alter appreciably on keeping in air, even at a temperature of 100° C. If, however, the atmosphere is very damp a slow oxidation occurs. Comparative experiments shov that solutions oxidise the more rapidly as they are les concentrated, both in the cold and at the boiling point.
—F. H. L.

Cyanogen Compounds in Blast-Furnace Flue Dus C. Bolin. Teknisk Tidsskrift, 1904, **34**, 24. Chem. Zeit., 1904, **28**, Rep. 95.

While a large proportion of the cyanogen compound formed in the blast furnace are destroyed in the uppe portions, a certain quantity escapes decomposition and i found in the flue-dust, the colour of which is brighter a it contains more cyanogen. The solution obtained b treating the dust with water contains alkali cyan de thiocyanate, cyanate, sulphide, and chloride, and the autho gives a scheme of analysis for determining these. He ha found in flue-dusts as much as 1·43 per cent. of petassiu cyanide and 2·60 per cent. of thiocyanate.—J. T. D.

Iron Carbonylferrocyanide: a Constituent of Spent Oxid M. Stoecker. J. Gasbeleucht., 1904, **47**, 338—342.

The author has ascertained the presence, in spent oxid of small amounts of a violet-coloured compound, ferr carbonylferrocyanide, $FeFeCO(CN)_5$. The average pr portion appears to be about 0·11 per cent., and it is du included in the result when cyanogen is determined in spe oxide by Knublauch's and the other usual methods. As is readily decomposed, it is for the most part converted i simple ferrocyanide compounds in working up spent oxi in the usual way for the production of ferrocyanide; a any of it which escapes conversion may easily be tra formed into ferrocyanide. To detect its presence in sp oxide, 10 grms. of the sample are digested for 17 ho with 50 c.c. of caustic potash solution (10 per cent.); fr the filtrate the ferrocyanide is precipitated by means of h acetate, and to the filtered solution is added concentrated ferric chloride solution. After standing for several days, the liquid is filtered, when the violet compound remains on the filter.—H. B.

Liquid Oxygen; Solubility of Nitrogen in ——. A. Stock. Ber., 1904, **37**, 1432—1434.

The solubility of nitrogen in liquid oxygen mentioned by Erdmann and Bedford (this J., 1904, 441), is a simple case of the physics of two miscible liquids; and their quantitative results could all have been predicted from the figures given by Baly. No chemical relationship between the two substances can be inferred from the facts; and the analogy between the solubility of nitrogen in oxygen and that of ammonia in water is purely accidental.—J. T. D.

Separation of Gases by means of Centrifugal Force; Principles of the ——. G. Bredig and F. Haber. Z. angew. Chem., 1904, **17**, 452—464.

The authors give a mathematical discussion of the physico-chemical principles underlying the problem, and arrive at the following conclusions:—The centrifugal separation of air as proposed by V. Calzavara is impracticable, the circumferential velocity required in a single stage separator being greater than any known material of construction can withstand. A multiple stage separator is impracticable, as the chambers and shaft would have to be of enormous length in order to yield a sufficient quantity of air rich in oxygen. The energy required for the actual separation is small, but great losses are caused by friction in the bearings of the separator. All these difficulties are due to the circumstance that the difference in density of the gases to be separated is very small, and that the rate of diffusion of the two gases, on which depends the rate of production of a gas rich in oxygen, is also small.—L. F. G.

Acid Nitrates. E. Groschuff. XXIV., page 505.

Potassium Platinous Chloride. P. Klason. XX., page 501.

Sodium Thiosulphate; Electrolytic Oxidation of ——. C. J. Thatcher. XI. A., page 493.

Potassium Double Cyanides; Electrolysis of ——. H. von Hayck. XI. A., page 493.

English Patents.

Glover Tower Process [Sulphuric Acid Manufacture]; Impt. upon the ——. H. Hegeler and N. L. Heinz, Ill., U.S.A. Eng. Pat. 2541, Feb. 2, 1904.

See U.S. Pat. 752,677, 1904; this J., 1904, 370. See also U.S. Pat. 728,914, 1903; this J., 1903, 742.—E. S.

Stones, Artificial, or Bricks; Manufacture of ——, *in which the Waste from the Leblanc or Ammonia Soda Process is used.* C. Ahrendts. Eng. Pat. 4130, Feb. 18, 1904. IX., page 490.

Slaked Lime, and Process of Preparing the same. J. J. Feely, White Plains. Eng. Pat. 4409, Feb. 22, 1904. Under Internat. Conv., March 5, 1903.

Quicklime is slaked by water containing acetic acid, and is subjected to attrition with exposure to the air for some hours. After a further period, the now dry slaked lime is ground to the desired fineness.—E. S.

Sea-Water; Apparatus for the Evaporation of ——. H. Schmidt, Hamburg-Uhlenhorst. Eng. Pat. 4597, Feb. 24, 1904.

The vertical boiler in which the sea-water is evaporated contains in its lower part a series of connected coils (for admission of high-pressure steam), the lowest of which coils is beneath a perforated plate constituting a lower chamber. This lowest coil is jacketed. The sea-water to be evaporated enters the annular space round the lowest coil, and has exit in a heated state below the perforated plate, through which it rushes in jets which play against the heated coils in the upper chamber. The water of condensation, from the steam injected into the coil, leaves by the lowest coil, where it serves to heat the incoming sea-water. In a modified form of apparatus, the sheath or jacket to the lower coil, is longitudinally constricted in parts so as to be maintained in place. The upper part of the boiler is occupied by baffle-plates, obstructing the passage of the spray through the outlet for the steam to the condenser. —E. S.

Hydrogen Gas; Apparatus and Method for the Production of Pure or Nearly Pure ——. H. G. Hills and H. Lane, Hyde. Eng. Pat. 10,356, May 7, 1903.

Hydrogen gas is produced by passing steam, preferably superheated, over iron contained in heated retorts; and the mixture of hydrogen and steam is led through coolers, from which the hydrogen passes to a gasometer. By means of reversing valves, controlling inlet and outlet passages, a reducing gas, such as water-gas, coal-gas, or the like, is then led through the retorts, to reduce the iron oxide formed, and then steam is again passed through.—E. S.

Graphite; Treatment of —— *for the Separation of Impurities therefrom.* R. Glogner, Freiburg. Eng. Pat. 14,831, July 3, 1903.

See Fr. Pat. 333,553 of 1903; this J., 1903, 1348.—T. F. B.

United States Patent.

Cyanamide Salts; Manufacture of ——. G. Erlwein, Assignor to Cyanid Ges., Berlin. U.S. Pat. 757,185, April 12, 1904.

See Eng. Pat. 16,298 of 1902; this J., 1903, 554.—T. F. B.

French Patents.

Catalytic Reactions; Process for Conducting —— *[Manufacture of Sulphuric Anhydride by the Contact Process].* W. Kauffmann. Fr. Pat. 337,424, Dec. 5, 1903.

The sulphur dioxide is preliminarily heated to a temperature suitable for initiating the reaction, and is passed into a vessel charged with contact material so limited in quantity as to restrict the increased temperature of the issuing gas, due to heat of reaction, to a certain range. From this first reacting vessel the gases pass through a heat exchanger, in which their excess heat is communicated to sulphur dioxide on its way to the heater; and the cooled gases enter, at a suitable temperature for initiating reaction, a larger vessel packed with contact material, in which the oxidation is completed.—E. S.

Barium Manganate; Manufacture of a Special —— *and of all the Permanganates.* A. Tixier, R. Cambier, and C. E. Adnet. Fr. Pat. 337,629, Dec. 12, 1903.

Barium manganate is formed, either in the wet way, by reacting with barium hydroxide or a soluble barium salt on solution of an alkali manganate or permanganate; or air, free from carbon dioxide, is passed over a dry mixture of manganese dioxide with caustic soda or potash, at a low red heat; the product is lixiviated, and the solution is precipitated by barium hydroxide. The barium manganate thus obtained may serve for the preparation of permanganates; as, for instance, by the action upon it of sulphuric acid in presence of a soluble sulphate.—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

United States Patents.

Glass-Furnace. S. O. Richardson, Toledo. U.S. Pat. 756,409, April 5, 1904.

The furnace consists of a receiving-chamber; a closed melting-pot divided into a melting-chamber and a planing chamber by a partition, which is provided with an opening communicating with both chambers; a feed opening leading into the melting-chamber; a dam for maintaining the "metal" at a desired height in the planing-chamber; an enclosed passage-way arranged to convey the overflow from the planing-chamber into the receiving-chamber; and means, in communication with the interior of the receiving-chamber, for maintaining the metal therein in a sufficiently fluid condition. A number of continuously operating, closed melting-pots placed opposite to each other may be arranged so as to discharge into a common run-way, feed-openings being provided for continuously charging the pots from outside the heating-chamber, and means being arranged outside the pots for melting their contents, as well as a working-chamber to receive the metal from the run-way. The contents of the pots may also be melted by means of an arrangement outside them.—A. G. L.

Glass-Reheating Furnace. J. L., C. V., F. J., P. R., and F. L. Arbogast, Pittsburg. U.S. Pat. 756,557, April 5, 1904.

A VERTICAL heating chamber is arranged in conjunction with an endless chain carrier, pivoted "blank-supporting plates" being carried by this chain, and a "tripper" adapted to tilt said plates.—A. G. L.

Glassware; Method of Manufacturing ——. J. T., C. V. F. J., F. L., and P. R. Arbogast, Pittsburg. U.S. Pat. 756,558, April 5, 1904.

"BLANKS" are pressed of suitable form, and allowed to cool without annealing; a number of the "blanks" are then reheated simultaneously, and successively blown to form articles from a part of the mass of glass contained in the "blanks," after which the completed article is cracked off from the rest.—A. G. L.

[Glass-] Furnace. S. O. Richardson, Toledo. U.S. Pat. 756,894, April 12, 1904.

THE furnace is provided with a working-chamber and a casting-chamber in free communication with each other. The casting-chamber is provided with an opening leading to its exterior, the upper part of this opening being below the level of the metal-line in the working-chamber. A movable carrier moves into and out of the casting-chamber through the opening and carries moulding means which are supplied with fluid "metal" from the working-chamber. The whole is so arranged that the casting-chamber is closed by the carrier and moulding means, whilst they are within the chamber, so as to prevent a fall of temperature. —A. G. L.

Glass Articles; Process of Manufacturing ——. S. O. Richardson, Toledo. U.S. Pat. 756,895, April 12, 1904.

GLASS articles are manufactured continuously by casting a definite quantity of the refined "metal" at a high temperature, at which the "metal" is maintained in the liquid condition, cooling the "metal" so cast to a lower temperature, and then manipulating the glass to the required form.—A. G. L.

Pottery-kiln. E. S. Bacon, Detroit. U.S. Pat. 756,561, April 5, 1904.

IN the kiln are arranged, in conjunction with an external shell, a muffle located in this shell, a pipe hanging from the wall of the shell and leading through an opening in the bottom, a fuel-receptacle sleeved within this pipe, and provided with an air-inlet through the bottom of the pipe, and with air-inlets through the side walls, and with a fuel-chamber surrounding the inlet through the bottom. Means are provided for adjusting the fuel-chamber with respect to the hanging pipe, and thus varying the combustion-chamber and regluating the combustion.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

Portland Cement; New Definition of ——. Tonind.-Zeit., 1904, **28**, 302.

THE Association of German Portland Cement Manufacturers has adopted the following amended definition of the term Portland cement, *viz.*, a hydraulic cementing material, with a sp. gr. not less than 3·1 in the calcined condition, and containing not less than 1·7 parts by weight of lime to each 1 part of silica + alumina + iron oxide, the material being prepared by intimately mixing the raw ingredients, calcining them to not less than clinkering temperature, and then reducing the whole to the fineness of flour.—C. S.

Sand-Cement. H. Seger and E. Cramer. Tonind.-Zeit., 1904, **28**, 331—332.

Two opinions are current respecting the cause of the good qualities of Portland cement mixed with sand. One of them is that the increased fineness of the cement after grinding along with the sand is the sole cause of the improvement, whilst in the other the credit is given to the improved condition of the sand. To determine which view is correct, the authors made comparative trials with cement alone and in admixture with 25 per cent. of glass sand, or with the same proportion of pure quartz that had been calcined in a porcelain kiln. The results showed that, so far from the soluble silica in the calcined quartz improving the tensile strength of the mixture, the contrary is the case, at least when the test blocks are stored in air. In those stored under water the difference is inappreciable. Although the initial strength of the mixtures of cement and sand or quartz is lower than that of the pure cement, the conditions are reversed at the end of 3—6 months. At the outset, the relation between tensile and crushing strengths is more favourable in the case of the mixtures, but by the end of three months the difference has disappeared. There is no advantage in using calcined sand for the mixture.—C. S.

ENGLISH PATENTS.

Waste Heat in Brick and other Kilns; Utilising ——. T. Kirkland, London, and F. H. Cooke, Peterborough. Eng. Pat. 7128, March 27, 1903.

Two or more kilns are connected with flues and dampers in such a way that the hot products of combustion of one kiln can be passed through the others.—W. H. C.

Brick Kilns. T. Crew, Tipton. Eng. Pat. 1617, Jan. 22, 1904.

THE waste heat from one brick kiln is utilised to dry and heat unburnt bricks contained in a second kiln by connecting the flues inside the first kiln with outside flues laid all round the kiln. These flues join outside flues of the other kiln, which communicate with the interior of the latter by means of branches of brickwork extending under the furnace holes.—A. G. L.

Stones, Artificial, or Bricks; Manufacture of —— *in which the Waste from the Leblanc or Ammonia-Soda Process is used.* C. Ahrendts, Strassburg. Eng. Pat. 4130, Feb. 18, 1904. Under Internat. Conv., May 5, 1903.

SAND, or ground silicious slag or the like, and slaked lime are mixed with a large amount of alkali waste, water being added to promote the mixing. Bricks or blocks are formed from the mass obtained, pressed, and placed in trucks which are pushed over a series of pipes through which steam is led. A cover is placed loosely over the bricks, which gradually attain a temperature of 30° to 40° C., at which they are kept for 10 or 12 hours. The whole vessel is then tightly covered and supplied with high-pressure steam so as to harden the bricks.—A. G. L.

Cement; Improved Process for Manufacturing ——. R. Liebold, Weimar. Eng. Pat. 4606, Feb. 24, 1904.

TEN litres of boiling water, in which are contained 245 grms. of stearine, 12 grms. of potash, and 10 grms. of colophony, are added to 100 kilos. of calcined but unground cement. The whole is then dried and ground as usual.—A. G. L.

UNITED STATES PATENTS.

Stone; Artificial ——. V. Steger, Bonham. U.S. Pat. 756,295, April 5, 1904.

A SOLUTION of 8 lb. of sodium carbonate in 100 galls. of water is added to a mixture of 93 per cent. of sand and 7 per cent. of lime. The mixture is then formed into bricks or the like and treated for about 10 hours with steam previously brought into contact with a mixture of 9 lb. of caustic potash and 8 lb. of flowers of sulphur.—A. G. L.

Slag Cement; Apparatus for the Manufacture of ——. C. Gramm. Frankfort-on-Maine, Assignor to H. Edmunds, London. U.S. Pat. 757,035, April 12, 1904.

The material is conveyed to a rotary distributor contained within a stationary casing, and from the former the material passes to a conical rotary table, provided with an adjacent stationary scraper, located below the distributor and outside the casing. Means are provided for imparting different rotary movements to the table and to the distributor. —B. N.

Magnesia Cement Composition. E. Bidtel, Milwaukee. U.S. Pat. 757,252, April 12, 1904.

A powdered substance containing magnesia is mixed with powdered magnesium sulphate and barium chloride, and the mixture treated with water. Barium sulphate and magnesium chloride are produced, and the latter at once combines with the magnesia and causes the whole to set gradually. The composition of the cement is expressed by the formula $MgCl_2.5MgO.BaSO_4.17H_2O$.—A. G. L.

French Patents.

Stone [Artificial]; Manufacture of Calcareous ——. Second Addition, of Nov. 2, 1903, by H. C. Meurer, to Fr. Pat. 291,906 of Aug. 21, 1899, by H. C. Meurer and F. T. Bormann-Zix.

In making bricks by adding hot sand to quicklime and quenching the lime by means of hot water, it has been found o be advantageous to regulate the temperature by adding a part of the hot sand only after the mixture of the lime with he remainder of the hot sand has been quenched and has been allowed to lose a part of its heat. The whole is then at once reheated by means of steam or in any other convenient way.—A. G. L.

Wood; Process for the Rapid Drying of ——. Soc. Anon. Le Trénailage. Fr. Pat. 337,378, Nov. 19, 1903.

The wood is dried by alternately subjecting it in a closed essel, to increased and diminished pressure at a temperaure which may reach 60° to 80° C., but preferably does not xceed 30° to 40° C.—A. G. L.

Surfaces [Building Materials] exposed to the Air; Process for Waterproofing and Preserving ——. E. M. Caffall. Fr. Pat. 337,773, Dec. 16, 1903.

ee Eng. Pat. 27,426 of 1903; this J., 1904, 254.—T. F. B.

X.—METALLURGY.

old-Selenium-Silver Ores; Treatment of ——*. which are finely dispersed through the Gangue and form a large amount of Slimes.* M. Merz. Oest. Zeits. Berg- u. Huttenw., 1904, **52**, 59, 70, 86, 99; Chem.-Zeit., 1904, **28**, Rep. 103.

rom a Sumatran ore (54·21 grms. of gold and 369·86 of ver per 1,000 kilos.) containing selenium, only 75 per cent. its gold and 50 per cent. of its silver could be extracted the ordinary processes. A very large amount of potasm cyanide was consumed, and a great deal of slime was rmed, which hindered the lixiviation. The ore could not roasted, because of the selenium it contains, and the use oxidisers during lixiviation did not aid the extraction. e author proposes to treat the ore by a decantation ocess, the whole of the ore being in the first place wetound to extreme fineness, concentrated, and treated by algamation.—J. T. D.

Zinc; Metallurgy of ——. H. Brandhorst. Z. angew. Chem., 1904, **17**, 505—517.

ende is the most important ore in Silesian practice; as chanically prepared ready for roasting it usually contains –70 per cent. of zinc sulphide, 10—25 of iron pyrites, –35 of dolomite, and about 5 per cent. of quartz and ena, with occasionally a little calamine. When gradually ted in air, the pyrites burns first (at low redness); at a higher temperature the zinc sulphide oxidises; this temperature is above that of complete decomposition of zinc sulphate, so that no sulphate is formed, only oxide. The roasted ore always retains 1—2 per cent. of sulphur as zinc sulphide. The loss of zinc in Silesian practice is considerable, only 65—70 per cent. of the zinc contained in the ore being actually obtained as metallic zinc; while the Belgian process yields 85—90 per cent., or even more. The loss arises from: (1) Zinc remaining in the residue in the muffle; (2) Zinc in the gaseous form permeating the muffle or becoming absorbed in its substance; (3) Zinc passing the condenser, and being lost with the furnace gases. Investigation of the residues of a number of years' production has shown that in the Silesian works by far the largest proportion of the total loss of zinc is due to the first cause. Experiments were made, with eight different varieties of ore, in which the ore was reduced in crucibles (working with 200 grms. of ore) heated in crucible furnaces just to the temperature of the ordinary zinc-muffle. The residues in the crucibles were all free from zinc, or contained at most traces, proving that no chemical reason for the retention of zinc in the muffle-residues exists, and also that a small proportion of sulphur in the roasted blende does not harmfully affect the reduction. To ascertain whether the temperature and mechanical condition of the contents of the muffle affected the question, experiments were made at a higher temperature, with the addition to the charge of sufficient clay to form a slag, fusible at the temperature of the operation. These were so successful that a trial was made on a small manufacturing scale. Instead of muffles, vertical fireclay cylinders, open at both ends, were used. The lower ends rested in and were luted to fireclay trays resting on the bed of the furnace, while the upper ends projected through the furnace roof. Through holes in the centre of the trays passed vertical fireclay tubes, ending below in horizontal or gently inclined tubes to take away the metal, and projecting into the cylinders to about one-fourth of their height. The upper ends of these tubes were protected against the entrance of solid material by caps. The cylinders were filled with broken coke to the level of the top of the tubes, and the charge was put in above this from the top. The cylinders were heated by gas, the final temperature being sufficient to melt the slag, which collected at the bottom and could afterwards be run off. A charge containing 20 parts of incompletely roasted blende, 5 of white calamine, 5 of coke, 6 of clay, and 2 of lime, thoroughly mixed, yielded 92 per cent. of its total zinc and a slag containing only 0·3 per cent. of zinc. As far as the experiments have yet gone, the apparatus promises to be durable against both chemical and mechanical injury, and works off in 24 hours from 60—120 kilos. of ore per sq. metre of surface (against 34—39 kilos. for a Silesian muffle, and 25—30 kilos. for a Belgian tube). Added to this, the mechanical arrangements for charging, &c., are very convenient, and damaged cylinders are easily removed and replaced. In Upper Silesia there exist large amounts of ores containing low percentages of zinc. From some of these the zinc can be extracted by wet treatment with ammonium carbonate and ammonia; silicates are not amenable to this treatment, but an iron-containing oxide, of formula $2ZnO.Fe_2O_3$, can be treated if the ferric oxide be previously reduced to ferrous oxide by the reducing gases from the blende-roasting. The solutions so obtained have not as yet been treated profitably by electrolysis, but when heated they give off ammonia and ammonium carbonate, and deposit a double zinc-ammonium carbonate, which, decomposed by heat, gives zinc oxide. This oxide yields by reduction a very pure metal. The ammonium compounds can be recovered and used again. Concentration of the Silesian zinc ores by removal of the associated dolomite has of late been attempted. This is effected by dissolving the carbonates in sulphurous acid, furnished by the sulphur dioxide evolved in roasting the blende. The washed gases are pumped into vessels in which the crushed ore is agitated with water, under a few feet of water-pressure, and the sulphite solutions so obtained are sold for wood-pulp manufacture. This is probably a more profitable use of the sulphur dioxide than making sulphuric acid, and it enables ores to be worked that would otherwise be too poor to use. —J. T. D.

Carbon and Silicon; Some Compounds of —— with Metals; and a generally applicable Method for the Determination of Carbon in Metals. W. Hempel. Z. angew. Chem., 1904, **17**, 296—301, 321—325.

By heating together finely-divided iron and lamp-black in the electric furnace, carbon-iron alloys containing up to 4·96 per cent. of carbon were prepared. With cobalt, products containing up to 8·45 per cent., and with nickel, up to 6·25 per cent. of carbon were obtained. In the case of iron and cobalt, the greater part of the carbon in the cooled product is chemically combined, but in the case of nickel, nearly the whole of the carbon in the final product is present as graphite. Platinum can take up 1·2 per cent. of carbon, whereby it becomes brittle; copper, up to 0·03 per cent.; silver, up to 0·04 per cent.; gold, up to 0·31 per cent.; manganese, 0·47 per cent.; chromium, 2·23 per cent.; and tungsten, 3·3 per cent. of carbon. By fusing a mixture of the reduced metal with powdered silicon crystallised from zinc, silicon-cobalt alloys containing up to 19·3 per cent. of silicon were obtained, the products being extremely hard and brittle. The corresponding nickel alloys contained up to 19·95 per cent. of silicon. With mixtures of silicon and carbon, together with cobalt and nickel respectively, amounts of silicon less than 1·4 per cent. have little influence on the quantity of carbon taken up, but if the silicon be present in excess, the amount of carbon taken up is less, the greater the quantity of silicon in the final product. Commercial zinc is stated to be quite free from carbon. For the determination of the carbon in metals, the author recommends Weyl's method of dissolving the metal by the aid of the electric current. A piece of glass tubing is made with one end in the form of a flat plate with a hole in the middle. The material is placed on this plate and the tube is immersed in dilute hydrochloric acid, so that about one-third of the material is covered. The current flows through a platinum wire in contact with the material being examined. The undissolved carbon is determined by combustion with chromic acid by Ullgren's method. In the case of metals such as platinum, the author finds that the metal is quickly dissolved by approximately the theoretical amount of *aqua regia*, if the mixture of metal and acid be heated at 130° C. in a sealed tube. The undissolved carbon may then be determined by combustion, and any carbon dioxide formed determined gasometrically.
—A. S.

Cyanogen Compounds in Blast-Furnace Flue Dust. C. Bolin. VII., page 488.

Tin; Determination of —— in Tinplate. H. Angenot. XXIII., page 504.

English Patents.

Metals [Precious]; Apparatus for Separating —— from their Crushed Ores or Material containing same. W. N. Turner, Ipswich. Eng. Pat. 12,778, June 6, 1903.

The apparatus is especially applicable to the treatment of alluvial gold-bearing substances by the "dredger process." The ore passes through the revolving screen of the ordinary apparatus into a receiving vessel having division plates with a series of gates or sluices opening from them into separate channels, which latter are provided with adjustable baffles for directing the flow upon the tables.—E. S.

Aluminium and Alloys containing Aluminium; Alloy for and Process of Soldering and Brazing ——. L. Trezel and A. J. Compte de Montby, Paris. Eng. Pat. 4973, Feb. 29, 1904.

The alloy consists approximately of 100 parts of zinc, two parts of bismuth, and one part of nickel, melted together in a plumbago crucible, cast, and rolled into thin bars. These, cleaned by dilute hydrochloric acid, are coated with mercury nitrate, and placed in a silver bath if it be desired to solder pure aluminium, or in a nickel bath if the solder be intended for an aluminium alloy, to receive a thin layer of one or other of these metals. To use the alloy, the parts to be soldered are heated to 100° C., rubbed with stearine, and, when wiped dry, are soldered or brazed in the usual way.—E. S.

Zinc; Process for the Treatment of Metallic ——. P. and A. Gührs, Berlin. Eng. Pat. 12,186, May 28, 1903.

See Fr. Pat. 332,657 of 1903; this J., 1903, 1247.—T. F. B.

United States Patents.

Crude Iron; Process of Converting —— into Malleable Iron or Steel. J. J. Deemer, Chester. U.S. Pat. 757,276, April 12, 1904.

The bath of molten crude or cast-iron is subjected to oxidising blasts directed against the surface of the metal by an annular series of jets extending downwards and obliquely, and converging to a common point centrally on the surface of the bath, and then to similar blasts from jets directed upwards and obliquely to converge as in the former case.—E. S.

Roasting or Desulphurising Furnace. F. J. Falding, New York. U.S. Pat. 756,485, April 5, 1904.

The furnace has a combustion chamber and heating flue; the roasting chamber consists of separated sets of superposed hearths above the heating flue, and is provided with stirring and conveying arrangements. The heating flue discharges into "an uptake and downtake chamber" at the rear of the lower hearths, and extends up to the level of the upper hearth, air-heating flues extending below opening into the chamber. The stirring mechanism includes a rotatory hollow column having hollow stirrer arms, a pneumatic fan for blowing air through the same, and pipes leading to the arms, and valves whereby these are individually subject to control of the air passed.—E. S.

Zinc; Furnace for Producing ——. P. Schmieder, Lipine. U.S. Pat. 757,059, April 12, 1904.

The claim is for "the combination of a vertical receptacle or shaft for the charge of ore mixed with fuel, with a device for heating the upper part of the charge through the walls of said receptacle, a number of condensers or collectors of the liquid zinc for this reduction chamber, a number of tuyères in the lower part of the shaft, which is not arranged to be heated, an oxidation chamber, a condensing chamber and openings above the tuyères and suitable channels for leading the gases from this oxidation chamber for the slag to the condensing chamber."—E. S.

Ores; Process of Smelling ——. A. R. Partridge, Assign to F. W. Page, both of San Francisco. U.S. Pat. 757,22 April 12, 1904.

Air at atmospheric pressure is freely admitted to t bottom of the smelting furnace, in which a suction induced by injecting steam or air through a narrow passag across an outlet at the top of the furnace, into a wid passage beyond the outlet.—E. S.

Smelting Furnace. A. R. Partridge, Assignor to F. Page, both of San Francisco. U.S. Pat. 757,221, April 1904.

The smelting furnace is provided, near its closed top, wi a side horizontal flue opening into a vertical flue, of whi the upper part leads to the chimney, its lower part havi a tube closed at its lower, contracted end, which end recei an injector pipe, the tube having a widened opening imm diately below the outlet, so that when a "fluid" (as stea or air) is injected, suction is induced in the furnace.—E.

Smelting Furnaces; Hearth for ——. A. R. Partrid Assignor to F. W. Page, both of San Francis U.S. Pat. 757,222, April 12, 1904.

The hearth or crucible of the furnace is provided wit double wall entirely around it, forming a water-sp outside which a water-pipe extends, having branched val pipes opening into the water-space. A water-supply p leads into the surrounding water-pipe, and there is a wa discharge from the water-space.—E. S.

French Patents.

Steel; Hearth Furnace for the Manufacture of ——. V. Defays. Fr. Pat. 337,589, Dec. 11, 1903.

At each end of the longer axis of the hearth are three channels, inclined from above downwards, each independently connected to a system of regenerative chambers. The central channel serves for the passage of gas, and the two channels, one on each side, converge so that the air-blast carried by each meets and mingles with the gas from the central channel, in a movable chamber of combustion contiguous to and inclined towards the bath of molten metal. At the opposite end of the bath the arrangement of flues, &c., is the same. Means for controlling the air-blasts are provided.—E. S.

Oil Furnace [for Soldering Pipes, &c.]. G. L. Bourne. Fr. Pat. 337,477, Nov. 16, 1903.

The furnace contains a primary combustion chamber, at the bottom of which is placed an oil burner, and at the top of which rests a secondary combustion chamber, provided laterally with an air pipe, which draws its supply from a pipe feeding the burner. From the secondary combustion chamber, and connected with it, extends a horizontal heating chamber with narrowing brickwork passages and closed end, the products of combustion escaping through a central transverse channel in which the pipes to be soldered are placed. Combustion is complete, and the absence of carbon or oxygen in the waste gases is of special advantage in soldering. The furnace can also be used for smelting, tempering, for heating stampings, forgings, and rivets, and for general forge work.—L. F. G.

Aluminium and Similar Metals; Soldering of ——. C. Ellis and O. J. Flanigan. Fr. Pat. 337,500, Dec. 7, 1903.

See U.S. Pat. 746,802 of 1903; this J., 1904, 66.—T. F. B.

Pyrophoric Alloys for Use in Igniting and Illuminating. C. Auer von Welsbach. Fr. Pat. 337,320, Oct. 31, 1903. II., page 484.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Silver; Double Salts of ——. Bodländer and Eberlein. Z. anorg. Chem., 1904, **39**, 197—239.

The authors have investigated, by electro-chemical methods, the ionic conditions under which the double silver salts which are formed by solution of a silver salt in the corresponding potassium salt, exist in aqueous solution. They find that the tendency to form double salts increases with the negative radicles Cl, Br, CNS, I, CN, in the order given. In a solution of potassium cyanide, silver, like gold, is quite insoluble in the absence of oxygen, and for silver voltameters the use of a cyanide bath is recommended, with the addition of a piece of silver foil surrounding the cathode. To deposit it from cyanide solutions, a higher E.M.F. is required for silver than for gold, and a still higher for mercury.—W. A. C.

Potassium Double Cyanides; Electrolysis of ——. H. von Hayek. Z. anorg. Chem., 1904, **39**, 240—256.

The electrolytic oxidation of potassium ferrocyanide to ferricyanide is brought about by the combination of one anion, $Fe(CN)_6$, with three molecules of $K_4Fe(CN)_6$. At he same time the anion $Fe(CN)_6$ may react thus: $Fe(CN)_6 + 2H_2O = H_4Fe(CN)_6 + O_2$, but if the liquid be kept alkaline there is no loss, since the nascent oxygen oxidises he ferrocyanide to ferricyanide. The secondary electrolysis of ferricyanide and of alkali, however, leads to loss, as ndicated by evolution of gaseous oxygen. To secure the best results the liquid should be kept alkaline; the anode, which may be of nickel, should be rotated; and the volume of anode-liquid should be twice that of the cathode-liquid, from which it is separated by a porous cell. The current efficiency remains about 100 per cent. until the concentration of ferrocyanide falls so far (about 1·75 grm. per 100 c.c.) that oxygen is evolved.—W. A. C.

Sodium Thiosulphate; Electrolytic Oxidation of ——. C. J. Thatcher. Z. physik. Chem., 1904, **47**, 641—720.

By the aid of platinised electrodes, sodium thiosulphate can be oxidised to tetrathionate, which, in neutral or acid solutions, is not further oxidised. Sodium thiosulphate solutions are faintly alkaline, and so long as this slight degree of alkalinity is maintained, the oxidation of S_2O_3 ions to S_4O_6 ions is the only reaction which takes place. The formation of sulphur, sulphite, or sulphate, is the result of secondary reactions, which only occur in more strongly alkaline or in acid solutions. The chief reaction, *viz.*, the conversion of S_2O_3 ions into S_4O_6 ions, is not a direct electrolytic one, but is due to a secondary chemical oxidation by an oxidising agent, probably oxygen, which is produced primarily by the electrolysis. In this chemical oxidation the platinised platinum exerts a catalytic influence. Sodium tetrathionate is unstable in alkaline solution, undergoing hydrolysis, with formation of thiosulphate and trithionate. It is probable that tetrathionic acid is a hydrogen peroxide derivative of thiosulphuric acid, and this opens out an interesting field for research.—A. S.

Tetra-ethylammonium Iodide; Electrolysis of ——. E. Goecke. Z. Elektrochem., 1904, **10**, 249.

By the electrolysis, at the ordinary temperature, with a current of 0·5 ampère, of a solution of 10 grms. of tetra-ethylammonium iodide in 100 c.c. of water, between platinum electrodes without a diaphragm, from 3·5 to 4 grms. of tetra-ethylammonium tri-iodide, $N(C_2H_5)_4I.I_2$, and a smaller quantity of iodoform were produced. The tetra-ethylammonium tri-iodide is deposited on the anode and on the bottom of the containing vessel as a reddish-brown product, which is insoluble in ether, but soluble in acetone. The yield of iodoform increases with rise of temperature and strength of current.—A. S.

English Patents.

Electrolytic Meters. E. A. Carolan, London. From the General Electric Co., New York. Eng. Pat. 7587, April 1, 1903.

A glass float carries one of the electrodes in a pierced bulb at its lower end and a scale in its upper portion, the reading index being also supported by a second float. The change in weight of the electrode produces a relative movement between the two floats, which is irrespective of the level of the electrolyte, and thus indicates the amount of current passed through the meter. The second electrode is placed in a trough attached to the outer vessel, or may be carried by the float which supports the reading index, so as to obtain a greater relative movement between the scale and reading index. Mercury is used for the electrodes, and a solution of mercurous nitrate as the electrolyte.
—B. N.

Anodes for Electrolytic Operations. F. Greenfield, Birmingham. Eng. Pat. 11,579, May 21, 1903.

The anode consists of two or more concentric rings connected together by radial arms, and is suspended by means of a conducting-rod covered with insulating material, the latter pressing against insulating washers so as to prevent the portion of the rod immersed from coming into contact with the electrolyte. The rod may be threaded and screwed into a tapped hole in the anode so as to adjust the height of the latter in the liquid, or the rod may be screwed into a socket wormed internally which is sunk into the anode so as to make contact at its lower end, and the remainder of the socket is covered with insulating material. In a third form the anode has a lug threaded externally, and the suspender rod is provided with a socket wormed internally at its lower end to screw on to the lug, both rod and socket being covered with a sleeve of insulating material.—B. N.

Water; Apparatus for [Electrically] Separating Oily and Similar Impurities from ——. Davis-Perrett, Ltd., H. T. Davis, and E. Perrett, London. Eng. Pat. 8175, April 8, 1903.

See U.S. Pat. 744,171 of 1903; this J., 1903, 1362.—T. F. B.

United States Patent.

Chemical Compounds; [Electrolytic] Process of Producing ——. J. J. Griffin, Washington. U.S. Pat. 757,036, April 12, 1904.

An electric current is passed from an anode of carbide to a cathode of carbide, one or both of which may consist of calcium carbide, through an electrolyte, such as sulphuric acid, which reacts chemically with the carbide, and which yields an electrolytic product reacting with the products of the chemical action, or with the carbide, to give the desired compound. Instead of using carbide for both electrodes, one only may be made of carbide, and an insoluble substance, which will react with the electro-chemical product, may be maintained in suspension in the electrolyte. —B. N.

French Patent.

Ozone; Production of —— for Application as a Disinfectant. A. D'Arsonval, G. E. Gaiffe, and G. Gallot. Fr. Pat. 337,531, Dec. 8, 1903. XVIII. C., page 500.

(*B.*)—ELECTRO-METALLURGY.

English Patent.

Electric Furnaces. C. A. Keller, Paris. Eng. Pat. 3790, Feb. 15, 1904.

See Fr. Pat. 336,403 of 1903; this J., 1904, 377.—T. F. B.

United States Patents.

Metals; Precipitating —— from [Cyanide] Solutions. C. Butters, Berkeley. U.S. Pat. 756,211, April 5, 1904.

Metals are precipitated from solutions (chiefly from cyanide solutions) by the use of cathodes having smooth tin surfaces and anodes of lead peroxide, operating with an electric current of high density.—E. S.

Ores and Tailings [Precious Metals]; Process of Treating Low-Grade —— by Electrolysis. E. Fahrig, Philadelphia. U.S. Pat. 756,223, April 5, 1904.

The low-grade ore or tailings is made into a pulp with water and a suitable electrolyte, and the pulp is passed by gravity between a series of pairs of anode and cathode plates, inclined alternately and arranged in a tower fashion one below the other in an oxidising atmosphere at a pressure equal to the height of the tower. The precious metal is deposited, and the partially extracted pulp is subjected to an oxidising action, then to a leaching action for some time, and then to successive electrolytic, oxidising, and leaching actions until the precious metal in the partially extracted pulp has been almost completely dissolved. The solution is subjected to defecation, the defecated liquor is heated, and the latter is finally submitted to electrolytic action so as to obtain the last traces of precious metal.—B. N.

Gold and Silver; Recovery of [Electrolytically] —— from Cyanide Solutions. S. B. Christy, Berkeley. U.S. Pat. 756,328, April 5, 1904.

Continuous circulation is induced between a large volume of dilute cyanide solution of precious metals contained in a storage tank, and an electrolytic cell having "primary cathodes" of large area alternating with suitable anodes, and the circulation is maintained at a stated rate until the gold and silver are sufficiently deposited on the cathodes. Secondly, a small volume of a cyanide solution is similarly circulated through an electrolytic cell containing the primary cathodes from the first-named solution, which primary cathodes are now made secondary anodes in alternation with suitable secondary cathodes of smaller area, so that the gold and silver deposited upon the original cathodes are concentrated upon those of smaller area. Zinc anodes, as grains or shavings, are used, coated with a "previous cathode coating of an electro-negative metal." Residual zinc is removed from the precious metals precipitated on the zinc grains or shavings, by constituting such zinc residues anode in a circulating solution of an electro-negative metal until the zinc is dissolved.—E. S.

French Patents.

Electric Furnace worked by Induced Currents. A. Fauchon Villeplée. First Addition, dated Dec. 2, 1903, to Fr. Pat. 336,313 of Oct. 30, 1903.

The furnace is adapted for use as a reverberatory furnace, and can be used for smelting, for the manufacture of steels, for annealing, carbonising, and for the maintaining of substances at a uniform temperature.—L. F. G.

Tantalum or other Slightly Fusible Metals; Production of Homogeneous Bodies of ——. Siemens and Halske A.-G. Fr. Pat. 337,607, Dec. 12, 1903.

To facilitate the working of tantalum and other metals of high fusing points, the metal, in the form of powder, is compressed into a sufficiently coherent form, and is then fused *in vacuo* by means of an electric arc. The arc may be formed between two compressed electrodes of the metal to be fused, and, to prevent loss by volatilisation, a large mass of another metal (*e.g.*, silver) is placed in proximity to the arc. This seems to cool the arc, and permits the fusion of the metal into large drops without sensible loss by volatilisation. Preferably the metal to be fused forms the positive electrode, whilst the large mass of metal itself forms the negative electrode.—H. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Almond and Allied Oils; Characteristics of ——. J. Lewkowitsch. Analyst, 1904, **29**, 105—110.

The analytical constants of genuine almond, peach-kernel, and apricot-kernel oils are given, and it is shown that these cannot be relied upon as differentiating tests. Bieber's test (in which 5 parts of oil are treated with 1 part of a mixture of equal parts of sulphuric acid, fuming nitric acid, and water) is as yet the best test. The reagent should be freshly prepared, and it should be noted that fresh peach-kernel oil gives a more pronounced coloration than that which has been kept for six months or more. It is unsafe to base a judgment of the adulteration of a given sample of almond oil with either peach- or apricot-kernel oil on the results of this test. He has also found Maben's elaïdin and zinc chloride tests quite useless for the purpose. The results obtained in the determination of the neutralisation and saponification values of the fatty acids of the different oils examined did not confirm the statement of Tortelli and Pergami that most fatty acids contain small quantities of lactonic substances (this J., 1902, 1187).—C. A. M.

Chinese Tallow-Seed Oil [Stillingia Oil]. L. M. Nash. Analyst, 1904, **29**, 110—112.

The specimen examined was dark brown and had an odour recalling that of tung oil. It had about three-fifths the viscosity of rape oil at 15° C., and had good drying properties, yielding a hard film when exposed on glass for six days. It did not give any deposit of stearine when cooled to 0° C.; but the fatty acids separated on standing into a solid and a liquid portion. The following values were determined:—Sp. gr. at 15·5°/15·5° C., 0·9395; free fatty acids (as oleic acid), 3·1 per cent.; unsaponifiable matter, 0·44 per cent.; saponification equivalent, 277; iodine value (Hübl), 160·7; iodine value of fatty acids, 165; Hehner value, 94·4; insoluble fatty acids, 93·96 per cent.; molecular equivalent of fatty acids, 272; rotation in 100 mm. tube, about $a_D = -4°$; Butyro-refractometer reading at 20° C., 89·1; and refractive index, n_D at 20° C., 1·4835. On treating the liquid fatty acids of this oil with bromine Lewkowitsch obtained 25·78 per cent. of hexa-bromides; linseed oil yielding upwards of 40 per cent.—C. A. M.

Castor Oil Product, "Floricin," which is miscible with Mineral Oils. G. Fendler. Deutsch. pharm. Ges. Ber., 1904, **14**, 135. Chem.-Zeit., 1904, **28**, Rep. 101.

When castor oil is distilled at 300° C. till it has lost between 5 and 10 per cent. of its weight, the residue (to which the name *floricin* has been given) is miscible with mineral oils, ceresin, or vaseline, though not with alcohol or acetic acid. "Floricin" is yellowish-brown, with a green fluorescence. An examination seems to indicate that it contains a considerable quantity of the glyceride of undecylenic acid.
—J. T. D.

Fucol: a Cod-liver Oil Substitute. H. Norrenburg. XX., page 501.

English Patents.

Soaps; Manufacture of Hard Alcoholic ——. R. Falck, Breslau. Eng. Pat. 2343, Jan. 30, 1904.

Soda soaps are mixed with water and dissolved in alcohol of high strength (*e.g.*, 80 per cent.), or intimate combination between the anhydrous soda soap and the alcohol may be effected by the addition of potash soap. Owing to the large amount of alcohol, antiseptic or medicinal substances can be readily introduced into the soap.—C. A. M.

Basic Colouring Matters; Manufacture of Soluble Compounds or Salts of —— [for Soaps, Varnish, &c.]. J. Y. Johnson. From Badische Anilin u. Soda Fabr. Eng. Pat. 12,681, June 5, 1903. IV., page 485.

French Patent.

Soap; Preparation of Insoluble —— so as to readily separate the Glycerin. P. Krebitz. Fr. Pat. 337,509, Dec. 8, 1903.

The fats are boiled with a metallic hydroxide, such as milk of lime, the insoluble soap allowed to settle, and washed with hot water, and the glycerin recovered from the aqueous layer and washings.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

French Patents.

Oil Colour. M. Hérisson. Fr. Pat. 337,440, Dec. 5, 1903.

Claim is made for an oil colour containing aluminium silicate, zinc oxide, linseed oil, and barium chloride.
—C. A. M.

Pigment; Composition for ——. W. A. Hall. Fr. Pat. 337,723, Dec. 14, 1903.

See Eng. Pat. 26,903 of 1903; this J., 1904, 328.—T. F. B.

Greases [Lubricants], Plasters, and Waterproofing Compositions [Paints]; Process of Making ——. J. Girard and P. J. Tabourin. Fr. Pat. 337,753, Dec. 15, 1903. III., page 484.

(*B.*)—RESINS, VARNISHES.

English Patent.

Basic Colouring Matters; Manufacture of Soluble Compounds or Salts of —— [for Soaps, Varnish, &c.]. J. Y. Johnson. From Badische Anilin u. Soda Fabr. Eng. Pat. 12,681, June 5, 1903. IV., page 485.

United States Patent.

Varnish. A. Müller-Jacobs, Richmond Hill, Assignor to Cosmos Chemical Co., New York. U.S. Pat. 756,975, April 12, 1904.

Solutions of an amide of one of the higher fatty acids, in which some of the hydrogen has been replaced by an alkyl group ("stear-amid"), are mixed with varnish or varnish constituents.—R. L. J.

XIV.—TANNING; LEATHER, GLUE, SIZE.

United States Patents.

Tanning Wheel. B. Allen, jun., Buford. U.S. Pat. 756,553, April 5, 1904.

Mechanical details are given of a tanning plant consisting of vats arranged in pairs, with storage tanks, and troughs for transferring the liquor from one vat to another. Tanning wheels mounted on horizontal shafts revolve in the vats, being turned by suitable machinery either in unison or independently of one another.—R. L. J.

Tanning Drum. B. Allen, jun., Buford. U.S. Pat. 756,554, April 5, 1904.

Mechanical details are given of a drum provided (1) with a hinged door and special mode of closing it; (2) with parallel guides at the ends of the drum, and movable slides to be placed in same and spaced according to requirements; and (3) means for supporting and revolving the drum.
—R. L. J.

XV.—MANURES, Etc.

English Patent.

Distillery Effluents or other Polluting Liquids, Sewage or other Putrescible Material, Soils for Filtering Purposes, and Agricultural Land; Treatment of ——. J. Hunter. Eng. Pat. 15,555, July 14, 1903. XVIII. B., page 500.

XVI.—SUGAR, STARCH, GUM, Etc.

Cane Sugar; Alteration of —— on Storing. F. Strohmer. Oesterr.-ung. Zeits. Zucker-Ind. u. Landw., **32**, 710—712. Chem. Centr., 1904, **1**, 1111—1112.

In the interior of a heap of raw sugar, 5 m. high, was found, after four months' storing, about 50—60 double centners of a dark-coloured product of composition differing considerably from that of the outer portions of the heap. The author found that the alteration of the sugar was due to bacterial action, invert sugar and other optically-active and reducing substances being formed. The dark-coloured product contained considerably more bacteria (*cocci*) than the normal product. It is probable the sugar was placed on the heap whilst still warm, and that consequently the sugar in the interior of the heap could only cool slowly, and thus it became a favourable medium for bacterial action.—A. S.

Diffusion Juice [Sugar]; Preservation of ——. Herrmann. Zentralbl. Zuckerind., 1904, **12**, 701. Chem.-Zeit., 1904, **28**, Rep. 108—109.

The author states that with normal beets and with a proper method of working and the use of perfectly clean vessels for holding the samples and taps for drawing off the same, samples of diffusion juice can be obtained, which, in closed vessels, will not undergo alteration within two hours; the amount of "apparent dry substance" remains unaltered for at least four hours. The following method of control for diffusion juice is recommended. Samples of the juice are withdrawn every two or four hours from several vessels in each battery, the density and polarisation are immediately determined, and the figures compared with the corresponding ones obtained from an average sample of the juice from the whole plant. Of the preservatives generally used, 1/20 vol. of lead acetate preserves the juice unaltered for at least 36 hours.—A. S.

Green Syrups; Treatment of —— by the Karlík-Czapikowski Method. K. Andrlík and V. Staněk. Z. Zuckerind. Böhmen, 1904, **28**, 283—291.

The authors give a further account (see this J., 1903, 564) of the working of this method at Nymburg, and of various improvements introduced into the process. During the past campaign about 55 per cent. of fine, light sugar and 1·3 per cent. of molasses were obtained from the second "Füllmasse."—T. H. P.

Sugar Works; Use of Sulphurous Acid in ——. J. Weisberg. Bull. Assoc. Chim. Sucr. et Dist., 1904, **21**, 972—986.

The process of "sulphicarbonation," patented by Steffen in 1893, consists in cooling the filtered juice from the first carbonation to 30°—40° C., then passing in sulphur dioxide until the acidity reaches 1 grm. or 1·5 grm. per litre, with or without subsequent treatment with finely-powdered bone-black; the acid juices, filtered from the bone-black, are rendered slightly alkaline with milk of lime, reheated to 80°—85° C., filtered, and sent to the evaporators. The disadvantages of this method are overcome in the author's modification of it, in which the carefully filtered juice from the first carbonation, which has an alkalinity to phenolphthaleïn of 0·7 to 1·2 grm. per litre and a temperature of 60°—80° C., is run directly into the boilers and at once sulphited to reduce the alkalinity exactly to the necessary minimum, depending on the initial alkalinity of the juice. From 1 to 2 litres of milk of lime are then added per hectolitre of juice and the temperature is raised to 80°—85° C., at which point carbonation is commenced; this is continued to the extent usual in the second carbonation, the juice being at the same time heated to brisk boiling, which is kept up for one or two minutes. The liquid is then filtered and treated in the ordinary way. The addition of barium carbonate with the milk of lime, precipitates any calcium sulphate formed by the use of the sulphurous acid. Other processes involving the employment of sulphurous acid as a defecating agent are described.—T. H. P.

Sugar; Tin in ——. M. Pitsch. Zeits. Ver. Deutsch. Zucker-Ind., 1904, **54**, 353—357.

Examination of many samples of beet-sugar showed them to be quite free from tin, whilst four samples of Demerara sugar were found to contain appreciable quantities of this metal, probably owing to the use of a tin salt for the production of "bloom." The following are the percentages of ash and, approximately, those of tin (calculated as chloride) in the four samples:—

Description.	Ash.	Stannic Chloride.
"Yellow Post"	0·76	0·0112
"White Post"	0·32	0·0014
Molasses sugar for direct consumption	2·90	0·042
Dark crystals for the American market	0·47	0·01

—T. H. P.

Cane-Sugar; Inversion of —— *by Platinum Metals.* F. Plzák and B. Hušek. Z. physik. Chem., 1904, **47**, 733—739.

Ráyman and Šulc in 1896 (Z. physik. Chem., 1896, **21**, 481) found that the hydrolysis of cane-sugar is accelerated by the platinum metals, with the exception of iridium. Later, Sulc found (this J., 1900, 698) that the hydrolysis of cane-sugar by very dilute hydrochloric and sulphuric acids is considerably retarded by palladium. The authors' experiments with commercial powdered palladium led to conflicting results. After ignition in air the palladium almost completely prevented the inversion of cane-sugar by N/500 hydrochloric acid at 80° C.; after being boiled with dilute hydrochloric acid and then ignited in air, it retarded the inversion only to a much smaller degree; whilst after being ignited in hydrogen, it was practically without influence on the inversion. The palladium was found to contain a small amount of iron and a considerable quantity of zinc, and it is to the presence of the latter the authors consider the retardation of the inversion is chiefly due. That the presence of a small amount of a foreign metal in the palladium can considerably retard the inversion of the sugar, was proved by an experiment, in which 0·2 per cent. of manganese was added to the palladium. Pure palladium, prepared by reduction of the chloride with formaldehyde, had a very considerable accelerating influence on the inversion of cane-sugar by water at 99° C., and also slightly accelerated the inversion of the sugar by N/500 hydrochloric acid at 80° C. After being ignited in the air, the palladium had practically no effect on the inversion of the sugar by water at 99° C. during the first three hours, but after that time the inversion was accelerated to almost the same degree as before. Experiments with pure platinum gave similar results, but the accelerating influence of the latter is much greater than that of palladium. The accelerating effect of iridium is somewhat slighter than that of palladium. The authors consider the action of the platinum metals to be due to oxides produced during the drying of the finely-divided metals in air; and as a confirmation of this view, they state that the accelerating action of palladium on the inversion of cane-sugar is increased by prolonging the drying.—A. S.

Cane-Sugar, Dextrose and Lævulose; Analysis of a Mixture of ——. E. Remy. XXIII., page 504.

l-Arabinose; Action of Lime on ——. H. Kiliani and F. Koehler. Ber., 1904, **37**, 1210—1215.

l-Arabinose, prepared by the hydrolysis of cherry gum, was treated with milk of lime in the proportions: arabinose, 1 part; water, 10 parts; and quicklime, 0·2 part, for 14 days. At the end of that time it was found that 0·37 mol. of lime per 1 mol. of arabinose had been neutralised. Attempts to isolate the free organic acids produced (other than acetic and lactic acids), having failed, the neutralised solution of calcium salts was submitted to fractional precipitation by alcohol. Five fractions were thus obtained; the analysis of the two main groups of products indicated salts corresponding to the formulæ $(C_5H_9O_5)_2Ca$ for the less soluble, and $(C_6H_{11}O_6)_2Ca$ for the more soluble. The last fraction but one contained still less calcium than the above, and the last liquor contained cupric reducing substances. As in the case of the saccharinic acids, the ratio of C to O in the above salts = 1. The production of molecules containing six (and probably even more) carbon atoms from a sugar containing only five, tends to confirm the theory previously put forward, that, under the influence of lime, the sugar molecule is partially broken up, and that the fragments are utilised for the synthetical building up of higher molecules.—J. F. B.

United States Patents.

Sucrose; Process of Extracting ——. W. J. Gibbens, New Orleans, and E. W. Christie, New York, Assignors to the Christie Engineering Co., Ltd., New Orleans, U.S. Pat. 757,295, April 12, 1904.

Sugar cane is crushed by an ordinary cane-mill; the bagasse is then subjected to a series of immersions in an extracting liquid, and is pressed between each pair of immersions, being finally conveyed to a second heavy cane-mill, which removes most of the liquid contained in the bagasse. The liquid from the last mill is injected, together with water, into the last member of the series of immersion tanks, and passed onwards through the whole series in a direction contrary to that of the travel of the bagasse, the strongest liquor overflowing from the first immersion tank. —J. F. B.

Sugar Cane; Apparatus for Extracting Sucrose from ——. W. J. Gibbens, New Orleans, and E. W. Christie, New York, Assignors to the Christie Engineering Co., Ltd., New Orleans. U.S. Pat. 757,296, April 12, 1904.

The apparatus for carrying out the extraction of sugar from sugar cane (see preceding abstract) comprises two cane-mills, a series of immersion tanks, means for conveying the bagasse from one mill into the series of immersion tanks, rotary pushers armed with V-shaped pusher-teeth situated in each of the tanks, scrapers for cleaning the pushers, a pair of press-rolls between each pair of tanks, means for conveying the bagasse to the second cane-mill, and means for circulating the liquid in a contrary direction to the bagasse.—J. F. B.

French Patents.

[*Sugar*] *Juice Heater situated between the Vacuum Pan and Condenser.* L. Bernot and F. Massicot. Fr. Pat. 337,313, Oct. 24, 1903.

The heat contained in the vapours discharged from the vacuum pan during boiling is utilised for heating juices or syrups. A juice-heater, consisting of a large number of tubes enclosed in a casing, is inserted between the vacuum pan and the condenser, and whilst the juice is circulated through the tubes it is heated by the vapours drawn through the casing by the air-pump.—J. F. B.

Charcoal for Clarification. Soc. Brunon and Rothé. Fr. Pat. 337,321, Oct, 31, 1903.

A form of animal charcoal is obtained by heating ossein in closed vessels. The ossein is obtained as a residue from the extraction of bones with hydrochloric acid: it is freed from chlorine and arsenic compounds by neutralisation with slaked lime before calcination.—J. F. B.

Crystallisation of Massecuites; Process of Rapid ——. M. Lambert. Second Addition, dated Nov. 21, 1903, to Fr. Pat. 301,258, June 14, 1900.

A non-conducting screen is interposed between each of the crystallising vessels in such a way that these are only heated or cooled by the air circulating around them. Various sets of crystallisers are placed in rows in different rooms, which may be maintained at temperatures suitable for the different stages of the manufacture.—J. F. B.

Syrup from Beetroot, Cane, Grain, Roots, or other Bodies containing Saccharine Substances; Process for Producing ——. W. C. Salisbury and A. J. Kramper. Fr. Pat. 337,573, Dec. 10, 1903.

See U.S. Pats. 748,313 and 748,314 of 1903; this J., 1904, 124.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Cane-Sugar Yeast from Nicaragua. M. E. Pozzi-Escot. Bull. Assoc. Chim. Sucr. et Dist., 1904, **21**, 1007—1008.

The author describes a yeast isolated from a sample of Nicaraguan molasses. When grown in malt wort, the young cells are round, but become elongated like a sugar oaf; it imparts a strong odour of sugar-cane juice to the wort. It is most active at a temperature of 30°—35° C., and it ferments cane-sugar, dextrose, and maltose, but not actose or galactose. It grows readily in musts of high density, and without preliminary acclimatisation yields wines ontaining 14—15 per cent. of alcohol.—T. H. P.

Pressed Yeast; Detection of Bottom-Fermentation Beer Yeast in ——. P. Lindner. Z. Spiritusind., 1904, **27**, 156—157. (See also this J., 1904, 762.)

HE author proposes a method for the differentiation of op-fermentation and bottom-fermentation yeasts, based on he different manner in which the two types multiply. The east to be tested is suspended in wort at such a dilution hat, when preparations are made by the "droplet" method, ach droplet shall contain not more than 2 or 3 cells. A umber of hemispherical pearl-shaped droplets are made with a pen on the underside of a cover glass. These are lowed to hang freely, and are examined after an interval ot exceeding 24 hours. In this way, with about 30 droplets, nd the degree of dilution described, about 100 cells are btained for the analysis, and the result can be read off n the following morning. All the top-fermentation easts which the author has examined multiply with the roduction of squarrose budding chains in a manner hich may be described as a monopodial ramification, e original axis continuing as such. On the other nd, the bottom-fermentation yeasts, even when they are having temporarily as top yeasts, grow with a sympodial mification, the main axis suddenly ceasing, whilst a side anch takes up the functions of the main axis. In other ords, if the yeast aggregates could grow freely like trees, e top yeast would resemble a fir tree and the bottom yeast a birch tree. This difference is put forward as being perfectly characteristic, whilst a simultaneous observation of the purity of the yeast can be carried out on the same set of preparations. In cases of doubt, a dilute streak culture may be made with a brush on a gelatin plate, and the colonies which develop may be picked off with a needle and stirred in a drop of water. The top-fermentation yeasts will then be found to make a uniform emulsion, whilst the bottom yeasts clot together in flaky aggregates.—J. F. B.

Yeast; Observations on the Period of Vitality of Dried ——. H. Will. Z. ges. Brauw., 1904, **27**, 269—271.

In concluding the present series of experiments, the author remarks that the asbestos conserve (see this J., 1903, 1097) still contained living cells after more than 17 years; these cells were, however, exclusively those of wild yeasts. The vitality of wild yeasts considerably exceeds that of the culture yeasts, especially when it is considered that the proportion of the former in the original samples was very small. Of the culture yeasts the top-fermentation varieties are less resistant than the bottom yeasts. None of the top-fermentation yeasts survived for 10 years, whilst a conserve of bottom-fermentation yeast in wood-charcoal contained a large number of living cells after 13 years. In considering the period of vitality of different types and races of yeast preserved in the same manner, the physiological condition of the yeast at the time of drying must be taken into account. Substances which absorb moisture strongly, such as gypsum and kieselguhr, are not so advantageous as wood-meal, asbestos, and, above all, wood-charcoal for making the conserves. Preservation in sealed vessels at low temperatures is advantageous. The most favourable proportion of moisture in the prepared conserve is probably between 3 and 6 per cent. (15—20 per cent. in the yeast). A comparatively rapid drying, preferably by a strong current of dry air, with a gradual rise of temperature not higher than 40° C., is recommended.—J. F. B.

Barleys; Germination and Kiln-drying of ——. *I.* A. J. Murphy. J. Fed. Inst. Brewing, 1904, **10**, 99—148.

Chemical analysis, so far, is of little use for determining the age and germinating power of barley. In case of necessity the moisture in matured barleys may be reduced to 8 per cent., or perhaps lower, without detriment to the vitality. Excessive steeping is often responsible for irregular growth. Aeration during steeping is advantageous. Kiln-drying is not only of value for the maturing of barleys when maturation is defective, but the reduction of the moisture also assists the uniform soaking of the grain in the steep. It is recommended that the temperature of kiln-drying should be recorded by a thermometer which is not in contact with the grain, but which is freely bathed by a current of the hot gases employed. Drying at low temperatures is to be avoided because it favours the development of moulds, especially when the drying process is long-continued and when a large proportion of damaged corns is present. A fairly high temperature (160° F., measured by a protected thermometer in the grain) may be employed without injury. If maturation only be desired, the temperature of hot sunshine, 140° F., is perhaps the best. Long-continued drying causes such an accumulation of heat in the grain and expels so large a proportion of water that a "resting period" is necessary before steeping, in order that the grain may cool down and recover its normal content of moisture. Kiln-drying can, however, be regulated in such a way that no "resting period" is necessary. Barleys stored at ordinary temperatures should retain their germinative power, possibly indefinitely, provided they contain a minimum proportion of moisture (*e.g.*, 8 per cent.), together with practical freedom from adherent germs and absence of broken or snipped corns damaged by threshing. Absence of these conditions facilitates the growth of moulds, which is regarded as the chief cause of loss of germinative power.—J. F. B.

Malt; Soluble and Coagulable Nitrogenous Matters of ——. K. Dinklage. Z. ges. Brauw., 1904, **27**, 249—251.

In continuation of a previous paper (this J., 1903, 1370) the author discusses the results of further analyses carried out upon 21 samples of malt by the method proposed (*loc. cit.*). With the exception of three abnormal samples, the total nitrogen of the malts lay between the limits of 1·5 and 1·8 per cent. on dry substance. With the above exceptions the proportions of soluble and coagulable nitrogen were quite independent of that of the total nitrogen. The proportions of soluble and coagulable nitrogen varied together in a perfectly parallel manner. The paler types of malt were always richer in soluble and coagulable nitrogen than the darker types. The proportions of soluble and coagulable nitrogen were in close relationship to the method and temperature of kilning. With higher kilning (increasing colour) the soluble nitrogenous matter is increasingly converted into insoluble matters; the same conversion also takes place to a still greater extent in the case of the coagulable nitrogenous matter. The author lays down the rule that, in the case of malts containing a normal proportion of total protein, *i.e.*, 9—11 per cent. on the dry substance, the soluble and coagulable nitrogenous matters should lie within the following limits:—

Type of Malt.	Per Cent. on Malt. Dry Substance.	
	Soluble Nitrogen.	Coagulable Nitrogen.
Pale to gold-coloured ..	0·48—0·54	0·11—0·13
Dark-coloured.........	0·39—0·48	0·08—0·11
Very dark coloured....		0·07—0·08

If the above relations be not fulfilled, it may be concluded with great probability that the malt has been kilned by a treatment which is not in accordance with its type, or else that the composition of the malt or barley is abnormal.

—J. F. B.

Malt; Determination of the Proteolytic Capacity of ——. P. Schidrowitz. J. Fed. Inst. Brewing, 1904, **10**, 166—172.

In carrying out the determination of the proteolytic capacity of malt by the method described in this J., 1903, 958, the author has found that the results may vary enormously according to the nature of the gelatin employed and to its acid or alkaline reaction. Only fine qualities of gelatin are to be used, and these should be either neutral or slightly acid. The solution of gelatin is made up as follows:—64 grms. of gelatin are dissolved in 500 c.c. of hot water (measured at 15° C.), and a volume of N/10 caustic soda solution, calculated from a preliminary titration of the acidity towards phenolphthalein, is added. Sufficient water is then added to bring the total volume of liquid (water + N/10 alkali) used for dissolving the gelatin, up to 736 c.c. The solution is cooled to 45° C., the white of an egg, previously beaten, is mixed in, and the whole is heated gradually to 80°—90° C. on the water-bath, and maintained at that temperature for 10 minutes. The solution is filtered hot through paper, and when the filtrate has cooled to about 50° C., 4 grms. of powdered thymol are added. The above quantities of water are used for a gelatin containing 16·8 per cent. of moisture, and are to be varied proportionately with any variation from that percentage.—J. F. B.

Barley, Malt, and Unhopped Wort; Tannin Constituents of ——. A. Reichard. Z. ges. Brauw., 1904, **27**, 229—235, 253—258, 271—275.

When a section of a barley or malt corn is treated with ferric chloride or gold chloride reagent, a sharply defined blue-black or violet stain appears in the form of a peripheral ring beneath the husk, owing to the presence of tannin. The tannin appears to be confined solely to the cells of the integuments of the seed, and the stain shows very little tendency to spread. The constituent in question is not free tannin, but most probably a tannin-albuminoid compound. This constituent is almost insoluble in cold water, but it is readily extracted from the cells by means of hot water (from which it separates to a large extent on cooling), or by means of alcohol, in which it is freely soluble. During the malting process, the subsequent solubility of the tannin compound in cold water is considerably increased by the action of the alcohol produced by the germinating grain. This tannin compound is found in unhopped worts, its proportion being greater, relatively to the extract, in the last sparging liquors than in the main wort. In unhopped worts and beers the tannin constituents occur in four different forms:—(1) coarse flocks, films, or corpuscles, which settle out, and are readily stained with reagents; (2) turbidities, which make the obtainment of bright liquors by filtration very difficult; (3) an emulsified form, which is not in true solution, but which occurs in perfectly bright and settled liquors; (4) the truly dissolved form, which is more abundant in beer than in wort, owing to the influence of the alcohol present in the former. The forms (2) and (3) tend to clog the pores of filters; they also have a tendency to be co-precipitated with turbidities, such as those due to gluten. Moreover, these forms penetrate the pores and attach themselves very readily to the walls of the vessels in which the beer is kept; they thus form the basis of "beer-scale," from which they can be extracted by alcohol. The action of the yeast cells in removing the finely-divided forms of the tannin compounds is probably greatest after the active fermentation has ceased. Whilst fermentation is in progress, the alcohol diffusing from the cells would preserve their membranes free from tannin deposits. It has been found, however, that the addition of lactic acid to unhopped worts and beers, causes the precipitation of the tannin compounds in a form which is insoluble in alcohol. Hence it is inferred that infection with bacteria which produce lactic acid, would lead to a speedy clogging of the yeast by tannin compounds in this form.—J. F. B.

Distillery Fermentation Tuns; Suggestions for Treatment of ——. G. Heinzelmann. Z. Spiritusind., 1904, **27**, 157.

The tuns should be constructed only of sound, non-resinous pine wood (pitch-pine), free from knots. At the time of the non-working season, the tuns should not be left full of water, since development of putrefactive organisms will cause the wood to rot. Before going out of use, the tuns should be cleansed, freed from scale, and allowed to dry; they should then be painted inside and out with "carbolineum"; the hoops should be tightened as the wood shrinks. Internal coating with paint, tar, or lacquer is not to be recommended. Before re-starting, the tuns are to be scrubbed and thoroughly soaked with water. During the working season, the tuns are to be cleaned each time before filling, by scrubbing thoroughly with brushes and hot water. A coat of strong, freshly prepared milk of lime is then to be given inside and on the edges; it should remain on for about one hour. The lime is then removed by scrubbing with sand and washed away with hot water. Any calcareous scale which tends to accumulate may easily give rise to infections, and it should be loosened from time to time by the application of dilute hydrochloric acid and subsequent scrubbing. For the purification of badly infected tuns, which have been causing excessive acidities, the following directions are given:—Wash out all traces of fermented wort with hot water, using the brush; apply a wash of dilute caustic soda to all parts of the tun, including edges and crevices; leave for at least an hour, then wash off with hot water. The tun should then be steamed with moderation, since frequent steaming tends to soften the fibres of the wood. Before use, paint the tun with dilute sulphuric acid, which need not be washed off.

—J. F. B.

Fermentations; Action of Oxidising Agents on the Purity of ——. H. Alliot and G. Gimel. Comptes rend., 1904, **138**, 911—913.

The authors have investigated the influence exerted on the amount of acid produced in a malt wort (acidity, 0·5 grm. of sulphuric acid per litre) by butyric bacteria, by 1 grm. per litre of the following oxidising agents:—Sodium and calcium hypochlorites, ferric chloride, potassium chlorate, perchlorate, and bichromate, manganese dioxide and hydrogen dioxide. The last-named exhibits the greatest bactericidal action, but is only slightly more effective than calcium hypochlorite and manganese dioxide, the use of which in practice is recommended by the authors.

These agents also accelerate the multiplication of the yeast cells and destroy any sulphurous acid—either free or as potassium hydrogen sulphite (bisulphite)—present in the wort.—T. H. P.

Beer Filtration and Permanence of "Head." W. Windisch. Woch. Brau., 1904, **21**, 194—198.

The author discusses the theory that the "head"-retaining properties of beer are dependent on the presence of minute suspended particles of colloidal bodies which are not in a state of true solution. The effect of filtration, if very efficient, may be to remove these bodies and thus impair the "head"-retaining properties. Cases are quoted in which the introduction of the filter into certain breweries has resulted in a marked falling-off in the quality of the beer. The removal of the colloidal bodies in quasi solution by filtration, besides affecting the permanence of the "head," may deteriorate the flavour (*a*) by reducing the palate-fulness which is probably dependent on these colloids, and (*b*) by imparting an after-flavour characteristic of the filter, derived from the filtering medium and the metallic surfaces. The author contends that the competition to create and to satisfy a public demand for the brightest beers has led to the result that modern filters are too perfect. In the early days of the beer-filter, owing to a lower filtering efficiency, a small filter could deal with a relatively large volume of beer. But in recent years the increase in the density of the medium, in order to obtain the brightest possible effluent, has resulted in the removal of the colloidal bodies above referred to, and has necessitated an enormous increase in the ratio of filtering medium and metallic surface to the volume of beer treated. —J. F. B.

Beer Filtration. E. Ludwig. Woch. Brau., 1904, 214—215.

The author agrees with the views expressed by Windisch (see preceding abstract) that modern beer filters are too efficient from a filtration point of view, and that the quality of the beer suffers in consequence. He considers that the evil effects are due to the ever-increasing density of the filtering medium, involving an increased pressure. In modern filters the beer is forced through what are practically solid cakes of pulp, instead of through a mass of loose pulp as formerly. Consequently a thick slimy layer of impurities collects on the surface of the cakes. Under the influence of very high pressures the impurities in this layer of sludge are far more soluble in the beer than under moderate pressures; hence the appearance of an unpleasant flavour. The ideal system of filtration would be a "mass" filtration, as opposed to a "surface" filtration, in which the final degree of purity should be attained in several progressive stages under a low pressure.—J. F. B.

Beer; Metallic Turbidities in ——. F. Schönfeld. Woch. Brau., 1904, 209—210.

The author has confirmed the general accuracy of his observations (this J., 1904, 332) on the action of metals on beer. He has repeated his experiments with metals of undoubted purity, and states that there was no doubt as to the galvanic efficiency of his couples. It is not contended that those metals which give a negative result are absolutely without action on beer. On the contrary, changes in the colour of the beer are frequently to be noticed, owing to the metal entering into solution, but only tin (even the purest Banca tin) gave the characteristic heavy albuminoid turbidity. The contentions of Sellenscheidt (this J., 1904, 333) as to the indifference of tin, when pure, and the harmful effects of zinc and lead, are not confirmed. After tin, iron is the next most harmful metal in producing turbidities in beer.—J. F. B.

English Patents.

Malt Furnaces and other Kilns and Drying Apparatus. E. S. Beaven, Warminster. Eng. Pat. 8847, April 18, 1903.

In malt kilns and other drying furnaces in which the products of combustion come into direct contact with the material to be dried, the arch, posterior end, or walls of the furnace structure are perforated so as to be capable of supporting blocks of lime, limestone, or other basic filtering material, thus forming a chamber in which the gases of combustion are freed from arsenical and other deleterious constituents before they reach the drying chamber. Arrangements are made for heating the air in channels, constructed in the furnace, before it enters the combustion chamber. The filtering chamber is constructed with a sloping floor, and the contaminated material is removed from the bottom, fresh blocks being introduced from above.—J. F. B.

"Whizzer" or Hydro-extractor for Drying Grain and the like. H. Simon and G. Huxley, Manchester. Eng. Pat. 11,064, May 15, 1903.

A perforated vertical cylindrical casing, of one or more segments, joined by flanges which are attached to an outer casing, is provided with solid end pieces. A rotating barrel having slightly inclined lifting blades, is arranged within the casing so as to lift the grain upwards to the outlet. The barrel is perforated about the centre, and has fans or blades at the ends to draw air from the end openings and deliver it through the central perforations. Tangental blades are arranged in the upper end piece, which may be rotated to sweep the grain outwards to the delivery spout. Means are provided for feeding the grain tangentally at the bottom of the casing.—W. H. C.

Fermentation of Liquids. G. Johnson and P. R. Hare, Bromley. Eng. Pat. 10,093, May 4, 1903.

A species of yeast called *S. thermantitonum* is claimed for fermenting saccharine worts. This yeast is isolated from eucalyptus leaves, and the cells, which are somewhat smaller and more oval than those of ordinary yeast, are generally observed in compact masses hanging together by means of a membranous substance or web. This yeast possesses the peculiarity of resisting the action of high temperatures; it can be freed from foreign organisms by pasteurisation, and will resist a temperature of 170° F. for a short time. It ferments best at temperatures between 80° and 110° F. Its industrial value lies in the fact that it can be sown in sterilised hot worts at a temperature of 175° F., the worts being then rapidly cooled in closed vessels to 105° F. When fermentation subsides, this yeast, owing to its peculiar agglutinating properties, is found at the bottom of the vessel in a compact mass, whilst the liquid is run off perfectly clear.—J. F. B.

Distillery Effluents or other Polluting Liquids, Sewage, or other Putrescible Material, Soils for Filtering Purposes, and Agricultural Land; Treatment of ——. J. Hunter. Eng. Pat. 15,555, July 14, 1903. XVIII. B., page 500.

United States Patent.

Whisky, Gin, or other Spirits; Manufacture of ——. J. M. Sanguineti, Lille. U.S. Pat. 757,352, April 12, 1904.

See Eng. Pat. 27,068 of 1902; this J., 1903, 815.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

English Patents.

Nutritive Substance [from Blood]. W. P. Thompson. From Actienges. für Chem. Ind., Vienna. Eng. Pat. 15,606, July 14, 1903.

One kilo. of blood or a 20 per cent. hæmoglobin solution, is mixed with 50 c.c. of sodium hydroxide solution (35° to 40° B.) and after 24 hours the mixture is heated to a temperature of 80° to 85° C. for two hours. The solution is then acidified with hydrochloric acid, and the precipitated albuminoids separated and dried at a low temperature. The product so obtained is then digested with artificial gastric juice.—W. P. S.

Furze; Treatment of ——, for Obtaining a Food for Cattle, Paper Pulp, and an Ammonium Salt which may be used as a Manure. G. P. Horteloup, Paris. Eng. Pat. 26,150, Nov. 30, 1903. Under Internat. Conv., April 14, 1903.

See Fr. Pat. 331,176 of 1903; this J., 1903, 1145.—T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

English Patents.

Sewage; Process for the Purification of ——. F. Eichen, Wiesbaden. Eng. Pat. 14,258, June 27, 1903.

See Fr. Pat. 335,406 of 1903; this J., 1903, 1362.—T. F. B.

Distillery Effluents or other Polluting Liquids, Sewage or other Putrescible Material, Soils for Filtering Purposes, and Agricultural Land; Treatment of ——. J. Hunter, Edinburgh. Eng. Pat. 15,555, July 14, 1903.

The effluent is heated and treated with slaked lime or other alkaline substance, either during or after the heating. Calcium phosphate or phosphoric acid is then added and the heating continued until thorough precipitation has taken place. The liquid portion is then passed on to bacterial beds, or used for irrigation purposes. Calcium and magnesium carbonates are added to the filter-beds or to the soil to favour the action of the nitrifying bacteria. Claim is also made for the use of calcium sulphate, alone or mixed with carbonates, in evaporation processes employed in the purification of distillery effluents.—W. P. S.

House or other Refuse; Process of Treating ——, for Converting it into Substances of Commercial Utility. T. G. Charlton, Loughton. Eng. Pat. 16,304, July 24, 1903.

The sorted refuse is heated in closed retorts until completely carbonised, the volatile products being led off and dealt with as in gas-works. The residue left in the retorts is then quenched with water, sifted and again sorted, mixed with a quantity of tar obtained in the distillation, and pressed into briquettes. From 12 to 14 galls. of tar per ton of carbon is a suitable quantity. About 4 per cent. of pitch may also be added to make the briquettes weatherproof.—W. P. S.

French Patents.

Water; Installation for the Oxidation or Biological Treatment of ——. W. P. Dunbar. Fr. Pat. 337,301, Oct 20, 1903.

The water is allowed to run over a bed constructed of fine material at the top and coarse pieces at the bottom. Various forms of these beds are described and they can be used singly or in series. The water after treatment is collected in gutters at the bottom of the bed.—W. P. S.

Water and other Liquids; Sterilisation of ——, by Filtration through an Oxidising Bed of Barium Manganate. R. Cambier, A. Tixier, and C. E. Adnet. Fr. Pat. 337,630, Dec. 12, 1903.

Water is sterilised by passage through an oxidising bed of specially active barium manganate, such as that produced by one of the processes described in Fr. Pat. 337,629 (see page 489).—E. S.

(*C.*)—DISINFECTANTS.

English Patent.

Liquid Compounds of Phenol or Cresol and Soap which are Soluble in Water and form Emulsions, Intensifying at the same time their Antiseptic Properties; Process for Solidifying such ——. E. M. Raetz, Cöln-Merheim. Eng. Pat. 27,889, Dec. 19, 1903.

Solutions containing from 30 to 60 per cent. of cresol or phenol and soap are mixed in an autoclave with from 5 to 10 per cent. of an aldehyde (formaldehyde) or a ketone and a small quantity of an alkali. The mixture is heated to 150° C. and then cooled. A solid product is obtained which is soluble in water.—W. P. S.

French Patent.

Ozone; Production of ——, for application as a Disinfectant. A. D'Arsonval, G. E. Gaiffe, and G. Gallot. Fr. Pat. 337,531, Dec. 8, 1903.

The air to be disinfected is "cooled and moistened" by being caused to traverse an ozonising apparatus, entering at the lower part of an attached chamber in which ice is supported on a horizontal perforated partition separating the chamber into two compartments; or the lower compartment may be occupied by perforated vessels containing a refrigerating mixture. In a third form of apparatus, air enters the ozoniser through a chamber cooled by a coil through which a flow of liquid carbon dioxide is maintained. Or the apartment to be disinfected may be sprayed with liquid air whilst the air is being passed through the ozoniser, the apartment being meanwhile "hermetically" closed. —E. S.

XIX.—PAPER, PASTEBOARD, Etc.

Normal Papers [German]; Transparency of ——. W. Herzberg. Mitt. K. tech. Versuchsanst., 1903, **21**, 176—188.

The German Government having complained of the excessive transparency of normal papers of the highest classes, owing to which the writing shows through on the back of the paper, the Charlottenburg Institute has addressed a circular to the chief manufacturers of these papers inviting suggestions on this subject. The replies of 25 mills are recorded. It is contended that increased opacity can only be obtained by the relaxation of some of the most stringent demands as to the quality of the paper. The transparency of normal papers is due to the fact that the normal standards of breaking length and elongation can only be reached by the use of linen rags almost exclusively, and these have to be beaten to a "wet" pulp for a very long time. The cotton fibre is considerably more opaque than the linen fibre, but the addition of a sufficient proportion of the former would necessitate a lower standard of strength. Some writers suggest that a larger proportion of cotton rags could be used, whilst maintaining the strength, if the stringent demands for purity, whiteness, and freedom from specks were relaxed so as to permit of the use of stronger linen rags unweakened by extreme bleaching. The yellow tone of less highly bleached linen is, moreover, more favourable to opacity than the milk-white colour now required; the tone might even be increased by ochre. The Institute cannot, however, assent to any such relaxation as regards the appearance of the paper. The attainment of the high elongation on breaking is very difficult and necessitates a very "wet" pulp; the Institute is therefore prepared to meet this cause of transparency by lowering the standard elongation on breaking from 4·5 to 4·0 per cent. in class 1 and from 4·0 to 3·5 per cent. in class 2, whilst maintaining the standard breaking length and resistance to creasing unaltered. There remain two other means of increasing the opacity, viz., increase in thickness of the paper and the addition of mineral loading. Some of the manufacturers suggest that to increase the thickness of such strong papers would introduce difficulties in the making and in the production of a legible water-mark. The price of the paper and the cost of postage would also be increased. For special purposes, however, where cost is subordinate to increased opacity, the Institute proposes to permit the use of heavier papers to the extent of 15 per cent. above the present weights. It is generally admitted that the addition of mineral loading in the proportion of 10 per cent. would tend to increase the opacity of the paper, but at the same time the mechanical properties would only be maintained with difficulty, and the paper would be thinner for the same weight. Nevertheless, the Institute has determined to recommend that the restrictions as to ash be abolished and that the manufacturer be permitted to improve the appearance, writing surface, and (possibly) opacity of his paper by the addition of mineral loading, so far as he can do so without lowering the normal standards of the mechanical properties.—J. F. B.

English Patents.

Cellulose Compounds; Process for the Manufacture of Variously-Shaped Industrial Objects from ——. L. Lederer, Sulzbach. Eng. Pat. 7341, March 30, 1903.

See Fr. Pat. 330,714 of 1903; this J., 1903, 1100.—T. F. B.

United States Patents.

Paper; Utilisation of Waste Products from the Manufacture of ——. W. N. Cornell, Massena. U.S. Pat. 756,214, April 5, 1904.

The waste product known as "screenings" is reduced to pulp by a combined process of crushing and rubbing the material, stirring the crushed screenings in a suitable liquid, and then repeating the grinding or rubbing process, the latter operations being repeated until the particles are of the desired size.—J. F. B.

French Patents.

Papier-mâché; Manufacture of Articles of ——. C. Gaertner. Fr. Pat. 337,480, Nov. 19, 1903.

See Eng. Pat. 27,339 of 1903; this J., 1904, 453.—T. F. B.

Cellulose Xanthate; Purification of ——, for the Preparation of Viscose. Soc. Franç. de la Viscose. Addition, dated Nov. 25, 1903, to Fr. Pat. 334,636, Aug. 14, 1903. See this J., 1904, 75.

After coagulation, the crude cellulose xanthate is treated, at a temperature not above 50° C., with a solution of an lkali or alkaline earth sulphite, either alone or in conunction with aluminium sulphate, alum, sodium bicarbonate, tc.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Potassium Platinous Chloride. P. Klason. Ber., 1904, **37**, 1360—1361.

his substance is made commercially by reducing chloroatinic acid by means of sulphur dioxide, and then adding ice the calculated quantity of potassium chloride to the t solution. The salt separates out, is drained on the mp, washed with alcohol, and dried at the ordinary temrature in the dark. This method is preferable to that rting from potassium chloroplatinate. Vézes' method heating together potassium chloroplatinate and potassium alate in equimolecular proportions cannot be carried out h pure platinum compounds. It is a catalytic action, l depends upon the presence of iridium.—J. T. D.

hujone; Certain Derivatives of ——. L. Tschugaeff. ., 1904, **37**, 1481—1486. (Compare this J., 1901, 65.)

hen the methyl ester of thujylxanthogenic acid, $H_{17}O.CS.SCH_3$, is distilled, two isomeric thujenes are ained, *viz.*, α-thujene produced from the less stable tion of the xanthogenic ester, and β-thujene from the t stable portion. These two hydrocarbons boil almost a he same temperature, but α-thujene yields a crystalline d ntenedihydrobromide with hydrobromic acid, melting at 5 –59° C., whereas β-thujene does not. Probably these t thujenes are derived from two stereo-isomeric thujyl a hols produced by the reduction of thujone; they differ o in the position of the ethylenic bond in the nucleus. α- ujene yields on oxidation α-tanacetonedicarboxylic acid, a β-thujene yields homotanacetone dicarboxylic acid. By tr ment of thujamenthol, the alcohol corresponding with is njone, by the xanthogenic method, the author obtained a lrocarbon, $C_{10}H_{18}$, b.pt. 157°—159° C., which he terms *th menthene*.—J. F. B.

Menthol; Dehydration of —— by Organic Acids. J. Zelikow. Ber., 1904, **37**, 1374—1383.

Th production of unsaturated hydrocarbons by heating the aturated alcohols with oxalic acid (this J., 1901, 12 can also be effected with other polybasic organic aci Positive results have been obtained with succinic, citric, phthalic, terephthalic, and camphoric acids, but not with tartaric acid. A menthene is thus obtained by heating together camphoric acid and menthol, and it has an exceptionally high rotatory power. The presence of an excess of the free acid exerts an important influence in increasing the yields of hydrocarbon, since it neutralises the tendency, manifested when the acid esters are heated by themselves, to the production of free alcohols and neutral esters, together with the hydrocarbons. This tendency can be checked also by employing the salts of the acid esters.—J. F. B.

Cineol; Reduction of ——. H. Thoms and B. Molle. Arch. Pharm., 1904, **242**, 181—194.

Cineol has been reduced by the action of hydriodic acid in the presence of mercury, the reduction products being a new hydrocarbon, *cineolene*, $C_{10}H_{18}$, and a polymerised hydrocarbon $(C_{10}H_{16})x$. Cineolene boils at 165°—167° C., is optically inactive and has the sp. gr. 0·8240 at 18° C. By the action of bromine on it, hydrobromic acid is formed. By the action of concentrated sulphuric acid, α-2-cymenesulphonic acid was produced.—J. O. B.

"Fucol": a Cod-Liver Oil Substitute. H. Norrenberg. Pharm. Centralh., 1904, **45**, 34.

Dried seaweeds containing iodine are submitted to a roasting process, whereby an empyreumatic greenish oil rich in iodine is formed. The roasted material is then extracted with an edible fatty oil.—J. O. B.

Cinchona Alkaloids; Dibromo-addition Compounds of ——, and Compounds of their Hydrochlorides with Metallic Perchlorides. A. Christensen. Videnskabernes Selskab's Skrifter, 1904, **6**, 329; Chem.-Zeit., 1904, **28**, Rep. 93.

Like the corresponding cinchonine compound, cinchonidine dibromide is a mixture of two isomerides; when a molecule of HBr is split off from either of them, the same mono-bromo-substitution derivative remains. The two isomerides differ in the solubilities of their sulphates and of some of their other derivatives. Lead tetrachloride gives with the hydrochlorides of the cinchona alkaloids, in strong hydrochloric acid solution, compounds which fall as yellow crystalline precipitates. Similar compounds (hygroscopic and unstable, quickly turning brown in the air) are formed when hydrochloric acid gas is passed through glacial acetic solutions of the alkaloids, in which finely-divided manganese dioxide is suspended. Ferric chloride, added to solutions of the dibromo-addition compounds, forms compounds which are precipitated by hydrochloric acid as yellow amorphous substances.—J. T. D.

Colchicine Content of Colchicum Seeds. H. Blau. Pharm. Centralh., 1904, **45**, 39.

The amount of total colchicine in the seeds examined was 0·379 per cent.; the brown seed-coats contained 0·377 per cent. Seeds one year old gave 0·504 per cent.; some 20 years old, not carefully stored, yielded 0·180 per cent.; another sample, over 30 years old, kept in a well-closed vessel, gave 0·202 per cent.; seeds kept more than 20 years in a metal-lined drawer, 0·2108 per cent. It is evident therefore that the seeds deteriorate in the amount of active principle by storing, and that the seed-coat should not be removed from the drug, since it contains practically as much colchicine as the seed.—J. O. B.

Essential Oils obtained by Extraction of Fresh Blossoms with Volatile Solvents. ("Essential Blossom-extract Oils.") H. v. Soden. J. prakt. Chem., 1904, **69**, 256—271.

To obtain these oils, fresh blossoms are repeatedly treated with light petroleum spirit in the cold. The solvent is then removed from the extract by a careful distillation, often *in vacuo*. According to the author, the perfumes so obtained are distinguished by the delicacy of their aroma. They were purified for investigation by extraction with cold alcohol and distillation in a current of steam. A description of the properties of the extracts so obtained from violets, orange-blossoms, mignonette, rose-blossoms, jasmine, and cassia-blossoms is given. The extracted essential oil from violets contains a number of odoriferous substances, of which a "violet-ketone" is probably the most important. Essential orange-blossom extract contains 6·9 per cent. of methyl anthranilate and 26·7 per cent. of linalyl acetate. Essential oil of mignonette-blossom extract contains considerable amounts of aldehydes. The extract from French rose-blossoms contains 60 per cent. of phenylethyl alcohol and 20 per cent. of a mixture of geraniol, nerol, and citronellol. The oil from German rose-blossoms contains 75 per cent. of phenylethyl alcohol and 15 per cent. of primary terpene alcohols. The extract-oil from jasmine-blossoms contains 43—51 per cent. of benzyl acetate and considerable quantities of indole. Cassia-blossom oil contains about 31 per cent. of methyl salicylate, also benzyl alcohol, decyl aldehyde, a ketone with an odour of violets, cumin aldehyde, farnesol (a sesquiterpene alcohol), and probably linalool and geraniol.—E. F.

Jasmine Flowers; Essential Oil of ——. *VII.* A. Hesse. Ber., 1904, **37**, 1457—1463. (See also this J., 1899, 396, 513, 1153; 1900, 770; 1901, 275, 1137.)

The oil obtained by extracting freshly picked jasmine flowers with petroleum spirit, and distilling the extract, was dissolved in ether, and a mixture of 1 vol. of concentrated sulphuric acid and 5 vols. of ether added. This liquid was shaken with sodium bicarbonate solution and distilled with steam; a quantity of oil distilled over (equivalent to 447 grms. per 1,000 kilos. of flowers), of sp. gr. 1·015 at 15° C., $\alpha_D = +1° 45'$; saponification value 222·0; and containing 0·42 per cent. of methyl anthranilate and 2·1 per cent. of indole. An experiment on a larger quantity of flowers gave an oil of sp. gr. 1·001, containing 0·38 per cent. of methyl anthranilate and 2·0 per cent. of indole. Before the steam distillation no methyl anthranilate or indole could be detected in the oil. By extracting the flowers in a similar manner with ether, and distilling the extract with steam, an oil was obtained equivalent to 385 grms. per 1,000 kilos. of flowers; sp. gr. (15° C.) 0·9935; $\alpha_D = +2° 36'$. No methyl anthranilate or indole could be detected in this oil. The flowers, after extraction with ether or petroleum spirit, yielded, on distillation in steam, a small quantity (about 50 grms. per 1,000 kilos. of flowers) of an oil, which contained about 4·5 per cent. of methyl anthranilate, and also a base, which on diazotisation and coupling with β-naphthol, gave a strong coloration. Jasmine flowers which had been subjected to *enfleurage* were extracted with petroleum spirit; the oil obtained, contained no indole or methyl anthranilate. It thus appears that neither indole nor methyl anthranilate exists in the free state in jasmine flowers; the indole compound is decomposed by steam distillation, but not by dry distillation (this J., 1901, 1137). The methyl anthranilate compound is easily decomposed by steam, and also by dry distillation. The author points out, in conclusion, that the figures previously given (this J., 1901, 1137) for the amount of oil obtainable from fresh flowers by extraction should be doubled, according to his later experiments; thus the statement that "nine times as much oil is obtained by *enfleurage* as by extraction," must be modified to "four or five times."—T. F. B.

Laurel Leaves; Essential Oil of ——. H. Thoms and B. Molle. Arch. Pharm., 1904, **242**, 161—181.

The leaves of *Laurus nobilis* yielded from 1 to 3 per cent. of a light yellow oil with an agreeable powerful odour and sharp, somewhat bitter taste. It had a distinctly acid reaction, and the $\alpha_D - 15·95°$ at 17° C.; sp. gr. 0·9215 at 17° C. A specimen about a year old had the sp. gr. 0·9257 at 17° C. Its acid value was 2·74; ester value 47·10. The presence of methyl-chavicol in the fractions boiling above 180° C., as suggested by Wallach, was not confirmed. The acid reaction was found to be due to the presence of free acetic, iso-butyric, and iso-valeric acids. The oil contained 1·7 per cent. of free eugenol, and 0·4 per cent. as ester. The chief ester present was an acetate, but esters of caproic and valeric acids were also present. Besides these, a small quantity, 0·07 per cent., of another unidentified acid, having the formula $C_{10}H_{14}O_2$ was isolated in the form of partially aggregated, glittering scales; m.pt. 146°—147° C. It was strongly attacked by permanganate, and combined with two atoms of bromine. Pinene was found in the oil which had not been treated with alkali. Cineol was present to the extent of about 50 per cent. Geraniol was detected in the fraction boiling between 212°—230° C. The higher boiling fractions are oxygenated, and probably contain, besides a sesquiterpene, a sesquiterpene alcohol. The original oil, and in particular the high boiling fractions thereof, gave an intense blue colour reaction when the solution in glacial acetic acid was treated with bromine vapour, or a trace of nitric acid.—J. O. B.

Entada scandens; Saponins of ——. L. Rosenthaler. Arch. Pharm., 1903, **241**, 614.

Crude saponin was extracted from the seeds after removal of the fat, by means of 90 per cent. alcohol, and precipitated by ether from the cold alcoholic extract. By precipitation with barium hydroxide solution, a saponin, named "Saponin A" was removed from the aqueous solution of this crude saponin. The solution thus freed from "saponin A" was evaporated to dryness, after removing the excess of barium hydroxide, the dry residue extracted with hot 90 per cent. alcohol, and the alcoholic solution fractionally precipitated with chloroform and ether. The aqueous solution of the ether precipitate was dialysed, and the residue evaporated to dryness *in vacuo* over sulphuric acid "Saponin B" $C_{15}H_{22}O_{10}$ was thus obtained as a whitish hygroscopic powder, which became brownish on heating to 110° C. It was precipitated from strong aqueous solution by basic, but not by normal lead acetate. It gave a darl reddish-violet colour with strong sulphuric acid, eventuall turning brown. On hydrolysis, a sugar identical wit galactose, a sapogenin soluble in ether and in alcohol, an another body insoluble in those solvents and in ammoni were formed.—J. O. B.

Dipteryx Odorata, Presence of a Copal in the Fruit, an a Kino in the Bark of ——. E. Heckel, H. S. de Co demoy, and F. Schlagdenhauffen. Rép. Pharm., 190 **16**, 97—104 and 151—161.

The entire fruit of the Tonka bean. *Dipteryx odorota*, fro French Guiana, where it is known as "Gayne," contai 16·4 per cent. of a resin which in characters compares wi the best grades of commercial copal. It is best extract from the integoments of the fruit by means of chlorofor Incision into the bark of the tree yields a kino which rich in tannin, and gives reactions similar to other medicin kinos.—J. O. B.

English Patents.

Colloidal Products containing Bismuth Oxide; Manuf ture of ——. G. W. Johnson, London. From Kalle Co., Biebrich-on-the-Rhine. Eng. Pat. 12,773, Jun 1903.

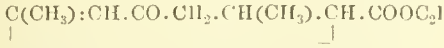
See Fr. Pat. 332,980 of 1903; this J., 1903, 1307.—T. F

Anæsthetic Compounds; Manufacture of Medical —— E. Ritsert, Frankfort. Eng. Pat. 8095, April 7, 1903

See U.S. Pat. 748,101 of 1903; this J., 1904, 383.—T. F

Cyclohexane and Cyclohexene; Manufacture of Der tives of ——. O. Imray, London. From Farbw vorm. Meister, Lucius und Brüning, Höchst Eng. Pat. 11,137, May 15, 1903.

By reducing cyclohexenone carboxylic acids or ester their alkyl derivatives, the corresponding hydroxyc hexane carboxylic acids and hydroxycyclohexane carb are produced. If the hydroxycyclohexane carboxylic be treated with dehydrating agents, cyclohexene carbo acids are formed. All these products are applicab perfumery, having floral odours. The products ch ıclude the hydroxycarbinols and hydroxycarboxylic acids ıd esters from dimethylcyclohexenone carboxylic ester—



$$C(CH_3):CH.CO.CH_2.CH(CH_3).CH.COOC_2H_5$$

ıd those from the esters of trimethylcyclohexenone ırboxylic acid (see U.S. Pat. 743,305 of 1903; this J., ı03, 1307); also the corresponding cyclohexene derivatives. —T. F. B.

roducts useful in Therapeutics; Manufacture of ——. A. Zimmermann, London. From Chem. Fabrik auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 12,282, May 29, 1903.

leum rusci, oleum fagi, or other varieties of wood tar, are ·ated with formaldehyde, paraldehyde, or chloro-methyl cohol. As an example, 1 kilo. of *oleum rusci* and ı0 grms. of paraldehyde are heated to 130° C., for some ne, and the product is washed with ether. The compounds ıtained are brown powders, insoluble in water, but soluble acetone and chloroform, and are of value in skin seases.—T. F. B.

otarnine Salts; Manufacture of New ——. F. W. Howorth, London. From Knoll and Co., Ludwigshafen-on-Rhine. Eng. Pat. 13,889, June 22, 1903.

E U.S. Pat. 742,532 of 1903; this J., 1903, 1307.—T. F. B.

onoformyl Derivative of 1.3-*Dimethyl*-4.5-*diamido*-2.6-*dioxypyrimidine; Manufacture of the* ——. H. E. Newton, London. From the Farbenfabr. vorm. F. Bayer and Co., Elberfeld. Eng. Pat. 14,430, June 29, 1903.

E U.S. Pat. 740,636 of 1903; this J., 1903, 1207.—T. F. B.

United States Patents.

anthine Derivatives; Art of Preparing ——. M. C. Massie, Washington, Administrator to F. Ach, Assignor to C. F. Boehringer und Soehne, Mannheim-Waldhof. U.S. Pat. 757,328, April 12, 1904.

E Eng. Pat. 27,485 of 1902; this J., 1903, 378.—T. F. B.

anthine Derivatives; Process of Making ——. M. C. Massie, Washington, Administrator to F. Ach, Assignor o C. F. Boehringer und Soehne, Mannheim-Waldhof. J.S. Pat. 757,329, April 12, 1904.

E Eng. Pat. 27,532 of 1902; this J., 1903, 378.—T. F. B.

yloxy-caffeine, and Process of Making same. M. C. lassie, Washington, Administrator of F. Ach, Assignor o C. F. Boehringer und Soehne, Mannheim-Waldhof. J.S. Pat. 757,330, April 12, 1904.

LKYLOXY-8-CHLOROCAFFEINE (see Eng. Pat. 16,231 of); this J., 1899, 1051) on treatment with an alkali holate in alcohol solution, yields a dialkyloxycaffeine, h, on further treatment with dilute hydrochloric acid the water bath, gives 3′-alkyloxy-8-hydroxycaffeine. lethoxy-8-hydroxycaffeine is thus obtained as a colour-substance, of m. pt. 228°—229° C., soluble in water, lis, and hot alcohol; it gives the murexide reaction. complete process of preparing it from 3′.8-dichloro-ine by means of methyl alcohol, sodium methylate, and is claimed.—T. F. B.

obenzoylarbutin; Process of Making ——. C. Vilmar, Zellerfeld. U.S. Pat. 757,370, April 12, 1904.

UTIN is treated with benzoyl chloride and the product alised with an alkali (see this J., 1904, 453). —T. F. B.

cal Compounds; Diluent for ——. J. M. Schutz, Minneapolis. U.S. Pat. 757,419, April 12, 1904.

IN and glucosides are removed from resinous barks, iue bark, by treatment with running water, and the ct is dried and powdered.—T. F. B.

French Patent.

Alpha- and Beta-cyclogeraniolidene-acetone; Process for Making ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 337,355, Feb. 13, 1903.

See Eng. Pat. 3173 of 1903; this J., 1904, 203.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Gold and Platinum Toning Baths; Presence of Chlorides in ——. R. Namias. Rev. Suisse; through Phot. Mitt., 1904, **41**, 97—98.

It is highly desirable that photographic toning baths of gold and platinum should contain a soluble chloride. After exposure ordinary printing-out paper contains silver nitrate and citrate, only a little of which is removed by the preliminary washing. When the paper, therefore, is immersed in the toning bath, these salts react with the gold chloride; but since the nitrate and citrate of gold, even if capable of existence, are very unstable, the gold is precipitated instead of being deposited on the image. It is customary to tone from 8 to 10 sheets of paper 50 × 60 cm. in size with the aid of 1 grm. of gold chloride; but since each sheet contains at least 0·5 grm. of combined silver, which is equivalent to 0·16 grm. of chlorine, the gold may be thrown out of the bath entirely by the time two or three sheets have been finished. The gold toning bath should therefore be made up with a soluble chloride in it, a suitable formula being 5 grms. of sodium chloride per 1 litre of bath containing 1 grm. of gold chloride. Presence of a chloride is still more desirable in platinum toning. The ordinary bath, composed of potassium platinous chloride and phosphoric acid, often exhibits a yellow precipitate after a few prints have been immersed, and frequently the substance attaches itself to the pictures. The phosphoric acid should be replaced by oxalic acid, and the bath itself should be prepared as follows:—Platinum salt, 1 grm.; hydrochloric acid, 5 grms.; oxalic acid, 10 grms.; water, 1 litre. —F. H. L.

Sodium Sulphite; Spontaneous Oxidation of ——, *in Air.* A. and L. Lumière and Seyewetz. VII., page 188.

French Patent.

Dyestuffs suitable for Sensitising Purposes; Process for Preparing ——. Soc. Anon. Prod., F. Bayer and Co. Fr. Pat. 337,704, Nov. 16, 1903. IV., page 486.

XXII.—EXPLOSIVES, MATCHES, Etc.

Explosives and Ignition Mixtures; New Discoveries in ——. General Hess. Z. angew. Chem., 1904, **17**, 545—554.

A lecture embodying a report on recent advance and improvements.—J. T. D.

English Patent.

Matches; Manufacture of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim - Elektron, Frankfort. Eng. Pat. 15,208, July 9, 1903.

See Fr. Pat. 333,816 of 1903; this J., 1904, 36.—T. F. B.

French Patent.

Explosive for Mines; Method of and Apparatus for Making an ——. W. O. Wood and H. Knudsen. Fr. Pat. 337,328, Nov. 5, 1903. Under Internat. Conv., Nov. 14, 1902.

See Eng. Pat. 25,025 of 1902; this J., 1903, 1208.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUALITATIVE.

Titanium Salts as Laboratory Reagents. E. Knecht. J. Soc. Dyers and Colourists, 1904, **20**, 97—100.

Titanium oxalate may be used instead of nitrate of iron for the valuation of tannins by means of dye-trials on cotton.

By the action of titanous sulphate on a sulphuric acid solution of a copper salt, the latter is reduced quantitatively to copper, and the reaction is so delicate that 1 part of copper in 1,000,000 parts of water can be detected. The reaction is suitable for detecting copper in dyed fabrics. The material is boiled for one minute with dilute sulphuric acid, and the cold solution treated with a few drops of titanous sulphate solution and allowed to stand for 10 minutes. If copper be present a precipitate is produced readily discernable by reflected light, but not by transmitted light. (See also this J., 1903, 232, 762, 825.)—A. B. S.

INORGANIC—QUANTITATIVE.

Sulphur; Determination of ——, in Calcium Carbide. H. Lidholm. Z. angew. Chem., 1904, **17**, 558—560.

About 3 grms. of the sample are mixed with 15 grms. of potassium sodium carbonate and 6 grms. of ammonium chloride, and the mass is fused in a porcelain crucible over a spirit flame. After five minutes the fusion is poured out on to a marble slab, and when cold the solidified mass and the crucible are placed in a flask of about 500 c.c. capacity, connected on one hand with a carbon dioxide supply, and on the other through a reflux condenser with a couple of absorption tubes containing cadmium acetate solution (25 grms., or 5 grms. with 20 grms. of zinc acetate, dissolved, warm, in 200 c.c. of glacial acetic acid and some distilled water, and made up to a litre with distilled water). When the apparatus is full of carbon dioxide, 100 c.c. of water are added through a stoppered funnel, followed by 25 c.c. of hydrochloric acid (sp. gr. 1·19) slowly dropped in. When gas ceases to be evolved, the liquid is heated to ebullition for a few minutes while carbon dioxide is slowly passed, so that all hydrogen sulphide is expelled from the apparatus and caught by the cadmium solution. The latter is washed into a beaker, 10 c.c. of copper sulphate solution are added (120 grms. of the crystallised salt, 120 c.c. of concentrated sulphuric acid, water to make 1 litre), the copper sulphide is filtered, washed, dried, converted into oxide by ignition in air, and weighed.—J. T. D.

Tin; Determination of ——, in Tinplate. H. Angenot. Z. angew. Chem., 1904, **17**, 521—523.

The sample is cut up into fragments with sides not more than 1 c.m. in length, and about 3—4 grms. are weighed off. This quantity is mixed in an iron crucible with twice its weight of sodium peroxide, so as to be well covered, and the covered crucible is very gradually heated till the peroxide is completely fused. After 10 minutes more it can be seen that the tin is entirely removed from the fragments; the crucible is allowed to cool, placed in a covered beaker, 100 c.c. of water added, and the crucible tipped over so as to give the water access to the contents. When action is over the contents of the crucible are washed into the beaker. The liquid is made up to 250 c.c., well shaken, and filtered through a dry filter. To 200 c.c. of the filtrate sulphuric acid (1 vol. of strong acid, 2 vols. of water) is added just to acid reaction, the liquid is boiled for five minutes, filtered, and the precipitate washed free from sulphuric acid, dried, ignited, and weighed as tin oxide. If the tin contained lead (seen by testing a few drops of the alkaline filtrate with sodium sulphide) the precipitate on acidifying will be brownish, and will contain lead. The washed precipitate and filter must in this case "be digested at a gentle heat in a small beaker till the precipitate is white"; water is then added, the liquid boiled and filtered, the precipitate washed, dried, and ignited as before.

—J. T. D.

Carbon and Silicon; Some Compounds of —— with Metals; and a generally applicable Method for the Determination of Carbon in Metals. W. Hempel. X., page 492.

ORGANIC—QUALITATIVE.

Petroleum; Determining Impurities [Water] in Boryslaw (Galicia) ——. M. Wielczynski. Naphta, 1904, **12**, 23—25.

The chief impurity in Boryslaw crude oil being water, the author recommends the use of calcium carbide as a reagent for its quantitative determination. The oil is shaken with an excess of carbide, and the acetylene disengaged is collected and measured.—C. S.

ORGANIC—QUANTITATIVE.

Nitrogen [in Organic Compounds]; Determination of ——. L. Déboordeaux. Comptes rend., 1904, **138**, 905—907.

The process devised by the author for the determination of nitrogen in organic compounds, yields pure ammonia without any admixture of amines, which are obtained in other methods, and is applicable to the following classes of compounds:—(1) Oxygenated compounds. (2) Hydroxylamine. (3) Nitro-derivatives in which the nitro-group has a phenolic function. (4) Nitriles, cyanides, and double cyanides. (5) Cyanates and thiocyanates. (6) Amides and imides "in which the nitrogen is not again substituted by a carbon radicle." (7) Amines in which the radicle possesses an acid function. The method consists of two successive distillations in a cast-iron flask communicating with a modified form of Schloesing's apparatus constructed of glass. In the first case, the substance is distilled until dry with 50 grms. of crystallised potassium thiosulphate and 200 c.c. of a solution of potassium monosulphide prepared by saturating a certain volume of potassium hydroxide solution of sp. gr. 36° B. with hydrogen sulphide and then adding an equal volume of the same alkali solution. For the second distillation, which removes the last traces of ammonia formed, 25 c.c. of the potassium hydroxide solution are added, and 250 c.c. of water, about 150 c.c. of distillate being collected. The ammonia is absorbed in excess of pure hydrochloric acid and can then be determined exactly by weighing as ammonium chloride.—T. H. P.

Organic Substances; Analysis of ——, with the help of Sodium Peroxide. H. H. Pringsheim. Amer. Chem. J., 1904, **31**, 386—395.

The method described for the determination of halogens in solid organic compounds (this J., 1904, 76), is modified for liquids as follows: The substance is poured on to sodium peroxide contained in a cylindrical flat-bottomed crucible (the quantities used being the same as described before, *loc. cit.*) and thoroughly mixed; a thick lid, into which is sealed a glass capillary tube containing a copper wire (the end of which is formed into a loop), is screwed on to the crucible, a washer of some soft metal (*e.g.*, copper) being used. A piece of platinum wire, just long enough to reach to the bottom of the crucible, is attached to the loop of the copper wire. The mixture is ignited by connecting the copper wire and the crucible with the poles of an electric battery. When the crucible is cool, its contents are treated as before (*loc. cit.*).

Phosphorus and arsenic may be determined by a similar method, a silver crucible and a copper wire being used instead of iron, and about 50 per cent. more sodium peroxide being employed than for the halogen determinations. In phosphorus determinations, the resulting solution should be acidified with hydrochloric acid, neutralised with ammonia, and precipitated by means of magnesia mixture. Arsenic is determined by using the method of Friedheim and Michaelis (this J., 1895, 887).—T. F. B.

Cane-sugar, Dextrose and Levulose; Analysis of a Mixture of ——. E. Remy. Bull. Assoc. Chim. Sucr et Dist., 1904, **21**, 1002—1006.

The author points out that the formula generally employed for determining the cane-sugar by Clerget's inversion method in a mixture containing levulose, takes no account of the fact that the rotation of levulose is not the same in a strongly acid solution as it is in aqueous solution; if the levulose constitutes a considerable proportion of the mixture this difference in rotation introduces a very appreciable error. For a mixture of cane-sugar, dextrose and levulose the following formula is deduced—

$$M = \frac{(288 - t)\ Ri - 200\,Ai + 200\,aPd}{(288 - t)\ i + 200\,d}$$

where M represents the rotation due to the two reducing sugars, R the direct rotation of the mixture, *t* the temperature, P the weight of reducing sugars determined by means of Fehling's solution ; $i = a + b$ and $d = b' - b$, *a* being the ratio of the specific rotation of dextrose to that of cane-sugar, *b* the same ratio for levulose (in neutral solution) and cane-sugar and *b′* that for levulose (in acid solution) and cane-sugar. Having obtained M from the above formula, the rotation due to the cane-sugar is given by R – M. The levulose is calculated from the formula $L = (aP - M) / (a + b)$ and the dextrose from $D = (M + bP) / (a + b)$. The factor *a* has the value 0·797, and the other factors employed in the above formula are given in the following table:—

Temperature.	Rotatory Power of Levulose. In Aqueous Solution.	Rotatory Power of Levulose. In Acid Solution.	*b*.	*b′*.	*d* or (*b′* – *b*).	*i* or (*a* + *b*).
° C.	°	°				
15	–92·82	–98·94	1·3958	1·4878	0·0920	2·1928
15·5	92·54	98·62	1·3916	1·4830	0·0914	2·1886
16	92·26	98·30	1·3874	1·4782	0·0908	2·1844
16·5	91·98	97·98	1·3832	1·4734	0·0902	2·1802
17	91·70	97·66	1·3789	1·4686	0·0897	2·1759
17·5	91·42	97·34	1·3747	1·4638	0·0891	2·1717
18	91·14	97·02	1·3705	1·4590	0·0885	2·1675
18·5	90·86	96·70	1·3663	1·4542	0·0879	2·1633
19	90·58	96·38	1·3621	1 4493	0·0872	2·1591
19·5	90·30	96·06	1·3579	1·4445	0·0866	2·1549
20	90·02	95·74	1·3537	1·4396	0·0859	2·1507
20·5	89·74	95·42	1·3495	1·4348	0·0853	2·1465
21	89·46	95·10	1·3453	1·4300	0·0847	2·1423
21·5	89·18	94·78	1·3411	1.4252	0·0841	2 1381
22	88·90	94·46	1·3368	1·4204	0·0836	2·1338
22·5	88·62	94·14	1·3326	1·4156	0·0830	2·1296
23	88·34	93·82	1·3284	1·4108	0·0824	2·1254
23·5	88·06	93·50	1·3242	1·4060	0·0818	2·1212
24	87·78	93·18	1·3200	1·4012	0·0812	2·1170
21·5	87·50	92 86	1·3158	1·3964	0 0806	2·1128
25	87·22	92 54	1·3116	1·3916	0·0890	2·1086

—T. H. P.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Acid Nitrates. E. Groschuff. Ber., 1904, **37**, 1486—1493.

Ammonium trinitrate, $NH_4NO_3.2HNO_3$, is obtained in needles by dissolving 80 grms. of ammonium nitrate in 126 grms. of nitric acid (sp. gr. 1·514) redistilled from sulphuric acid, and cooling in ice. It melts at 29°—30° C. and is soluble in water without decomposition. If to the melted salt be added 80 grms. of ammonium nitrate, and he solution be cooled rapidly to 10° C., and then very radually to 6° C., plates of *ammonium dinitrate*, NH_4NO_3. HNO_3, separate, decomposing at 11·5° C., or on the addiion of water. *Potassium trinitrate*, $KNO_3.2HNO_3$, is repared like the corresponding ammonium compound. It nelts at 22° C., and the solution with another molecule of otassium nitrate forms a eutectic mixture, from which can e obtained *potassium dinitrate*, $KNO_3.HNO_3$, by cooling a carbon dioxide and ether, quickly heating to 23° C., and eeping at this temperature for some time. It is rapidly ecomposed by water, whilst the trinitrate is unaffected by nall quantities of water, though a great excess decomposes . The solubilities of all these salts in nitric acid are given nd illustrated by curves.—J. T. D.

ilver Nitrite ; Action of Iodine on ——. W. Neelmeier. Ber., 1904, **37**, 1386—1388.

y the action of iodine upon silver nitrite in carbon tetraloride solution, a quantitative yield of nitrogen peroxide as obtained.—J. T. D.

uinonoid Hydrocarbon ; A ——. J. Thiele and H. Balhorn. Ber., 1904, **37**, 1463—1470.

treating a boiling ethereal solution of phenyl-magnesium omide with a solution of terephthalic acid dimethyl ester benzene, the dimethyl ether of tetraphenyl-*p*-xylyleneglycol $(C_6H_5)_2:C(OCH_3).C_6H_4.(OCH_3).C:(C_6H_5)_2$, is produced, which on treatment with a solution of hydrobromic acid in glacial acetic acid, yields tetraphenyl-*p* xylylene bromide. From the latter the bromine can be separated by means of silver, whereby tetraphenyl-*p*-xylylene or 1.1-bisdiphenylmethylenecyclohexadiëne (2.5), $(C_6H_5)_2:C:C_6H_4.C:(C_6H_5)_2$, is produced. This quinonoid hydrocarbon crystallises from ligroïn (petroleum spirit) in orange-coloured needles, melting at 239°—242° C. with decomposition. It is soluble with difficulty in the usual solvents, the solutions having an intense yellow to orange colour, with strong golden-yellow fluorescence ; on exposure to light, the solutions are rapidly decolorised. On treatment with bromine it is converted back into the dibromide.—A. S.

Peroxides ; Function of —— in the Chemistry of Living Cells. VIII. The Nature of the Action of Peroxydases. A. Bach and R. Chodat. Ber., 1904, 1342—1348.

By the method described in the fourth paper (this J., 1903, 384), a preparation of peroxydase was made from horseradish, which was perfectly free from all other enzymes. This preparation was used for a study of the mechanism of the "activifying" influence of peroxydase upon hydrogen peroxide. Pyrogallol was selected as the oxidisable substance, since it is not sensibly oxidised, either by peroxydase or hydrogen peroxide separately. Moreover, the oxidation product, purpurogallin, being insoluble, any secondary influence of the product of reaction is avoided. The results showed that with constant amounts (excess) of either peroxydase or hydrogen peroxide, the quantity of purpurogallin produced was proportional to the variable quantity of hydrogen peroxide or peroxydase respectively employed. Increase of the concentration of the pyrogallol (in excess) had no influence on the results. Hence it is concluded that, in the "activification" of hydrogen peroxide, the peroxydase behaves as a definite chemical compound, and that the peroxydase and hydrogen peroxide participate in the oxidation of pyrogallol in constant equivalent proportions, both being used up in the course of the reaction. When peroxydase and hydrogen peroxide are mixed in equivalent quantities, the peroxydase is completely destroyed after 24 hours at the ordinary temperature. On the subsequent addition of pyrogallol and excess of peroxydase to the mixture, it was found, however, that 85 per cent. of the original hydrogen peroxide was still unaltered, the balance having presumably been used up in the oxidation of the substratum of the original peroxydase.—J. F. B.

New Books.

A Method for the Identification of Pure Organic Compounds by a Systematic Analytical Procedure based on Physical Properties and Chemical Reactions. Vol. I. Containing Classified Descriptions of about 2,300 of the more important Compounds of Carbon with Hydrogen and with Hydrogen and Oxygen. By Samuel P. Mulliken, Ph.D., of the Massachusetts Institute of Technology. John Wiley and Sons, New York ; Chapman and Hall, Ltd., London. Price 21*s*.

Large 8vo volume, containing 237 pages of subject-matter, with 11 illustrations. Besides the preface and tables of Contents and Abbreviations at the beginning, there are at the end Alphabetical Indexes of Subjects and Formulæ, with three cards giving colour standards for definition and comparison. The leading subjects treated of in the 13 chapters of this volume are as follows :—I. Classification of Compounds and the Analytical Procedure. II. Ordinal Tests. III. Aldehydes. IV. Carbohydrates. V. Acids. VI. Phenolic Compounds. VII. Esters. VIII. Acid Anhydrides and Lactones. IX. Ketones. X. Alcohols. XI. Hydrocarbons. XII. Coloured Compounds of Order I. XIII. Special Methods, Apparatus, and Reagents. In most of these chapters the treatment of the subject is similar, falling under the following three groups in Chapters III. to XII. : (i) Generic Characterisation ; (ii) Analytical Tables ; (iii) Numbered Specific or Semi-specific Tests.

The Experimental Bacterial Treatment of London Sewage. Being an Account of the Experiments carried out by the London County Council between the Years 1892 and 1903. By Prof. Frank Clowes D.Sc., and A. C. Houston, M.B., D.Sc. P. S. King and Son, 2 and 4, Great Smith Street, Victoria Street, Westminster, London, S.W., 1904. Price 10*s*.

8vo volume, containing 225 pages of subject-matter, with 63 illustrations and 14 diagrams, and an alphabetical index. The work is classified under three Divisions:—I. Chemical and General. II. Bacteriological. And III. Particulars of Bacterial Works at Various Centres. Next follows an Appendix, under the following headings:—(i) Reduction in the number of Bacteria in Sewage by Bacterial Treatment. (ii) Bacterial Examination of Average Samples from the Sewage Treatment Plant at Christ's Hospital, Horsham. (iii) Bacterial Examination of the Feed and of the Effluent of the One-acre Bacterial-bed at the Northern Outfall Works (Barking). (iv) The Number of Bacteria in Sewage Sludge produced at the Northern Outfall Works (Barking). (v) Reduction in the Number of Bacteria present in River Water by passage down the Stream. (vi) Bacterial Examination of the Water of the North Sea and of the Water, Mud, and Sands of the Thames Estuary in the vicinity of the Barrow Deep. (vii) Comparison of the Effect of Sea-water and of Fresh-water upon Bacterial Life. (viii) Determination of Maximum Solubility of Atmospheric Oxygen in Water of different Degrees of Salinity. Division I. Chemical, &c., is sub-divided into 14 groups, the first six relating to the Sewage-treatment at the Northern Outfall (Barking), and the latter four, to that at the Southern Outfall (Crossness. Chapters or Groups xi to xiv give the Conclusions arrived at by the experimental treatment; tabulation of results of Chemical examination of the crude and settled sewage and of the effluents at the Outfall Works. Methods employed in chemically examining the sewage and effluents, and also an alteration of method of treatment suggested by the experiments.

Die Elektrolytische Raffination des Kupfers. Von Titus Ulke, M.E. Ins Deutsche übertragen von Viktor Engelhardt. Wilhelm Knapp's Verlag, Halle a/S. 1904. Price M. 8.

This forms Bd. X. of the series of "Monographien über angewandte Elektrochemie," and is an 8vo volume containing 150 pages of subject-matter, with alphabetical index and series of 10 sheets of plans of plant and apparatus. The text itself is illustrated with 86 engravings, and is subdivided into three branches, *viz.*:—I. Development, Processes, and Arrangement for the Electrolytic Refining of Copper. II. Description of Electrolytic Copper Works in the United States, Great Britain, Germany, Austro-Hungary, France, and Russia. III. Estimate of Establishment and Working Costs of an Electrolytic Copper and Nickel Factory on the American System with Details and Plans. IV. Appendix with Chronological List of most important Patents, Books, and Publications on the Processes and Apparatus for the Electrolytic Refinement of Copper.

The Vegetable Alkaloids, with Particular Reference to their Chemical Constitution. By Dr. Amé Pictet. From the Second French Edition. Rendered into English, Revised, and Enlarged, with the Author's Sanction, by H. C. Biddle, Ph.D. First Edition. John Wiley and Sons, New York. Chapman and Hall, Ltd., London. 1904. Price 21*s*. nett.

8vo volume, containing 494 pages of subject-matter and an alphabetical index. The following are the Group Headings under which the complete subject is arranged:—I. Artificial Bases closely related to the Natural Alkaloids, *viz.*, (i) Pyridine and its Homologues. (ii) Pyridine Carboxylic Acids. (iii) Dipyridyls. (iv) Quinoline and Derivatives. II. The Natural Alkaloids: (i) Distribution and General Properties. (ii) Hemlock Alkaloids. (iii) Piperine. (iv) Trigonelline. (v) Alkaloids of the Betel-nut Palm (*Areca Catechuo*). (vi) Citrazinic Acid. (vii) Tobacco Alkaloids. (viii) Jaborandi Alkaloids. (ix) Cytisine. (x) Sparteine. (xi) Alaloids of the Lupine; (xii) of Solanum; (xiii) of Coca; (xiv) of Pomegranate; (xv) of Opium; (xvi) from Hydrastes Canadensis. (xvii) Corydalis Cava. (xviii) Cinchona. (xix) Strychnos. (xx) Peganum Harmala. (xxi) Aconite. (xxii) Veratrum. (xxiii) Colchicine. (xxiv) Xanthine Group. (xxv) Allantoïn. (xxvi) Asparagine Group. (xxvii) Choline Group. (xxviii) Mustard-Seed Alkaloids. (xxix) Trimethylamine. (xxxix) Alkaloids of Unknown Constitution.

The Elements of Chemistry. By M. M. Pattison Muir, M.A., Fellow and Praelector in Chemistry of Gonville and Caius College, Cambridge. J. & A. Churchill, 7, Great Marlborough Street, London. 1904. Price 10*s*. 6*d*. nett.

8vo volume, containing 542 pages of subject-matter, with 26 illustrations. The text is subdivided as 26 chapters, and an Appendix. The work closes with an alphabetical index. The object of the book is "to present some of the fundamental facts, generalisations, principles, and theories of chemistry, lucidly, methodically, and suggestively."

A Text-Book on Ceramic Calculations, with Examples. By W. Jackson, Lecturer in Pottery and Porcelain Manufacture for the Staffordshire and Hanley Education Committees. Longmans, Green, and Co., 39, Paternoster Row, London; New York and Bombay. 1904. Price 3*s*. 6*d*. nett.

Small 8vo volume, containing 67 pages of subject-matter. The text is divided into 10 groups; the principal are as follows:—(I) Loss of weight of potters' materials on drying and firing. — Contraction; Porosity; Specific Gravity. (II) Relation between Specific Gravity, Dry contents, and slop weights of slips, &c. (III) Fineness of ground materials. (IV) From a potter's recipe, to calculate the formula of a glaze or fritt. (V) Rational analysis of clays, and the methods of calculation based upon it, &c.

Trade Report.

I.—GENERAL.

Argentine Republic; Trade of the —— in 1903.

Bd. of Trade J., April 21, 1904.

According to official figures from the Argentine Director General of Statistics, the value of the imports of merchandise into Argentina in 1903 was 131,206,600 dols gold, as compared with 103,039,256 dols. in 1902. The exports of merchandise were valued at 220,984,524 dols gold, as compared with 179,486,727 dols.

Of the total import trade during 1903, the share of the United Kingdom was 34·2 per cent., that of the United States 12·7 per cent., Germany 13 per cent., Italy 11·2 per cent., and France 9·8 per cent. Of the total export trade in 1902 the United Kingdom took 16·1 per cent., France 15·5 per cent., Germany 12·1 per cent., and the United States 3·6 per cent.

The following table shows the value of certain of the articles of import in the years 1902 and 1903:—

——	1902.	1903.
	Dols.	Dols.
Manufactures of stones, earths, &c. ...	10,908,694	11,859,788
Iron and iron manufactures*.........	17,916,082	26,844,523
Oils	8,982,800	4,110,6
Chemicals and drugs..................	3,697,800	4,491,15
Paper and manufactures of	2,557,019	2,975,391

* Includes machinery and implements.

The values of exports of chemical interest from Argentina during the past two years were as follows :—

——	1902.	1903.
	Dols.	Dols.
Maize	22,094,060	33,147,249
Linseed	17,540,952	21,239,894
Quebracho logs	2,457,233	2,002,010
Quebracho extract	919,904	1,204,049

II.—FUEL, GAS, AND LIGHT.

ANTHRACITE COAL IN BRITISH COLUMBIA.

Bd. of Trade J., April 21, 1904.

The United States Consul at Vancouver states that anthracite coal has been discovered in the vicinity of Cumberland, British Columbia, and the mine is being developed. Samples contain 83 per cent. of carbon and 5·75 per cent. of ash. The coal is compact and quite lustrous in appearance. It has been tried in the open grate and in heaters, and gives satisfaction, giving off little smoke, very little flame, and much heat. It should, therefore, with a suitable fire-box and draft, make excellent steam coal. It will take at least six months to so develop the mine that regular shipments can be made in quantity.

CALCIUM CARBIDE; BYELAWS REGULATING THE CONVEYANCE OF —— ON THE THAMES.

The following byelaws have been confirmed by the Board of Trade, and came into force on March 31 last :—

1. The byelaws for regulating the conveyance of carbide of calcium on the River Thames made by the Conservators in 1899 are repealed.

2. Consists of definitions.

3. The owner or master of every ship carrying a cargo any part of which consists of carbide of calcium shall on entering the Thames immediately give notice of the nature and quantity of such cargo to the harbour master at his office at Gravesend.

4. The hold of every ship carrying carbide of calcium shall be efficiently ventilated from the time of entering the Thames until all the carbide of calcium has been discharged, or until the ship has left the Thames.

5. All carbide of calcium discharged from any ship shall be removed without unnecessary delay to some duly licensed place of storage, or beyond the limits of the jurisdiction of the Conservators.

6. The master of every ship carrying a cargo, any part of which consists of carbide of calcium, shall only discharge such carbide of calcium at a wharf, jetty, or place approved by the Conservators, and no carbide of calcium shall be conveyed on the Thames from any such wharf, jetty, or place except in a licensed barge.

7. A licensed barge, having taken on board carbide of calcium, shall forthwith proceed to its destination, so that there shall be no delay in the removal of such cargo to some duly licensed place of storage, or beyond the jurisdiction of the Conservators.

8. Carbide of calcium shall only be brought into or carried on the Thames in hermetically closed metal vessels containing, each, not more than 224 lb., of such strength and construction or so protected as not to be liable to be broken or to become defective or insecure in conveyance otherwise than by gross negligence or extraordinary ccident.

9. No vessel containing carbide of calcium shall be pened within the jurisdiction of the Conservators except n some duly licensed place of storage.

10. Every reasonable precaution shall be taken to prevent the contact of water or moisture with the carbide of alcium, and where such contact may have occurred, to revent the gas evolved from being ignited.

11. Every vessel containing carbide of calcium shall be belled, which label shall bear in conspicuous characters he words "Carbide of calcium. Dangerous if not kept ry," and with the following caution :—"The contents of this package are liable, if brought into contact with moisture, to give off a highly inflammable gas," and with the addition of the name and address of the sender.

12. Every ship having carbide of calcium on board shall, whilst anchored or moored in the Thames, be watched by a competent person on board such ship, to be appointed for that purpose by the master or other person in charge of such ship.

13. The owner or master of the ship, or the owner of the carbide of calcium, shall, when so required by the harbour master or other officer duly appointed by the Conservators, or by any police constable, show to such officer or constable all carbide of calcium under his control or upon his ship, and shall afford every reasonable facility to enable such officer or constable to inspect and examine such carbide of calcium so as to ascertain whether these byelaws are duly observed.

14. The names and expressions used in the foregoing byelaws, where not herein specially defined, shall have the same meaning as is assigned to the same names and expressions in the Petroleum Act, 1871.

15. The penalties for offences against these byelaws are those provided by the Petroleum Acts.

III.—TAR PRODUCTS, PETROLEUM, Etc.

PETROLEUM IN BORNEO.

Eng. and Mining J., April 14, 1904.

According to A. Gurgenianz, the oil-fields of Borneo are of great promise. Development has been in progress five years, and now there are from 50 to 60 wells in the north-east part of the island with a total daily production of 600 tons

IV.—COLOURING MATTERS, Etc.

INDIGO; GERMAN ——.

Chem. and Druggist, April 23, 1904.

In 1897 the German export of indigo did not attain the value of 5,000,000 m.; in 1903, however, thanks to the success of artificial indigo, it amounted to more than 25,000,000 m. In the three preceding years the exports more than doubled in value. The chief buyers in 1903 were the United States, to the value of 6,000,000 m.; Great Britain, about 4,000,000 m.; Austria-Hungary, 1,500,000 m.; and China, 2,500,000 m.

COAL-TAR DYESTUFFS: U.S. CUSTOMS DECISIONS.

March 28 *and* 30, 1904.

The following dyes are dutiable at 30 per cent. *ad valorem* as "coal-tar colours," under paragraph 15 of the present tariff act:—Sulphur Black G T, N B, G R, Sulphur Brown G R M, Sulphur Bronze G, Sulphur Blue B, Thiogen Brown R, Melanogen Blue B, Melanogen Tg. B, Thiogen Dark Blue R, Melanogen G and T, Thiogen Brown, Thiogen Brown G and R, Thiogen Blue B, Sulphur Black 1.

—R. W. M.

VII.—ACIDS, ALKALIS, Etc.

PHOSPHATE TRADE; AFRICAN ——.

Eng. and Mining J., April 7, 1904.

Shipments of phosphates from North Africa in the past year were large, chiefly the result of great activity in Tunis, where the Compagnie des Phosphates de Gafsa increased its exports from 65,209 metric tons in 1899 to 358,471 tons in 1903. An increased export trade was also done through the port of Boné in Algeria, and, adding the smaller shipments from Bougies, the total increased 113,719 tons, or over 21 per cent. Prices were higher, namely: 63 to 70 per cent. rock, 4·5 to 6·25*d.* per unit (5·98 dols. to 8·31 dols. per ton); 58 to 63 per cent., 4·25 to 6*d.* (5·10 dols. to 7·20 dols.); 53 to 58 per cent., 4·125 to 5·875*d.* (4·62 dols. to 6·58 dols.). Ocean freights to European ports were 6*s.* to 8*s.* 6*d.* (1·44 dols. to 2·04 dols.) from Boné, and 7*s.* to 10*s.* 6*d.* (1·68 dols. to 2·52 dols.) from Sfax, Tunis.

In detail, the African exports in 1902 and 1903 were as below, in metric tons :—

Destination.	1902.	1903
Austria	7,650	11,500
Belgium	3,850	20,080
France	172,739	190,660
Germany	78,986	79,283
Great Britain	106,290	160,229
Holland	28,230	34,676
Italy	80,396	99,584
Russia	5,400	12,080
Spain	7,530	13,820
Other countries	25,336	14,090
Total, Boné and Sfax	516,407	636,002
Bougies exports	17,720	11,844
Grand total	534,127	647,846

These phosphates, both from Algeria and from Tunis, pay an export tax to the local governments.

ARSENIC MINE IN VIRGINIA, U.S.A.

Foreign Office Annual Series, No. 3133.

In his recent report, H.M. Consul at Baltimore remarks that what is said to be the largest arsenic mine in the world, and stated to be at present turning out 70 tons per month, is situated in Floyd County, Virginia, 17 miles from Christiansburg, the nearest railroad point. The number of persons employed at the mine is about 125, who are housed and supplied with the necessaries of life by the company owning the mine. The camp is provided with electric lights, and the plant, which is considered the most modern in existence for the treatment of the ore, is driven by electric power.

GRAPHITE, ANTIMONY, AND COPPER IN THE HIMALAYAS.

Civil and Military Gazette, March 1904.

There is good and pure graphite in Lahoul, but the cost of mining and carriage about balances the selling cost in England. The abundant deposits of antimony, also in Lahoul, have been rendered unworkable by the drop in price. The Ropa Copper Mine in Busahir, situated high up on one of the tributaries of the Sutlej, is a regular mountain of copper ore, assaying 33 per cent. of metallic copper, but is very inaccessible, and little fuel is available on the spot.

MINERAL SALTS; PRODUCTION OF —— IN GERMANY IN 1903.

Chem. Trade J., April 16, 1904.

The German Imperial Statistical Office has just issued the provisional returns relating to the production of the mines during 1903. Among others, the following may be mentioned: Mineral salt, 1,095,541 tons; kainite, 1,557,243 tons; various potassium salts, 2,073,721 tons; table salt, 599,385 tons; potassium chloride, 280,248 tons. The quantity of sulphuric acid produced amounted to 928,190 tons, as compared with 891,025 tons in 1902, the values being estimated at 1,282,500*l.* and 1,209,700*l.* respectively.

X.—METALLURGY.

GOLD IN AUSTRALIA IN 1903.

Australian Mining Standard.

A return of the Australasian gold yield for 1903 shows the total of 4,997,708 crude ounces, equal to 4,225,538 ounces fine. As the yield from metallurgical works in Queensland is not included, and the Tasmanian yield is omitted, the completed statistics will show a total Australasian output of over 5,000,000 crude ounces, against 3,844,241 ounces for the previous year.

West Australia continues to make rapid advance in production; its annual output now exceeds 2,000,000 ounces fine. Queensland again occupies second place on the crude-ounce return, but has to give place to Victoria on the actual value of the gold produced. The completed returns from Queensland for the past year show the total output of Queensland for the 12 months to have been 921,363 crude (equal to 668,546 fine) ounces, or an increase of 60,910 crude (equal to 28,083 fine) ounces, as compared with the yield for 1902.

MINING INDUSTRY OF NEW SOUTH WALES.

U.S. Cons. Rep., No. 1929, *April* 16, 1904.

From an advance report of the Under-Secretary for Mines the following facts are gathered respecting the mining interests of New South Wales during 1903:—

The aggregate value of the mineral wealth to the end of 1903 produced in this State is estimated at 154,112,125*l.* The value of the production for 1903 is 5,897,698*l.*, a net increase of 417,291*l.* over that of the previous year.

The total number of persons employed in and about the mines of the State during the year was 37,739, an increase of 4,044 over the previous year. The total value of the machinery erected at the mines (other than coal and shale mines), inclusive of dredging plants, is 2,041,701*l.* This does not include the value of the various smelting plants.

Estimated Production of Minerals in 1903.

	£		£
Gold	1,051,192	Diamonds	9,720
Silver, silver lead, and concentrates	1,461,315	Cobalt	1,528
Lead	37,556	Ironstone flux	15,411
Zinc	84,275	Iron oxide	1,149
Copper	419,673	Limestone flux	13,511
Tin	121,558	Lime	16,753
Alunite	6,046	Hydraulic cement	54,252
Antimony	131	Opal	97,330
Bismuth	9,282	Platinum	1,033
Chrome	7,146	Molybdenite	4,339
		Other minerals	9,226

BESSEMER STEEL PRODUCTION OF U.S. IN 1903.

Eng. and Mining J., April 14, 1904.

The American Iron and Steel Association has just published complete statistics, received direct from the manufacturers, of the production of Bessemer steel ingots and castings in the United States in 1903; also of Bessemer steel rails by the producers of Bessemer steel ingots.

The total production of Bessemer steel ingots and castings in 1903 was 8,577,228 gross tons, against 9,138,363 tons in 1902, a decrease of 561,135 tons, or over 6 per cent. The production of 1902 was much the largest recorded.

There were no Clapp-Griffiths works in operation in 1903 and only two Robert-Bessemer plants were active. Seven Tropenas plants were at work, as compared with five in 1902. In addition one plant made steel by the Bookwalter process, and one plant on the Pacific coast made a small quantity of steel in a special surface-blown converter. One plant also made steel by the Evans-Wills process. All these active works produced steel castings only.

The production of all kinds of Bessemer steel rails by the producers of Bessemer steel ingots in 1903 was 2,813,583 gross tons, against a similar production in 1902 of 2,876,293 tons.

There was a large increase in 1903 in the production of Bessemer steel rails weighing 85 lb. and over as compared with 1902 and a considerable decrease in rails weighing 45 lb. and over and less than 85 lb. The production in 1903 of rails weighing less than 45 lb. also shows a decrease.

The total production of rails in 1903 will include rails made from open-hearth steel, rails rolled from purchased Bessemer blooms, rails re-rolled by non-producers of Bessemer steel ingots, and iron rails. The total from all these sources in 1902 amounted to 71,640 tons.

Tin Deposits of Alaska: U.S. Geological Survey.

Bd. of Trade J., April 28, 1904.

The known occurrences of tin in Alaska are in what is called the York region of the Seward Peninsula. It extends westward from Cape York and includes Cape Prince of Wales, the most western point of the continent. The region has the form of an isosceles triangle, with its apex at Cape Prince of Wales, and its two sides formed by the shore lines of the Arctic Ocean and Behring Sea.

The occurrence of tin-bearing lodes in the bed rock has been verified by the Geological Survey at points known as Lost River and Cape Mountain. The occurrence of tin in placer deposits has been confirmed on Anikovik River, Buhner Creek, a tributary of the Anikovik, and on Buck Creek, a tributary of Grouse Creek, which flows through Mint River into the Lopp Lagoon. Tin ore has also been reported from a great many other localities which have not been thoroughly examined by geologists. The tin deposits, so far as is known, do not follow any definite system, and are confined to no particular belt or zone. The known occurrences of tin ore are described under the headings "Lost River," "Cape Mountain," "Buck Creek," "Buhner Creek," and "Anikovik River."

Mineral Resources of the Dutch East Indies.

Eng. and Mining J., April 14, 1904.

In Sumatra and in Borneo there are many deposits of tertiary coal. The principal mines are at Ombilien, Pengarou, and Poeloe-Laoet. The Ombilien mines, which are worked by the State, produce about 200,000 tons of coal yearly.

The most profitable production is that of petroleum, of which the yearly output approaches 430,000 metric tons. The principal deposits of oil in Sumatra are in the districts of Perlak, Langat, and Palembang; in Java, at Rembang, Soerabaya, and Madoera; in Borneo, in the Roetei district. There are refineries in the islands having a capacity sufficient to treat all the oil produced. The refined oil is chiefly exported, while the residuum is used for fuel, a great part of it being consumed by the steamers trading in the islands.

Tin is found in alluvial deposits in the small islands of Banka, Billiton, and Singkep. There are deposits in Sumatra and Borneo, but they are of low grade The Banka mines are worked by the State, and produce about 12,000 tons yearly. The others are worked by private companies, the output from Billiton being about 5,000 tons yearly, while that from Singkep is less than 1,000 tons. The mining or washing is done entirely by Chinese miners; but natives of the island are employed to remove the waste or overburden.

Gold is found in Borneo, Sumatra, and Celebes, both in alluvial deposits and in veins. There are several vein mines being operated, the principal ones being at Redjang-Lebong and Soemalato. Both these mines are rich, but the ores are complex, and difficult to treat.

Deposits of galena and zinc-blende exist in Borneo, and of copper in Celebes. Several of these deposits are now being explored. A peculiar industry exists in the Soerabaya district in Java, where iodide of copper is obtained from the waters of a group of mineral springs.

In Java there are quarries of very fine marble. Diamonds ave been found in Borneo, on the west coast. They are btained from the beds of certain streams by the natives. he production, however, is small, having been between 00 and 800 carats yearly for several years past.

XII.—FATS, FATTY OILS, Etc.

Cottonseed Meal: U.S. Customs Decision.

March 31, 1904.

Cottonseed meal is dutiable at 20 per cent. *ad valorem* nder section 6 of the present Tariff Act, as a "manufac-red article unenumerated." The claim of the importer at it was free of duty as "oil cake" under paragraph 625 as overruled on the ground that it was an article produced om oil cake rather than oil cake itself.—R. W. M.

XVII.—BREWING, WINES, SPIRITS, Etc.

Denatured Alcohol; Exemption of —— from Internal Tax in Argentina.

Bd. of Trade J., April 21, 1904.

The Argentine "Boletin Oficial" for the 10th February contains the text of a law exempting from internal taxation denatured alcohol of national production for heating or lighting purposes, or for use as a motive power, or in the manufacture of varnishes.

XVIII. A.—FOODS.

Dried Fruit; Sulphurous Acid in ——.

Under date of January 12, 1904, the Prussian Minister of Commerce and Industry, in conjunction with the Minister of Religion, Instruction, and Medical Affairs, issued the following order:—

"In the interest of an equable mode of procedure we will, following the precedence of other Federal States, but with the understanding that such cases as are now pending before the courts are not being reflected upon, until further notice, through the officials connected with the control of food products, make no objection to a maximum of 0·125 per cent. sulphurous acid in evaporated fruits. In all cases where a higher percentage of sulphurous acid is found criminal proceedings should be instituted in accordance with the requirements of the law of May 14, 1879."

XX.—FINE CHEMICALS, Etc.

Camphor Flowers: U.S. Customs Decision.

April 5, 1904.

The Board of General Appraisers affirmed the assessment of duty at 6 cents per lb. as "refined camphor," under paragraph 12 of the present Tariff Act, on flowers of camphor. The claims of the importer for free entry as "camphor, crude," under paragraph 515, or at $\frac{1}{4}$ cent per lb. and 10 per cent. *ad valorem*, as "gum advanced in value," under paragraph 20, were overruled.—R. W. M.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 8978. Don. *See under* IX.

„ 9187. Candy and Candy. Filters. April 21.

„ 9445. Orbison. Melting furnaces.* April 25.

„ 9516. Lennox. Evaporator for the liquid in brewers' wash, sewage, waste or spent dyes, or the like, and concentrating the solids in the same. April 26.

„ 9635. Rider. Apparatus for dissolving, filtering, condensing, evaporating, and separating organic and inorganic substances.* April 27.

„ 9729. Gutensohn. *See under* VII.

„ 9730. Gutensohn. *See under* X.

„ 9751. Cook. Apparatus for obtaining combustion products under great pressure. April 28.

„ 9835. Mathieson. Condensers. April 29.

[A.] 9853. Espenhayn. Chemical heating device.* April 29.

„ 9904. Young. Centrifugal apparatus for separating dust from blast-furnace gases or other vapours. April 30.

[C.S.] 9308 (1903). Glass and Glass. Vacuum drying and evaporating apparatus. April 27.

„ 10,866 (1903). Henderson. Regenerative steel furnaces, glass and heating furnaces, &c. April 27.

„ 13,907 (1903). Hatmaker (Merrett). Cylindrical drying machines. April 27.

„ 15,948 (1903). Marshall. Filters. May 1.

„ 5370 (1904). Knight. Filters. May 4.

„ 6855 (1904). Jensen (White-Mylin Furnace Co.). Furnaces. April 27.

II.—FUEL, GAS, AND LIGHT.

[A.] 8880. Graham. Coke ovens. April 18.

„ 8993. Poetter. Gas-producing plant.* April 19.

„ 9071. Rouse and Cohn. Manufacture of briquette fuel from coal-mine waste or dust coal. April 20.

„ 9149. Parsons. Gas washers. April 21.

„ 9190. Weldon. Arc-lamp electrodes. [U.S. Appl., April 21, 1903.]* April 21.

„ 9206. Bernheim and Wagner. Purification of illuminating gas. [Fr. Appl., April 22, 1903.]* April 21.

„ 9382. Debauche. Manufacture of fuel blocks, briquettes, and the like.* April 23.

„ 9396. Reese. Gas producer. April 25.

„ 9443. Wright. *See under* XI.

„ 9464. Akester and Paterson. Manufacture of mantles for incandescent gas burners. April 25.

„ 9512. Helps. Gas manufacture, the recovery of by-products, and retort settings and apparatus therefor. April 26.

„ 9514. Redman. Purification of gas. April 26.

„ 9573. Edelmann. Artificial fuel, and a process for its production. April 26.

„ 9608. Whitfield. Gas-producer plant. April 27.

„ 9668. Lymn. Gas producers. April 27.

„ 9693. Mason. Process for increasing the explosive force of petrol, paraffin, and other hydrocarbons. April 28.

„ 9935. Weeple. Smokeless fuel. April 30.

„ 9942. Boutillier. Gas-generating apparatus for producing poor gas free from tarry matters. [Fr. Appl., Aug. 18, 1903.]* April 30.

[C.S.] 9396 (1903). Gutknecht. Recovery of the residual products obtained in the purification of coal-gas. April 27.

„ 13,476 (1903). Dowson. Gas generators. April 27.

„ 22,946 (1903). Deegen. Gas-retort furnace. April 27.

„ 3781 (1904). Marks (International Fuel Co.). Artificial or composite fuels. May 4.

„ 6302 (1904). Loomis and Pettibone. Manufacturing wood gas. April 27.

„ 6303 (1904). Loomis and Pettibone. Manufacturing producer gas. April 27.

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[A.] 9751. Cook. *See under* I.

„ 9953. Newton (Bayer and Co.). Manufacture of new phenol compounds, and the separation of phenols from phenol mixtures. April 30.

[C.S.] 6302 (1904). Loomis and Pettibone. *See under* II.

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[A.] 9439. Read Holliday and Sons, Ltd., Turner and Whittaker. Preparing and dyeing colours for wool and silk fast to milling. April 25.

„ 9456. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of cyanine dyestuffs. April 25.

„ 9460. Johnson (Chem. Fabr. Griesheim Elektron). Process for chlorinating toluene and its homologues in the side chain. April 25.

„ 9675. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds suitable for use in the preparation of colouring matters. April 27.

„ 9932. Oakes. Processes for extracting from vegetable matters glucosides possessing colouring or tanning properties, and also the products resulting from such processes.* April 30.

[C.S.] 10,536 (1903). Johnson (Badische Anilin und Soda Fabrik). Manufacture of disazo colouring matters. May 4.

„ 11,882 (1903). Shillito (Aniline Colour and Extract Works, formerly J. R. Geigy). Basic dyestuffs. April 27.

„ 14,676 (1903). Johnson (Badische Anilin und Soda Fabrik). Manufacture of phenylglycin carboxylic acid nitrile and intermediate products relating thereto. April 27.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 8851. Graham and Cope. Means for and method of bleaching animal fibres. April 18.

„ 9311. Stohr. Apparatus for dyeing hanks of yarn.* April 22.

„ 9341. Morton. Method of and apparatus for printing warps. April 23.

„ 9439. Read Holliday and Sons, Ltd., Turner and Whittaker. *See under* IV.

„ 9516. Lennox. *See under* I.

„ 9787. Ellis. Machine for washing, bleaching, dyeing, or similarly treating hanks of yarn, slubbing, warps, &c. April 29.

[C.S.] 7054 (1903). Medley. Conditioning, colouring, or loading yarns during spinning and the like. April 27.

„ 10,802 (1903). Schoening and Eisengiesserei und Werkzeug-Maschinenfabr. Act.-Ges. Printing of patterns on piece goods, paper, &c. May 4.

„ 13,827 (1903). Imray (Meister, Lucius und Brüning). Process for producing white discharges in printing fabrics, and discharges therefor. April 27.

„ 16,588 (1903). Thiele. Manufacture of artificial silk. May 4.

„ 17,857 (1903). Lichtenstadt. Machines for treating fabrics to render them waterproof. April 27.

„ 25,555 (1903). Détré. Apparatus for dyeing under pressure. May 4.

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[A.] 9175. Kron. *See under* IX.

„ 9455. Abel (Act.-Ges. f. Anilinfabr.). Process for dyeing furs, hairs, and feathers. April 25.

[C.S.] 10,802 (1903). Schoening. *See under* V.

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[A.] 8877. Burleigh and King. *See under* XV.

„ 9265. Paul. Preparation of lime water and milk o lime. April 22.

[A.] 9619. Parker. Production of Glauber salts and ferrous sulphate from nitre cake or acid sodium sulphate.* April 27.
„ 9634. Lyle. Process and apparatus for separating and recovering oxygen and nitrogen from air. April 27.
„ 9729. Gutensohn. Means for forming sulphate or carbonate of lead into blocks to facilitate transport. April 28.
„ 9765. Denaeyer. *See under* IX.
„ 9930. Fairweather (Levy). Industrial treatment of aluminium silicates of the leucite group. April 30.
[C.S.] 9360 (1903). Bollé (Chem. Fabr. Grünau, Landshoff und Meyer). Production of solid zinc hydrosulphite difficultly soluble in water. May 4.
„ 13,412 (1903). Grossmann's Cyanide Patents Synd., Ltd., and Grossmann. Manufacture of hydrocyanic acid and cyanides. April 27.
„ 16,298 (1903). Claude. Manufacture of oxygen by means of liquid air. May 4.

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[A.] 8884. Richards. Manufacture of coloured tiles. April 18.
„ 9544. Hall. Porcelain plate. April 26.
„ 9776. Richardson. Process of and apparatus for the manufacture of glass.* April 28.
[C.S.] 10,866 (1903). Henderson. *See under* I.
„ 13,110 (1903). Orrock. Furnaces for the manufacture of glass. May 4.
„ 13,354 (1903). Cox. Printing of earthenware, &c. April 27.
„ 14,219 (1903). Kenyon and Hobson. Method of enamelling metallic articles. May 4.
„ 20,679 (1903). Arbogast. Method of manufacturing glassware. April 27.

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[A.] 8892. Gerrard and Heesom. Cement, artificial stone, building materials, tiles, paving stones, and the like. April 18.
„ 8978. Don. Rotary kilns. April 19.
„ 9175. Kron. Apparatus for impregnating and dyeing wood. April 21.
„ 9318. Scammell and Muskett. Insulating and waterproofing compositions. April 23.
„ 9444. Jacobs. Compound for coating bricks, plastering, &c.* April 25.
„ 9680. Lake (Jenequel and Hayn). Manufacture of building materials, insulating materials, &c. April 27.
„ 9765. Denaeyer. Cements and limes.* April 28.
„ 9769. Lefranc. Manufacture of artificial stone in imitation of marble or granite. April 28.
„ 9944. Ducastel. Agglutinant or cement, and method of manufacturing the same.* April 30.
„ 9963. Imray (The Carborundum Co.). Manufacture of carborundum articles.* April 30.
[C.S.] 6923 (1904). Reineke. Manufacture of cement asphalt plates or slabs. May 4.
„ 7028 (1904). Levie Frères (Soc. en nom Collectif). Process of preparing and burning cement and other analogous materials. May 4.

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[A.] 8994. Wedge. Preparing iron pyrites for desulphurisation.* April 19.
„ 9110. Talbot. Manufacture of iron and steel. April 20.
[A.] 9152. Jousset. Metallic alloys for solders, &c. April 21.
„ 9202. Daelen. Manufacture of iron and steel. April 21.
„ 9384. Haddan (Electrodon Ges. m. b. H.). Process for obtaining metals in a pure state, and apparatus therefor. April 23.
„ 9482. Nau. Process of refining metals. April 25.
„ 9584. Routin and Mourraille. Metallic alloy. [Fr. Appl., May 25, 1903.]* April 26.
„ 9730. Gutensohn. Means for forming manganese ore into blocks to facilitate transport. April 28.
„ 9836. Lévy. Production of metallic deposits to prevent oxidation. [Fr. Appl., May 1, 1903.]* April 29.
[C.S.] 1966 (1903). Vernon. Manufacture of steel. May 4.
„ 10,866 (1903). Henderson. *See under* I.
„ 14,219 (1903). Kenyon and Hobson. *See under* VIII.
„ 14,361 (1903). Massenez. Manufacture of iron and steel from chromic pig iron, &c. May 4.
„ 27,132 (1903). Marks (Delprat). Extracting zinc and other sulphides from their ores. May 4.
„ 1695 (1904). Morgan Crucible Co., Ltd., and Fox. Manufacture of cupels. April 27.
„ 2187 (1904). Atha. Treating scrap sheet steel and recarbonising the same. May 4.
„ 6775 (1904). Parker. Production of black magnetic oxide of iron. April 27.

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[A.] 8984. Delafon. Manufacture of positive electrodes for galvanic batteries. April 19.
„ 9443. Wright. Vacuum electrodes for the production of X-rays with currents of high frequency. April 25.
„ 9468. Neuburger. Method of and apparatus for heating the charge of electric furnaces.* April 25.
„ 9547. Levis (Gen. Electric Co.). Electrodes. April 26.
[C.S.] 3913 (1903). Keÿzer. Process and apparatus for the generation of electric energy. April 27.
„ 20,313 (1903). Wedekind and Porscke. Production of a porous, hard electrode mass, insoluble in alkalies, from metallic oxides or powders. April 27.

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[A.] 9018. Van Meerdervoort. Process and apparatus for the continuous manufacture of sterilised fish oil and fish guano.* April 19.
„ 9620. Claus and Rée. Production of new compounds of glycerine. April 27.
„ 9638. Nusch (Chem. Werke vorm. Dr. C. Zerbe). Manufacture of a soap preparation as a protection against lead poisoning.* April 27.
„ 9696. Blackadder. Soft soap. April 28.
[C.S.] 8897 (1903). Schneider. Apparatus for extracting fat and other substances by means of vapours or volatile solvents. April 27.
„ 13,747 (1903). Lewy. Manufacture of a wax-like composition. April 27.

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[A.] 9537. Carpenter. Paints or enamels, and method of applying same. April 26.
„ 9674. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring-matter lakes. April 27.

[A.] 9689. Craven and Craven. Ingrain ink. April 28.

„ 9861. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring-matter lakes. April 29.

[C.S.] 12,713 (1903). Lake (Synd. pour l'Exploitation des Inventions du Prof. Oettli). Manufacture of white lead. April 27.

(*B.*)—Resins, Varnishes.

[A.] 9975. Godfrey. Manufacture of linoleum. April 30.

„ 9976. Godfrey. Manufacture of linoleum. April 30.

[C.S.] 14,987 (1903). Blume. Manufacture of an improved varnish substitute from rosin oil. May 4.

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[A.] 8877. Burleigh and King. Production of monocalcium ortho-phosphate for use as a fertiliser, &c. April 18.

„ 8949. Bell. Fertiliser and insecticide.* April 19.

„ 9018. Van Meerdervoort. *See under* XII.

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[C.S.] 9106 (1903). Aspinall. Preparation of wort for brewing or distilling purposes. April 27.

„ 1797 (1904). Sulzen. Apparatus for making malt and for treating similar materials. April 27.

„ 6975 (1904). Imray (Brauerei Gross-Crostitz Act.-Ges.). Process and apparatus for drying, desiccating, and roasting germinated and non-germinated grain. May 4.

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[A.] 9550. Mason. Foodstuffs. April 26.

„ 9684. Maggi. Manufacture of milk powder. [Fr. Appl., April 1, 1904.]* April 27.

„ 9703. Shackleton. Treatment of flour. April 28.

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„ 8979. Dewhurst. Treatment of clinker from refuse destructors, and apparatus connected therewith. April 19.

[A.] 9219. Filby. Process for the purification of sewage. April 22.

„ 9297. Haller. Treatment of residuary liquors containing viscous organic matter. April 22.

„ 9516. Lennox. *See under* I.

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[A.] 8949. Bell. *See under* XV.

„ 9218. Proctor. Antiseptic and disinfectant. April 22.

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„ 9277. Woodward and Maclean. Production of non-inflammable celluloid. [Ger. Appl., April 6, 1904.]* April 22.

„ 9487. Boult (Fabr. Gebrauchsfertiger Holz- und Marmorimitationen Fried. Schwartz und Co.). Wall and like paper.* April 25.

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„ 6428 (1904). Lepetit. Manufacture of a condensation product from hæmatoxylin and formaldehyde. April 27.

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[A.] 9962. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of coherent and opaque films, sheets, or masses of pyroxyline, collodion, celluloid, or the like. April 30.

[C.S.] 11,219 (1903). Fulton and Gillard. Production of photographs on linen or other fabrics or substances. May 4.

„ 3855 (1904). Hoffsümmer. Process of preparing photographic printing paper or the like. April 27.

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[A.] 8985. Clark (Badische Maschinenfabr. und Eisengiesserei vorm. Sebold, and Sebold and Neff). Match-making machines. April 19.

[C.S.] 13,531 (1903). Wetter (Westfälisch-Anhalt. Sprengstoff Akt.-Ges.). Explosives or blasting compositions. April 27.

„ 14,827 (1903). Johnson (Soc. Anon. des Poudres et Dynamites). Manufacture of explosives. April 27.

„ 3301 (1904). Führer. Explosives. April 27.

* * *

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The following take office in Sept. next:—*Chairman:* C. F. Chandler. *Committee:* V. Coblentz, A. H. Elliott, E. G. Love, H. A. Metz, F. Schniewind, and C. B. Zabriskie.

Nottingham Section.

Chairman: J. T. Wood.
Vice-Chairman: S. F. Burford.

Committee:

L. Archbutt.
F. J. R. Carulla.
R. M. Caven.
F. Stanley Kipping.
G. D. Lander.
H. B. Mayfield.

J. O'Sullivan.
J. M. C. Paton.
A. L. Stern.
G. J. Ward.
J. White.

Hon. Treasurer: S. J. Pentecost.

Hon. Local Secretary:
S. R. Trotman, King's Walk Chambers, Parliament Street, Nottingham.

The following takes office in Sept. next:—*Committee:* J. Golding.

Scottish Section.

Chairman: *T. L. Patterson.*
Vice-Chairman: *D. J. Playfair.*

Committee:

H. Bumby.
D. B. Dott.
Thos. Ewan.
J. Arnold Fleming.
W. Frew.
G. H. Gemmell.
Jas. Hendrick.
Jas. Hope.

H. Ingle.
D. S. Jerdan.
W. G. Johnston.
J. Falconer King.
J. G. F. Lowson.
J. S. Macarthur.
J. McCulloch.
M. A. Parker.

Hon. Secretary and Treasurer:
Thomas Gray, c/o Gourlay and Deas, 180, Hope Street, Glasgow.

The following take office in Sept. next:—*Chairman:* R. T Thomson. *Vice-Chairman:* J. S. Macarthur. *Committee:* W. S Curphey, L. Dobbin, Robt. Hamilton, T. L. Patterson, and D. J Playfair.

Sydney, N.S.W., Section.

Chairman: A. Liversidge.

Committee:

W. A. Dixon.
J. F. Elliott.
F. B. Guthrie.
L. Meggitt.
J. Morison.

A. A. Ramsay.
J. A. Schofield.
R. Greig Smith.
H. G. Smith.
T. Steel.

Hon. Local Secretary:
T. U. Walton, Colonial Sugar Co., O'Connell Street, Sydney, N.S.

Yorkshire Section.

Chairman: *Jas. E. Bedford.*
Vice-Chairman: G. W. Slatter.

Committee:

C. S. Bedford.
E. A. Brotherton.
John W. Cobb.
W. M. Gardner.
A. J. Murphy.
H. R. Procter.

F. W. Richardson.
Geo. Ward.
H. A. Watson.
Thorp Whitaker.
J. B. Wilkinson.

Hon. Local Secretary and Treasurer:
T. Fairley, 17, East Parade, Leeds.

The following take office in Sept. next:—*Chairman:* H. Procter. *Committee:* W. Ackroyd, J. E. Bedford, F. Bran B. A. Burrell, and A. Smithells.

N.B.—The names in *italics* are those of members of Committee who retire from their respective offices at the end of the current sess

Notices.

ANNUAL GENERAL MEETING, NEW YORK, 1904.

The Annual General Meeting will be held in New York City on Thursday, Sept. 8th, and following days. Members who propose to attend the meeting are requested to inform he General Secretary, as soon as possible, by what steamer hey will travel. Each boat will be met on arrival at New York by a representative of the Reception Committee, with a list of apartments, at various prices, which have been eserved for the Society. The same system will be observed at all the other cities visited by the special train. A revised programme appeared in the March 31st issue.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire rom their respective offices at the forthcoming Annual Meeting.

Mr. Wm. H. Nichols has been nominated to the office of President under Rule 8; Dr. Edw. Divers, Prof. W. R. Eaton Hodgkinson, Mr. Max Muspratt, and Mr. T. J. Parker have been nominated Vice-Presidents under Rule 8; and Sir Wm. Ramsay has been nominated a Vice-President under Rule 11.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the ordinary members of the Council. Forms for this purpose can be obtained, on application, from the General Secretary, or from the Hon. Local Secretaries of the Canadian, New York, and Sydney Sections.

Extract from Rule 18:—"No such nomination shall be valid unless it be signed by at least ten members of the Society who are not in arrear with their subscriptions, nor unless it be received by the General Secretary, at the Society's Office, at least one month before the date of the Annual General Meeting at which the election to which it efers takes place. Nor shall any such nomination be valid the person nominated be ineligible for election under Rules 2 or 15. No member shall sign more than one nomination orm."

COMMUNICATIONS.

Authors of communications read before the Society, or ny of its Local Sections, are requested to take notice that nder Rule 43 of the Bye-laws the Society has the right of iority of publication for three months of all such papers. fringement of this Bye-law renders papers liable to be jected by the Publication Committee, or ordered to be stracted for the Journal, in which case no reprints can furnished to the author.

DUTY-FREE ALCOHOL.

At a meeting of the Joint Committee of the Chemical de Section of the London Chamber of Commerce and the Society of Chemical Industry, held May 3rd, 1904, . John C. Umney in the chair, it was resolved:—

"That, having regard to the development of the question the use of alcohol for industrial purposes, and the stence already of the Joint Committee of the London Chamber of Commerce and the Society of Chemical Industry, is desirable to secure the co-operation of other interested sympathetic bodies or persons in order to take joint on for obtaining untaxed alcohol, denatured or otherwise, legislative means."

The Secretary of the Chamber, subject to the sanction o he Council, is hereby instructed to communicate with t e indicated by the Chairman of the Section and the c vener of the Society of Chemical Industry Spirit Com- n ee."

t a meeting of the Council of the London Chamber of Commerce held on May 12th, 1904, the above resolution was u nimously confirmed.

List of Members Elected

24th MAY 1904.

Buchanan, Joshua D., c/o Nobel's Explosives Co., Ltd., Polmont Station, N.B., Chemical Analyst.

Cameron, Walter Scott, 239, West 136th Street, New York City, U.S.A., Manufacturing Perfumer.

Cargill, John T., 175, West George Street, Glasgow, East India Merchant.

Coysh, Basil R., 23, Woodville Gardens, Ealing, W., Manufacturing Chemist.

Crossley, T. Liosey, Hawkesbury, Ont., Canada, Analytical Chemist.

Erdmann, Prof. Dr. H., Bismarck Strasse 12, II, Charlottenburg, Berlin, Germany, Professor of Inorganic Chemistry.

Ewing, Dr. A. Ramsay, Rose Cottage, Lennoxtown, Stirlingshire, Technical Chemist.

Forrest, Charles N., New York Testing Laboratory, Long Island City, N.Y., U.S.A., Chemist.

Fraser, James Dick, 3, Melbourne Road, Waltham Cross, Essex, Chemist.

Gross, Henry B., Royal Societies Club, St. James' Street, London, S.W., Chemical Manufacturer.

Hacking, D. H., Henfield House, Clayton-le-Moors, near Accrington, Lancs., Soap Manufacturer.

Joy, Dr. J. Holmes, Manor House, Tamworth, Staffordshire, Physician.

Kaus, Dr. Emil, c/o Roessler and Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Chemist.

Lasher, F. G., The Lake Pigment Co, Dunellen, N.J., U.S.A., Chemist.

Lichtenthaeler, Robt. A., University of Florida, Lake City, Fla., U.S.A., Chemist.

Lieber, Hugo, 25, West Broadway, New York City, U.S.A., Chemist.

McMullen, Alan, 108, James Street, Dublin, Ireland, Brewer.

Mair, William, 7, Comiston Road, Edinburgh. Chemist.

Martin, W. C., College Station, Texas, U.S.A., Instructor in Industrial Chemistry.

Murdoch, Alexander, Park Terrace, Brightons, Polmont Station, N.B., Analytical Chemist.

Olney, L. A., 118, Riverside Street, Lowell. Mass., U.S.A., Professor of Chemistry and Dyeing (Lowell Textile School).

Olshausen, B. A., Columbia University, New York City, U.S.A., Student.

Page, Edwin P., Heath Street, Stourbridge, Worcestershire, Chemist.

Prideaux, E. B. R., 17, Barnmead Road, Beckenham, Kent, Student.

Ratcliffe, Mrs. F. A., 111, Croxted Road, West Dulwich, S.E.

Rhett, Edmund, American Ether Co., Richmond, Va., U.S.A., Superindent.

Riley, Oliver, Arden Hall, Accrington, Lancs., Chemical Manufacturer.

Rodger, Robert, Government Laboratory, Clement's Inn. Passage, Strand, W.C., Analytical Chemist.

St. Clair-Fewings, L., 3, Bolingbroke Grove, Wandsworth Common, S.W., Incandescent Mantle Chemist.

Sanger, Charles Robert, Harvard College, Cambridge, Mass., U.S.A., Professor of Chemistry.

Schenck, Henry, 80, Washington Square, New York City, U.S.A.

Schultze, Dr. H. S., Griesheim a/Main, Germany.

Sharples, G. H., Holly Villas, Sutton Lane, Middlewich, Cheshire, Works Chemist.

Vernon, Richard Henry, Villa Verdeil, Lausanne, Switzerland, Student.

Walker, John P., c/o B. and M. Smelter, Great Falls, Montana, U.S.A., Metallurgical Chemist.

Weil, Jacob A., 39, Victoria Street, Westminster, S.W., Chemist.

Wheawill, Cornelius, 11, Westbourne Road, Huddersfield, Chartered Accountant.

Wilkinson, Prof. J. A., Transvaal Technical Institute, P.O. Box 3572, Johannesburg, Transvaal, Professor of Chemistry.

Wright, A. M., 62, Harman Street, Addington, Christchurch, N.Z., Works Chemist (Christchurch Meat Co.).

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

Bechi, G. de, l/o Church; 11, Walton's Parade, Preston, Lancs.

Bek, Lars P., l/o Sydney; Goondi, Johnston River, North Queensland, Australia.

Bowden, Thos., l/o Rochdale; Starring Grove, Stubley, Littleborough, Lancashire.

Brookman, F., l/o 8; 6, West Street, Rochdale.

Cady, Wm. H., l/o Philadelphia; 127, Power Street, Providence, R.I., U.S.A.

Chorley, Jno. C., l/o Warrington; Bewsey, Oxford Road, Birkdale, Lancs.

Connah, J., l/o Sidcup; 31, Rudall Crescent, Hampstead, N.W.

Davis, Chas. B.; communications to c/o Dr. F. Wyatt, S.W. corner of 23rd Street and 9th Avenue, New York City, U.S.A.

Dunlop, Robt., l/o Shettleston; 5, Morrison Terrace, North Road, Bellshill, N.B.

Ellis, E. Victor, l/o Castle Street; 7, Hillside Crescent, Edinburgh.

Gas, Jas. K., l/o Camden; Haddon Heights, N.J., U.S.A.

Gate, T. Erskine; Journals to The Santubong Cutch and Tanning Extract Co., Ltd., Santubong, Sarawak, *viâ* Singapore.

Jacobs, C. B., l/o Broad Street; c/o American Lithographic Co., 19th Street and 4th Avenue, New York City, U.S.A.

Johnson, Thos., l/o 149; Caixa 91, Pernambuco, Brazil.

Kawai, I., l/o Tokyo; Camphor Monopoly Bureau, Fukuoka, Japan.

Lacey, T. S.; l/o King's Cross; The Gasworks, Bromley-by-Bow, E.

Leman, W. T., l/o Coraopolis; c/o The Texas Co., Beaumont, Tex., U.S.A.

Lippincott, W. B.; all communications to c/o United Zinc and Chemical Co., Argentine, Kansas, U.S.A.

Mills, Prof. E. J., F.R.S., l/o Harrow; 64, Twyford Avenue, West Acton, London, W.

Mitsugi, R., l/o Kobé: Engineering College, Imperial University, Tokyo, Japan.

Morson, T., l/o Southampton Row; 14, Elm Street, Gray's Inn Road, W.C.

Ogden, R. L., l/o Bethlehem; Room 21, P.O. Building, Harrisburg, Pa., U.S.A.

Pauli, Dr. H., l/o Frankfurt; Gersthofen bei Augsburg, Germany.

Pettitt, Alf., l/o Brooklyn; 3121, Avenue G., Flatbush, N.Y., U.S.A.

Phillips, Harcourt, l/o Bolton; Lynwood, Turton, Lancashire.

Pringsheim, Dr. H. H.; Journals to Gartenstrasse 68, Breslau, Germany (temporary).

Proctor, W. W., l/o 33; 8 & 10, The Side, Newcastle-on-Tyne.

Rawson, Christopher, l/o Bedford; c/o Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany.

Riederer, Dr. H. S.; all communications to 251, West 95th Street, New York City, U.S.A.

Russell, Thos. A.; Journals to 3, Queen's Park, Toronto, Canada.

Scrutton, W. J. C.; all communications to Grindley Lane, Blyth Bridge, Staffs.

Smith, Ewing, l/o Glasgow; c/o The Borneo Co., Ltd., Kutching, Sarawak, Borneo.

Smith, Francis P., l/o London; c/o C. W. Smith, 119-121, Elizabeth Street, New York City, U.S.A.

Smith, Jno., l/o Hartley Street; Calder Wharf Dyeworks, Ravensthorpe, Dewsbury.

Thiry, J., l/o Chislehurst; 95, Rue St. Lazare, Paris.

Thomson, Jno., l/o Alexandria; Devon Lodge, Helensburgh, N.B.

Townsend, Oliver C., l/o Horton Crescent; New Bilton, Rugby.

Trantom, Dr. Wm.; all communications to Haselmere, Maltman's Road, Lymm, near Warrington.

Uhlig, E. C., l/o New York; c/o Brooklyn Union Gas Co., Nevins and Degraw Streets, Brooklyn, N.Y., U.S.A., Gas Works Chemist.

Wade, F., l/o Shirley Road; 44, Beech Farm Road, Southsea.

MEMBER OMITTED FROM LIST.

Johnson, Saml. H., jun., Hempstead House, Woodford Wells, Essex, Chemical Engineer.

Deaths.

Hands, Jas., 127, Gosford Street, Coventry.

MacKinlay, R. W., Ameliaville, Aytoun Road, Pollokshields, Glasgow.

Canadian Section.

Meeting held at Toronto, on March 24th, 1904.

PROF. W. R. LANG IN THE CHAIR.

THE IMPROVEMENT OF BOILER FEED WATER.

BY A. McGILL, B.A., ETC.

Part IV.—Experimental Investigation of Certain Problems in Water Treatment.

Problem I.—Conditions of working, and limits of error, in the use of "Soda Reagent" in Water Assay.—"Soda Reagent" is a decinormal solution of soda, in which half the soda exists in the caustic and half in the carbonated state. It is used with Methyl Orange as indicator. For the explanation of its action see this J., 1904 (April 15th), p. 355. It is necessary to use "Soda Reagent" in distinct excess of the amount required by theory, and the following may be taken as minimum quantities, when work is done on 100 c.c. of the sample. For each one part per million in solution:—(1) Lime (in any combination) use 0·10 c.c. "Soda Reagent"; (2) Magnesia (as $MgSO_4$ or $MgCl_2$) use 0·15 c.c. "Soda Reagent"; (3) Magnesia (as bicarbonate) use 0·30 c.c. "Soda Reagent." The actual volume to be employed in the determination of total hardness is calculated from that base which predominates. Since in the case of magnesia it is the caustic moiety of "Soda Reagent" which alone enters into reaction, while in the case of lime it is the carbonated moiety only, it is not necessary to consider both magnesia and lime in the calculation. It is important to note that, after determinatio of "Alkalinity" (*loc. cit.*), free carbon dioxide must b boiled off before adding "Soda Reagent" for the precipitation of magnesia, since otherwise the caustic moiety o the reagent will be more or less carbonated, and incomplete precipitation of magnesia may result. This reagent i employed for two distinct purposes, *viz.*:—(1) To determine permanent hardness (Hp): (2) To determine tota hardness (H). Temporary hardness is, of course, the difference between these numbers. In such cases, where it is known that alkali carbonates do not exist in the water under examination, the "Alkalinity" number is at the same time a measure of the temporary hardness, and the permanent hardness may, in these cases, be obtained by a method of difference, since Total Hardness = Temporary H. (Alkalinity) + Permanent H.

In the direct determination of permanent hardness, a measured volume of "Soda Reagent" $(=Q^2)$ is added to 100 c.c. of the sample (from which free carbon dioxide has been expelled, if necessary), which is then boiled for a few minutes, cooled, diluted to 200 c.c., filtered (or otherwise clarified), and 100 c.c. of this filtrate is titrated with N/10 hydrochloric acid (volume used $= r^2$). Permanent hardness, in terms of lime per million, is calculated by formula 4 (p. 357)—$Hp = 28\ (Q^2 - 2\ r^2)$.

In the determination of total hardness by "Soda Reagent" it is necessary first to convert all carbonates into salts of the stronger acids. It is therefore usual to work on the solution in which alkalinity has been determined. This solution contains the bases in the form of chlorides, excepting such as originally existed as sulphates. The solution contains more or less free carbon dioxide, which must be boiled off before adding "Soda Reagent." The reagent is now added in distinct excess (Q^1), and the solution boiled a few minutes, cooled, made to 200 c.c., filtered (or otherwise clarified), and 100 c.c. of the filtrate titrated with N/10 hydrochloric acid (volume used $= r^1$). The total hardness (H) is calculated by formula 3 (p. 355)—$H = 28\ (Q^1 - 2r^1)$.

The precipitation of lime and magnesia in these operations is so close that the filtrates give but very faint reactions for these bases when tested, under most rigorous conditions, by oxalate and phosphate, provided that the filtrates in question are perfectly clear. Nevertheless an experience, based upon many hundreds of tests, convinces me that an error which may amount to 50 parts per million invariably occurs in this method of assay. The whole of the sources of this constantly occurring error are not known, but the following list comprises the most important :—

Source of Error.	Effect of Error.
1. Personal error in reading to tint with Methyl Orange.	Increases the value of (r); hence reduces that of H, making hardness too low.
2. The solubility of calcium carbonate is 10—20 parts of lime per million. (Comey's Dict. of Solubilities, p. 82.)	Same as above.
3. The solubity of magnesium hydroxide is about 20 per million (*op. cit.*, p. 216).	Same as above.
4. Presence of alkali chlorides increases the solubility of magnesium hydroxide.	Same as above.
5. Turbidity of the filtrate, due to floating particles of calcium carbonate or magnesium hydroxide which have passed through the pores of the filter.	Same as above.

Error 1 will naturally vary in amount with different ndividuals, being, to some extent, a personal one. So far s cases coming under my observation are concerned, may be taken as varying from 0·1 c.c. to 0·2 c.c. N/10, us introducing an error of from 5 to 10 parts per million to the final result.

This error may be compensated by the use of a constant, scertained once for all by each analyst.

Errors 2, 3, and 4 will vary more or less with different pes of water. The first two are fairly constant, and may considered as inevitable, and inherent in the method; hich may therefore be taken as showing a hardness of out 10 to 30 per million below the truth, under the most vourable conditions. It is probable that an addition of per million to the indicated hardness would be an improvement, so far as these errors are concerned; and I n inclined to recommend the adoption of this constant for e correction of total hardness, and for permanent hardness en directly determined.

Error 5 is a very variable one, since the precipitates are always thrown down in a finely divided state, and sometimes the obtaining of a clear filtrate is next to impossible. I have ascertained the possible magnitude of this error by substituting clarification with a centrifuge for filtration; and may put on record the following results :—

Substances in Solution.	CaO Actual.	CaO Found.	Error.	Remarks
1. Contained calcium sulphate only.	454	401	53	Filtrate turbid.
	454	403	51	" "
	454	426	28	Centrifuge, till clear.
2. Contained calcium bicarbonate only.	277	258	19	Filtrate clear.
	277	263	14	" "
	518	493	25	" "
3. Contained both calcium sulphate and bicarbonate.	310	293	17	" "
	230	174	56	" turbid.
	150	73	77	" "
	150	140	10	Centrifuge, till clear.
	390	358	32	Filtrate clear.
	150	67	83	" turbid.
	150	134	16	Centrifuge, till clear.
	615	552	63	Filtrate turbid.

NOTE.—The filtrates above described as turbid were, nevertheless, so nearly clear that the turbidity was apparent only to careful observation. They had repeatedly passed through ordinary filter paper, and in routine work would certainly have been considered satisfactory. The solutions worked on were prepared with great care.

It will be noted that this experimental investigation covers only the case in which lime is in solution. The influence of magnesia has not been specially studied in this connection; but the following table contains a series of naturally occurring waters in which magnesia was present.

The subjoined table contains a series of natural waters, in which the lime and magnesia were determined in the ordinary way, and the total hardness was also determined by the method of assay with "Soda Reagent" already described. The magnesia (found by gravimetric analysis) is multiplied by 1·4 to convert it into an equivalent of lime; and the sum of lime and magnesia gives the actual total hardness in terms of lime. It will be seen that in a few instances the number found by assay with soda reagent agrees very closely with the actual hardness; but, in most cases, it is considerably lower than this. I may say that no corrections have been introduced into any of these results,

Serial No.	Name.	By Ordinary Quantitative Analysis.			Hardness as CaO by Soda Reagent.	Error.	
		CaO.	MgO × 1·4.	Sum.		Excess.	Defect.
1	Portage	184	176	360	347	..	13
2	Calgary	121	160	281	286	5	..
3	Regina	219	211	430	414	..	16
4	Farm Dam	349	376	725	711	..	14
5	Plum Coulee	359	276	535	521	..	14
6	Maniton	63	42	105	95	..	10
7	Mooris	270	197	467	403	..	64
8	Snowflake	494	232	726	689	..	37
9	Kincorth	129	102	231	196	..	35
10	Lenore	184	141	325	319	..	6
11	Binscarth	239	104	343	347	4	..
12	Moosomin	298	160	458	437	..	21
13	Lillis	234	127	361	330	..	31
14	Gretna	354	270	624	622	..	2
15	Suffield	106	78	184	151	..	33
16	Virden*	246	136	382	308	..	74
17	La Rivière	121	64	185	179	..	6
18	Gull Lake	264	224	488	442	..	46
19	Broadview	170	113	283	252	..	31
20	Wapella	149	132	281	269	..	12
21	Holmfield	234	134	368	358	..	10
22	La Salle	159	225	384	353	..	31
23	Woodbay	163	71	234	213	..	21
24	Lacombe	390	279	669	650	..	19
25	Cheadle	106	125	231	207	..	24
26	Arcola	196	90	286	230	..	56
27	Trenouth	129	61	190	174	..	16
28	Whitewood†	446	308	754	666	..	88
29	Carberry	109	62	171	162	..	9
30	Langdon	81	80	161	129	..	32
31	Elkhorn	131	64	195	179	..	16
32	School Lake	147	76	223	196	..	27

* High chlorides. † Much soda.

and that the analytical numbers quoted are taken quite at random from the pages of my notebooks. It was the observation of this constant departure from the hardness as indicated by quantitative analysis that led me to investigate more closely the results given by the method of assay with "Soda Reagent." It will be seen that the amount of the difference referred to does not seem to bear any constant relation to the total amount of lime or magnesia in solution. For this reason I am inclined to think that a turbid filtrate (although the turbidity may seem so slight as to be negligible) is the most important source of error, and that which is least easily avoided or corrected by the use of an arbitrary constant.

The following conclusions are reached, in consequence of the studies just put on record:—

1. Great care must be taken to secure a clear liquid in determining the values r^1 and r^2.

2. Where a centrifuge is available, this is preferable to filtration through paper.

3. An error of defect is constantly found.

4. While this error may reach 50 parts of CaO per million, it does not usually reach more than 25 parts per million.

5. If a constant of 25 parts of lime per million is added to the results of experiment, a closer approximation to the truth will be obtained.

6. All indirect methods of determining magnesia, by taking the difference between the lime (directly estimated) and the total hardness as determined by assay with "Soda Reagent," and from this difference calculating magnesium by the factor 0·714 $\left(=\frac{1}{1\cdot 4}\right)$, will be inexact to the extent that determination of hardness is inexact.

7. When the magnesia is an important factor in the hardness, it is, for this reason, desirable that magnesia should be independently determined, by one or other of the methods of exact analysis.

8. The method of assay by "Soda Reagent" is rather to be recommended as a simple and expeditious than as an accurate and reliable mode of analysis.

Problem II.—Pfeifer (Zeits. angew. Chem., 1902, 201) says:—"The quantity of lime added may vary within certain limits without seriously affecting the resultant water." He gives examples of treatment, which may be summarised thus:—

—	IV.	VII.	IX.	X.
Total hardness of the sample....	377	345	885	403
Hardness due to magnesia......	102	293	504	137

Results of treatment, in which the theoretical quantities of soda ash were used, so that the only deviation from normal treatment is in the lime. (C = Causticity; H = Residual Hardness.)

—	IV.		VII.		IX.		X.	
	C.	H.	C.	H.	C.	H.	C.	H.
(1) Normal amount of lime...	12	48	22	26	17	42	12	56
(2) Deficiency of about 10 " ..	0	58	23	38	20	64	13	73
(3) Excess of about 10 "	9	34	22	17	26	12	9	5

The residual hardness is somewhat higher when a deficiency of lime is used, and somewhat lower when an excess of lime is used, the limit of 10 per cent. from the normal quantity being respected. These results justify Pfeifer's assertion that a variation of 10 per cent. from the normal lime quantum does not seriously affect the character of the resultant water.

In order to study the influence of an excess of lime, where only lime hardness is present, I treated an artificial water containing 500 parts of CaO as bicarbonate with lime as follows:—

Treatment.	Causticity.	Alkalinity.	Total Hardness.
(1) The natural water......	0	500	500
(2) Added 500 parts of lime, without expelling free carbon dioxide........	0	260	263
(3) Added 500 parts of lime, after expelling free carbon dioxide........	6	39	39
(4) Added 550 parts of lime, *i.e.*, 10 per cent. excess	20	39	28
(5) Added 600 parts of lime, *i.e.*, 20 per cent. excess	76	84	84

NOTE.—Determination (2) in the above table is introduced to show the influence of free carbon dioxide in interfering with lime treatment. It is true that the sample worked on is not a natural water. Nevertheless, it had stood in an open bottle for many hours and showed no bubbles of gas. I have found natural waters with more free carbon dioxide than was contained in this sample $\left\{(263 - 39) \times \frac{44}{56} = 176 \text{ carbon dioxide per million}\right\}$.

From this it appears that, up to 10 per cent. excess of lime, the hardness of the water is not increased, although the causticity is affected. Addition of more than 10 per cent. excess of lime is decidedly injurious.

Problem III.—I have put on record elsewhere (J. Amer. Chem. Soc., 1904, 184) the fact that bicarbonates of lime, magnesia, soda, and barium are more or less decomposed into monocarbonates and free carbonic acid, on prolonged agitation of their solutions. In the case of calcium and barium, the monocarbonates formed are immediately precipitated, excepting 15 to 20 parts per million, representing the solubility of these carbonates in pure water. Magnesium monocarbonate remains in solution up to at least 170 parts per million, and sodium monocarbonate is indefinitely soluble. All of these monocarbonates react alkaline to phenolphthalein; and despite their slight solubility, even calcium and barium monocarbonates give the pink coloration quite distinctly.

When using a current of air in order to drive off free (dissolved) carbon dioxide (*op. cit.*) there is danger of passing the point at which uncombined acid is disengaged, and bringing about decomposition of bicarbonates, as described above. By adding phenolphthalein to the sample and carefully noting the appearance of a pink tinge, it is easy to prevent any considerable error of this kind. When lime alone is present the pink tinge remains rather faint no matter how far the decomposition proceeds, because the maximum solubility of calcium carbonate is reached almost immediately after passing the neutral point. It is differen when magnesia or soda is present, because the decide solubility of their monocarbonates produces a cumulativ effect, and the red colour becomes increasingly intens In order to ascertain the rate and the extent of decomposi tion of bicarbonates on agitation the following experiment were made. Agitation was produced by a rapid current o air:—

Sodium Bicarbonate.—(1) A solution containing 53 Na_2O per million was used. After 10 minutes, 12 Na_2((= 2 per cent.) existed as monocarbonate. After 2 minutes, 28 Na_2O (= 5 per cent.) existed as mon carbonate. (2) A solution containing 778 Na_2O was use After 60 minutes it contained 117 Na_2O (= 15 per cent as monocarbonate.

Magnesium Bicarbonate.

MgO (per Million) in Solution.	Time of Agitation (Minutes).	MgO existing as Monocarbonate.	Per Cent.
276	60	37	13
276	150	39	14
276	360	51	19
343	15	28	8
343	20	30	[illegible]
343	25	34	10
343	30	40	12
343	60	62	18
600	15	107	18
600	30	147	24
600	60	193	32

The decomposition is more rapid in concentrated solutions. No precipitation of magnesium carbonate occurred in any of these solutions.

Calcium Bicarbonate.—Air was rapidly bubbled through a solution of calcium bicarbonate for periods of varying duration, and the resultant water assayed.

Time of Agitation.	Causticity.	Alkalinity.	Hardness by Soda Reagent.	Percentage of CaO removed.
Original sample.	0	518	493	..
10 minutes......	3	445	409	17
35 „	3	325	269	45
60 „	3	269	224	54
20 hours	3	90	50	89

It thus appears that a water which owes its hardness to calcium bicarbonate alone can be softened fully 50 per cent. by vigorous agitation for one hour, without addition of any chemicals.*

Problem IV.—A current of air was blown through a solution of 365 parts of magnesia as bicarbonate and 210 of lime as sulphate. In two hours the hardness (total) was reduced from 721° to 526°, and in three hours it was reduced to 448°. The softening of the water in this instance cannot, however, be wholly ascribed to precipitation of magnesia as monocarbonate, since reaction is possible between calcium sulphate and magnesium carbonate with the preciptation of calcium carbonate, leaving magnesium sulphate in solution. On allowing the above solution to remain at rest for 48 hours, a crystalline deposit was formed, which proved to be calcium carbonate. That the interaction between magnesium carbonate and calcium sulphate (which occurred in this case) is accelerated by agitation is shown by the following experiment. A sample containing 332 parts of lime as sulphate and 292 of magnesia as bicarbonate was agitated by an air current for periods of one and two hours, and the lime remaining in solution was determined:—

	Per Million.
Lime in solution at first	332
„ „ after 1 hour....................	224
„ „ „ 2 hours.................	157

Hence it may be inferred that magnesium carbonate and calcium sulphate cannot exist together in natural waters. Where, therefore, we find magnesia in a sulphated water, we are entitled to express it as $MgSO_4$ up to the extent of one or other of the radicles concerned.†

Problem V.—Böhlig (abst. in J. Chem. Soc., 36, 963) states that if, in waters containing lime and magnesia with carbon dioxide and sulphuric acid, the free carbon dioxide be removed below a boiling temperature, calcium carbonate is precipitated and magnesium sulphate remains in solution. This agrees with the work recorded in Problem IV. He further states that if the free carbon dioxide be removed by simple boiling, the precipitate consists entirely of calcium carbonate if sufficient magnesia is present; but when the boiling point becomes higher, as in the case of steam boilers, calcium sulphate is precipitated. On boiling magnesium sulphate with calcium bicarbonate Böhlig found carbon dioxide to escape, while calcium sulphate remained in solution, basic magnesium carbonate being precipitated, or even magnesium hydroxide when the boiling point was considerably raised. Böhlig considers that when the magnesia is not greater than the temporary hardness, it should be expressed as carbonate, and only the excess of magnesia as sulphate. This opinion is at variance with my own; and is dissented from by Allen (this J., 1888, 801). The following experiment in illustration of this point may be put on record.

Three volumes of a water sample (Pembina), having the composition given below, were concentrated by slow boiling, under atmospheric pressure, to two volumes. The precipitate contained the whole of the lime as carbonate, and only 5 per cent. of the magnesia present in the original sample.

Pembina.—Analysis gave:—

	Parts per Million.
Dissolved solids, dry at 160° C................	3,183
„ „ heated to redness..........	2,613
Loss on heating	570
Residue on sulphation........................	2,984
Lime, CaO.....................................	360
Magnesia, MgO................................	303
Soda, Na_2O..	524
Sulphuric acid, SO_3..............................	1,305
Chlorine (Cl)	24
Fully combined carbon dioxide.............	299 +

To determine whether any notable amount of calcium sulphate is formed on concentrating a solution containing lime as bicarbonate and soda as sulphate, a solution containing 370 parts of lime as bicarbonate and 500 of soda as sulphate was concentrated by slow boiling, at atmospheric pressure, to one-eighth volume. A very considerable precipitate of calcium carbonate was formed, containing only a trace of sulphates.

Problem VI.—Since barium carbonate is somewhat more soluble in water than barium sulphate, the continued agitation of barium carbonate with a solution of calcium sulphate might be expected to cause the gradual production of barium sulphate and calcium carbonate, both of which substances would be precipitated up to their limit of solubility. Barium carbonate, if in excess, would also remain dissolved up to its maximum of solubility; but the exceedingly small solubility of all these salts would leave the water practically a soft water.

Experiment.—300 c.c. of a sample containing 259 parts of lime as sulphate, and 269 of lime as bicarbonate, was agitated for 30 minutes with an excess of barium carbonate. The filtrate contained 317 parts of SO_3 as against 370 originally present, *i.e.*, about 15 per cent. of the sulphuric acid entered into reaction with barium carbonate, according to the following equation:—

$$CaO, SO_3 + BaO, CO_2 = BaO, SO_3 + CaO, CO_2.$$

An old sample of barium carbonate was used in this experiment. If freshly precipitated carbonate were used it is probable that the reaction would have proceeded further. The best results should occur when the barium carbonate reacts *in statu nascendi.*

Comment.—The sample contained no free carbon dioxide to begin with; but it may be that the carbon dioxide continually disengaged from the calcium bicarbonate may have aided solution of barium carbonate.

Problem VII.—The general case of the reaction between calcium sulphate and barium oxide may be expressed thus:—

$$\underset{a}{CaO}, \underset{a}{SO_3} + \underset{a}{BaO} = \underset{a}{BaO}, \underset{a}{SO_3} + \underset{a}{CaO},$$

where a = CaO originally present, or its chemical equivalent in other radicals. The constants for such a water, before and after treatment with barium, should be as follows:—

In Solution.	Before.	After.
CaO	a	a
SO_3..	a	0
Causticity	0	a
Alkalinity	0	a
Hardness (permanent).....................	a	0
„ (temporary)	0	a
„ (total)...........................	a	a

---

* It will be observed that the determination of hardness in such a water, with the use of "Soda Reagent" (see Problem I.), yields a result lower than the truth by about 25 parts of CaO per million. The "alkalinity" number is a truer index to the amount of lime in solution. The percentage of "lime removed" is calculated upon a basis of 493 per million originally present, as indicated by the assay number.

† According to Pfeifer (Zeits. f. angew. Chem., 1902, 194) the readily soluble magnesium salts react with the difficultly soluble calcium salts under boiler pressure, and give rise to the formation of difficultly soluble magnesium compounds, and more easily soluble calcium compounds. Magnesia is found as sulphate in many boiler scales, doubtless as the comparatively insoluble Kieserite modification ($MgSO_4$, H_2O).

Driffield states (this J., 1887, 178) that where waters containing magnesium carbonate are used, the magnesia found in the boiler scale occurs as oxide, and not as carbonate.

The above assumes that baryta is added in equivalent amount to the lime present; and that barium sulphate is absolutely insoluble.

The following samples contained calcium sulphate only, and were treated with an equivalent amount of barium hydroxide. Constants are stated in terms of CaO per million:—

Actual Value of "*a*."	Before Treatment. Assay with Soda Reagent.				After Treatment. Assay with Soda Reagent.			
	Caust.	Alk.	H.	Hp.	Caust.	Alk.	H.	Hp.
390	0	7	355	348				
	0	9	379	370				
	0	9	359	350	364	375	358	0
Mean	0	8	365	357				
441	0	21	442	421	363	368	387	19
573	0	11	543	532	493	506	523	17

It will be noted that the value of "*a*" as given by Soda Reagent varies farther from the actual value after treatment with barium hydroxide than before treatment.

When lime as bicarbonate is in solution along with calcium sulphate, and baryta is added in amount equivalent to the lime present as sulphate, there will be an immediate formation of barium sulphate and carbonate, the whole of the baryta being thrown out of solution in one or other of these combinations. We have seen (Problem VI.) that prolonged agitation will gradually bring about solution of barium carbonate and cause the final precipitation of most of the baryta as sulphate. If we assume the ultimate precipitation of all the baryta in this form, the general case may be thus expressed:—

a = CaO present as sulphate, or its chemical equivalent in other radicals.

b = CaO present as bicarbonate, or its chemical equivalent in other radicals.

Case I. (1)—$a = b$:—

$$\underset{a}{\mathrm{CaO}}, \underset{a}{\mathrm{SO_3}} + \underset{a}{\mathrm{BaO}} + \underset{b}{\mathrm{CaO}}, \underset{2b}{(\mathrm{CO_2})_2} = \underset{a}{\mathrm{BaO}}, \underset{a}{\mathrm{SO_3}} + \underset{2a}{2\mathrm{CaO}}, \underset{2b}{\mathrm{CO_2}}.$$

Case I. (2)—$a > b$:—

$$\underset{a}{\mathrm{CaO}}, \underset{a}{\mathrm{SO_3}} + \underset{a}{\mathrm{BaO}} + \underset{b}{\mathrm{CaO}}\underset{2b}{(\mathrm{CO_2})_2} =$$
$$\underset{a}{\mathrm{BaO}}, \underset{a}{\mathrm{SO_3}} + \underset{2b}{\mathrm{CaO}}, \underset{2b}{\mathrm{CO_2}} + \underset{a-b}{\mathrm{CaO}}.$$

Case I. (3)—$a < b$:—

$$\underset{a}{\mathrm{CaO}}, \underset{a}{\mathrm{SO_3}} + \underset{a}{\mathrm{BaO}} + \underset{b}{\mathrm{CaO}}\underset{2b}{(\mathrm{CO_2})_2} =$$
$$\underset{a}{\mathrm{BaO}}, \underset{a}{\mathrm{SO_3}} + \underset{2a}{\mathrm{CaO}}, \underset{2a}{\mathrm{CO_2}} + \underset{b-a}{\mathrm{CaO}}\underset{2(b-a)}{(\mathrm{CO_2})_2}.$$

The constants before and after treatment should be:—

In Solution.	Before.	After. I (1).	After. I. (2).	After. I. (3).
CaO	$a + b$	0	$a - b$	$b - a$
SO_3	a	0	0	0
CO_2	$2b$	0	0	$2(b - a)$
Causticity	0	0	$a - b$	0
Alkalinity	b	0	$a - b$	$b - a$
Hardness (permanent)	a	0	0	0
" (temporary)	b	0	$a - b$	$b - a$
" (total)	$a + b$	0	$a - b$	$b - a$

If a portion of the barium carbonate first formed remain undissolved, let x represent such portion. This case is expressed in the following equations:—

Case II. (1)—$a = b$:—

$$\underset{a}{\mathrm{CaO}}, \underset{a}{\mathrm{SO_3}} + \underset{a}{\mathrm{BaO}} + \underset{b}{\mathrm{CaO}}\underset{2b}{(\mathrm{CO_2})_2} =$$
$$\underset{(a-x)}{\mathrm{BaO}}, \underset{(a-x)}{\mathrm{SO_3}} + \underset{x}{\mathrm{BaO}}, \underset{x}{\mathrm{CO_2}} + \underset{(2a-x)}{\mathrm{CaO}}, \underset{(2a-x)}{\mathrm{CO_2}} + \underset{x}{\mathrm{CaO}}, \underset{x}{\mathrm{SO_3}}.$$

Case II. (2)—$a > b$:—

$$\underset{a}{\mathrm{CaO}}, \underset{a}{\mathrm{SO_3}} + \underset{a}{\mathrm{BaO}} + \underset{b}{\mathrm{CaO}}\underset{2b}{(\mathrm{CO_2})_2} =$$
$$\underset{(a-x)}{\mathrm{BaO}}, \underset{(a-x)}{\mathrm{SO_3}} + \underset{x}{\mathrm{BaO}}, \underset{x}{\mathrm{CO_2}} + \underset{(2b-x)}{\mathrm{CaO}}, \underset{(2b-x)}{\mathrm{CO_2}} + \underset{x}{\mathrm{CaO}}, \underset{x}{\mathrm{SO_3}} + \underset{(a-b)}{\mathrm{CaO}}.$$

Case II. (3)—$a < b$:—

$$\underset{a}{\mathrm{CaO}}, \underset{a}{\mathrm{SO_3}} + \underset{a}{\mathrm{BaO}} + \underset{b}{\mathrm{CaO}}\underset{2b}{(\mathrm{CO_2})_2} =$$
$$\underset{(a-x)}{\mathrm{BaO}}, \underset{(a-x)}{\mathrm{SO_3}} + \underset{x}{\mathrm{BaO}}, \underset{x}{\mathrm{CO_2}} + \underset{(2a-x)}{\mathrm{CaO}}, \underset{(2a-x)}{\mathrm{CO_2}} + \underset{x}{\mathrm{CaO}}, \underset{x}{\mathrm{SO_3}} +$$
$$\underset{(b-a)}{\mathrm{CaO}}\underset{2(b-a)}{(\mathrm{CO_2})_2}.$$

And the constants of the water before and after treatment should be as follows:—

In Solution.	Before.	After. II. (1).	After. II. (2).	After. II. (3).
CaO	$a + b$	x	$a - b + x$	$b - a + x$
SO_3	a	x	x	x
CO_2	$2b$	0	0	$2(b - a)$
Causticity	0	0	$a - b$	0
Alkalinity	b	0	$a - b$	$b - a$
Hardness (permanent)	a	x	x	x
" (temporary)	b	0	$a - b$	$b - a$
" (total)	$a + b$	x	$a - b + x$	$b - a + x$

NOTE.—In the above synopses, no account is taken of the solubility of barium sulphate and carbonate or calcium carbonate. Experimental numbers will naturally vary from the theoretical numbers given in the tables to the extent of the normal solubilities of these salts.

A comparison of the two cases shows that in proportion as baryta is thrown out of solution in the form of carbonate, the resultant water contains more lime, more sulphuric acid, and consequently a higher permanent (and total) hardness, the measure of the increase of each of these quantities being x.

The following work is in illustration of the case ($a > b$). If x had any value we should expect the hardness, after treatment by baryta, to exceed the quantity ($a - b$) by that value. In only one instance (No. 3) does the total hardness possess a higher value than ($a - b$). Even if we make a correction, to compensate for the inevitable error due to working with "soda reagent" (see Problem I.), the value of x indicated would be very small, and would still be zero, in cases 1, 2, and 5. It would therefore appear that barium hydroxide possesses its full value as a precipitant for sulphuric acid, even in the presence of carbonates, when vigorous agitation is used. In all the cases here recorded, the samples were shaken at frequent intervals, for an hour, and then allowed to stand at rest for 20 hours.

Serial Number.	Actual Values.			Values found after Treatment. "Assay with Soda Reagent."				Difference.	
	a	b	$a - b$	Caust.	Alk.	H.	Hp.	Excess.	Defect.
1	573	90	483	384	392	403	11	..	80
2	573	189	393	336	347	347	0	..	46
3*	430	270	160	174	186	179	0	19	..
4	390	80	310	283	294	293	0	..	17
5	390	160	230	196	207	174	0	..	56
6*	390	240	150	168	176	140	0	..	10
7	390	240	150	148	143	134	0	..	16

* Numbers high for causticity and alkalinity.

The experimental treatments recorded in the appended table are pretty fully explained by the accompanying notes. The following additional notes furnish what is lacking:—

Sample I. (1)—The natural water.

(2)—CaO equivalent to lime present. (Formula 9.)

(3)—Same, but free carbon dioxide not removed prior to treatment.

(4)—Like (2), but using 10 per cent. excess of lime.

(5)—Like (2), but using 20 per cent. excess of lime.

Sample II. (6)—The natural water.

(7)—Lime treatment, after carbon dioxide equilibrium. (Formula 9.)

(8)—Soda used for the magnesia component of hardness.

Sample III. (9)—The natural water, calculated.

(10)—The natural water, experimental.

(11)—Lime, to reduce temporary hardness only.

(12)—Normal lime + soda ash treatment. (Formulæ 9 and 12.)

(13)—Baryta, equal to sulphuric acid. (Formula 13.) The liberated lime reduces temporary hardness.

Sample IV. (14)—The natural water.

(15)—Normal lime + soda ash treatment. (Formulæ 9 and 12.)

(16)—Lime equivalent to the half bound carbon dioxide (Formula 6); soda equivalent to magnesia (Formulæ 7 and 10).

(17)—Soda equivalent to the magnesia existing as sulphate + twice the magnesia existing as bicarbonate.

(18)—Half the quantities used in (17).

Sample V. (19)—The natural water, calculated.

(20)—The natural water, experimental.

(21)—Normal lime + soda ash treatment. (Formulæ 9 and 12.)

(22)—Equivalent to (21), but used soda instead of sodium carbonate and lime. Less sludge will be formed.

(23)—Soda to precipitate magnesia only. (Formulæ 7 and 10.)

(24)—Baryta to precipitate half the sulphuric acid. (Formula 13 ÷ 2.)

Sample VI. (25)—The natural water, calculated.

(26)—The natural water, experimental.

(27)—Normal lime + soda ash treatment. (Formulæ 9 and 12.)

(28)—Baryta, to precipitate sulphuric acid. (Formula 13.)

Sample VII. (29)—The natural water, calculated.

(30)—The natural water, experimental.

(31)—Normal lime + soda ash treatment. (Formulæ 9 and 12.)

(32)—Baryta, equivalent to magnesia.

Sample VIII. (33)—The natural water, calculated.

(34)—The natural water, experimental.

(35)—The natural water, boiled 10 minutes.

(36)—The natural water, boiled 30 minutes.

NOTE.—In these treatments, the sodium bicarbonate is converted into monocarbonate, and this reacts with the magnesium sulphate, leaving sodium sulphate and magnesium carbonate in solution. Hardness, so far as magnesian hardness is concerned, is not removed, but is converted into temporary instead of permanent. The lime hardness is removed by boiling off the half bound carbon dioxide.

Sample VIII. (37)—Normal lime + soda ash treatment. (Formulæ 9 and 12.) Is not warranted, because *real* permanent hardness is non-existent in this sample.

(38)—Lime, to combine with the half bound carbon dioxide. (Formula 6.)

(39)—Lime, corresponding to the alkalinity and to the magnesia. (Formula 9.)

Regina. (40)—The natural water, calculated.

(41)—The natural water, experimental.

(42)—Normal lime + soda ash treatment. (Formulæ 9 and 12.)

(43)—Baryta treatment. $BaO = 1.912(SO_3 - 4/3Na_2O)$.

(44)—Same, using half quantity.

(45)—Baryta treatment, following lime to neutralise half-bound carbon dioxide.

Tables Illustrating Experimental Treatments.

The experimental treatments tabulated have been carried out on artificial water samples of 400 degrees of hardness (= 50 degrees English).

One litre of each sample contains as follows (the figures given are milligrammes):—

Sample I.—400 lime (CaO) dissolved in excess of carbonic acid. II. 124 lime and 194 magnesia (MgO) dissolved in excess of carbonic acid. III. 200 lime, dissolved as bicarbonate, and 200 lime as sulphate. IV. 116 magnesia as sulphate and 170 magnesia as bicarbonate. V. 200 lime and 143 magnesia, both as sulphates. VI. 72 lime and 86 magnesia, both as sulphates, together with 32 lime and 126 magnesia, both as bicarbonates. VII. 178 lime as bicarbonate, and 160 magnesia as sulphate, together with 240 soda (Na_2O) as sulphate. VIII. 178 lime as bicarbonate and 160 magnesia as sulphate, together with 240 soda as bicarbonate.

Regina.—Analysis gave:—Lime (CaO), 143; magnesia (MgO), 158; soda (Na_2O), 170; sulphuric acid (SO_3), 484; ully bound carbon dioxide (CO_2), 114.

For explanations as to the several treatments, see the text of the paper.

Reagents.—Quantity is given in lbs. per 1,000 gallons. Cost is given in cents per thousand gallons.

Sample.	Number of Treatment.	Reagents.			Hardness.					Soda (Na_2O).				Remarks.
		Kind.	Quantity.	Cost.	Causticity.	Alkalinity.	Temporary.	Permanent.	Total.	Original.	Added.	Total.	Mag. MgO.	
I.	1	None	0	0	0	400	400	0	400	0	0	0	0	Calculated. Soft scale forming.
	2	CaO	4·0	2·0	5	31	31	0	31	0	0	0	0	Normal treatment. Free CO_2 removed. Water good.
	3	„	4·0	2·0	0	208	210	0	210	0	0	0	0	Free CO_2 not removed. Treatment unsatisfactory.
	4	„	4·4	2·2	16	31	22	0	22	0	0	0	0	Used 10 per cent. excess lime. Water too caustic.
	5	„	4·8	2·4	61	67	67	0	67	0	0	0	0	Used 20 per cent. excess lime. Water very caustic.
.	6	None	0	0	0	396	396	0	396	0	0	0	194	Calculated. Soft scale forming.
	7	CaO	6·69	3·34	33	72	26	0	26	0	0	0	..	Very fair water. Will form a little soft scale.
	8	„ Na_2O	3·97 3·02	1·98 10·57	153	299	15	0	15	0	302	302	..	Treatment unsatisfactory and expensive. The water will foam.
				12·55										
.	9	None	0	0	0	200	200	200	400	0	0	0	0	Calculated from known composition.
	10	„	0	0	0	175	175	212	388	0	0	0	0	Experimental numbers. Bad feed water.
	11	CaO	2·0	1·0	28	32	32	178	210	0	0	0	..	To eliminate temporary hardness only. Unsatisfactory.
	12	„ Na_2CO_3	2·0 3·8	1·0 5·7	0	126	102	0	102	0	222	222	..	Fairly satisfactory.
				6·7										
	13	BaO	5·47	16·41	0	48	48	14	61	0	0	0	..	A very good feed water.

Tables Illustrating Experimental Treatments—continued.

Sample.	Number of Treatment.	Reagents.				Hardness.				Soda (Na_2O).				Remarks.
		Kind	Quantity.	Cost.	Causticity.	Alkalinity.	Temporary.	Permanent.	Total.	Original.	Added.	Total.	Mag. MgO.	
IV.	14	None	0	0	0	237	237	160	397	0	0	0	286	A very bad feed water. Calculated numbers.
	15	CaO	6·30	3·15	34	67	30	0	30	0	176	176	..	Satisfactory feed water.
		Na_2CO_3	3·01	4·51										
				7·66										
	16	CaO	2·34	1·17	146	246	9	0	9	0	436	436	..	Water is too caustic and will foam.
		Na_2O	4·36	15·26										
				16·43										
	17	Na_2O	6·95	24·32	247	450	0	0	0	0	695	695	..	Water much too caustic and will foam.
	18	„	3.48	12·16	160	364	161	0	161	0	348	348	..	
V.	19	None	0	0	0	0	0	400	400	0	0	0	143	Calculated from known composition.
	20	„	0	0	0	3	7	374	381	0	0	0	143	Experimental numbers. Forms hard scale.
	21	CaO	2·01	1·00	25	45	45	5	50	0	444	444	..	Will not form scale, but will foam.
		Na_2CO_3	7·60	11·40										
				12·40										
	22	Na_2CO_3	3·77	5·66	26	46	46	4	50	0	442	442	..	Result like (21), attained at greater cost, will be less sludge to get rid of.
		Na_2O	2·22	7·77										
				13·48										
	23	Na_2O	2·22	7·77	15	23	23	209	232	0	222	222	..	Magnesia hardness alone reduced. Will still form scale to about half the extent of original water.
	24	BaO	5·48	16·44	6	13	13	188	201	0	0	0	..	The expected results are given in the second line of figures. Is like (23), but free from soda salts.
					0	0	0	200	200	..	..	..	..	
VI.	25	None	0	0	0	209	209	193	402	0	0	0	212	Calculated from known composition.
	26	„	0	0	0	210	193	210	403	0	0	0	212	Experimentally determined. Bad water.
	27	CaO	5·00	2·50	48	91	67	0	67	0	214	214	..	Satisfactory.
		Na_2CO_3	3·66	5·49										
				7·99										
	28	BaO	5·28	15·84	115	295	295	13	308	0	0	0	..	Unsatisfactory.
VII.	29	None	0	0	0	178	178	224	402	240	0	240	160	Numbers calculated from known composition.
	30	„	0	0	0	179	193	202	394	240	0	240	160	Experimental numbers.
	31	CaO	4·02	2·01	72	132	45	0	45	240	249	489	..	Is satisfactorily softened, but will foam.
		Na_2CO_3	4·26	6·38										
				8·39										
	32	BaO	6·12	18·36	50	166	45	0	45	240	0	240	..	Very satisfactory treatment.
VIII.	33	None	0	0	0	394	178	224	400	240	0	240	160	Calculated from known composition.
	34	„	0	0	0	386	402	0	402	240	0	240	160	Experimental numbers. MgO shows up a carbonate.
	35	Boiled	10 minutes.		22	222	188	0	188	240	0	240	..	This water is only stable in the cold. Pre cipitates carbonates (chiefly $CaCO_3$) o boiling.
	36	„	30 minutes.		34	162	135	0	135	240	0	240	..	
	37	CaO	4·00	2·00	163	372	62	0	62	240	249	489	..	Treatment unwarranted. Produces a foamin supply.
		Na_2CO_3	4·26	6·39										
				8·39										
	38	CaO	3·94	1·97	110	195	90	0	90	240	0	240	..	Treatment satisfactory.
	39	„	6·10	3·05	28	65	54	0	54	210	0	240	..	„ very satisfactory.
Regina	40	None	0	0	0	145	..	..	364	170	0	170	158	Calculated from results of analysis.
	41	„	0	0	0	151	..	..	372	170	0	170	158	Experimental numbers. Forms hard scale.
	42	CaO	3·72	1·86	45	84	39	0	39	170	268	438	..	Satisfactorily softened, but will foam.
		Na_2CO_3	4·58	6·87										
				8·73										
	43	BaO	4·88	14·64	34	95	67	0	67	170	0	170	..	Very good feed water.
	44	..	2·44	7·32										

Liverpool Section.

PRESENTATION TO DR. T. LEWIS BAILEY.

A dinner was held at the Hotel St. George on Tuesday, 26th April, at which Dr. Bailey was the guest of the members of the section.

During the evening Mr. Frank Tate (chairman of the section), after reading letters of regret at their inability to attend from Mr. Eustace Carey, Mr. Forbes Carpenter, and Dr. Chas. A. Kohn, presented to Dr. Bailey a silver salver. Letters were also received from Sir David Gamble, Mes W. H. Lever, Thos. Tyrer, H. T. Mannington, Wats Smith, Roscoe Brunner, and Wm. Earp.

The Chairman said when at the end of last year th heard with so much regret that Dr. Bailey had resign the local honorary secretaryship, it was felt he could be allowed to retire without the members of the secti showing their appreciation of his long and excellent servic In asking Dr. Bailey's acceptance of the salver on beh of the members of the section, he did so remembering many years of steady and unostentatious work Dr. Bai had performed for the section, his splendid powers organisation and command of detail, and his ever ready courtesy and kindness, and, on more than one occasion, his quiet diplomacy. He asked Dr. Bailey to receive the salver from the members of the Liverpool Section as a token of their gratitude for his past services and of their best wishes for his future happiness and prosperity.

The inscription on the salver read as follows: "Presented to Dr. T. Lewis Bailey by the members of the Liverpool Section of the Society of Chemical Industry as a token of their appreciation of his valuable services as Honorary Secretary to the Section, 1894–1904."

Dr. Bailey, replying, expressed his heartfelt thanks for the goodwill of the members in so hospitably entertaining him and presenting him with a lasting memento of his connection with them. The Liverpool Section held a very satisfactory position in regard to its papers, and subjects had been introduced of a type which was worthy of more consideration—such subjects as, for instance, Railway Rates on Heavy Chemicals, the Development of Canals, &c. A great deal might be gained by discussing subjects of general interest to chemical manufacturers and bringing such subjects to the notice of the proper authorities where changes were considered necessary for the well-being of the industry. He referred also to attempts made in the section to bring members together in such a way as to give more opportunity for an exchange of ideas than was possible at ordinary meetings. In a scattered section great difficulties were necessarily experienced in the attainment of such a desideratum, but perhaps his worthy successor would be able to see some way of bringing members together in such a way as to produce a firmer bond of union, and consequently a stronger and more weighty organisation. Thanking the members for their goodness to him that evening in recognising services which any member, he trusted, would willingly render to their Society, he could not refrain from expressing his thanks also to all with whom he had had dealings, chairmen and members generally, for the ever ready assistance they had at all times accorded him.

London Section.

Meeting held at Burlington House, on Monday, May 2nd, 1904.

MR. WALTER F. REID IN THE CHAIR.

The Chairman said the Committee of the Section had just decided to send a resolution to the Council, inviting the Society to meet in London in 1905. They had generally held the meeting in London every four years, but this year, being the fourth since they last met in London, the choice had fallen on New York. He understood that their American friends were providing a most lavish programme, and that they had made every preparation to receive the members with the utmost hospitality. He made this announcement now in the hope that the members would support the invitation when it came forward, and would also be prepared to help when the time came for making the arrangements for 1905. He was also pleased to announce that Prof. Liversidge, the chairman, and Mr. Walton, the secretary, of the New South Wales Section were present that evening.

DETERMINATION OF MINUTE QUANTITIES OF BISMUTH IN COPPER AND COPPER ORES.

BY T. C. CLOUD, A.R.S.M., F.I.C., F.C.S.

In the Journal of the Chemical Society for 1862 there appears a paper by Abel and Field entitled "On the Analysis of Commercial Coppers," in which they describe a qualitative test for bismuth based upon the fact that when lead iodide is precipitated in the presence of even minute traces of this metal, the iodide precipitate is coloured a dark orange or crimson tint, the depth of colour varying in intensity with the amount of bismuth present. They also show that this coloration is still more marked if the precipitate is re-dissolved by heating the liquid and allowing it to cool again, when the lead iodide crystallises out from the solution in the form of scales. If no bismuth is present these scales are of a brilliant golden yellow colour, while the smallest trace of bismuth gives to the scales a more or less orange or red tint.

Field, in the same journal, points out that the colour is seen to greater advantage if the lead iodide precipitate is dissolved in boiling dilute hydrochloric acid and then allowed to crystallise out on cooling. I confirmed this observation, and now make the qualitative test by adding to the mixed lead and bismuth solutions only just sufficient potassium iodide solution to precipitate the whole of the lead. I then add just sufficient hydrochloric acid to entirely dissolve the precipitate at the boiling temperature. On now allowing the solution to cool by placing it in cold water, the lead iodide crystallises out from the solution in the form of scales, which collect at the bottom of the test tube and indicate by their colour the presence or absence of bismuth. The delicacy of this test is proved by the fact that even so small a quantity of bismuth as 0·000001 grm. is distinguishable.

About 15 years ago I made a number of experiments on this reaction with the view of evolving a quantitative method from it, the result of which I now propose to place before you. I found, after a long investigation, that with quantities of bismuth of about 0·0001 grm., the colour of the crystalline precipitate varied considerably although the quantity of bismuth was the same and the experiments were performed under the same conditions so far as practicable. The rate of cooling had a marked effect, as might be expected, on the size of the crystals, and consequently on the colour of the crystalline precipitate. The lustre of the crystals also varied, and this increased the difficulty. Finally, this method was abandoned. It afterwards occurred to me that the colours of the precipitate produced in the first instance, and without re-solution and subsequent separation in a crystalline form, might be comparable. After a searching investigation, this was found to be the case, and a quantitative method was evolved which easily determines 0·00001 grm. of bismuth.

For the determination the following solutions are made up:—

Bismuth Nitrate, by dissolving pure bismuth oxide in nitric acid and diluting so that 1 c.c. contains 0·0001 grm. bismuth. Sufficient nitric acid must be present to prevent basic bismuth salt from precipitating when the solution is diluted.

Lead Nitrate Solution, made by dissolving 6 grms. of pure lead in nitric acid. The solution is evaporated until excess of nitric acid is removed and lead nitrate crystallises out. This is then dissolved in water and made up to one litre.

Potassium Iodide Solution, made by dissolving 35 grms. of the salt in water and making up to 4 litres. In order to make the determination I take the solution containing the unknown quantity of bismuth, and which must be free from lead, and add to it a definite quantity of the lead solution, and then precipitate the lead iodide with the potassium iodide solution in a Nessler's tube, and compare the colour of the precipitate produced with that formed under similar conditions, using known quantities of the bismuth solution run from a burette. A series of precipitates are produced in this way until one is made of the same shade as that produced in the solution under examination. The quantity of bismuth solution used in producing this particular shade of precipitate then gives the quantity of bismuth present.

The comparative experiments are made as follows:—5 c.c. of the lead solution are measured with a pipette into a Nessler's tube, to this is added 1 c.c. of dilute nitric acid (1—24), and then the known quantity of bismuth solution from a burette. The solution is now made up with water to the 25 c.c. mark on the tube and then potassium iodide solution added to bring the quantity up to the 50 c.c. mark.

The contents of the tube are well agitated and allowed to stand for 15 or 20 minutes before making the final comparison.

In dealing with metallic copper the following procedure is adopted. A suitable quantity of the metal is dissolved in nitric acid. To the cold solution carbonate of soda is added carefully until a permanent precipitate commences to form; the solution is now added very slowly drop by drop with constant stirring until a small quantity of permanent precipitate is produced. The beaker is allowed to stand in the cold with frequent stirring for about three or four hours and the solution is then filtered. The precipitate without washing is dissolved in dilute hydrochloric acid and precipitated with hydrogen sulphide. The precipitate is washed with a solution of hydrogen sulphide and is then dissolved in nitric acid, the solution being received in a $\frac{1}{4}$-litre flask. If the copper contains an appreciable quantity of lead the original solution must be evaporated with sulphuric acid, cooled, taken up with water and filtered, before precipitating with hydrogen sulphide. From the solution in the $\frac{1}{4}$-litre flask 125 c.c. are taken and to this 5 c.c. of the standard lead solution are added. After agitating, the solution is neutralised with ammonia and then ammonium carbonate is added drop by drop with constant stirring until in slight excess, and finally ammonia, also in excess, sufficient to keep all the copper in solution. It is heated on water bath and then allowed to cool. The precipitate is filtered off on to a small filter and washed with water containing ammonium carbonate until all copper is removed. The precipitate is dissolved on the filter with dilute nitric acid and the filter washed with dilute nitric acid and water, used alternately, the filtrate and washings being received in a small glass dish. The solution is evaporated on the water bath until the lead nitrate begins to crystallise out. The contents of the dish are dissolved in a little water and transferred to a Nessler's tube, using at first hot water, then diluted nitric acid (1—12), and finally water up to the 25-c.c. mark. The solution in the Nessler's tube is now made up to the 50-c.c. mark with the standard potassium iodide solution and the precipitate produced is compared with precipitates made as described above, using known quantities of standard bismuth solution until a precipitate of the same tint is produced, when the quantity of bismuth solution used for the production of this particular tint gives the quantity of bismuth present.

A large number of test experiments were made, using pure copper solutions to which known quantities of the standard bismuth solution were added and the process carried out as described. There was in no case any difficulty in determining quantities as small as 0·00001 grm., and differences of this amount are easily distinguishable in the colour of the precipitate produced.

In the case of copper ores, the method employed is to dissolve in a mixture of nitric acid and sulphuric acid, and evaporate until sulphuric acid fumes come off freely. When cool, the residue is treated with water, a drop or two of hydrochloric acid added and the solution filtered. The solution is now treated with hydrogen sulphide, and the process completed as described for metallic copper.

In the case of very pure copper or copper ores variations in the quantities of bismuth present, even when in so small a proportion as 0·001 per cent., is of the utmost importance.

After fifteen years' experience of this method in the very large number of determinations which I and my staff have had to make at the laboratory of the Wallaroo Smelting Works in South Australia, I can, with confidence, recommend it to your notice as a thoroughly reliable and delicate method for determining minute quantities of bismuth in copper or copper ores.

Discussion.

Mr. F. F. Renwick said that a method which depended on the variation in colour of a precipitate and which was to be used for the estimation of bismuth in small quantities must be used with the greatest caution, remembering the great variation in the colour of precipitates—especially the iodides—which was known to occur. He need only mention two; silver iodide varied considerably in colour according to the conditions under which it was precipitated and the treatment it received subsequently. A still more remarkable case was that of mercuric iodide. Under certain conditions the precipitate was yellow, whereas under others it had a brilliant red colour. An interesting example was recently described by Dr. Lüppo-Cramer in the Photographische Correspondenz for December 1903, who showed that if mercuric iodide was precipitated in the presence of gum arabic it had a brilliant red colour, whereas in the presence of gelatin it always came down yellow. There was a very marked difference in sensitiveness to light between the two varieties.

Mr. G. T. Holloway said he had used a qualitative method which he believed was first described to him by Mr. Arthur Wingham and which resembled that described as introduced by Abel. It was employed for testing the precipitate which had been weighed as bismuth oxide, to ascertain whether it contained lead. The method usually employed with metallic copper was to dissolve about 20 grms. in nitric acid, to add sodium phosphate and saturate with ammonia. Lead, bismuth, and iron were thus precipitated as phosphates, and after being filtered off were separated, the lead with sulphuric acid with the usual precautions, and the bismuth from the filtrate with sulphuretted hydrogen. The bismuth was finally weighed as oxide and then frequently contained a trace, and sometimes a good deal, of lead. One could obtain a good idea as to the amount of lead by a method similar to that described by Mr. Cloud. The weighed precipitate was dissolved in one drop of strong nitric acid, and about half a cubic centimetre of water, a couple of drops of cold saturated solution of lead nitrate, and a drop or two of 10 per cent. potassium iodide solution were added. If no bismuth was present the precipitate would of course be bright yellow, while bismuth rendered the precipitate more or less brown or reddish. If the original weighed precipitate, which perhaps only weighed half a milligramme, was practically pure bismuth oxide, the iodide precipitate would be distinctly red. With practice, the operator could tell whether the bismuth oxide was sufficiently pure to be counted as pure for ordinary purposes. He was speaking of ordinary commercial analyses, where, for instance, it was necessary to say whether the amount of bismuth present was above or below a certain stated limit.

Mr. Cloud, in reply, said the quantities of bismuth which affected Wallaroo copper was considerably smaller than generally occurred in ordinary commercial coppers. The average of a very large number of determinations over a period of some years showed they did not contain more than 0·001 per cent. If that amount was doubled it would materially affect the quality of the copper. The quantity he had named in the paper as being easily distinguishable was such that if that quantity was doubled, the difference in colour of the precipitate was most marked, and there was no difficulty in distinguishing between 0·001 mgrm. and 0·002 mgrm. Prepared as described, the precipitates were perfectly uniform in colour for the same quantity of bismuth, and the remarks of Mr. Renwick in reference to mercuric iodide did not in any way apply in the case of lead iodide, prepared as described in the paper.

DETERMINATION OF MINUTE QUANTITIES OF ARSENIC IN COPPER ORES AND METALLURGICAL PRODUCTS.

BY T. C. CLOUD, A.R.S.M., F.I.C., F.C.S.

The *Chemical News* of January 14th, 1881, quotes, apparently in full, a paper entitled, "On the Detection and Determination of Arsenic in Organic Matter," by Messrs. Chittenden and Donaldson, which appeared in the *American Chemical Journal*, vol. 2, No. 4. An arrangement of the Marsh apparatus is there described and figured; this arrangement I have employed for the last twenty years for the determination of minute quantities of arsenic in copper ore and metallurgical products with the most successfu results. When the process—as described in the paper mentioned—first came under my notice, I subjected it to a most severe investigation to ascertain if it was suitable for the purpose I had in view, *viz.*, the accurate determination of minute quantities of arsenic down to say 0·005 per cent. in cupriferous ores and metallurgical products. Numerous experiments were made with the apparatus, using known quantities of arsenic and conducting the experiments under the same conditions as would occur in practice with the materials under consideration. It was found that when all the precautions mentioned by the writers were observed in the use of the apparatus, thoroughly satisfactory results were obtained, with one curious exception which is not referred to by the authors of the paper. The experiments were performed in the following manner:—The solutions containing the known quantity of arsenic were evaporated with sulphuric acid until fumes of this acid came off freely; the cooled residue taken up with water and filtered, if necessary, into the funnel of the apparatus, from whence it was allowed to pass into the Marsh apparatus drop by drop. The portion of the tube containing the mirror was cut off and weighed with and without the mirror, the difference giving the amount of arsenic. I found that in the presence of iron salts the results were invariably low. I may say here that the authors recommend alloying the zinc with a small quantity of platinum. This precaution was not adopted as it was considered too troublesome, and pure zinc only was used. Some years previously Messrs. Gladstone and Tribe had introduced their copper zinc couple to the notice of chemists, and it occurred to me as being possible that if a small amount of copper were introduced into the Marsh apparatus so as to set up this combination, the defect to which I have referred might be removed. This was found to be the case. Duplicate experiments were performed, using the same quantities of iron and arsenic; in the one case there was no copper solution employed, and in the other the small necessary amount was added when starting the Marsh apparatus. In the former case—as previously stated—the amount of arsenic was invariably short of the proper quantity, while in the latter case the full amount of arsenic was evolved and collected in the form of a mirror.

Using 40 grms. of zinc it was found that the presence of 0·05 to 0·08 grm. of copper was required in order to ensure the complete evolution of all the arsenic. The Marsh apparatus which I have used is substantially as described in the paper to which I have referred, except that the funnel tube is very much shorter, the funnel being just clear of the stopper; the cork shown is not used, but a hollow glass stopper carrying the exit tube and the funnel is substituted for it. The generating bottle is placed in a beaker of cold water during the operation. For drying the gas I use a U tube, one leg of which is packed with filter paper and cotton wool and the second limb with granulated calcium chloride. The tube is of combustion glass 6 mm. internal diam. and of such length that at least two inches of the full-sized tube projects beyond the furnace, followed by about three inches drawn out to about 1 mm. internal diam., finishing with a finely drawn out jet.

The determination is made as follows:—2 grms. of the finely ground ore is treated in a covered beaker with 20—30 drops of concentrated sulphuric acid, then sufficient nitric acid is added and digested on a water bath until decomposed. I may here mention in passing that pyritic ores of copper are far more rapidly decomposed in this way than by heating at a higher temperature and without the annoying formation of sulphur globules. When the decomposition is completed, the cover and sides of the beaker are washed down and the solution evaporated n the beaker, first on the water bath and finally on the and bath, until nearly all excess of sulphuric acid is emoved. When cool, the residue is taken up with water, eated, and filtered. The filtrate is received in a beaker of uitable size for plating out the copper by the well-known lectrolytic method, either on a platinum cone or—as I refer—on a platinum cylinder. A previous determination f the copper on another portion of the ore having been made, it is easy to stop the electrolysis of the solution for he arsenic determination while it yet retains the proper mount of copper, *viz.*, 0·05—0·08 grm. The platinum cathode with its coating of copper is now washed in a dish, and the solution in the beaker with the anode is heated until all deposit on the anode has dissolved. The anode is then also washed in a dish and the contents of the dish added to the beaker and the whole evaporated down to a small bulk, about 5—10 c.c. The hydrogen bottle has, in the meantime, been charged with 40 grms. of zinc and dilute sulphuric acid (1—7 of water) run in, in sufficient quantity to cover the zinc. After the gas has been coming off freely for about 10 minutes, the gas burners are lighted and the tube heated to a red heat for a length of about 6 ins. At this stage the solution is transferred to the funnel, the stop cock of which has already been set so as to deliver the liquid in drops at the rate of about 2—3 a minute. Additional acid is added to the solution in the funnel, if necessary, in order to keep up an even production of gas, and the funnel is finally washed with this acid. The time required to pass the solution from the funnel to the flask will vary with the quantity of arsenic present. For quantities up to 2 mgrms. I allow about 2 hours and an extra hour for every additional mgrm. When the whole of the solution and washing have been transferred to the bottle, the heating of the tube is continued for about 15 minutes. The gas jets are now extinguished and the tube allowed to cool while the current of hydrogen still passes. When the tube is only just hand warm, the portion containing the mirror is cut off, wiped clean and placed in the desiccator, and weighed after 20 minutes. After weighing, the arsenic is dissolved from the tube with nitric acid, the tube washed with water and dried in the water oven and re-weighed, the difference between the two weighings giving, of course, the amount of arsenic.

It is needless to remark that blank experiments must be made with the zinc, sulphuric and nitric acids used.

It will be noticed that the process described involves the use of only three reagents, which are not difficult to obtain free from arsenic. The balance used is a fine instrument by Sartorius, which turns easily with 0·05 mgrm.

Discussion.

Mr. Fairley said as far as he could judge the process was an exceedingly good one. It seemed remarkable that the arsenic could be weighed in the manner described. It was evident that a very delicate balance was necessary, and he should like to know what the actual weight of arsenic obtained in a number of experiments might be. He gathered that the author operated on 2 to 4 grms. of ore which contained very minute quantities of arsenic, so he would have a very small quantity to weigh.

Mr. Grant Hooper asked if Mr. Cloud had had any experience in the estimation of arsenic in copper by Clark's process. A valuable paper was brought before the Society by Mr. Platten some years ago in which he pointed out the advantage and convenience with which arsenic in small quantities could be estimated in copper by dissolving the metal, preferably in the form of turnings, in ferric chloride solution and distilling it. He was aware that Mr. Cloud had specially referred to the estimation of arsenic in copper ores rather than in metallic copper, but it seemed to him that it must frequently happen that the quantity he had to deal with might turn out to be very much larger than would be suitably estimated by such a means as he had brought forward. If the nitric acid solution to which he referred were evaporated down, redissolved in hydrochloric acid, reduced by sulphurous acid or sulphite, and then added to Clark's solution in a small flask and distilled, a very ready means was presented of estimating even an exceedingly small quantity of arsenic. Two-tenths of a mgrm. of arsenious sulphide obtained by a distillation process of this kind could be accurately weighed and its identity established, but if the quantity of arsenic was still too small to be capable of any such gravimetric estimation then a portion of the same nitric acid solution reduced as described might be put into some such apparatus as Mr. Cloud had brought before them, but instead of weighing the tube with and without the arsenic mirror he would suggest that a more practical and certain way with such an exceedingly small quantity of arsenic would be to compare standard mirrors.

Mr. Cloud, in reply, said the quantities they had to deal with were too small for a distillation process, which they had used where they required to separate arsenic and antimony in any ores where these occurred in fairly large quantities. He quite agreed that in the case of very small quantities the standard mirror as applied to the process he had brought forward would very materially assist the work both in the matter of time and probably in accuracy. The quantities actually weighed were down to 0·1 mgrm. The balance turned to 0·05 mgrm., but anything lower was rarely actually weighed, for if 2 grms. of ore was taken and the arsenic in the tube appeared to be below the weighing capacity (the chemist soon got to know whether the quantity was worth weighing or not), he simply reported that it was below a certain amount which was sufficient for the practical operations of the smelting works.

TESTING COLLOIDS.

BY EDMUND J. MILLS, D.Sc., F.R.S., AND ARCHIBALD GRAY, F.I.C.

The testing of colloids is generally effected by methods which are in the main chemical, and have for their object to ascertain the amount of the particular colloid, ash, water, water absorbable, &c., in this way procuring some check on the quality and cost of the preparation. These methods are generally very easily carried out. On the other hand, and in supplement to the chemical processes, some physical examination is indispensable. Thus, we may determine the breaking strain of a glue-joint, or of the surface of a starch paste of known percentage value. For the most part, however, the manner in which the colloid behaves in practice is generally accepted. Such methods are distinctly imperfect, and beset with many difficulties.

In this paper we desire to place on preliminary record a physical method of testing which, though still far from being as successful as we could wish, is capable of giving results of some practical value, especially in the comparison of one colloid with another. Briefly described, it consists in coating a standard cotton thread with a given colloid, drying it, and determining the modulus of elasticity of the coat. The value of this modulus is directly related to the stiffening power of the colloid.

Preparation of the Thread.—The cotton thread we selected for our work was Brooks' No. 12 white, mainly on account of its freedom from finishing ingredients. In order to render the outside of this as smooth as possible, we constructed a little singeing apparatus, and with this burned away the projecting ends which surrounded the thread. The colloids we employed were potato starch, maize starch, and gum arabic. We made these into a paste or solution of known strength, immersed the thread in them, and then drew this through a perforated nozzle sectionally illustrated in Fig. 1. This having been repeated several times, the thread, generally a metre in length, was hung up to dry at the ordinary temperature with a weight of 18 grms. at its lower extremity. The nozzle was made of German silver, and its narrow tubulus was almost exactly 0·5 mm. in diameter. Various strengths of paste or solution were employed. The dried threads were cut into lengths of about 0·2 m. each, and the cuttings kept in tubes closed at both ends; these were opened the day before the readings were taken. Starch pastes could be dried in one night, but gum arabic required about four days.

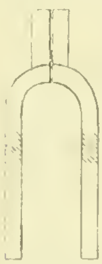


Fig. 1.—Nozzle for Coating Thread. × ½.

Determination of the Modulus.—The apparatus we used was extremely simple and constructed in the factory. As will be seen from Fig. 2, it consists of a couple of blocks capable of being moved towards or from each other by means of a right and left screw working in a bed below them. Each block carries a piece of quill glass tubing "scorched" at the inner end so as just to smooth the sharp edge. A thread was placed with either end in a tube, and its length measured by means of a verified millimetre scale. When the thread is lowered by a weight, or by its own weight, its length is $\frac{1}{3}[8a - A]$; where A is the chord of the whole arc = distance apart of the glass tubes, and a is the chord of half the arc. The deflections produced by adding a given weight, and the radii of the threads were measured with the laboratory kathetometer; doubtless a low-power microscope with micrometer eye-piece would do equally well. Our weights were S-shaped hooks of very thin copper wire, each weighing 0·03 grm., and up and down readings were always taken. A screen of thin transparent glass was placed between the observer and the thread.

If E is the modulus of elasticity, P the weight (kilos.) attached, l the exposed length (millimetres) of thread, s the deflection produced by the weight, and r the radius of the thread, $E = \frac{1}{12} \times \frac{P}{s} \times \frac{l^3}{\pi r^4}$; this is the ordinary formula for the modulus in the case of a circular section (kilos. per square millimetre of section). It is, of course, only approximately true for a mixed system of cotton and colloid. The value of the modulus for the thread alone was found to be—

$$E = \frac{1}{12} \times \frac{0{\cdot}00001}{0{\cdot}1885} \times \frac{(15)^3}{\pi(0{\cdot}2717)^4} = 86{\cdot}9,$$

a quantity to be deducted from all the observations.

Potato Starch.—The pastes were very roughly of 2, 3, 4, and 5 per cent. strength. They were prepared by grinding starch with cold water, heating on the water-bath until "made," and then straining through muslin. The exact amount of starch in the paste was determined, and corrected for ash. The results were as follows:—

Starch.	Deflection.	Radius.	E.	E calc.
Per Cent.				
1·83	0·2860*	0·225	135·2	..
2·68	0·2300*	0·220	183·9	181·9
3·34	0·3613	0·245	208·9	206·1
3·82	0·3125	0·250	222·7	226·7

* l = 50 mm. only; in all other cases 70 mm. nearly.

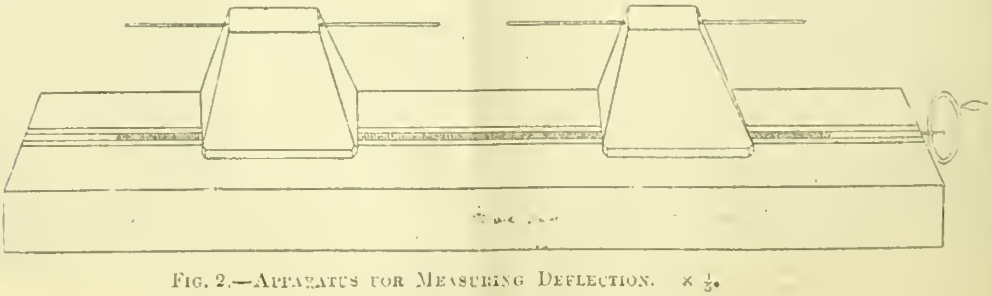


Fig. 2.—Apparatus for Measuring Deflection. × ⅓.

The equation is (c = colloid) E = 86·9 + 35·7 c. Probable error of a single comparison, 2·5 = 1·2 per cent. on the average E determined. Sum of the errors, 0·7.

[As regards the first experiment, see under Gum Arabic.]

Maize Starch.—Here the individual determinations were less satisfactory.

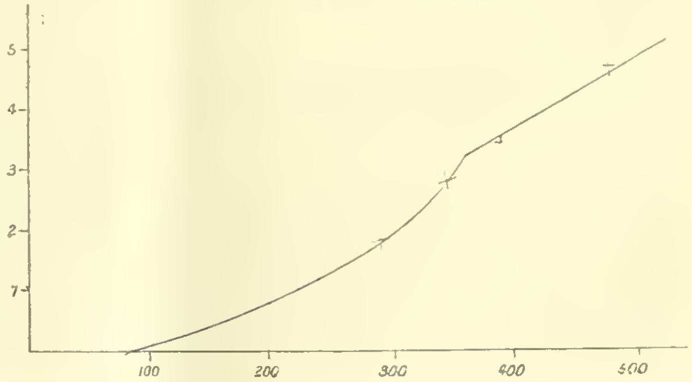
Starch.	Deflection.	Radius.	E.	E calc.
Per Cent.				
1·84	0·4517	0·1951	136·4	..
2·41	0·2855*	0·2074	187·5	203·5
3·70	0·4738	0·2160	263·6	270·3
4·62	0·4360	0·2079	333·7	310·5

The equation is E = 86·9 + 48·4*c*. Probable error of a single comparison, 13·8 = 5·3 per cent. on the average result. Sum of the errors, 0·7.

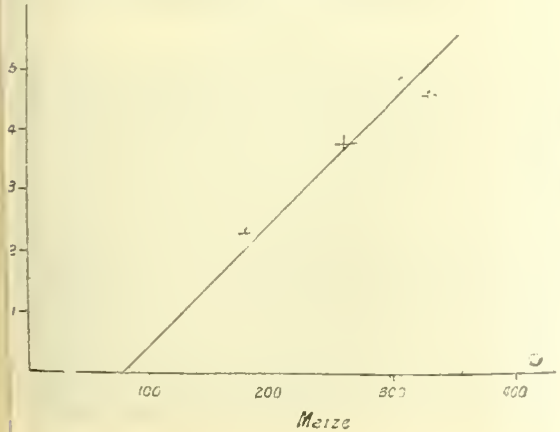
Gum Arabic.—The results were as follows:—

Gum.	Deflection.	Radius.	E.	E calc.
Per Cent.				
1·84	0·5940	0·1958	293·0	292·8
2·87	0·5022	0·1988	346·6	346·8
3·64	0·3898	0·2051	385·5	388·3
4·71	0·3633	0·1988	479·0	476·9

The equation, as before, to the last two results and the origin, is E = 86·9 + 82·8*c*; the equation to the first two results and the origin, is $E = \frac{194·7c}{1+0·4c}$. Probable error of a single comparison (first equation) 1·69 = 0·4 per cent. on the average value determined. Sum of the errors, 0·7.



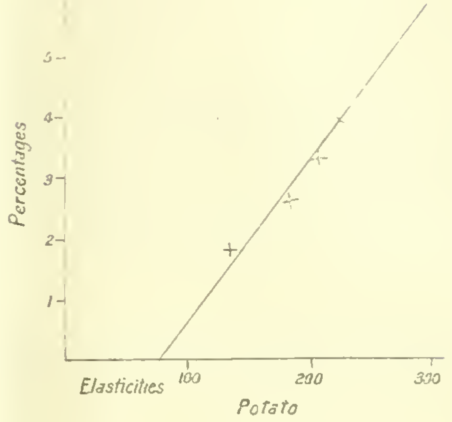
It was some time before we were able to interpret our experiments. At length it occurred to us that we were really dealing with two independent effects. Gum arabic may be regarded as an organic salt of lime, magnesia, and some other bases. When a solution of it is in contact with cotton, the cotton takes up lime or gum as a whole, and so becomes mordanted, or combined, making the elasticity too low. When this effect has ceased, further treatment with the gum produces the usual stiffening effect only. As other colloids generally contain a little mineral matter, the same result will be obtained with the earlier quantities of these, and for this reason we have not considered the first figures in our maize and potato experiments. In the case of gum arabic the phenomenon is naturally much more marked; the earlier effect is represented by the hyperbola usual in such cases; the later or normal effect by a straight line.



The two effects meet at the common point—

$$86·9 + 82·8c = \frac{194·7c}{1 + 0·4c}$$

whence *c* = 3·38 and E = 366·8.



Comparative Values. — The linear equations above obtained give us the modulus of elasticity per per cent. of coat. As the sum of their errors are in each case the same, we are in a position to compare the relative values of the three colloids. These are 35·7 : 48·4 : 82·8 for potato, maize, and gum respectively—numbers which are very nearly in the simple ratio 3 : 4 : 7 :—

$$\left.\begin{array}{l} 35·7 \div 3 = 11·9 \\ 48·4 \div 4 = 12·1 \\ 82·8 \div 7 = 11·8 \end{array}\right\}$$

In 1903 the average prices of potato starch and gum arabic were 12*s.* and 28*s.* per cwt.,—values strictly proportional to the elasticities. Maize starch is in general 3*s.*—4*s.* dearer than potato starch, and its price, therefore, should also follow the same relation. But quotations for maize starch were so anomalous and irregular (5*s.*—18*s.*) in that year as seldom to correspond to a true economical value.

In actual practice it would be easy to prepare and keep a number of smoothed threads coated to a given percentage (say 5 per cent.) with some given colloid; then coat some of the same thread with the same amount of a new sample, and place the two side by side in the machine. On opening the jaws, the weaker would be bowed the more. But for the comparative values of different colloids the work should be done as we have previously described.

We had intended determining some elasticities, using aluminium wire instead of thread; but circumstances have precluded our continuing these experiments.

We wish to record our thanks to Messrs. Findlay and Faill for assistance* in this investigation.

Discussion.

Mr. E. F. **Renwick** regretted the authors had given no information with regard to the behaviour of gelatine. Was it not possible in these 1 per cent. solutions that the material itself did not retain the form of the fibre? Possibly the section became elliptical instead of remaining circular, or the actual solution "ran" after the fibre was coated. Was the thread dried vertically or horizontally? In the case of gelatine he had frequently noticed marked changes in its properties according to the rate at which it was dried and he would like to know whether the drying conditions affected the elasticity in any way. Many people who had to do with colloids were concerned rather with different samples of the same colloid than with the differences between different colloids. Did different samples of the same material show marked differences of behaviour when tested by the author's method?

Mr. J. L. **Baker** thought the fluctuations which had been noticed in the price of maize starch were probably due to the glucose industry rather than to its colloidal nature, because the glucose manufacturer used the cheapest raw material on the market.

Mr. H. H. F. **Hyndman** asked if Prof. Mills had ever thought of using the method of oscillation instead of deflection. In such a method as this, where a fibre has been dealt with, it would be more accurate to employ an oscillation method, which could be used in a glass tube, and where the thread would be less affected by external conditions than by a deflection method, where there were more chances of inaccuracy. It might also possibly answer the question of the first speaker with regard to the testing of the same material under different conditions, because a fibre when hung vertically was less liable to alter its condition than when hung in the way described from two tubes, where a slight alteration of the arrangement of the tube, or the shape of the ends of the tube, would materially alter the coefficient of elasticity.

Mr. **Grant Hooper** asked if in these experiments Dr. Mills had had regard to the moisture of the atmosphere? In damp weather he thought it might be found that the moisture of the atmosphere was quite sufficient to considerably affect the result. As a practical application, he would like to hear whether any tests had been made with glues.

The **Chairman** said this was an exceedingly interesting paper, referring to a matter on which they all wanted more light. Even if this were not an ideal method, which would hardly be claimed for it, it was an important contribution to their knowledge. A method of estimating colloids, which would be absolutely accurate, was much sought after, and he was not aware that one had been devised. There were some points to be considered in connection with the method before them as to whether there might not be sources of error; for instance the fact that the thread used was a bundle of fibres, and the solution cemented the fibres together and in that way produced a greater or less stiffness of the thread on which to some extent the method was based. If a 5 per cent. solution of gum was compared with one of 2 per cent., the latter would sink into the fibres and cement them, but the former solution would not sink in so far and would cement them in a different way. There he thought there was likely to be a source of error not indicated in the figures obtained. Aluminium would, perhaps, be rather too strong, because the strength of the coating material would be small compared to the strength of the aluminium wire. Why not try a lead wire, or something still softer? Again, with regard to the coating of the thread. He feared that would differ according to the number of times it was passed through a solution, and also according to the strength of the solution. He had coated a great number of fibres of various kinds, including silk, cotton, ramie, and he found the weight per hundred yards varied very much according to the number of coats put on. They had either to take a considerable number of coatings, which would leave a very small margin for difference, or else to very carefully specify, not only the number of coatings but also the temperature at which it was done, and the ratio between the diameter of the thread in the loose state, and the nozzle through which it was pulled. Again, he thought the formula used for the thread, referred to a cylindrical body; but the thread was not only not cylindrical, it was spiral. It was also composed of fibres in a state of tension, and different samples might be in very different states of tension, although they might all be sold as Brook's best thread. They knew how thread was made, and how it differed not only according to the number of times the cotton was drawn out in the drawing rolls, but also according to the state of the drawing rolls; cotton might be passed in the process of spinning through the same rolls a definite number of times, but the same result was not obtained if the rolls had been in use for a fortnight or for two months. The difference might not be appreciable for sewing purposes, but for a test of this kind it was a serious consideration. Speaking in general terms he did not like the use of the thread at all. As to the prices, he thought there were many points besides the testing of the material which influenced them. He was inclined to believe that cordite had the most influence on the price of gum arabic.

Prof. **Mills** said he was much obliged for the various suggestions which had been made, and only regretted that Mr. Gray and himself could not continue their experiments and test some of them. They had unfortunately been unable to adopt the usually more accurate method of torsion, because it produced intrinsic twist. From the starch pastes, nothing soaked into the thread but water, leaving what had to be presumed to be a cylindrical coating of starch on the outside. On the other hand, gum arabic soaked in, and up to about a 3 per cent. strength produced the peculiar mordanting effect to which he had referred. A thread which had been pulled through the nozzle five or six times might be taken as having a fairly cylindrical coat. Their experiments, on repetition, gave very much the same results as before; they were always done in the same room heated by sufficiently distant water-pipes. Gelatines they had not tried, drying the threads in a horizontal position would have led to an undesirable bowing. He was, of course, aware that maize starch was largely in demand for glucose making, but its use as a stiffening material and as a finish by calico printers must be an important factor in the price, which, in any case, would depend on many other practical conditions. He was, however, informed on good authority that the main condition in very recent times had been the process now so well known under the name of "dumping."

INCANDESCENT ALCOHOL LAMPS.

BY THOS. TYRER.

Mr. **Thomas Tyrer** exhibited some incandescent lamps for burning alcohol which had been shown recently at the Society of Arts. The illuminating power, as could be seen, was certainly quite equal to or exceeded that of incandescent gas light. His object in showing these lamps now as well as at the Society of Arts was to illustrate an extended use of alcohol, which was daily becoming more common in Germany. Two of the lamps on the table were lent by Mr. W. H. Massey, Engineer to the Royal Palaces, who, hearing that a paper was going to be read at the Society of Arts, kindly offered to lend them. They were identical with those exhibited at Sandringham on a well known occasion. The lamps with glass bowls showed the arrangement of the wick and the wastage of spirit. These bowls as now seen had been alight about five hours. They had been again lit that evening and without replenishing all could see how little spirit had been used. There was no inconvenience or

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* Our work was well advanced when we found (Polleyon's "Die Appreturmittel," p. 49) that Prof. Wiesner had been working in the same direction. His method consisted in pushing upwards a coated thread through a clamp, until the remote end fell over, and came to the same level as the clamped end: the bowed length was his measure of comparative elasticity. He must, however, have far exceeded the elastic limit: and the results obtained were consequently unsatisfactory. His process of coating consisted in passing the pasted threads through the fingers.

smell. If they had been petroleum lamps it would have been scarcely possible to have had so much service out of them without betraying some smell and sootiness. Ordinary methylated spirit was being employed in these lamps. One of the lamps belonging to Mr. Lorenz had been in use for more than two months constantly, and nothing had to be done to it, but the very simple operation of filling the reservoir through the ordinary screw inlet when required, and setting the lamp going by means of the ignition of a few drops of spirit. There was no corrosion, no interference with the mantle, which had not been renewed; and the lamp never need be disturbed, as was the case when ordinary petroleum was used. Mr. Massey told him that he had six of them in use, that they ran for 11 or 12 hours without replenishing, and there was no trouble with them whatever; very little heat was given off, and the cost was $\frac{1}{6}$th penny per hour with methylated spirit at 2*s.* 4*d.* a gallon. The lamp was very simply lit, being that known as the "Amor;" a little filling instrument was provided by which a very small quantity of spirit was poured on to a platform just below the mantle and then ignited. The heat from that small quantity was conveyed to the wick tubes, capillarity was excited, the spirit was vaporised, and incandescence reached its maximum in from $\frac{3}{4}$ to 1 minute. A suggestion had been made that a lamp of this kind would be very useful for microscopic purposes, and he had no doubt that Mr. Lorenz would make enquiry as to that. He, the speaker, brought the matter forward because the Society had been associated with the Chemical Committee of the London Chamber of Commerce in promoting the industrial use of alcohol; and as it was a rigid rule of the Council and the Publication Committee not to permit correspondence to the Journal, he had asked permission to put these lamps before them in connection with one application for alcohol. The other apparatus shown included cookers, large and small ironing heaters, water boilers, milk warmers, vaporisers, curling iron heaters, &c., all of which worked simply, cleanly, and sufficiently. He was indebted to Mr. Joseph Flack for their use. He would conclude his remarks by the statement that the use of alcohol for motive power had enormously increased on the continent, and the quantity used for power, lighting, and heating greatly exceeded that used for Chemical ndustries.

The CHAIRMAN said they were much indebted to Mr. Tyrer for this interesting exhibit, and also to Ir. Lorenz and Mr. Massey who had lent the lamps. They already owed a great debt to Mr. Tyrer in connection with this subject, to which reference was now being made n various quarters, and papers were read before various ocieties, but most of them were simply digests of those hich had appeared in the Journal of their Society.

New York Section.

Meeting held at Chemists' Club, on April 22nd, 1904.

DR. VIRGIL COBLENTZ IN THE CHAIR.

IDENTIFICATION OF GUTTA-PERCHA AND ALLIED GUMS BY MEANS OF THEIR RESINS.

BY WILTON G. BERRY.

Having had occasion to look up the subject of gutta-percha and chicle gums for methods of distinguishing them from each other and from certain other allied pseudo gums of similar appearance and composition, aside from their physical characteristics, which are sometimes misleading, it became evident that, with exception of gutta-percha, scarcely any available analytical data was at hand, so far as I am aware, to apply in such emergencies, the pseudo gums and even chicle having received scant attention aside from their physical appearance and characteristics.

While engaged in working out suitable methods for identifying the various gums, it seemed that the most promising field lay in ascertaining the characteristics and constants of the individual resins peculiar to each, together with their possible relations to the hydrocarbons present. This line of proceedure, in the case of the few already experimented upon, has been so satisfactory that it seems much may be hoped for, and it may be of interest to put forth what data has so far been gathered on the subject. Future work in this line will be presented later.

Owing to the difficulty of securing representative samples, and from these, sufficient quantities of the resins to work upon, results will necessarily be slow in attaining. The present article relates to the general appearance and characteristics of the various resins so far isolated, with their saponification and acid values. Other constants will doubtless likewise be of value towards distinguishing them, and it is hoped from these facts, from a quantitative analysis of the corresponding gum and the apperance of the extracted hydrocarbons, that it will be possible to identify any given sample. The resins present are more or less extracted by the various resin solvents, but in the following experiments boiling absolute alcohol is the solvent used on the previously dried material, the results given being in each case on the resins thus extracted. Possibly other solvents might yield resins differing somewhat in their constants.

The only resins thus far investigated by experimenters to any great extent seem to be those from gutta-percha (albane and fluavil), combined in the gum in the proportions of about one of the former to three of the latter. The resins of chicle gum, tuna, balata, and doubtless many of the other gums, may each likewise be separated into at least two resins, combined in proportions differing from those of gutta-percha and in some with very decided differences. Thus far only the corresponding resins of chicle have been experimented upon and treated of in this article, being designated as Resin A and Resin B in default of names.

The various resins are in general amorphous bodies, varying in color in the melted state from almost colourless to deep yellow. The hard resins when powdered are almost colourless or slightly yellow. Their consistency is hard or brittle, pasty or liquid. Some are capable of crystallizing. The constants were obtained by saponification, with boiling N/2 alcoholic potash and titration hot with normal hydrochloric acid, or in the case of acid values with N/10 acid. The acid values are very low, in some cases nil, hence the resins are combined and contain but small amounts of free resin acids. Saponification under pressure might afford higher values. Of course, to obtain satisfactory deductions many determinations should be taken on different specimens of the same gum, and the results given below can be taken only as indications of the probable constants in each case.

The accompanying quantitive determinations were obtained on the dry material by extracting successively with hot acetone, alcoholic potash, and petroleum ether. Quantitative determinations of the resins and gutta in gutta-percha are omitted, as they are too well known to remark upon.

Gutta-percha (P ilaquium Sp.).

Resins: Soft and pasty, yellow.

——	I.	II.	III.	IV.
Saponification value	79·8	77·4	79·5	77·3
Acid value...............	5·0	5·0	5·0	5·0
Ester value	74·8	72·4	74·5	72·3

Saponification value: Albane, 83·50; fluavil, 71·45.

A sample of very old, hard, oxidised gutta-percha ("dead gutta") consisted of 96·75 per cent. resins with 0·25 per cent. gutta. The resins are very dark brown yellow, about the consistency of beeswax, with saponification value, 166·75. This sample is interesting, as showing the deterioration and change which goes on as a result of oxidation, the gutta being changed almost completely into resins. The high saponification value of the resins would indicate that the oxidation of gutta proceeds much further than the change into albane and fluavil, the final product being resins of an entirely different nature.

Chicle (Achras Sapota).

Composition.

—	I.	II.	III.	IV.
Resins	55·78	38·08	43·78	35·60
Hydrocarbons	13·81	10·39	11·29	10·50

Resins: Hard, brittle, grayish-yellow.

—	I.	II.	III.	IV.
Saponification value	101·7	103·6	103·0	104·1
Acid value	trace	trace	trace	trace

Saponification value: Resin A, insoluble in cold absolute alcohol, 129·0; Resin B, soluble in cold absolute alcohol, 100·8.

Hydrocarbons: Tough, inelastic, almost colourless.

Tuno (sterile rubber tree, Cent. Am.).

Composition.

—	I.	II.
Resins	86·13	80·0
Hydrocarbons	3·50	7·06

Resins: Hard, brittle, dark yellow.

—	I.	II.
Saponification value	78·5	76·0
Acid value	5·76	5·46
Ester value	72·74	70·54

Hydrocarbons: Sticky, inelastic, brownish-grey.

Almeidina (potato gum, W. Africa).—Composition: Resins, 82·78; hydrocarbons, 9·40.

Resins: Hard, brittle, yellow. Saponification value, 50·4; acid value, 11·0; ester value, 39·4.

Hydrocarbons: Soft, sticky, greenish-brown.

Jelutong or Pontianak (Dyera Costula).

Composition.

—	I.	II.
Resins	76·55	75·00
Hydrocarbons	16·04	19·40

Resins: Soft, brittle, yellow.

—	I.	II.
Saponification value	76·6	78·4
Acid value	trace	trace

Hydrocarbons: Soft, sticky, dark brown.

Balata or Bully Tree (Mimusops Sp.).—Composition: Resins, 25·08; hydrocarbons, 47·60.

Resins: Turbid, liquid, yellow. Saponification value, 69·2; acid value, trace.

Hydrocarbons: Tough, inelastic, nearly colourless.

Payena ("Yellow Gutta").

Two samples of uncertain origin, probably payena sp., are interesting as illustrating a gum of dual composition containing the hard resins characteristic of chicle, and the elastic caoutchouc-like hydrocarbon characteristic of rubber. This gum is known as "yellow gutta," but seems to be more nearly allied to rubber than to gutta-percha.

Composition.

—	I.	II.
Resins	79·75	80·00
Hydrocarbons	11·59	12·38

Resins: Same as chicle resins, in appearance.

—	I.	II.
Saponification value	103·4	104·1
Acid value	trace	trace

Hydrocarbons: Similar to caoutchouc.

Balata is also sometimes classed as gutta. If the hydrocarbons respectively from gutta-percha, chicle, and balata, be extracted with ether and precipitated therefrom by alcohol, they will differ from each other in several particulars, as follows:—Gutta-percha separates in pinkish white flocculent masses; solution clear. Chicle separates in pure white flocculent masses; solution very milky. Balata separates quickly in tough pinkish white agglomerated masses; solution turbid.

Average Saponification Values of Resins.

Gutta-percha	78·5
Albane from gutta-percha	83·5
Fluavil „ „	71·45
Chicle	103·1
Resin A from chicle	129·0
Resin B „	100·8
Tuno	77·3
Jelutong	77·5
Almeidina	50·4
Balata	69·2
Payena Sp.	103·7

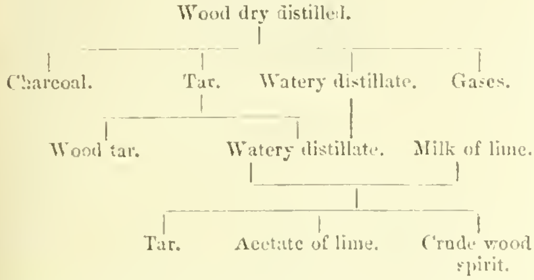
The saponification values of gutta-percha, tuno, and jelutong resins are nearly identical, but the accompanying hydrocarbons are quite different. A further separation of the resins of tuno and jelutong into their several component resins, as in the case of gutta-percha resins into albane and fluavil, will effectually differentiate the one species from the other.

ANALYSIS OF COMMERCIAL ACETATE OF LIME.

BY W. M. GROSVENOR, JUN.

As there has recently been considerable discussion of methods for the analysis of acetate of lime, it seems proper to present some points from the acid manufacturer's side. The financial aspect of the subject is as interesting to him as to the dealer. Added interest, however, is found when investigation of new methods of manufacture and minor economies begins. For some purposes, greater accuracy, but especially greater reliability is desired than for commercial work. No method is reliable until its sources of error are known and can be guarded against. The subject, therefore, has been investigated from time to time in several of the General Chemical Company's laboratories, but the work has been frequently interrupted and is not by any means complete. The rigorous testing of the distillation method has been done by Mr. Bishop at our Laurel Hill Works under the guidance of our chief chemist, Mr Ferguson.

Like many substances presented to the chemist for commercial assay, acetate of lime is a mixture of compounds s closely related as to practically defy attempts at accurat analysis. Those familiar with its manufacture can best realise its complexity. The grey lime on the market results, as a rule, from the following series of steps:—



The two watery distillates are combined and redistilled through boiling milk of lime. The products of this destructive distillation which are certain to combine with the calcium are the acids, formic (99° C.), acetic (119°), propionic (140°), butyric (163°), normal- and iso-valerianic (186° and 174°), caproic (205°), and normal- and iso-crotonic (182°). Further some 30 other products have been isolated, many of which may be present in traces along with calcium hydroxide, calcium carbonate and mineral acids, particularly hydrochloric, which is sometimes used to slightly acidify these liquids in recovering certain bye-products. The complete separation of acetic acid from such a mixture will be possible only by improvements that revolutionise organic analysis. Practically all the acids are volatile with steam, most of them distilling out faster than acetic. The solubilities of the salts are graded and electrolysis produces mixed condensation products. Several methods of separating the earlier members have been suggested, *e.g.*, that of Holzmann based on fractional liberation from salts and distillation, acetic and formic acids being liberated last and largely together. Also Leys determines formic acid in presence of acetic acid, alcohol, or aldehyde by a precipitation of mercurous acetate, while Haberland has proposed to remove propionic acid as a basic lead salt, formic acid by taking advantage of the insolubility of the zinc salt in absolute alcohol, and finally to separate the acetic and butyric acids by crystallising the silver salts.

So far as we can learn, the only analytical method relied upon in Germany is that originated by Fresenius and modified by Stillwell and Gladding, which will be considered in detail later. Some analysts show a strong proclivity for begging the question, assaying for acetic acid by determining calcium. Other workers precipitate the calcium with excess of sodium sulphate, filter, evaporate, ignite, dissolve in a known amount of hydrochloric acid and titrate back. Many experiments with this method have failed to remove all the acetic acid from the precipitate; organic impurities in the filtrate are likely to reduce the calcium and sodium sulphate on ignition and give high values, and the method has a further objection of frequent manipulations and loss of time. The precipitation method of Fresenius has not been carefully examined, but as described seems less rapid than the distillation test.

The two methods of analysis largely used in America are the so-called "English Commercial test" and the distillation test. The former has in the last few years been deservedly rejected. The method simply consists of a determination of the calcium by ammonium oxalate, and it seems strange indeed that chemists, of all men, should have been willing to buy acetic acid raw material on its contents of calcium. Obviously limes can be made to show 80 per cent. "Commercial Test" and yet contain anything from zero to 77 per cent. of actual acetic acid, equivalent to 102 per cent. of calcium acetate. Years of experience on commercial acetates show the error of this test to vary from + 3 to − 2 per cent. of the acid actually obtainable.

The distillation test at worst should give, within a few tenths of 1 per cent., the true value of the lime for manufacture of acid. From the seller's point of view, it has the advantage of never giving falsely low results, while the manufacturer knows that all the acid represented is saleable as acetic acid. Overlooking the inclusion of other organic acids (small percentages of which are not objectionable in commercial acetic acid), the method is sound, and only requires the use of proper precautions. Finally, it can be made available for many research purposes by avoiding in the experiment the presence of other fatty acids. Analytical difficulties occur solely in separation, as there is no difficulty in making correct determinations of pure acetic acid within 0·02 per cent. For commercial purposes, however, analysis must be preceded by correct sampling, the vital importance of which is too frequently overlooked. We are not, as a rule, dealing with material in bulk, but in bags. The material is not homogeneous. No lime plant in America makes a 50,000 lb. carload in a single pan; parts of a car are sure to come from different runs. Different parts of each bag will differ noticeably in composition, not through any sharp practice in filling, but because calcium acetate is hygroscopic and common changes of weather alter its moisture contents from 2 to 12 per cent. Thus the outer layers of the bag may be better or worse than the average, depending on the exposure. (Table I.) Even individual pieces of rge size will show variations, for the solid is not rystallized or even fished out, but dried down with its other liquor in it. (Table II.) When it is remembered at calcium acetate has the solubility curve shown in ig. 1, and that the dried material, consisting largely of $Ca(C_2H_3O_2)_2, H_2O$ formed at 85° to 100° C., is taken from the pan moist, cools as it goes to the drying benches, and is there heated from below, it is not surprising that large variations should exist. It is therefore desirable that at least every fifth bag should be sampled with a hollow brass

TABLE I.

Hydroscopic Action of Acetate of Lime.

The material treated was: A, a well-mixed sample ground to 100 mesh; B, small lumps of average character and $\frac{1}{16}$th inch in size.

—	A.			B.		
	Weight.	Difference.	Per Cent.	Weight.	Difference.	Per Cent.
Original condition	9·9930	..	100·0	2·00	..	..
Dried 3 hours at 100° C.	9·7729	− 0·2201	2·2	1·9064	− 0·0936	4·68
Dried 1 hour more at 100° C.	9·7641	− 0·0088	0·08	..	..	..
Exposed 1 min. in dry room	9·77	+ 0·0059	0·06	1·9083	+ 0·0019	0·09
„ 2 „	9·78	+ 0·01	0·10	1·9115	+ 0·0032	0·16
„ 4 „	9·79	+ 0·01	0·10	1·9195	+ 0·0080	0·40
„ 10 „	9·8052	+ 0·0152	0·15	..	..	..
At 100° humidity 12 hours	10·8729	+ 1·0677	10·68	..	..	..
„ 20 „	11·1571	+ 0·2842	2·84	2·5684	+ 0·6480	32·49
Exposed 1 min. in dry room	11·14	− 0·0171	0·17	2·5614	− 0·0070	0·35
„ 2 „	11·13	− 0·01	0·10	2·5544	− 0·0070	0·35
„ 3 „	11·122	− 0·008	0·08	2·5492	− 0·0052	0·26
„ 4 „	11·117	− 0·005	0·05	..	..	..
Exposed to constant, 18 hours	9·9548	− 1·1622	11·62	1·9514	− 0·5978	29·89

tube like an apple corer not less than 24 inches long, tapering backward from $1\frac{1}{2}$ to 2 inch bore, $\frac{1}{16}$th inch wall, with strong handles forming a cross about 2 inches from the large end. The small end should be screwed 18 inches into the end of the bag, preferably as it lies in pile, choosing top ends and bottoms about equally.

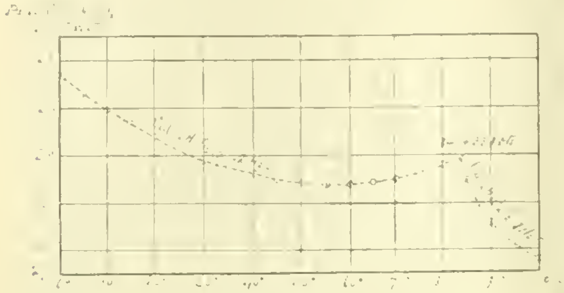


Fig. 1.

Table If.

Analysis of Lumps of Acetate of Lime selected at random from carload that had been about six weeks in dry storage loft. January and February.

——	2-in. Hard Scale.	1-in. Soft Lump.
Inside....................	65·16	65·14
Outside..................	66·27	63·72

In dealing with a hygroscopic and variable material we believe the present methods are open to criticism. Until after the whole sample is finely ground and thoroughly mixed, no small sample can be obtained that fairly represents the lot. Any attempt to thoroughly dry the large lumps is unsatisfactory, and loss by exposure during grinding should be carefully avoided. We therefore recommend the following procedure. The contents of the sampler are discharged into an air-tight vessel, as light in weight as possible, having a capacity of about 3 cb. ft. For this purpose thin-walled rubber bags having rubber necks ¼ in. thick, 3 ins. long, 2½ in. bore possess the advantages of lightness and ease of handling. Also when empty they contain no air to be displaced by the entering lime; the air currents being inward none of the dust is lost. These bags should be numbered, and their empty weights accurately taken. When the filled bag containing 25—50 lb. of lime reaches the laboratory it is carefully reweighed. Its neck is then connected with the inlet of any suitable form of mill having dust-tight casing and bearings, and it is ground through into a similar weighed bag attached to the outlet of the mill. The material retained by the mill should be checked by weighing both bags and contents, and should be less than 0·2 per cent. This could not under any circumstances affect the composition of the rest more than 0·01 per cent. Should the lime as received be too wet for grinding, the neck of the bag may be tightly plugged with cotton to catch dust, connected with a receiver containing pumice and sulphuric and the air exhausted by good suction. Leave in the warm room overnight and reweigh the bag before grinding. While in the second bag the samples may be thoroughly mixed by kneading and shaking. By connecting the neck of the rubber bag with a bottle, the record sample may be taken practically without air contact, and similarly the amount needed for acid and moisture determination placed in proper vessels and covered at once by glasses. Weighing by difference in weight of the bag and using the neck of the bag to distribute it the rest of the sample may be spread upon a large plate for the technical moisture determination to be carried out on 15—30 lb. The distillation sample may be taken after drying (grinding more finely if desired), quartering down systematically on the plate; correcting the distillation result by a special moisture determination on a part of the quarterings.

A most convenient sample jar is the "Lightning" preserve jar, made of glass, provided with rubber sealing rings and a wire fastener. The sampling should be done as near the time of weighing as possible, certainly the same day.

This care may seem unnecessary, but samples of lime have repeatedly lost 0·5 to 1 per cent. in ordinary grinding, and "average" samples from the same car have shown differences as high as 1 per cent. on distillation test. This method requires no more labour than is demanded by a car of 33 per cent. pyrites, which costs about 6 dols. a ton or 18 dols. per ton of sulphur. Acetate of lime is worth 35 dols. a ton, carries about 60 per cent. of acetic acid, equal to, roughly, 60 dols. per ton of acetic acid.

Four analytical samples are to be taken, two for acetic acid and two for moisture determinations. The moisture determination is not of vital importance to most manufacturers and will be passed over with the remarks that careful investigation has repeatedly shown that acetate of lime cannot be completely dried by heat alone without decomposition; that impure limes are much more readily affected than pure calcium acetate; that about 25° C. is the limit of perfect safety for commercial limes, and three hours at 100° C. generally gives nearly constant weight. (Fig. III.) The drying is best done on a ground watch glass in the steam bath, another glass, tared with the first, being used for a cover the instant it is removed from the bath, while cooling and weighing. There is no objection to drying agent in the desiccators used for cooling, as 16 hours over

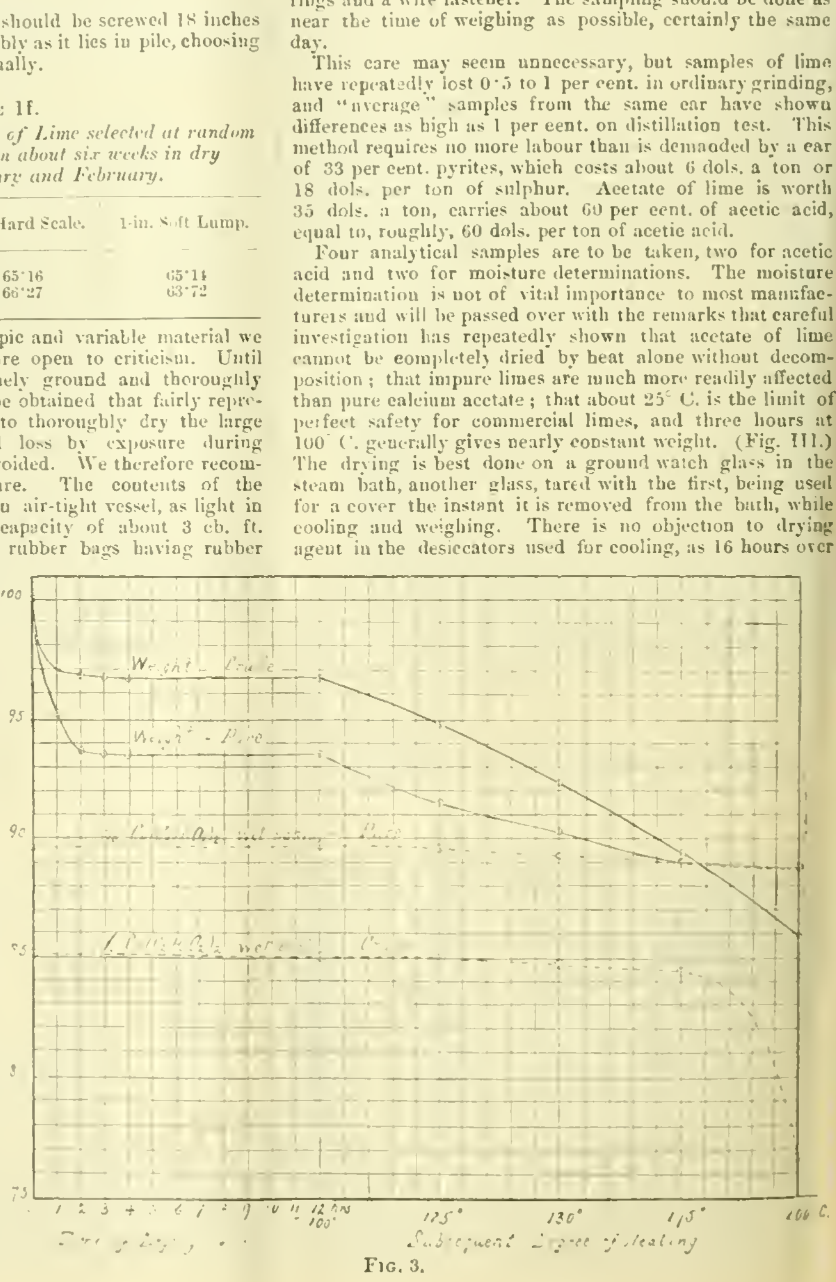
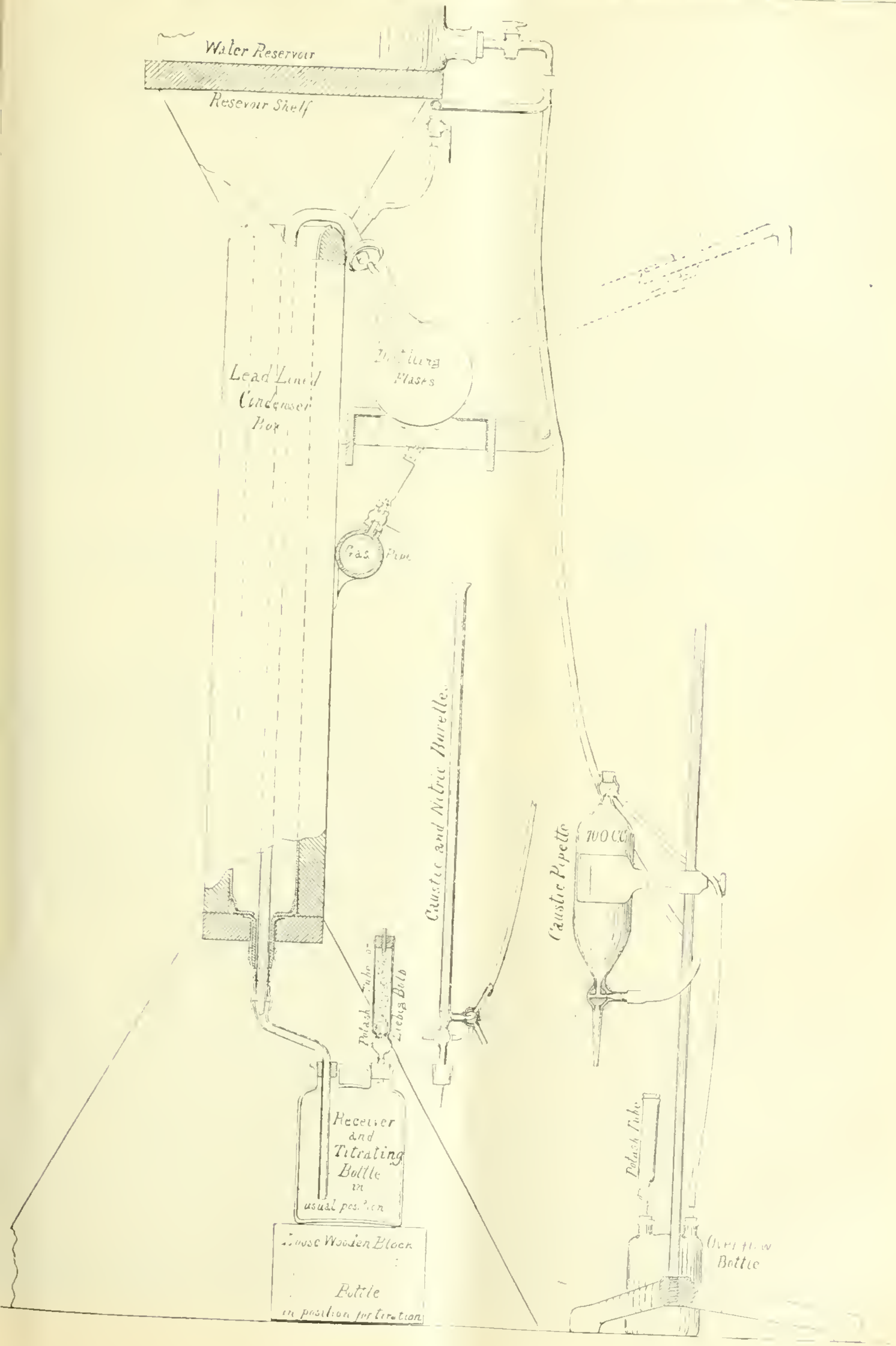
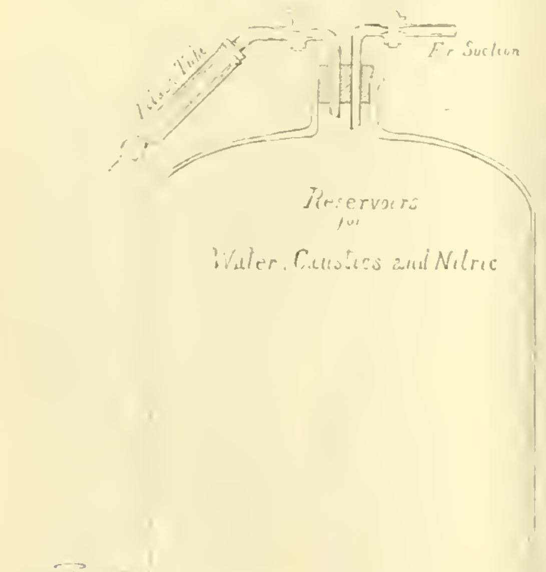


Fig. 3.


Water Reservoir
Reservoir Shelf
Lead Lined Condenser Box
Distilling Flasks
Gas Pipe
Caustic and Nitric Burettes
Potash Tube or Liebig Bulb
Receiver and Titrating Bottle in usual position
Loose Wooden Block
Bottle in position for titration
100 CC
Caustic Pipette
Potash Tube
Overflow Bottle

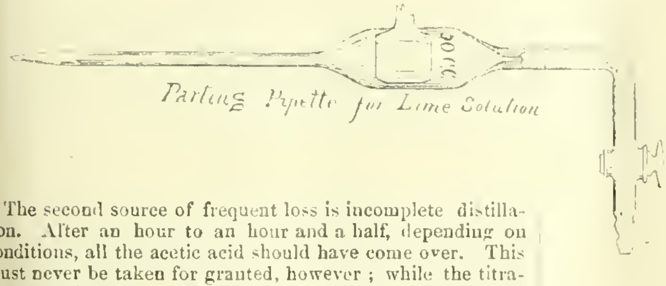
phosphoric anhydride made only 0·02 per cent. difference in weight. For the distillation test exact factor-weights should be used whenever possible, as much more accurate results are obtained. This cannot be done with acetate of lime unless the factor weight be large, and the surface exposed while weighing not only small but well below the rim of the weighing vessel to retard free circulation of air. Our experience indicates that the usual 2 grm. samples of acetate of lime, when either unusually dry or very moist cannot, except by accident, be factor-weighed on a watch glass within 0·1 per cent. Queen beakers of the deep pattern provided with covers of thin glass are very satisfactory, and 20 to 50 grms. is a better weight. After taking the three decimal tare of the beaker and cover, slightly more than the factor weight of acetate of lime is put in it, the beaker placed on the front edge of the balance pan, and the excess of acetate of lime quickly removed by a pair of broad nosed tweezers to within 2 mgrms. of swinging balance, *i.e.*, 0·01 per cent. on 20 grms. In referring to the record sample, portions for analysis may be removed from the sample jar by a thin walled glass tube of about 1 in.-bore, marked at a point which experience shows will contain more than the factor-weight; if this is pushed down at an angle into the ground lime in the sample jar, slightly more than the required depth, on inclining the jar about 60 it can be removed nearly horizontal, its end covered with the Queen beaker, its contents discharged and the beaker at once covered without appreciable error.



For the distillation test, the two samples first trimmed (40 grms. each) should be used. They are washed with cold water into porcelain mortars, gently stirred with successive portions of water decanted into a narrow necked litre flask until practically all of the calcium acetate is dissolved. The residue is thoroughly ground with final portions of water and washed into the flask, which is then made up to the mark, thoroughly mixed, and immediately parted with a 50 c.c. capillary pipette. The pipette should have a 1 mm. capillary upper tube and about $\frac{1}{4}$ in. lower tube drawn down to a 1 mm. opening. A free run from the pipette, taking only the first drop that falls after the stream stops, gives the most satisfactory draining. Working and standardising in the same way with solutions of about the same physical properties (sp. gr., capillary constant, and coefficient of viscosity) this parting can be done with less than 0·01 per cent. error. The pipette need not be quite 50 c.c., nor the flask marked at an exact litre, but 20 pipettes as used must fill the dry flask exactly to the mark. The standardising should have been done at about the working temperature. No correction need be made for temperature. Its effect is only indirect and very small, causing slight variations in draining. This 50 c.c. is placed in a 200 c.c. Kjeldahl distillation flask, and about 15 c.c. of 50 per cent. phosphoric acid is added, the neck of the flask being then washed down with a few c.c. of water from the wash bottle. The phosphoric must contain no volatile acids (particularly nitric). The flask is then connected by a glass tube of not less than $\frac{1}{4}$ in. bore with some form of straight glass condenser in such a manner that the flask shall be inclined at an angle of not less than 60 from the perpendicular. The $\frac{1}{4}$-in. gas exit should pass through the stopper as near the upper side as possible; the inner end be ground off at an angle. Through the same stopper a small glass tube is passed, extending only about quarter of an inch on the inside of the stopper and slightly bent, so that it may be brought near one of the walls. The distillation flask is supported upon a piece of heavy asbestos board through which a hole has been cut of such diameter (about 2 ins.) that only the portion of the flask covered by 50 c.c. of liquid will be exposed to the direct flame. The exit of the condenser is connected with a piece of $\frac{1}{4}$ in. glass tubing which passes through a rubber stopper in one tubular of a 500 c.c. Wolf bottle and reaches to the bottom. The other neck of this bottle should be provided, during the first hour of the distillation, with a tightly fitting stopper which carries a small tube of soda-lime. For titrating there are two other stoppers through one of which pass a small piece of capillary tubing and the delivery tip of a 20-c.c. burette divided to $\frac{1}{10}$ c.c. and approximately readable to hundredths. The other stopper carries only a similar burette. Above the entire distillation apparatus is located a reservoir which can be readily connected with the small tube in the stopper of the distillation flask by a piece of rubber tubing, the flow through which is regulated by a screw cock. Instead of pure water an extremely dilute solution of phosphoric acid free from carbon dioxide is used. Into the receiving bottle is exactly measured by a capillary pipette (standardised against the burettes) 100 c.c. of caustic soda solution containing approximately one-tenth as much barium hydroxide as sodium hydroxide, and of such alkalinity that 100 c.c. is equivalent to the acetic acid contained in 2 grms. of 80 per cent. calcium acetate. The first 20 c.c. burette contains nitric acid, of which 200 c.c. corresponds to the acetic in two grms. of absolute calcium acetate. The other burette contains caustic soda-baryta solution equivalent to the nitric acid.

After distillation has reduced the volume in the flask to 75 c.c., a slow stream of water should be admitted, the volume never being allowed to become less than 50 c.c. The rate of distillation does not seem to be as important as other considerations, and the fastest operation permitted by the ordinary Bunsen flame is quite safe. An hour and a half is ample time for complete removal of the acetic acid if the work has proceeded properly, and the complete test, from sample-weighing to final safeguards, may be carried out in about two and a half hours.

In the distillation itself we have found five common sources of error, and thoroughly tested the above method in these respects. First, phosphoric acid is extremely likely to be carried over with the distillate, so much so that we have been reliably informed that it is volatile with steam. This was definitely disproved by the use of a small centrifugal separator similar to that used for drying steam. The pressure necessary to operate this effectively was obtained by exhausting the receiver, a difference of 15 lb. being thus possible without risk of blowing up the distillation flask. Under identical conditions it was found practically impossible, using upright flasks, to avoid passing over the phosphoric acid without the separator, whereas, with it, no matter how violent the distillation, none was found in the distillate. It is therefore carried over solely in the form of mist, entrained vapour, and splashed particles. Phosphoric acid is very prone to form mist during the last stages of evaporation. To be conclusive, the test for phosphoric acid must be made on distillates after neutralizing, concentrating to about 25 c.c., adding 10 c.c. of ammonia and acidifying with nitric acid, and allowing to cool, and examining carefully for silica (which is apt to be precipitated at this point)or any other precipitate, which should be filtered off before testing for phosphoric acid. In the ordinary dilution of 500 c.c. the distillate may contain phosphoric acid equivalent to 0·1 or 0·2 per cent. of acetic acid without responding well to the molybdate test. At 50 c.c. 0·005 per cent. is easily detected. Further, commercial caustic soda contains phosphoric acid, which must be removed before using for these titrations. Mr. Stillwell kindly tested a number of these distillates and, finding no phosphoric acid, suggested an exchange of phosphoric samples. Before this was effected, however, a visit to his laboratory confirmed his tests, and called attention to the marked inclination of his distillation flasks. Several of these were placed upright, and immediately their distillate showed phosphoric acid. Surprising as it seems, the slow movement of gas in the neck of the flask is sufficient to overcome gravitation when directly opposed to it, and to carry over the mist; whereas, when the vertical component of this velocity is only half (ccs. 60°) as great, the effect on a given surface is only one-fourth as great, and the mass of the drop supported only about one-fourth. Similar considerations forbid the use of very narrow-necked flasks, for doubling the diameter gives four times the cross-section, one-fourth the velocity, and one-sixteenth of the lifting effect on a given drop. With the inclined flask, gravity quickly pulls the splashes downward against the lower side of the neck, the water introduced at the top washes them back, becoming itself less volatile thereby, finally mixing better with the residue in the flask, and carrying out the acetic Acid more quickly.



Parting Pipette for Lime Solution

The second source of frequent loss is incomplete distillation. After an hour to an hour and a half, depending on conditions, all the acetic acid should have come over. This must never be taken for granted, however; while the titration is being made, distillation should be continued, and this distillate tested. Using the apparatus above outlined, phenolphthalein (the same quantity as used in standardizing) is put into the barium hydroxide solution when the distillation is regarded as probably complete, and the stopper carrying the nitric acid burette inserted. The excess of alkali being almost neutralised, the distillation is allowed to proceed. If the colour then disappears, the second burette of equal strength alkali is used, and, drop by drop, the colour is restored, until 10 or 15 minutes' distillation no onger discharges it.

The third and most prolific source of disagreement is arbon dioxide present in the acetate of lime, in the water r steam added to the distillation, and in the standard alkali. n the latter it could be largely allowed for by frequent tandardising or by making the final titration boiling hot rom the acid side. If this is relied upon, the boiling of cetic acid solutions should be carried out with a very fficient reflux condenser not less than $\frac{1}{2}$ in. bore and 24 ins. ong. We finally found the cause of discordance in a long eries of results to be slight losses of acetic acid during the oiling and hot titration. For accurate boiling titration the olubility of the glass should be determined and, if need be, llowed for, as it sometimes affects results to the extent of ·05 per cent. On the whole, we have obtained much more tisfactory results with the sodium hydroxide containing aryta. This has the advantage of serving as a fairly nsitive indicator for both carbon dioxide and phosphoric id (the most common causes of high results) and, as a feguard, is sensitive to 0·02 per cent. Steam should ever be used for distillations, as it actually prolongs the ne required, increases the volume of the condensate, variably contains carbon dioxide, and is far more difficult regulate than a visible dropping of water. The use of ater freed from carbon dioxide is easily accomplished by having two reservoirs filled alternately with distilled water condensed hot directly into them, adding a few c.c. of phosphoric acid, and applying suction till violent boiling ensues. One is allowed to cool and settle while the other is being used. After exhaustion, these reservoirs should connect with the atmosphere only through potash bulbs and the connection with the distillation flask should be broken as seldom as possible

The fourth source of error, small but very general, we believe, lies in the use of sodium carbonate ignited at a red heat as a standard for acidimetric work. Sodium bicarbonate recrystallised, dried at 100°, washed with distilled water until it no longer gives the tests for chlorides or sulphates, again dried at 100° C., and heated to constant weight at 300° in an air bath, gives more correct results, differing from the other by approximately 0·01 per cent.

Lastly, hydrochloric acid is not infrequently present in acetate of lime, and although the amount present is small, we have, in some instances, found it equivalent to 0·05 per cent. of the acetic present.

Having proved the distillation to be complete, and having titrated the acetic acid, along with any carbon dioxide, phosphoric and hydrochloric acids, which may have been carried over, it now remains to test for the hydrochloric acid, and determine the amounts of phosphate and carbonate if the appearance of a precipitate has shown either to be present. To this end the now neutral solution is washed from the receiving bottle upon a filter, and the collected precipitate thoroughly washed with water, washings being added to the filtrate. In this filtrate the hydrochloric acid is directly titrated with silver nitrate, using potassium chromate as indicator. The precipitate with the filter is transferred to a flask, water is added, and the amount of carbon dioxide directly titrated with nitric acid, using Methyl Orange as indicator, shaking vigorously after each addition of acid. To this liquid, transferred to a porcelain vessel (alkalis, and even neutral salts, abstract detectable amounts of silica from glass), ammonia is added and excess of nitric acid to dissolve the barium phosphate. This liquid is boiled and brought to about 25 c.c.; it is then filtered and, after standing till cold, molybdic acid is added.

Tests of the above method show that, in the large majority of cases, the amount of hydrochloric acid obtained will be less than 0·01 per cent. of the acetic acid. No phosphoric acid should be found in the distillate, and less than 0·01 per cent. of carbon dioxide unless the lime contains carbonate. Checks have been obtained against a known quantity of absolute acetic acid to within 0·02 per cent.

It cannot be claimed that these methods are complete, as they have not yet been tested to our entire satisfaction, but they are certainly more reliable than the single distillation, and are offered for the benefit of those who care to test and further improve them.

The use of standard caustic baryta-soda to receive the distillate seems long and awkward in description, entailing, as it does, exclusion of air, but in practice it is found to be actually quicker, and certainly more reliable than boiling titration.

Obituary.

PROF. A. W. WILLIAMSON, D.C.L., LL D., F.R.S.,

EMERITUS PROFESSOR OF CHEMISTRY IN UNIVERSITY COLLEGE, LONDON; AN ORIGINAL MEMBER OF THE SOCIETY OF CHEMICAL INDUSTRY (1881–1887).

Alexander William Williamson was born at Wandsworth on May 1st, 1824, and studied chemistry under Gmelin in Heidelberg, and Liebig in Giessen, in the latter University also graduating PhD. He, further, spent some years in the study of the higher mathematics under Compte in Paris.

In 1849, Williamson was appointed professor of chemistry in University College, London, where he continued to teach till 1887, when he retired with the title of Emeritus Professor. He was elected Fellow of the Royal Society in 1855, and received a Royal medal in 1862. He was twice President of the Chemical Society (1863-65 and 1869-71), and was one of the six guests at the banquet given in London by the Chemical Society in 1898 in honour of those of its past presidents who had been Fellows for half a century. In 1873 Professor Williamson was elected President of the British Association, and in 1876 he succeeded Dr. Letheby as Chief Gas Examiner to the City of London, and continued to discharge the duties of the post till about three years ago, when advanced age and failing sight obliged him to resign. On Sunday, May 1st, he attained his 80th birthday, and died on May 6th. In the development of chemical doctrine half a century ago Williamson took a prominent part. Considering that the method of stating the rational constitution of bodies by comparison with water was susceptible of great extension, and would be of service in simplifying the ideas of chemists by the establishment of a uniform table of comparison by which bodies might be judged, Williamson was particularly active in supporting this conception, and one of his own contributions was the introduction of the doctrine of condensed types, according to which a double or triple water-type was employed to explain the construction of bodies that could not be well referred to the simple type. In the course of his study of this question he carried out the classical research with which his name will be ever associated, resulting as it did in the full elucidation of the process by which ether is formed by the interaction of alcohol and sulphuric acid. This research in establishing the theory of the etherification process has rendered eminent service to chemical industry. In another direction Williamson also showed himself a pioneer in chemical thought, being one of the first to introduce dynamical ideas into chemical science. Thus, so far back as 1850, in the same paper as that in which he explained etherification, he advanced a view which is fundamental in the hypothesis of ionic dissociation. In this the doctrine is evolved that the atoms composing the molecules of the compound are continually in motion and interchange, any particular atom now forming part of one molecule, then exchanging into another, next into a third, and so on through an unending course of ionic migration.

SIR CLEMENT LE NEVE FOSTER, F.R.S.,

Professor of Mining in the Royal School of Mines, one of His Majesty's Inspectors of Mines, &c.

Sir Clement Le Neve Foster was born at Camberwell in 1841, and was the second son of Peter Le Neve Foster, formerly a secretary of the Society of Arts. At the age of twelve he was sent to school in France, and returning to England in 1857 he entered the Royal School of Mines, where he had a brilliant career. He then went to study in the Freiberg School of Mines, and even before completing the course there was appointed to the Geological Survey of Great Britain by Sir Roderick Murchison in 1860. During the five years following this appointment he was engaged on the work of the Survey, first on the Wealden beds of Kent and Sussex and subsequently in Derbyshire and Yorkshire, his spare time being spent in preparing for the D. Sc. degree, which he took in 1865. In that year Le Neve Foster resigned his post to become Lecturer to the Miners' Association of Cornwall and Devon, and in that capacity he interested himself in the question of introducing improved appliances into the mines. Two years later he gave up this appointment for the sake of mining exploration in Sinai, and after visiting Venezuela in 1868 in connection with gold mining, he accepted an appointment with the Pestarena Gold Mining Co. in Italy, which he held until 1872. On the passing of the Metalliferous Mines Regulation Act of 1872, Le Neve Foster was appointed one of her Majesty's Inspectors of Mines to carry out its provisions. In 1894 he became Editor of the Mineral Statistics issued by the Home Office, and of the Annual Reports on the Mines and Quarries of the United Kingdom. He resigned his official position in 1901, and last year his services received the recognition of knighthood. In addition to numerous official and other publications, he was the author of a treatise on "Ore and Stone Mining," and of the articles on mining in both the ninth edition of the "Encyclopædia Britannica" and in the supplementary volumes. In 1890 he succeeded Sir Warington Smyth as Professor of Mining at the Royal School of Mines, and in 1892 the Royal Society elected him a Fellow.

Sir Clement Le Neve Foster was an ideal lecturer on subjects relating to mining.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

English Patents.

Drying and Evaporating Apparatus; Vacuum ——. J. and R. Glass, Leipzig. Eng. Pat. 9308, April 24, 1903.

See Fr. Pat. 323,961 of 1902; this J., 1903, 544.—T. F. B.

Drying Kilns. W. P. Thompson, London. From J. F. Hanrahan, Ottawa. Eng. Pat. 4602, Feb. 24, 1904.

A preliminary drying or "sweating" chamber is combined with a second or finishing drying chamber. Each is closed to the external air, and is provided with a heating coil at the bottom and a condenser with suitable cooling coils above. The heated air, laden with moisture, rises, deposits the condensed water, and, being now cooler, falls through suitable channels to the space beneath the heating coils to be used over again.—W. H. C.

Filters. A. J. A. Reeb, Paris. Eng. Pat. 10,498, May 8, 1903.

The filter is so arranged that the thickness and material of the filtering medium can be easily varied. It may be made of enamelled metal, and the rubber joints are protected from any action of the liquid being filtered.—W. H. C.

"*Heating Fluid; Utilising the Heat of Chemical Reaction for*" ——. A. Lang, Karlsruhe. Eng. Pat. 11,632, May 21, 1903.

This is a process for utilising the heat developed by the chemical reaction of "fluids of all kinds." The reacting material is contained in a thin-walled vessel of conducting material, which is wholly or partially immersed in the fluid to be heated—contained in another vessel.—W. H. C.

Mixing Liquids and Gases; Apparatus for ——. R. F. Wood-Smith, London. Eng. Pat. 13,224, June 12, 1903.

The liquid and gas are passed through a filter-pump into a trap, where the liquid and unabsorbed gas are separated. The liquid then overflows into a second pump, and, by the suction which it produces, draws the unabsorbed gas from the upper part of the trap along with it, a further mixing taking place. Any number of pumps and traps can be used in series.—W. H. C.

Centrifugal Machines. G. ter Meer, Hanover. Eng. Pat. 1505, Jan. 20, 1904.

The wedged-shaped chambers b, Fig. 3, are arranged radially about the driving spindle (Fig. 1) a; c and c^1 are the upper and lower limiting walls of the chambers, and are rigidly secured to the driving spindle a. The material to be treated is fed through the central supply pipe k, and delivered to the chambers b by the spouts k^1. The solid matter is driven by the centrifugal force to the outer end of b, whilst the liquid escapes through the rear perforated filtering wall d (Fig. 3), and passes by the spout h to the collecting channel i (Fig. 1). The discharge of the solid matter from b is effected by centrifugal force, the wall d^1 (Fig. 3), which occupies the position shown by the dotted lines whilst the chamber is filling, being caused to open and allow the solids to be discharged in the following manner:—A rotating worm shaft m (Fig. 1), the speed of which can be varied, rotates the circular track u, under the rollers t^1, ttached to a non-rotating carrier t. The sleeve s, about he central inlet pipe k, rests on balls on the carrier t, and s attached by the bell-crank r and the lever q to the pin n n the movable wall d^1 of the chamber b (Fig. 3). The rack u has two opposite projections u^3, and when these ass under the rollers t^1, the sleeve s is raised, the crank r ulls back the side d^1, and the solid is discharged. When he projections u^3 have passed the rollers t^1 the sleeve s rops again, allowing d^1 to close. Another concentric track , with projections v^1, rotates under the roller w (Figs. 2 nd 1), which is lifted by the projections, and closes the alve l by means of the crank x and lever y. When the

Fig. 1.

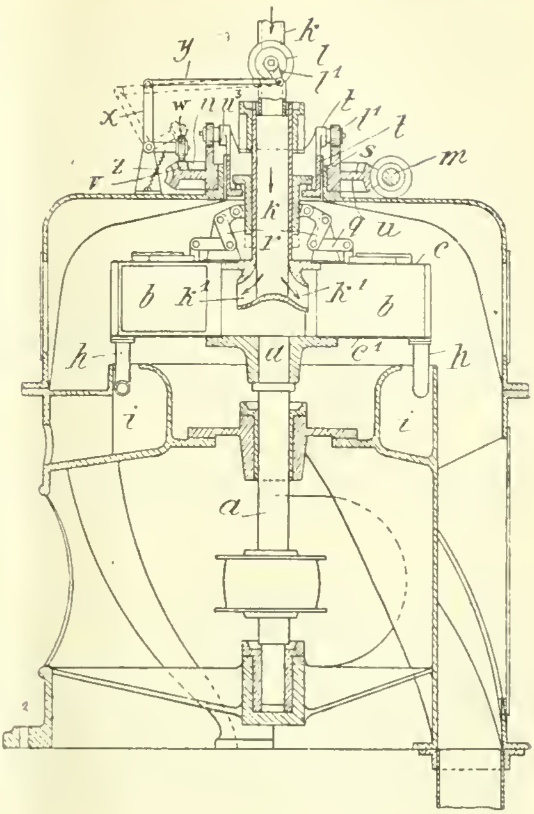


Fig. 2.

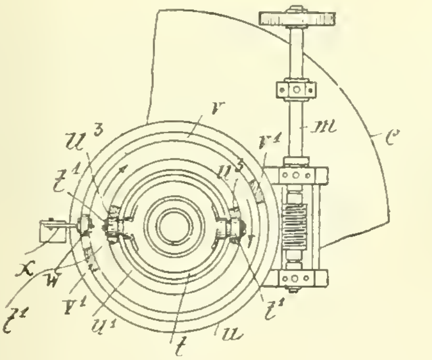
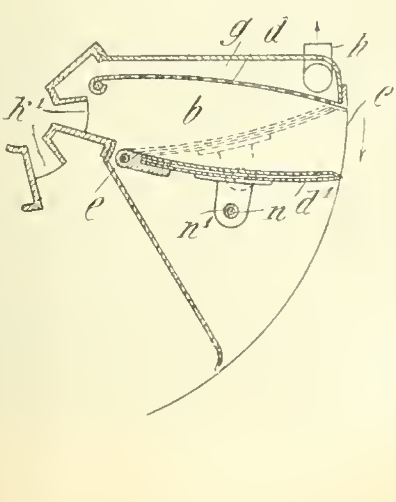


Fig. 3.



projection has passed, the valve is opened again by the action of the spring z. The projections n^5 and r^1 are so arranged that first the valve l is closed, then the side d^1 is opened, the solid discharged, and d^1 closed again, and last of all the valve l is opened again.—W. H. C.

Vacuum, Supplying an Absorbent, and Preventing Back Atmospheric Pressure; Apparatus for Producing a ——. O. Imray, London. From C. W. Stanton, Mobile. Eng. Pat. 5791, March 9, 1904.

Water or other suitable liquid from an overhead supply tank is passed down a vertical pipe, having a side tube which is connected to the apparatus in which a vacuum is to be created. The vertical pipe enters the bottom of an open-mouthed vessel, having an overflow pipe high up at the side. The flow of liquid from the overhead vessel to the bottom of the vessel down below, produces the vacuum by exhaustion through the side tube, and the liquid accumulated in the lower vessel, is of such a nature as to act as an absorbent.—W. H. C.

United States Patents.

Apparatus for Operating on [Purifying, &c.] Finely-divided Fluids or Solid Materials. J. Luhne, Aix-la-Chapelle. U.S. Pat. 757,757, April 19, 1904.

See Fr. Pat. 330,322 of 1903; this J., 1903, 1078.—T. F. B.

Heating or Cooling Liquids; Apparatus for ——. G. Braselmann, Darmstadt, and F. Lünnemann, Ruhrort. U.S. Pat. 758,045, April 26, 1904.

An agitator, with blades like those of a ship's propeller, is rotated by a hollow shaft in the liquid. The blades are hollow, and divided into two chambers by a partition. Through the hollow shaft a heating or cooling agent is admitted, through suitably placed openings, into the blades and caused to circulate in them. Means are provided for supplying and exhausting the circulating agent and for rotating the shaft.—L. F. G.

Steam-Condenser. O. H. Mueller, Berlin. U.S. Pat. 758,090, April 26, 1904.

The apparatus consists of a combination of jet-condensers, the first having a steam-inlet opening and a steam-outlet opening, whilst the steam-inlet of the second is connected to the steam-outlet of the first jet-condenser. A jet-device delivers cold water into the second condenser, and a second jet-device connected with the lower part of the second condenser discharges into the first. The condensers are otherwise unconnected, and an air-pump is connected to the second condenser.—L. F. G.

Filtration of Gases; Apparatus for the ——. G. C. Stone, Assignor to New Jersey Zinc Co., New York. U.S. Pat. 758,222, April 26, 1904.

The apparatus consists of a cylindrical drum with conical ends sloping outwards and each fitted with a gas inlet. The drum is divided into several compartments by conical diaphragms sloping upwards with a central hole, above these being placed screens on which is piled loose material. A deflecting plate in each screen protects the aperture in the diaphragm, and the spaces between the diaphragms and screens constitute liquid reservoirs and are provided with outlet pipes.—L. F. G.

Solutions; Process of Preparing Highly-diluted ——. E. Joseph, Berlin. U.S. Pat. 758,450, April 26, 1904.

The substances are dissolved in an appropriate solvent, and an indifferent salt added, which is soluble in the solvent, and of a higher specific gravity than water. The mixture is then poured into a great quantity of water containing a substance which is decomposed by the solvent mentioned above whilst chemically indifferent to the substance to be dissolved, an indifferent gas being obtained as the result of the action of the solvent on the substance dissolved in the water.—L. F. G.

French Patents.

Powder or Small Crystals from Saturated Solutions; Apparatus and Process for Obtaining Impalpable Crystalline ——. G. Ostini and A. Orlandi. Fr. Pat. 337,614, Oct. 14, 1903.

A continuous alternating or intermittent motion is imparted to the liquid, whilst it is being evaporated, by means of a paddle wheel and baffles placed in the evaporating tank. —W. H. C.

Fire-extinguishing Product; Manufacture of ——. M. Eberhardt. Fr. Pat. 338,076, Nov. 4, 1903.

Stated proportions of wheat starch, magnesium sulphate, sodium bicarbonate, sodium chloride, and water are mixed, a relatively large proportion of water is added, and, with active stirring, a solution of sodium silicate and another of calcium and magnesium chlorides. The mixture is completed for use by the addition of calcium phenate.—E. S.

Anti-Incrustant. A. Bonnotte. Fr. Pat. 337,796, Dec. 16, 1903.

A mixture of borax and potato starch with a small quantity of molasses and colouring matter in water. —W. H. C.

Evaporating Liquids, particularly those which Crystallise; Process and Apparatus for ——. E. N. Trump. Fr. Pats. 337,931 and 337,932, Dec. 22, 1903.

See U.S. Pats. 743,351 and 743,352 of 1903; this J., 1903, 1285.—T. F. B.

Drying, Decomposition, Absorption of Gases, &c.; Process for the Treatment of Substances, e.g., ——. E. N. Trump. Fr. Pats. 337,933 and 337,934, Dec. 22, 1903.

See U.S. Pats. 748,893 and 748,894 of 1904; this J., 1904, 111.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Peat Gas Works for Large Central Electric Power Stations. A. Frank. Z. angew. Chem., 1904, **17**, 289—296.

Since the author discussed this matter some years ago (this J., 1897, 663; 1898, 651), great progress has been made in the development of large gas-engines capable of being worked with low-grade gases; and in the distribution and transformation of electric currents of high potential. Generator-gas obtained from peat is stated as quite suitable for use in large gas-engines; and works are already

——		Fibrous Peat.	Pressed Peat.	Fibrous Peat.	Pressed Peat.
Percentage of water in the peat		25	22	24	36
Composition of the peat	Carbon	57·8	61·2	58·5	61·0
	Hydrogen	6·8	6·1	6·0	6·3
	Oxygen	34·0	30·6	33·3	30·6
	Nitrogen	1·4	2·1	2·2	2·1
Grate surface of the generators in sq. m.		0·0	2·64	0·84	1·6
Total capacity of the generators in cb. m.		22·8	22·4	1·9	21·9
Daily consumption of fuel in each generator		6262	7256	1495	8446
Number of times generator is filled in 24 hours		1·3	2·7	3·5	1·1
Temperature of the outflowing gases, C.		100	78	500	105
Yield of tar, calculated on the dry substance of the fuel, free from ash, per cent		3·4	..	..	8·5
Composition of the tar.	Carbon	79·6	..	..	79·8
	Hydrogen	9·3	..	..	9·2
	Oxygen	11·1	..	..	9·6
	Nitrogen		..	..	1·4
Composition of the generator gas.	Carbon dioxide	6·6	7·1	5·4	6·8
	Carbon monoxide	29·6	21·5	25·5	27·6
	Ethylene	0·7	0·4	0·3	0·4
	Methane	4·0	5·6	6·4	3·75
	Hydrogen	5·3	7·1	5·2	12·3
	Nitrogen	53·8	58·3	59·2	49·15

in operation in Germany and Sweden. Lürmann gives the foregoing figures with regard to the production of gas from peat in generators.

An important point is that for the production of peat-gas in generators, peat containing 45—50 per cent. of water can be used. 100 kilos. of peat yield about 250 cb. m. of gas having a calorific value of 1,200—1,400 cals. per cb. m. The author recommends the erection of a large central electric-power station at the place where the peat is found. On the assumption that 4 cb. m. of peat gas are consumed per h.p.-hour, it is calculated that for the production of 10,000 h.p. (*e.g.*, four large gas-engines, each of 2,500 h.p.), the yearly consumption of peat would be 96,000 tons, an amount which could be furnished for 60 years by a peat moor having an area of 7 sq. kilom. The use of peat-gas in this way would be specially advantageous in localities where lime also is found, the electric power produced being used in the manufacture of calcium carbide, and the latter being then employed as raw material for the production of calcium cyanamide by the aid of atmospheric nitrogen (see this J., 1903, 794, 809). With a central station capable of furnishing 10,000 h.p., 40 tons of calcium carbide could be produced in 24 hours, whilst by every 100 parts of carbide, 25 parts of atmospheric nitrogen could be fixed, with the production of 125 parts of calcium cyanamide containing 20 per cent. of nitrogen.—A. S.

Lamp; New Variety of Mercury Vapour Electric ——. H. Paweck. Z. Elektrochem., 1904, **10**, 297.

The progress of the mercury vapour lamp up to the present is briefly reviewed. The extreme greenness of the light can be mitigated by using amalgams, *e.g.*, of potassium, whereby red lines are introduced into the spectrum. The problem of starting the lamp by means of a momentary short circuit has been approached on three lines: (1) by bringing the electrodes together mechanically; (2) by causing a metallic film (when amalgams are used) to separate on the glass when cold; (3) by heating one electrode from outside and thus connecting the two through the condensed mercury. The author proposes a new lamp of the first variety, which is kept rotating whilst in action; the electrodes are in contact when at rest, and are kept asunder by centrifugal force during rotation.—W. A. C.

Sulphur in Oils, Bituminous Substances, Coal, and Similar Bodies; Determination of ——. E. Graefe. XXIII., page 563.

English Patents.

Fuel; Manufacture of Artificial ——. S. L. Gregor, F. C. Yeo, H. C. B. Forester, all of Swansea. Eng. Pat. 7871, April 6, 1903.

HE fuel consists of 5—6 per cent. by weight of gas-tar itch, about 2—3 per cent. of gas-tar, and 91—93 per cent. f bituminous or semi-bituminous coal. If more than 8 per ent. of pitch be used, the proportion of tar must be kept etween 1 and 2 per cent., and if more than 10 per cent. of itch be used, the tar added should not exceed 1 per cent. weight. Another suitable composition consists of 1—2 er cent. by weight of creosote oil, 5—7 per cent. of pitch, id 93—92 per cent. of crushed coal. The aforesaid ma- rials are thoroughly mixed together, and heated in a pug- ill by superheated steam to 700°—800° F., and the liquid ixture then cooled before passing to the presses. The oling may be effected by passing the mass by means of an rchimedean screw through a horizontal trough, the hot air ing exhausted by a fan at one end, whilst cold air is own in at the other end. After cooling, the mass is essed into briquettes.—L. F. G.

rnaces; Pulverised Fuel ——. W. W. Weaver, Chicago. Eng. Pats. 18,787 and 18,788, Sept. 1, 1903.

WDERED coal is supplied from a hopper to a feed-valve, ich consists of a drum with spiral pockets revolving in a sing, and which feeds the coal-dust gradually and con- uously into a pipe leading to the furnace. Air pre- ted to about 400° or 500° F. by passing through a pipe ng in the furnace, is blown into the coal-feed tube, and injects the coal-dust into the combustion chamber. The discharge ends of the feed tube are conical and flattened, and surrounded by a conical casing through which sufficient cold air is admitted to keep them from burning. The mixture of hot air and coal-dust thus blown into the furnace, impinges on an arch of firebrick kept incandescent by the burning fuel, and ignites; the fine coal-dust is immediately burnt, whilst the heavier particles of coal become coked and fall on to the grate, where they then undergo complete combustion. The furnace is provided with a regulating damper, and means are provided for cleaning out the tubes of the boilers with compressed air. —L. F. G.

Coal, Ores, and other Minerals; Method of and apparatus for Treating ——, *for draining them of Water.* F. Baum, Herne. Eng. Pat. 2485, Feb. 1, 1904.

A transporting belt carrying perforated draining buckets is made to pass slowly beneath the surface of a large body of quiescent water, through which the washed coal, &c., falls into the buckets. The buckets are gradually raised above the surface and the water drains away. The water level is kept constant by means of an overflow, and the fine sludge falls into pockets at the bottom, is lifted, and again discharged along with fresh-washed coal. A shield is provided to deflect this fine sludge to the sides away from the returning belt.—W. H. C.

Gas-Producers. R. M. L. Rowe and R. Bickerton, Manchester. Eng. Pat. 9818, April 30, 1903.

To eliminate tarry matters from producer-gas, the latter is passed through a pipe or retort, heated externally, containing incandescent coke or the like. The retort may be arranged vertically in the centre of the producer itself, having its inlet within the latter; or it may be arranged horizontally or vertically in a separate heating furnace.—H. B.

Lime and Fuel Gas; Method of, and Apparatus for the Manufacture of ——. R. Pearson, London. Eng. Pat. 10,624, May 9, 1903.

Chalk or limestone, fuel, and steam are continuously supplied to a kiln, the gaseous products from which are passed into converters regeneratively heated, in which converters the greater part of the carbon dioxide is transformed into carbon monoxide and the steam into water-gas. The waste heat of the incombustible gases resulting from the reheating of the converters is utilised in heating the steam supply to the kiln, as well as for drying the raw material and the fuel. The heat of the converted gases is utilised by passage of the gases through the boiler in which the steam is generated. Part of the air heated in the regenerators is used to ensure the complete combustion of the gases escaping from the converters. Reference is made to Eng. Pat. 3347 of 1903; this J., 1904, 316.—E. S.

Combustible Gases from Volatile Liquid Hydrocarbons; Apparatus for Producing ——. F. Jas, Paris. Eng. Pat. 13,206, June 12, 1903.

A horizontal carburetting cylinder is divided transversely into three chambers, in the first of which there rotates a horizontal shaft on which four helicoidal coils of pipes are wound. One end of each pipe is open, whilst the other communicates with a hollow portion of the shaft. The cylinder is filled to a certain level with volatile hydrocarbon drawn from a reservoir overhead, the level in the cylinder being maintained by means of a float-valve arranged in the third chamber. As the shaft rotates, the free ends of the pipes dip successively into the hydrocarbon; air and liquid are thus forced through the coils and emerge from the hollow portion of the shaft into the second chamber, where the unvolatilised hydrocarbon is separated from the carburetted air, which is led off for use.—H. B.

Gas; Apparatus for the Purification of ——. F. Jas, Paris. Eng. Pat. 13,222, June 12, 1903.

The apparatus is similar to that referred to in the preceding abstract, excepting that the third chamber and overhead reservoir are omitted. The apparatus is filled with water to a certain level, the gas to be purified is admitted to the first chamber, and, as the shaft rotates, water and gas alternately are forced along the coils, entering the second chamber, where the washed gas separates from the water, under pressure.—H. B.

Coal-Gas; Process for the Recovery of the Residual Products Obtained in the Purification of ——. H. Gutknecht, Zürich. Eng. Pat. 9396, April 25, 1903.

See Fr. Pat. 324,767 of 1902; this J., 1903, 620.—T. F. B.

United States Patents.

Retort Coke-Oven. A. C. Kloman, Assignor to W. M. Scott, both of Saxton. U.S. Pat. 757,469, April 19, 1904.

The horizontal bottom of each retort is composed of two sections, hinged together and supported on the pivot principle, and means are provided for raising the hinged portion, so that each section is swung into an inclined position, whereby a fulcrum is formed for breaking up the cake of coke. One section has a fixed pivot, whilst the other is pivoted on wheels which run on tracks when the hinged portion is pushed up. A portion of the oven flues is arranged in the movable bottom.—H. B.

Retort Coke-Oven. W. M. Scott, Saxton. U.S. Pat. 757,509, April 19, 1904.

The bottoms of the coke-ovens are mounted on the pivot principle, and are adapted to be swung upon their mountings by means of a beam carried on a truck which travels in a passage-way below the ovens. Compare preceding abstract.—H. B.

Gas; Apparatus for Making ——. P. Naef, New York. U.S. Pat. 753,296, March 1, 1904.

Several generators are connected together in series, either with or without the interposition of superheating stoves, and the end generator communicates with a tubular cooler and a scrubbing plant. The plant may be operated in various ways, according to the object aimed at. Water-gas may be produced by means of the usual intermittent process. If the by-products are of considerable value, the raw fuel may be charged only into the last producer, so that unnecessary heating of the volatile products is avoided; the coke formed can then be charged into the earlier producers. If, on the other hand, it is desired to convert the tarry matters of bituminous fuel into permanent gases, the raw fuel is charged into the earlier generators, and the coke produced is transferred to the later ones. The air supplies may be heated by circulation through the tubular cooler. —H. B.

Calcium Carbide; Process of Producing ——: also Electric Heating; Process of ——. W. S. Horry, Assignor to Union Carbide Co. U.S. Pats. 757,617—757,620, April 19, 1904. XI. A., page 548.

Electric Furnace. W. S. Horry and E. F. Price, Assignors to Union Carbide Co. U.S. Pat. 757,621, April 19, 1904. XI. A., page 548.

Electric Heating [Calcium Carbide]; also Electric Resistance Furnace. E. F. Price, Assignor to Union Carbide Co. U.S. Pats. 757,633 and 757,634, April 19, 1904. XI. A., pages 548 and 549.

French Patents.

Fuel Blocks. Soc. Chavoise, Jäger et Cie. (des procédés Cadoret). Fr. Pat. 337,771, Dec. 16, 1903.

The fuel is made by mixing 1 part of resin with 1 part of tar, and adding to the molten mass 1 to 5 parts of coal dust, dried leaves, or other vegetable refuse, one-half to 5 parts of a nitrate (such as potassium or sodium nitrate), 1 to 3 parts of nitrocellulose, and one-half to 2½ parts of crude camphor, which last two ingredients may be replaced by 1½ to 5½ parts of celluloid waste.—L. F. G.

Combustible [Briquettes]; Manufacture of a —— burning without Smoke, or with little Smoke. Hildesheimer Sparherd Fabrik A. Senking. Fr. Pat. 337,801, Dec. 16, 1903.

'Fatty' or 'meagre' [anthracitic] coal, coke, or lignite, are powdered, and mixed together, if necessary with the addition of an agglutinant, and pressed into briquettes. —L. F. G.

Gas Producer [Suction]. G. Viarmé. Fr. Pat. 337,974, Dec. 23, 1903.

A mixture of air and steam is aspirated from an annular superheater into the fuel near the lowest part of the producer, and the gas produced is withdrawn through a series of lateral orifices provided in the periphery of the producer, midway up the column of fuel. Each orifice communicates, by a separate pipe, with the off-take main at the top of the apparatus, and by means of a fixed perforated plate, covered by a rotating perforated slide, arranged between the main and the smaller pipes, each of the latter is successively placed in open communication with the main. The effect is that the gas produced is withdrawn through each of the lateral orifices in succession, and unequal consumption of the fuel is prevented. On raising the slide the gas may be drawn off from all the orifices simultaneously. The uniform consumption of the fuel permits of the use of the plant for gas engines of high powers.—H. B.

Carbon Dioxide in Furnace Gases; Method and Apparatus for the Determination of ——. A. Schlatter and L. Deutsch. Fr. Pat. 337,992, Dec. 24, 1903. XXIII., page 561.

Magnesium Carbides; Direct Manufacture of —— from Carbon and Oxides or Carbonates of Magnesium. H. Auziès and A. Ségoffin. Fr. Pat. 337,878, Nov. 11, 1903.

Magnesium oxide or carbonate is heated with carbon to about 3,000° C., in an electric furnace, to obtain magnesium carbide, to which the formula MgC_2 is attributed; when decomposed by water it is stated to yield more acetylene than calcium carbide. Dolomite may be similarly heated with carbon to obtain a calcium-magnesium carbide.—E. S.

Incandescence Lighting with Gas Generated by Aluminium Alloys. N. A. Helouis, L. Manclaire, and E. Meyer. Fr. Pat. 337,722, Dec. 14, 1903.

Hydrogen is generated by the action of aluminium-zinc, or aluminium-zinc-sodium, on a dilute solution of caustic soda the gas is carburetted in any suitable manner, and is burne in conjunction with an incandescence mantle. Compar Fr. Pat. 335,954; this J., 1904, 325.—H. B.

Carbons; Mineralised —— for Arc Lamps, for Regulating their Light. A. Blondel. Fr. Pat. 338,049, Oct. 2 1903. Under Internat. Conv., Oct. 24, 1902.

See Eng. Pat. 23,262 of 1902; this J., 1904, 112.—T. F.

Arc Lamp with Osmium Electrodes. Comp. Général d'Électricité. Fr. Pat. 337,927, Dec. 22, 1903.

Arc lamps are provided with electrodes of osmium, opera ing in an atmosphere of inert gas. The electrodes ma be obtained, for example, by producing an arc betwee carbon electrodes in an atmosphere of osmic acid, by mea of an alternating current. The osmium is deposited on t hottest parts of the electrodes in the form of extremely ha metallic pellets.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM AND MINERAL WAXES.

Petroleum Acts. Home Office Memorandum, May, 190

It has recently come to our knowledge that attempts being made by officers of Local Authorities to apply legal test for petroleum to samples of liquid metal-poli and we have satisfied ourselves by experiment that the results thus obtained are sometimes entirely misleading, as they do not represent the temperature of the portion of the liquid from which inflammable vapour is being evolved.

In carrying out the test prescribed in the Petroleum Act, 1879, the sample under examination is slowly heated in a closed cup, and the temperature is indicated by a thermometer the bulb of which is immersed in the liquid in the centre of the vessel. In these circumstances the heat communicated to the sample through the walls of the cup creates in such a liquid as petroleum convection currents, and through the circulation thus set up the temperature of the contents of the cup is equalised and the thermometer correctly indicates the temperature at which inflammable vapour is evolved by the liquid.

On the other hand, if the sample contains solid matter in suspension, as is the case with the liquid metal-polish in question, the formation of convection currents is interfered with, and the surface of the liquid from which inflammable vapour is evolved acquires a higher temperature than that of the portion in contact with the bulb of the thermometer. Thus, as we have ascertained experimentally, the thermometer may indicate a temperature of 59° F. when the temperature of the surface is 83° F., and a sample may be erroneously reported as having a flash point below the legal limit of 73° F. when the true flash point is far above the limit.

No doubt this would have been provided for when the Act was passed if at that time the need for applying the test to such substances had been foreseen, but it was not until judgment in the case of the London County Council *v.* Holtzapfel's Compositions Co., Ltd., was given in 1899 that mixtures containing petroleum were held to be petroleum within the meaning of the Acts.

In our handbook on petroleum published in 1901, we referred on page 90 to the necessity for a stirrer in the oil cup when the test specified in the Petroleum Act is employed for the testing of paints and other substances containing petroleum, and when opportunity occurs for a revision of the law this addition will doubtless be legalised.

We are, however, of opinion that in the meantime authorities charged with the administration of the Petroleum Acts should be made aware of the circumstances we have referred to, and that testing officers should take steps to ascertain the true flash point of samples of liquid metal polish or other substances which are not thoroughly liquid, and therefore cannot be satisfactorily tested in precise accordance with the directions given in the schedule to the Act. In many instances it may be possible to obtain a sample of the petroleum used in the substance, or the solid matter present in the sample can be removed by straining or filtration, care being taken to avoid loss of the more volatile constituents by evaporation, when the separated liquid can be tested in the prescribed manner. The liquid should not, however, be separated by distillation, as this operation may yield a distillate of lower flash point than that of the petroleum with which the mixture was made. For guidance in determining whether there has been any infraction of the law, the sample may also be tested in an apparatus provided with an efficient stirrer. In any case of doubt as to the true flash point of the material, we would suggest that reference should be made to H.M. Inspectors of Explosives, at the Home Office, who will be prepared to give advice as to the course which should be adopted.

(Signed) J. H. Thomson,
Captain, H.M. Chief Inspector of Explosives.
(Signed) Boverton Redwood,
Adviser on Petroleum to the Home Office.

"Asphalts"; Examination of ——. E. Donath and B. M. Margosches. Chem. Ind., 1904, **27**, 220—226.

In consequence of the appearance of Lunge and Krepelka's article (this J., 1904, 436), the authors publish some preliminary results of an investigation. They find that successive extractions of the product with light petroleum spirit (petroleum ether), benzene, and carbon bisulphide give useful indications as to its nature. For distinguishing between individual products, the following method is recommended: 10—15 grms. are subjected to dry distillation.

—		Petroleum Spirit Extract.	Benzene Extract.	Carbon Bisulphide Extract.	Residue.
		Per Cent.	Per Cent.	Per Cent.	Per Cent.
Coal-tar pitch	Soft	25·05	44·98	6·57	22·82
	Medium	15·14	49·03	7·10	38·06
	Hard ..	15·51	39·86	15·21	29·39
Lignite-tar pitch	Soft	81·30	15·50	0·70	2·60
	Hard ..	11·90	86·50	0·30	1·80
Petroleum pitch	Soft	68·50	28·50	1·50	1·50
	Hard ..	59·00	27·00	4·50	9·00
Sicilian asphaltum...		7·80	3·70	0·30	88·20

In the case of wood-tar pitch, a small quantity of a strongly acid aqueous liquor is obtained on which an oily layer floats. A confirmatory test for wood-tar pitch is that, when treated with carbon tetrachloride, the latter is scarcely coloured. In the case of coal-tar pitch the oily distillate dissolves completely in absolute alcohol and glacial acetic acid. Coal-tar pitch also always contains anthracene, which can be recognised by oxidising it to anthraquinone by means of chromic acid, and testing for the latter by Liebermann's reaction (production of intense red coloration by boiling with caustic soda solution and zinc dust). If the distillate does not give a clear solution with alcohol and glacial acetic acid, the product may be lignite-tar pitch, petroleum pitch, asphaltum, or a stearine pitch. A portion of the original product is boiled for some time with alcoholic potash, and the hot liquid filtered. In the case of wool-fat pitch, a fairly abundant precipitate forms on cooling, which gives the cholesterol reactions. In the case of stearine pitch no separation, as a rule, takes place, but on evaporating the alcohol and treating with dilute hydrochloric acid, the fatty acids separate. Natural asphaltum, when treated with alcoholic potash, colours the liquid only slightly at first, but more intensely after some time; lignite-tar pitch colours the liquid immediately; and petroleum pitch gives either no coloration at all or an extremely weak one. The behaviour on successive extractions with petroleum spirit, benzene, and carbon bisulphide also affords a means of distinguishing between lignite-tar pitch, petroleum pitch, and asphaltum. In the case of the last-named, the insoluble residue consists entirely of inorganic mineral matter. In practice the most common form of adulteration is the addition of coal-tar pitch to natural asphaltum. The authors recommend extraction of the product successively with petroleum spirit, benzene, and carbon bisulphide. If the sample be pure natural asphaltum, the insoluble residue will consist entirely of inorganic mineral matter. If coal-tar pitch be present, the residue will be black and will give a brownish-red solution with concentrated nitric acid. The presence of anthracene and the production of a coloured fluorescent solution with methyl or ethyl alcohol or chloroform yield additional evidence of the presence of coal-tar pitch.—A. S.

Pyridine Bases in Ammonia and Aliphatic Amines; Determination of ——. J. Milbauer and V. Staněk. XXIII., page 563.

Sulphur in Oils, Bituminous Substances, Coal, and Similar Bodies; Determination of ——. E. Graefe. XXIII., page 563.

English Patent.

Destructive Distillation; Recovery of By-Products in Processes of ——, *and Apparatus therefor.* The Otto-Hilgenstock Coke-Oven Co., Ltd., London. From C. Otto and Co., Dalhausen a/Ruhr. Eng. Pat. 16,005, July 20, 1903.

The condensing pipe of an apparatus such as a coke-oven or gas-retort is inclined upwards, and is of such a length that the products which condense above 70° C., or thereabouts, flow back along the tube, towards the retort, meeting the hot ascending gases; in this way a more effective separation of the products is obtained.—T. F. B.

UNITED STATES PATENT.

Wood; Apparatus for the Distillation of —— and Production of Charcoal. H. A. Mackie, Assignor to E. E. Wood, New Orleans. U.S. Pat. 757,939, April 19, 1904.

A LONG inclined retort, set in a charcoal kiln, is provided with doors at each end, and with a liquid-discharge pipe at its lower end, and a vapour-discharge pipe leading from the top of its lower end to a condensing tank. The charcoal kiln is provided with air inlets, and with a discharge pipe, with which a fan communicates.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

p-Phenylenediamine; New Base from ——. L. Paul. Z. angew. Chem., 1904, **17**, 589—591.

CERTAIN samples of impure *p*-phenylenediamine are converted on keeping into a blue or bluish-brown basic dyestuff, or into an insoluble black base, ammonia being formed. A sample which had undergone partial transformation consisted of *p*-phenylenediamine, an intermediate product easily soluble in water, and a black powdery base, insoluble in water, but soluble in hydrochloric acid. The solution can be diazotised and then couples with amines and phenols. The hydrochloric acid solution of the new base dyes unmordanted cotton in bluish-brown, tannined cotton in bluish-black, and wool in brownish-black shades. Unmordanted cotton, after being dyed with the new base, shows considerable affinity for ordinary basic dyestuffs. The new base can also be diazotised on the fibre. With fuming sulphuric acid it yields a sulphonic acid which dyes wool in brown shades. The brown soluble intermediate product forms the new base when its aqueous solution is evaporated or allowed to stand a long time. The new base is also formed if an aqueous solution of *p*-phenylenediamine containing hydrochloric acid is evaporated, also if an aqueous solution of *p*-phenylenediamine and common salt is boiled. In all cases where the new base is formed on evaporation, an insoluble violet dyestuff, soluble in hydrochloric acid, is formed on boiling in an open vessel.
—E. F.

Rosaniline; Root Carbinol of —— and its Isomers. A. Bistrzycki and J. Gyr. Ber., 1904, **37**, 1245—1253.

THE authors have prepared diphenyl-*o*-tolylcarbinol from *o*-toluic acid methyl ester by Grignard's method (Ber., 1904, 663). It is readily reduced to the corresponding methane, which is not identical with the isomer obtained from Rosaniline. From *m*-toluic acid methyl ester they have obtained a carbinol, presumably diphenyl-*m*-tolyl carbinol, which is entirely different from that obtained by E. and O. Fischer (Ber., 1876, 899) by elimination of the amino groups from leucaniline and oxidation of the diphenyltolylmethane so formed. On reduction it yields a methane which is seemingly identical with that obtained from leucaniline, but on careful oxidation the original isomeric carbinol is re-formed. The authors point out that the diphenyltolylmethane obtained by Hemilian, by oxidising the condensation product of diphenylcarbinol and *p*-xylene, reducing in alkaline solution, and splitting off carbon dioxide, is probably identical with the compound obtained from leucaniline (Ber., 1883, 2368).—E. F.

Quinone-di-imide. R. Willstätter and E. Mayer. Ber., 1904, **37**, 1494—1507.

THE authors obtain quinone-di-imide, $NH : C_6H_4 : NH$, by treatment of quinonedichloro-di-imide with dry hydrochloric acid gas in ethereal solution according to the equation $NCl : C_6H_4 : NCl + 4HCl = NH : C_6H_4 : NH . 2HCl + 2Cl_2$. The dihydrochloride first obtained yields the base on treatment with dry ammonia in ethereal solution. The base is mono-molecular and very unstable, unless very pure, when it is much more stable. It readily polymerises with explosive violence, also on standing for some days in the air. With aromatic amines and phenols it at once forms indamines and indophenols. On warming with dilute mineral acids it is hydrolysed to quinone and ammonia. Aqueous and alcoholic solutions rapidly darken in colour, with formation of a substance closely resembling tetraminodiphenyl-*p*-azo-phenylene.—E. F.

Indophthalone. C. Renz. Ber., 1904, **37**, 1221—1225.

WHEN 2 mols. of α-methylindole are heated to 150°—160° C. with 1 mol. of phthalyl chloride, indophthalone hydrochloride, $C_{26}H_{20}N_2O_2 . HCl$, is formed, with evolution of hydrochloric acid, according to the equation $2C_9H_9N + C_8H_4O_2Cl_2 = C_{26}H_{20}N_2O_2 + 2HCl$. The product is a red powder, from which sodium carbonate liberates the base $C_{26}H_{20}N_2O_2$, a brick-red precipitate, readily soluble in alcohol and in chloroform. Indophthalone has also the properties of a weak acid, and forms a well-defined potassium salt. A product, which is either identical with, or an isomer of indophthalone, is obtained by heating 2 mols. of α-methylindole with 1 mol. of phthalic anhydride to 185—190° C., but the yield is in this case small.—E. F.

Dyestuffs from Quinoline-α-carbonic Acids; New Class of ——. [Quinoline Dyestuffs.] E. Besthorn and J. Ibele. Ber., 1904, **37**, 1236—1243.

IF quinaldinic acid be heated to 140° C. with acetic anhydride a red dyestuff is formed, with evolution of carbon dioxide. The substance is extremely sensitive to light, being rapidly decolorised. Its absorption spectrum shows two absorption bands, one in the yellow, the other in the green portion of the spectrum. It has only very weak basic properties and only very slight affinity for the fibre, dyeing silk from alcoholic solution in pale salmon-red shades, with slight greenish-yellow fluorescence, very fugitive to light. The dyestuff is completely destroyed by weak oxidising agents, even by cold dilute nitric acid. It is relatively stable tawards reducing agents, and seems to form no leuco compound. The acetic anhydride in the above reaction may be replaced by benzoic anhydride or the anhydrides of other organic monocarboxylic acids. Anhydrides of dicarboxylic acids, such as phthalic and succinic acids, do not effect the reaction, which seems to apply to quinoline-α-carboxylic acids in general, but not to picolinic acid and other pyridine derivatives.—E. F.

Dyestuffs for Wool; New Classes of —— and New Reactions of Aldehydes. M. Prud'homme. Rev. Gen. Mat. Col., 1904, **8**, 129—130.

IT has been shown (this J., 1900, 729) that when acid solutions of dyestuffs, leuco-bases, or chromogens containing amino groups are treated with formaldehyde and sodium bisulphite, acid dyestuffs are obtained. If sodium hydrosulphite be used instead of sodium bisulphite, another class of dyestuffs is produced. Magenta and Acid Magenta, when decolorised with sodium hydrosulphite, treated with a mineral acid and formaldehyde, and then heated, give new violet-red dyestuffs. When no formaldehyde is used, orange dyestuffs are formed. On heating the diazo derivatives of certain basic dyestuffs, substituted primary amines, or diamines with sodium hydrosulphite, other acid dyestuffs are obtained. When a solution containing 0·5 grm. of Magenta, 2 grms. of hydrochloric acid, and 500 c.c. of water is diazotised in the ordinary way, 12 grms. of sodium bisulphite solution of 35° B. added, and the mixture left to stand for 24 hours, the solution turns orange. If it be heated on a water-bath to 60° C. and 12 grms. of hydrochloric acid of 21° B. added and again heated, the liquid turns deep violet and dyes wool a prune shade. The leuco-base formed on the condensation of diphenylcarbinol and *m*-sulphanilic acid, oxidised with lead dioxide, diazotised, and treated with sodium bisulphite and hydrochloric acid, gives a green fast to alkalis. Under the same conditions nitranilines give a pale yellow and benzidine an orange dyestuff. Better colours are obtained if, immediately after the addition of the sodium bisulphite and acid, aldehyde or a sugar be added, the hydrazines, formed by the action of the bisulphite and acid on the diazo bodies, probably giving hydrazones and osazones. Treated thus Magenta gives a much bluer shade, and *p*-Nitraniline Yellow, which is only a pale colour, dyes a full orange. If in the above cases the sodium bisulphite be replaced by sodium hydrosulphite, new colours with different and brighter shades are produced. When diazotised Magenta or Acid Magenta is acted on by benzaldehyde and sodium hydrosulphite, a pure blue is formed, that from the Magenta being only slightly soluble, and the one from the Acid Magenta quite soluble.

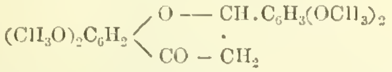
New Reactions for Aldehydes.—Schiff's reaction for aldehydes is much more delicate when the Magenta is decolorised with sodium hydrosulphite or bisulphite instead of with sulphur dioxide.—R. S.

Quercetin; Synthesis of ——. St. v. Kostanecki, V. Lampe, and J. Tambor. Ber., 1904, **37**, 1402—1405.

2′-Hydroxy-4′.6′.3.4-tetramethoxychalkone—

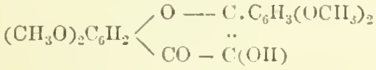
$$(CH_3O)_2(OH)C_6H_2.CO.CH:CH.C_6H_3(OCH_3)_2$$

is converted by boiling with dilute hydrochloric acid into 1.3.3′.4′-tetramethoxyflavanone—



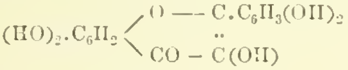
$$(CH_3O)_2C_6H_2\begin{cases}O - CH.C_6H_3(OCH_3)_2\\ \qquad\quad \cdot\\ CO - CH_2\end{cases}$$

This is converted into an isonitroso-derivative, which yields with dilute mineral acids 1.3.3′.4′-tetramethoxyflavonol—



$$(CH_3O)_2C_6H_2\begin{cases}O - C.C_6H_3(OCH_3)_2\\ \qquad\quad \cdot\cdot\\ CO - C(OH)\end{cases}$$

This is completely demethylated by hydriodic acid, forming quercetin—



$$(HO)_2.C_6H_2\begin{cases}O - C.C_6H_3(OH)_2\\ \qquad\quad \cdot\cdot\\ CO - C(OH)\end{cases}$$

E. F.

Indophenine Reaction. F. W. Bauer. XXIII., page 562.

English Patents.

Halogen Derivatives of Oxyanthraquinones; Manufacture of ——. [*Anthracene Dyestuffs.*] M. Iljinski, Krefeld, and R. Wedekind and Co., Uerdingen. Eng. Pat. 8503, April 14, 1903.

New halogen derivatives of *m*-hydroxyanthraquinone, anthraflavic acid, iso-anthraflavic acid, alizarin, flavopurpurin, and iso-purpurin are prepared by treating those substances in aqueous suspension with a halogen, or with a halogen compound adapted to allow the action of halogen in the nascent state in presence of an acid. The new products are very stable and can be sulphonated by means of fuming sulphuric acid without loss of halogen.—E. F.

Basic [*Acridine*] *Dyestuffs.* T. R. Shillito, London. From Aniline Colour and Extract Works, formerly J. R. Geigy, Basle. Eng. Pat. 11,882, May 25, 1903.

See Fr. Pat. 330,487 of 1903 and addition thereto; this J., 1903, 1082 and 1241.—T. F. B.

Anthracene Derivatives [*Nitro-amino-anthraquinones*]; *Manufacture of* ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld. Eng. Pat. 12,099, May 27, 1903.

See Fr. Pat. 332,321 of 1903; this J., 1903, 1241.—T. F. B.

Sulphurised [*Sulphide*] *Dyestuffs; Manufacture of* ——. O. Imray, London. From Soc. Anon. Mat. Col. et Prod. Chim. de St. Denis, Paris. Eng. Pat. 12,298, May 29, 1903.

See Addition, of May 19, 1903, to Fr. Pat. 292,400 of 1899; this J., 1903, 1241.—T. F. B.

Aniline Dyeing Compound. G. Rowland, Knoxville. Eng. Pat. 1502, Jan. 20, 1904.

An aqueous solution of a basic or neutral dyestuff is incorporated with a soap so as to form a hard cake readily soluble in water. Goods can be cleaned and dyed in one operation with this substance.—R. S.

French Patents.

Monazo Dyestuffs; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 338,103, March 9, 1903.

See Eng. Pat. 5269 of 1903; this J., 1904, 183.—T. F. B.

Sulphide Dyestuffs; Process for Preparing Black ——. Kalle et Cie. Fr. Pat. 337,278, Dec. 3, 1903.

By melting amino compounds of the benzene series and nitrophenols with alkali polysulphides, avoiding too rapid reduction of the nitro compound, dyestuffs are obtained which give black shades on cotton from a sodium sulphide solution. The dyestuff prepared from *p*-phenylenediamine and *o*-nitrophenol is described. The same class of dyestuff is also produced by melting benzene azo-*o*-nitrophenol or dinitrophenol with small quantities of sodium tetrasulphide.—T. F. B.

Tetrazo Dyestuffs, Dyeing Violet to Blue, derived from Aminonaphtholdisulphonic Acid 2.5.1.7; Production of New ——. [*Azo Dyestuffs.*] Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 337,891, Dec. 19, 1903.

See Eng. Pat. 28,033 of 1903; this J., 1904, 319.—T. F. B.

Azo Dyestuffs and Lakes produced therefrom; Preparation of New ——. Soc. Anon. F. Bayer et Cie. Fr. Pat. 337,942, Dec. 22, 1903.

Diazo derivatives of aminoanthraquinones or of aminoanthraquinone sulphonic acids are combined with naphthol sulphonic acids. Red to reddish-blue dyestuffs are so obtained of value for the production of lakes, fast to light, which are produced by dissolving, or suspending in water, an alkali salt of the dyestuff, and then adding a solution of a compound of calcium, barium, strontium, magnesium, aluminium, &c.—E. F.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Azo Dyestuffs on Cotton; Action of Copper Sulphate on Direct ——. J. Mueller. Chem.-Zeit., 1904, **28**, 423.

According to the author, the theory of A. Scheurer on the protection of dyestuffs against sunlight by copper oxide, still remains intact. Observations made show that the copper sulphate acts chemically on the direct azo dyestuffs on treating for some time with this salt after dyeing. A copper salt is formed with the dyestuff, the copper going, in the first place, into the sulpho group, and, in the second, into the hydroxyl groups. When sulpho and hydroxyl groups are found in the same molecule, the copper can, under certain conditions, go into both groups. —R. S.

"*Crude Fibre*"; *Preparation* [*Determination*] *of* —— *from Vegetable Fibres containing Lignin, by means of Sodium Peroxide.* A. Duschetschkin. XXIII., page 563.

Engraving Rollers for Calico and Carpet Printing; Employment of Photography in ——. P. J. Lamp'l. XXI., page 560.

English Patents.

Dyeing Sliver and other Textile Fibres: Apparatus for ——. H. H. Lake, London. From D. Mattei, Genoa. Eng. Pat. 6731, March 23, 1903.

See Fr. Pat. 334,681 of 1903; this J., 1904, 115.—R. S.

Cops, Cheeses, or the like; Machine for Dyeing, Scouring, Bleaching, or Treating with Liquids, Textile Fibres in the form of ——, *without Perforated Broaches or Tubes.* R. Rawson and E. Lodge, Huddersfield. Eng. Pat. 10,035, May 4, 1903.

This machine consists of a frame made up of bars and cross-bars forming a number of recesses into which the cops or cheeses fit so as to close up all openings. A number of these frames are placed one above the other in a vessel, and the liquid is forced through them by means of a pump. —R. S.

Printing Fabrics with Indigo. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine. Eng. Pat. 13,116, June 11, 1903.

In printing indigo by the hydrosulphite method, strong caustic alkalis are substituted for the alkali salts previously used, and the hydrosulphite is displaced by one of the new aldehyde-hydrosulphite compounds described in Eng. Pat. 5867, March 13, 1903 (this J., 1904, 369). Good results are obtained as follows:—120 grms. of formaldehyde-sodium hydrosulphite compound are dissolved in 50 grms. of water at 40°—50° C., cooled, and slowly stirred into 500 grms. of alkaline thickening agent; to this is added 150 grms. of 10 per cent. indigo paste, mixed with 180 grms. of the thickening agent. The thickening agent can be made from 120 grms. of "gomme industrielle" dissolved in 430 grms. of hot water, and when cold 450 grms. of solid caustic soda added with continuous stirring. The cotton, bleached, or dyed with Turkey red, is printed with this mixture, dried, steamed in a Mather-Platt for 2—3 minutes at 100° C., then washed, whereupon the Indigo White oxidises to Indigo Blue, which, if necessary, is finally acidified and soaped.—R. S.

United States Patents.

Matting or Felting Fibres together; Method of ——. G. Goldman, Baltimore. U.S. Pat. 758,243, April 26, 1904.

A dry finely-divided binding material, such as gelatin, is introduced between the fibres, together with a hygroscopic substance capable of imparting moisture to it, *e.g.*, magnesium chloride; or, after the introduction of the gelatin, the material may be treated with a solvent of the latter. The fibrous material is then submitted to heat and pressure.—A. B. S.

Felting or Matting Fibres together; Process for ——. G. Goldman, Baltimore. U.S. Pat. 758,244, April 26, 1904.

A dry, finely-powdered mixture of a soluble soap and a metallic salt, such as alum, is introduced between the fibres; the material is then submitted to the action of steam and pressure, which cause the formation of an insoluble metallic soap, which binds the fibres together.—A. B. S.

Uniting or Matting Fibres together; Process for ——. G. Goldman, Baltimore. U.S. Pat. 758,245, April 26, 1904.

A dry, finely-divided mixture of a resin and of a metallic oxide, such as zinc oxide, is introduced between the fibres. On submitting the fibrous material to the action of heat and pressure, a metallic resinate is formed, which binds the fibres together.—A. B. S.

Uniting or Matting Fibres together; Process for ——. G. Goldman, Baltimore. U.S. Pats. 758,246 and 758,247, April 26, 1904.

Finely-divided resin alone, or mixtures of finely-divided resin and a metallic resinate, or of resin and a metallic soap, are introduced between the fibres; the material is then submitted to heat and pressure.—A. B. S.

Felting or Matting Fibres together; Method of ——. G. Goldman, Baltimore. U.S. Pat. 758,311, April 26, 1904.

Dry flour is introduced between the fibres together with a substance containing water of crystallisation, such as crystallised sodium carbonate. The material is then submitted to heat and pressure in the presence of steam. —A. B. S.

Dyeing Apparatus; Automatic ——. J. Marshall, Fall River. U.S. Pat. 757,478, April 19, 1904.

A horizontal cylindrical dye-vat is divided into compartments by perforated vertical plates. A shaft, supported approximately in the axis of the vat, carries forks or prongs at short intervals; the mechanism provided gives the shaft a wide-angle oscillating movement, so that the forks raise the goods to be dyed out of the liquor, keeping them out for a short time, and then return them to the liquor, and out of it again at the other extremity of their oscillations. Steam- and water-inlets and a vapour outlet are also provided. —T. F. B.

Sizing [for Textiles]. A. Müller-Jacobs, Richmond Hill, Assignor to Cosmos Chemical Co., New York. U.S. Pat. 757,948, April 19, 1904

A sizing, suitable for fibrous substances, consists of an amide of a higher fatty acid suspended in "a soluble magma having the property of keeping it in a finely-divided, discrete, and insoluble state."—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

Record Ink; Commonwealth of Massachusetts Specifications for a Standard ——. Commissioner R. F. Swan. Govt. Specif. Commonwealth of Massachusetts, U.S.A.

The following specifications were prepared by B. F. Davenport, and have been adopted by the Commonwealth of Massachusetts. The ink must be a gallotannate of iron ink, not inferior in any essential quality to a typical ink properly prepared according to the following formula, the ingredients being of the quality prescribed by the U.S.P., and the percentage of true acid in the tannic acid having been determined by the Loewenthal and Schroeder method. Typical ink:—Dry pure tannic acid, 23·4 parts by weight; crystallised gallic acid, 7·7; ferrous sulphate, 30·0; gum arabic, 10·0; dilute hydrochloric acid, 25·0; phenol, 1·0; and water sufficient to make up the mixture at the temperature of 60° F. to the volume of 1,000 parts by weight of water. The ink must not contain less iron than the typical ink, and must have a specific gravity of 1·035—1·040 at 60° F. A fluid ounce of the ink allowed to stand at rest in a white glass vessel, protected from dust, but freely exposed to the air, in diffused daylight for two weeks, at a temperature of 50°—60° F., must remain as free from deposit as the typical ink under similar conditions. It must be as fluid, flow as well, and develop its colour as quickly as the typical ink, and must not penetrate the paper more readily, nor remain more sticky immediately after drying than the latter. The colour produced when the ink is used upon the standard record paper must, after a week's exposure to diffused daylight, be as intense a black as that produced by the typical ink, and must be equally resistant to the action of light, air, water, or alcohol.—A. S.

English Patent.

Spraying Colour on to Paper Fabrics and other Surfaces; Apparatus for ——. C. L. Burdick, Wood Green. Eng. Pat. 8703, April 16, 1903.

See Fr. Pat. 328,714 of 1903; this J., 1903, 994.—R. S.

VII.—ACIDS, ALKALIS, AND SALTS.

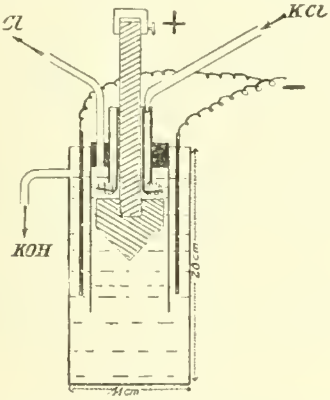
Weak Acid in presence of one of its Normal Salts; Apparent Diminution of Energy of a ——. G. Chesneau. Comptes rend., 1904, **138**, 968—970.

The addition of acetates to dilute acetic acid causes a considerable diminution in the rate of evolution of hydrogen by the action of the acid on zinc. The diminution does not, apparently, depend on the ionisation of the salt, since zinc acetate, which is little ionised, causes a much greater decrease in the evolution of hydrogen than does sodium acetate; whilst acetone, which is not ionised, reduces the rate of evolution to one-tenth.

Aqueous N/10 nickel acetate solution is not precipitated by sulphuretted hydrogen; the addition of small quantities of acetic acid gives a slight precipitate, which is redissolved on further addition. In presence of sodium acetate and acetic acid, however, a complete precipitation of nickel sulphide results. It is found that no alkali sulphide is formed on passing sulphuretted hydrogen into alkali acetate solution, even in presence of free acetic acid; this fact, then, the author concludes, accounts for the apparent diminution of the energy of the sulphuretted hydrogen and the incomplete precipitation of the sulphide.—T. F. B.

Electrolysis of Alkali Chlorides; "Bell Process" for ——. O. Steiner. Z. Elektrochem., 1904, **10**, 317—331.

The "bell process," now employed in one Austrian and three German works, relies (see Eng. Pat. 16,129 of 1898; this J., 1898, 1147) on the influence of density and a steady supply of fresh chloride solution to the anode for the effective separation of the anode and cathode products, no diaphragm being employed. To prevent the mixing caused by evolution of gas at the electrodes, the cathode and anode are separated by a bell, which covers the latter and reaches well below the electrodes (see figure). Extended laboratory experiments have been previously carried out to study this process (see Adolf; Z. Elektrochem., 1901, **7**, 581; this J., 1901, 715), but since their publication the German patent has been issued, which deals more fully with some of the principles of satisfactory working; and this information the present author has made use of, particularly in studying the conditions required for continuous production. Of primary importance is the way in which the chloride solution is allowed to flow into the anode chamber; it should form a homogeneous mixture with the solution around the anode, and not flow down, as it tends to do, on account of its density, and disturb the layers of solution at a lower level. If this condition be observed a neutral zone separates the alkaline cathode solution from the anode liquid, which is saturated with chlorine. This boundary layer can be clearly seen, on account of the difference in refractive index. If the addition of chloride solution correspond to the strength of current and cross-section of the bell, the downward motion of chloride prevents the hydroxyl-ions from reaching the anode, and the separating zone maintains its position unchanged. The clear definition of the boundary seems to depend to some extent on the formation of acid in the anode chamber, due, for instance, to the small amount of oxygen volved there in addition to chlorine; the hydrogen-ions hen migrate and neutralise the hydroxyl at the separating one. The lower the concentration of the chloride solution nd the lower the current density as measured in relation the cross-section of the bell, and further, the higher the lkali content of the cathode solution, the greater will be he distance of the boundary layer above the bottom edge of he bell, and consequently the less its distance from the node. For satisfactory working the neutral zone should be at least 1 cm. below the bottom of the anode. The uthor has shown by his experiments that an alkali lye of 0 to 130 grms. of caustic potash per litre can be connuously produced with a current yield of 85 to 94 per cent., nd that the anode gases contain 97 to 100 per cent. of lorine. The current density was 2 to 4 ampères per . dcm. of cross-section of the bell, and the difference of tential (P.D.), 3·7 to 4·2 volts. Up to a maximum of 0 grms. of caustic potash per litre, the yield is almost dependent of the strength of the alkali solution obtained. ith an anode of ordinary electrode carbon a colourless hode lye cannot be obtained without special treatment, Acheson graphite was found to be quite satisfactory. —R. S. H.



Barium Nitrate; Decomposition of —— by Heat. B. N. Gottlieb. Chem.-Zeit., 1904, **28**, 356.

By gentle and long-continued heating of barium nitrate in a current of dry air, only 30·7 per cent. of the nitrate was decomposed and 24·6 per cent. of nitric acid recovered, whereas by raising the temperature rapidly to a high point, 95·6 per cent. of the nitrate was decomposed and 38·6 per cent. of nitric acid recovered. Technically the best result is obtained by subjecting the nitrate, in small quantities at a time, to a white heat, so that decomposition takes place before the mass melts.—G. W. McD.

Silica; Reduction of —— by Hydrogen. A. Dufour. Comptes rend., 1904, **138**, 1101—1103.

Silica is reduced by hydrogen at a temperature above the fusing point of silicon, silicon hydride and water being formed. At rather lower temperatures silicon is formed, whilst lower still the inverse reaction takes place, *viz.*, silica and hydrogen are re-formed.—T. F. B.

Hydrofluoric Acid and Hydrofluosilicic Acid; Titration of ——. J. Katz. XXIII., page 562.

Sulphites; Electrolytic Oxidation of —— and Electrochemical Formation of Dithionate. A. Friessner. XI. A., page 548.

English Patents.

Acid Towers and Condensers; Packing for ——. J. S. Smithson, London. Eng. Pat. 10,053, May 15, 1903.

Calcined flints are used as packing for Glover or Gay-Lussac towers for sulphuric acid, or in condensers for other chemical gases.—W. H. C.

Hydrocyanic Acid and Cyanides; Manufacture of —— Grossmann's Cyanide Patents Syndicate, Ltd., and J. Grossmann, Manchester. Eng. Pat. 13,412, June 16, 1903.

See Fr. Pat. 331,331 of 1903; this J., 1903, 1130.—T. F. B.

[Acid] Sulphates of the Alkali Metals; Process for the Manufacture of Dry ——, and the Products thereof. S. Trivick, South Norwood. Eng. Pat. 8819, April 18, 1903.

See U.S. Pat. 728,335, of 1903; this J., 1903, 742.—T. F. B.

Lime and Fuel Gas; Method of and Apparatus for the Manufacture of ——. R. Pearson. Eng. Pat. 10,624, May 9, 1903. II., page 539.

United States Patents.

Nitric Dioxide and Nitric Acid; Process of Making ——. G. Pauling, Olbernhau. U.S. Pat. 758,774, May 3, 1904.

See Fr. Pat. 325,244 of 1902; this J., 1903, 696.—T. F. B.

Iron Pyrites; Preparing —— for Desulphurisation. U. Wedge, Ardmore. U.S. Pat. 757,531, April 19, 1904.

Iron pyrites, in small particles, is mixed with iron oxide (in the form of leached pyrites cinders or of purple ore, for instance) and with sulphuric acid, with or without ferrous sulphate, and the mass is made up into blocks or briquettes. Or iron pyrites is made into briquettes with ferrous sulphate, with or without iron oxide or lead sulphate. Another mixture consists of iron pyrites, ferrous sulphate, lead sulphate, sulphuric acid, and pyrites cinder, or the like, for briquetting.—E. S.

Titanous Compound [Titanous Sodium Sulphate], and Process of Making same. H. Spence, Assignor to Peter Spence and Sons, Ltd., Manchester. U.S. Pat. 758,710, May 3, 1904.

See Fr. Pat. 324,205 of 1902; this J., 1903, 628.—T. F. B.

French Patents.

Alkaline-Earth Bases; Manufacture of ——. E. Marlier. Fr. Pat. 338,059, Oct. 26, 1903.

A mixture of scrap zinc, crystallised hydrate of barium hydroxide, and of water, is gradually heated to 100° C. in a closed iron vessel. Barium sulphide solution is then added, whilst the solution of the zinc still proceeds, with continuous evolution of hydrogen. The "zincate" of barium formed in the process reacts with the barium sulphide in presence of water to form barium hydrate and zinc sulphide, which are separated by filtration. The process is applicable to the production of the hydrates of the alkaline earths generally.—E. S.

Magnesium and Zinc Peroxides; Electrolytic Process for the Manufacture of ——. F. Hinz. Fr. Pat. 337,285, Dec. 4, 1903. XI. A., page 549.

Nickel Monoxide; Preparation of a —— *suitable for Reduction in an Electric Furnace.* Soc. Siemens und Halske A.-G. Fr. Pat. 337,712, Dec. 12, 1903.

The nickel hydroxide thrown down from solutions of nickel chloride or sulphate by oxides or carbonates of alkali or alkaline-earth metals, is calcined, and plunged into water whilst yet hot, whereby it is freed from soluble chlorides and sulphates, and rendered suitable for reduction in an electric furnace. The same process is claimed as applicable to the purification of similar hydroxides, and especially of zinc hydroxide.—E. S.

Brine; Process and Apparatus for Evaporating Weak ——. E. Moll. Fr. Pat. 337,989, Dec. 24, 1903.

See Eng. Pat. 28,518 of 1903; this J., 1904, 441.—T. F. B.

Cyanides; Process for Preparing ——. J. Grossmann. Addition, dated Dec. 24, 1903, to Fr. Pat. 331,331, April 18, 1903.

See Eng. Pat. 4513 of 1903; this J., 1904, 370.—T. F. B.

VIII.—GLASS, POTTERY, ENAMELS.

Silicates; Reduced ——. C. Simmonds. Proc. Chem. Soc., 1904, **20**, 21.

The substance left when lead silicates are reduced by heating in hydrogen (this J., 1903, 1261) is in general shown to be a compound which can be regarded as a combination of the metal and silica, in the same sense as the original silicate is a combination of the metallic oxide and silica. In some cases, however, a certain proportion of metallic lead is mixed with the substance; this occurs when the original silicates (for example, orthosilicates and basic silicates) contain a greater number of basic than of acidic oxides in the silicate molecule. The reduced residues are generally more refractory than the original silicates. Treatment with the commoner acids and oxidising agents has little effect on them, but they are decomposed by hydrofluoric acid and by fusion with alkali carbonates. The term "silicites" is suggested for these reduced silicates. Similar results were obtained with the silicates of copper, iron, nickel, and cobalt.

English Patent.

Glass; [Use of Electric Current in] Working of ——. H. J. Hays, Pittsburg. Eng. Pat. 4501, Feb. 23, 1904.

The glass to be worked is maintained hot during the working by passing an electric current through the glass. A variable resistance is interposed in the circuit, so that the strength of the current can be altered.—A. G. L.

United States Patent.

Enamelled Ware; Manufacture of ——. T. M. Lunan, Newark, Assignor to the Central Stamping Co., New York. U.S. Pat. 758,325, April 26, 1904.

The cleaned article is subjected to the action of an oxidising agent, such as potassium chlorate solution, which will attack the metal of which the article is made. An enamel "carrying metallic bodies" and acid in character is then applied, followed, whilst still moist, by an agent suitable to precipitate the metallic constituents of the enamel, such as a non-metallic hydroxide. The whole is then heated, to flux and set the enamel.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

Ultramarine; Constitution of ——. P. Rohland. XIII. A., page 551.

English Patents.

Tiles or other Glazed Articles; Method of Manufacturing —— *from Slate or Slate Refuse.* K. N. Frydenlund, Christianshavn. Eng. Pat. 5985, March 11, 1904.

The finely-powdered slate, to which 5—8 per cent. of powdered chalk may be added, is moistened with a liquid prepared by heating 3 parts (by volume) of powdered sodium hydroxide with 16 parts of colophony and 30 parts of water, until a uniformly thin mixture is obtained, and then adding to this mixture a solution of 30 parts of sodium silicate and 10 parts of water to which 1 part of kaolin is preferably added. The plastic mass obtained is pressed into plates or tiles, using a pressure of 15 to 40 kilos. per sq. cm., which are then kept for some days at the ordinary temperature, after which they are dried for three days at 60° to 100° C., glazed, and burnt at 800° to 1000° C. —A. G. L.

Stone, Blocks, or Bricks; Manufacture of Artificial ——. V. Steger, Bonham. Eng. Pat. 6007, March 11, 1904.

See U.S. Pat. 756,295 of 1904; this J., 1904, 490.—T. F. B.

United States Patents.

Plaster of Paris; Manufacture of ——. W. Brothers, Prestwich. U.S. Pat. 757,649, April 19, 1904.

See Fr. Pat. 333,858 of 1903; this J., 1904, 20.—T. F. B.

Refractory Material [Cement]; Basic ——. A. T. Macfarlane, Rochester. U.S. Pat. 757,821, April 19, 1904.

See Eng. Pat. 4298 of 1902; this J., 1903, 366.—T. F. B.

Cementing Material, and Process of Making same. T. W. Cappon, Ossining. U.S. Pat. 757,883, April 19, 1904.

Calcined magnesian limestone, or a mixture of magnesia and lime, is partially hydrated, and a certain proportion of hydrochloric acid or of a suitable chloride is added, to form a cementing material. Dry mortars are prepared by mixing partly hydrated magnesia and lime with a large proportion of sand or the like, and adding a suitable chloride. Or the solution of such a chloride is sprinkled upon an agitated mixture of partially hydrated calcium-magnesium oxides.—E. S.

French Patents.

Stones, Artificial, suitable for Pavements, Buildings Above and Below Ground, and for Hydraulic Purposes; Process of Making ——. J. J. Niessen. Fr. Pat. 338,077, Nov. 4, 1903.

See Eng. Pat. 25,393 of 1903; this J., 1904, 254.—T. F. B

Stone; Process of Making Artificial ——. C. Reinke. Fr. Pat. 337,843, Dec. 19, 1903.

See Eng. Pat. 26,478 of 1903; this J., 1904, 188.—T. F. B

Paving or Asphalt Compositions, Waterproof Compounds and Paints, &c. W. P. Thompson. Fr. Pat. 338,106 Dec. 8, 1903.

See Eng. Pat. 24,807 of 1902; this J., 1904, 61.—T. F. B

Waterproofing Bricks, Stone, and Similar Porous Substances. N. Farnham. Fr. Pat. 337,846, Dec. 19, 1903.

See U.S. Pat. 748,595 of 1994; this J., 1904, 116.—T. F.

X.—METALLURGY.

Gold and Silver; Extracting —— *at Wallstreet Mill Colorado.* F. C. Perkins. Electrochem. Ind., 1904, 24—26.

The method used is that of electro-chlorination as devis by Greenawalt. The crushed ore is roasted, and dro from the roasting furnace into a furnace pit, where the silver and the base metals are converted into chlorides by means of common salt. The ore is then conveyed to leaching vats, where the gold is dissolved by a solution containing free chlorine and bromine, and oxygen compounds of these elements, obtained by electrolysing in "regenerating cells" a 15 per cent. solution of common salt containing $\frac{1}{2}$ per cent. of bromine in the form of a bromide. A current-density of 20 ampères per sq. ft. and an E.M.F. of $4\frac{1}{4}$ volts per cell are employed, with graphitised carbon anodes, lead cathodes, and diaphragms of asbestos. Any free chlorine or bromine escaping at the anodes is led into the furnace-pit to aid the chlorination. From the leaching vats the solution passes, in zigzag fashion, through precipitating cells fitted with lead anodes and cathodes, arranged $1\frac{1}{2}$ in. apart. By a current-density of $\frac{1}{36}$ ampère per sq. ft., the gold and silver are deposited together as a black slime upon the cathodes.—A. S.

Gold; Melting Point of ——. A. Jacquerod and F. L. Perrot. Comptes rend., 1904, **138**, 1032—1034.

A gold wire completing a telephone circuit was heated in a platinum resistance furnace in immediate proximity to the vitreous silica bulb of a constant volume thermometer, and the pressure of the enclosed gas read at the instant of interruption of the circuit. The result obtained, with nitrogen, at a pressure of 200 mm. at the ordinary temperature, as the thermometric gas, was 1067° C.
—J. T. D.

Copper and Arsenic; Alloys of ——. A. H. Hiorns. Electrochem. and Metall., 1904, **3**, 648—655.

Alloys containing from 0·1 to 43·0 per cent. of arsenic were prepared by adding the requisite amount of arsenic to melted copper and keeping at a temperature near 800° C. for an hour before finally cooling. No volatilisation of arsenic occurred with the poorer alloys; but alloys containing more than 43 per cent. of arsenic cannot be kept melted without continuously altering in composition from the rapid burning off of the arsenic. The freezing points and the microscopic appearance (both of the surface and of sections parallel and perpendicular to it) of the alloys were examined and recorded. The freezing-point curve shows a steady fall from 1060° C. (pure copper) to 685° C. (arsenic 19·2 per cent.), a rise through a point of inflexion it 750° C. (arsenic 28·3 per cent.; Cu_3As) to 807° C. (arsenic 32·19 per cent.; Cu_5As_2), a rapid drop to 695° C. arsenic 35 per cent.), a rise to a maximum at 740° C. arsenic 37·2 per cent.; Cu_2As), and a fall to 702° C. arsenic 41·0 per cent.). Alloys, the freezing-points of hich are at or near a maximum on the curve, show on icroscopic examination of the etched surface a uniform ıbstance—crystal grains with fine boundaries; leaving the ıaximum in either direction, the boundaries widen and are lled with a striated matter different from the crystal-grains -no doubt a eutectic; and at a minimum the eutectic :cupies the whole surface.—J. T. D.

Lead-Aluminium Alloys. H. Pécheux. Comptes rend., 1904, **138**, 1042—1044.

hen aluminium is melted and lead is added in proportion eater than 10 per cent., the metals separate on cooling to three layers: lead, aluminium, and between them an oy containing from 90 to 97 per cent. of aluminium. ıe alloys with 93, 95, and 98 per cent. have densities of 745, 2·674, 2·600 respectively, and melting-points near ıt of aluminium. Their colour is like that of aluminium, t they are less lustrous. All are malleable, easily cut, ter than aluminium, and have a granular fracture. remelting, they become somewhat richer in lead, ough a tendency to liquation. They do not oxidise moist air nor at their melting-points. They are attacked the cold by hydrochloric and by strong sulphuric acid, h evolution of hydrogen, and by strong nitric acid when ; strong solution of potassium hydroxide also attacks m. They are without action on distilled water, whether d or hot.—J. T. D.

Zinc-Aluminium Alloys. H. Pécheux. Comptes rend., 1904, **138**, 1103—1104.

Well-defined alloys were obtained from zinc and aluminium corresponding to the formulæ Zn_3Al, Zn_2Al, $ZnAl$, $ZnAl_2$, $ZnAl_3$, $ZnAl_4$, $ZnAl_6$, $ZnAl_{10}$, and $ZnAl_{12}$. Their fusing points and densities all lie between those of zinc and aluminium, and those containing most zinc are the hardest. They are all dissolved by cold hydrochloric acid and by hot dilute nitric acid. Cold concentrated nitric acid attacks the first three, and cold dilute nitric acid the first five. The alloys Zn_3Al, $ZnAl_6$, $ZnAl_{10}$, and $ZnAl_{12}$ are only slightly affected by cold potassium hydroxide solution; the others are strongly attacked, potassium zincate and aluminate probably being formed.—T. F. B.

Manganese in Presence of Iron [in Iron Ores, &c.]; Volumetric Determination of —— by Potassium Permanganate, Guyart-Volhard-Wolff Method. L. L. de Koninck. XXIII., page 562.

English Patent.

Coal, Ores, and other Minerals: Method of and Apparatus for Treating ——, for Draining them of Water. F. Baum. Eng. Pat. 2485, Feb. 1, 1904. II., page 539.

United States Patents.

Iron-Sand; Method of Converting —— into Briquettes or Lumps. T. Rouse, Assignor to H. Cohn, London. U.S. Pat. 758,853, May 3, 1904.

See Eng. Pat. 21,880 of 1902; this J., 1903, 1090.—T. F. B.

Copper and Zinc from Ores; Process of Electrolytically Extracting ——. S. Laszczynski, Kielce. U.S. Pat. 757,817, April 19, 1904.

See Fr. Pat. 326,542 of 1902; this J., 1903, 805.—T. F. B.

Metals; Apparatus for Extracting —— by Chemical Process. T. B. Joseph, San Francisco. U.S. Pat. 758,367, April 26, 1904.

The apparatus consists of a tank having a filter bottom, above and near which is placed a perforated pipe, connected to an air compressor, the pipe having lateral parallel branches extending across, such perforations being arranged to discharge small streams of air upwardly, with only a slight inclination, to drive the superincumbent slimes upwards. Compare U.S. Pats. 718,633, 728,397, and 732,639 of 1903; this J., 1903, 214, 747, and 914.—E. S.

Ores; Treating ——. W. F. Hannes, Assignor to W. J. Browning, both of Deming. U.S. Pat. 758,532, April 26, 1904.

Solid fuel and ore are supplied through separate vertical compartments merging together in the body of the furnace. Oxygen is admitted to the fuel compartment, and the resulting gases are led into the ore space in the body portion, to which excess of oxygen is supplied to burn any sulphur or other like impurities. The roasted ore is then fed into the zone of the fuel combustion, where reduction is effected, and the fused metal is withdrawn. Apparatus for the manipulation of the ore and fuel within the furnace is provided. Compare Eng. Pat. 10,929 and U.S. Pat. 712,374 of 1902; this J., 1902, 1141; and Fr. Pat. 321,087 of 1902; this J., 1903, 148.—E. S.

French Patents.

Steel Ingots; Process for Making Faultless —— a short time after Melting, and for Improving their Quality. R. W. Hunt. Fr. Pat. 337,876, Nov. 3, 1903.

See Eng. Pat. 23,821 of 1903; this J., 1904, 374.—T. F. B.

Cast-Steel Ingots; Process of Improving ——. R. W. Hunt. Fr. Pat. 338,071, Nov. 3, 1903.

See Eng. Pat. 23,821 of 1903; this J., 1904, 374.—E. S.

Cast-Steel Ingots; Process of Producing —— immediately before lifting the Moulds, without Defects, and Improved in Quality. R. W. Hunt. Fr. Pat. 338,073, Nov. 3, 1903.

See Eng. Pat. 23,821 of 1903; this J., 1904, 374.—E. S.

Iron-Nickel-Chromium Alloy. F. and M. Laur. Fr. Pat. 337,967, Dec. 23, 1903.

A SELECTION is made of chrome iron ore and of nickeliferous ores, such as "garnierite" (a magnesium-nickel silicate), a mixture of which is heated with the minimum of carbon necessary for reduction, in an electric or other furnace. The product may contain ordinarily from 10 to 30 parts each of iron, chromium, and nickel, 3 to 12 parts of silicon, and 3 to 5 parts of carbon. Such alloys are stated to be especially applicable in the preparation and refining of steel.—E. S.

Crucible Furnace. The Morgan Crucible Co., Ltd., England. Fr. Pat. 337,802, Dec. 16, 1903.

THE crucible is fixed in a double-cased iron furnace, lined with refractory material. The furnace stands on a hollow base, through which the air is led to the tuyères. A removable cover is arranged above the furnace, with a jacketted flue for the waste gases. The air supply is led between the flue and the jacket to the base, in this way taking up some of the waste heat. The furnace with the crucible can be elevated, turned and tilted by suitable means, enabling the contents to be poured without removing the crucible.—W. H. C.

Minerals; Separation and Classification of the Metallic Constituents of ——. The Cattermole Ore Concentration Syndicate, Ltd. Fr. Pat. 338,021, Dec. 26, 1903.

SEE Eng. Pat. 18,589 of 1903; this J., 1904, 256.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Sulphites; Electrolytic Oxidation of ——, and Electrochemical Formation of Dithionate. A. Friessner. Z. Elektrochem., 1904, **10**, 265—289.

BY the electrolysis of neutral or alkaline solutions of alkali sulphite, under suitable conditions, dithionate as well as sulphate is formed at the anode. The formation of dithionate takes place according to the equation—

$$2SO_3'' + 2OH' + 2H' + 2\,(+) = S_2O_6'' + 2H_2O.$$

Dithionate is not produced by the electrolysis of acid, *i.e.*, bisulphite solutions, under any conditions, but on electrolysing without a diaphragm, besides sulphate at the anode and hydrosulphite at the cathode, thiosulphate is also produced, probably at the cathode. The formation of dithionate occurs both at polished and at platinised platinum anodes, but not at the latter at the ordinary temperature if these have been previously subjected to cathodic or chemical depolarisation. A high anode potential favours formation of dithionate, and this is best attained by using a platinised platinum anode which has been previously subjected to anodic polarisation in caustic soda solution. The formation of dithionate is retarded by a high current density, but favoured by rise of temperature.—A. S.

Platinum; Electrolytic Solution of ——. New Process for Preparing Platinocyanides. A. Brochet and J. Petit. Comptes rend., 1904, **138**, 1095—1097.

PLATINUM is very rapidly dissolved in cyanide solutions when subjected to the action of an alternating current, platinocyanides being produced; starting with barium cyanide, barium platinocyanide is easily obtained from the resulting solution by evaporation. Platinum is dissolved to a smaller extent in hydrochloric acid under the same conditions. In these respects it closely resembles iron and cobalt.—T. F. B.

Peat Gas Works for Large Central Electric Power Stations. A. Frank. II., page 538.

Mercury Vapour Electric Lamp; New ——. H. Paweck. II., page 539.

Electrolysis of Alkali Chlorides; "Bell Process" for ——. O. Steiner. VII., page 545.

ENGLISH PATENTS.

Glass; [Use of Electric Current in] Working of ——. H. J. Hays. Eng. Pat. 4501, Feb. 23, 1904. VIII., page 546.

UNITED STATES PATENTS.

Calcium Carbide; Process of Producing ——. W. S. Horry, Assignor to Union Carbide Co., Niagara Falls. U.S. Pat. 757,617, April 19, 1904.

A RESISTANCE furnace is employed; the electric current being led to several electrodes in contact with different parts of a charge of carbide-forming materials. The current density is concentrated along the path of the current in the charge, as, for instance, by causing it to converge from the several electrodes towards one common electrode at the base of the furnace. In this way a sufficiently high temperature is obtained to produce carbide or to bring it into a molten condition suitable for tapping.—R. S. H.

Electric Heating; Process of ——. W. S. Horry, Assignor to Union Carbide Co., Niagara Falls. U.S. Pat. 757,618, April 19, 1904.

ANY conducting material is heated by causing different phases of a polyphase current to simultaneously flow along paths which cross each other through the material. The path of the phase of maximum E.M.F. is progressively shifted, each phase being caused to traverse a resistance corresponding to its E.M.F. There are 29 claims; the process of heating, in its several modifications, being applied to the reduction of compounds and to the formation of carbide.—R. S. H.

Electric Heating; Process of ——. W. S. Horry, Assignor to Union Carbide Co., Niagara Falls. U.S. Pat. 757,619, April 19, 1904.

THE heating is effected by the passage of polyphase currents through conducting material, but the different phases are caused to converge to a common point within the material. Applications to the reduction of compounds and to the production and tapping of carbide are mentioned.—R. S. H.

Electric Heating; Method of ——. W. S. Horry, Assignor to Union Carbide Co., Niagara Falls. U.S. Pat. 757,620, April 19, 1904.

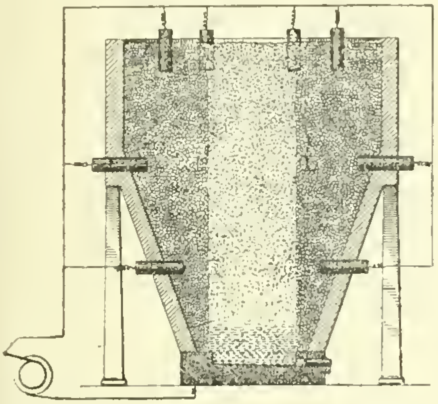
BY passing superposed electric currents through a pool of conducting material of varying cross-section, and thus maintaining a region of maximum current density, a heated zone is obtained suitable for effecting chemical or other changes in material fed into the pool. For the production of calcium carbide, the carbide-forming mixture is fed into the hottest zone of a pool of carbide, heated as above described, the product being withdrawn directly from this zone.—R. S. H.

Electric Furnace. W. S. Horry and E. F. Price, Assignor to Union Carbide Co., Niagara Falls. U.S. Pat. 757,621 April 19, 1904.

A RESISTANCE furnace is constructed with a hearth t support a charge of molten conducting material. Th several electrodes which conduct the current to the materi are so arranged as to produce a zone of maximum currer density. This object can also be attained by construc ing the hearth so that it converges towards the regio where the highest temperature is desired. The product withdrawn by gravity from this zone.—R. S. H.

Electric Heating [Calcium Carbide]. E. F. Price, Assi nor to Union Carbide Co., Niagara Falls. U.S. P 757,633, April 19, 1904.

A RESISTANCE furnace is constructed with a conduc ing core of broken or granular material. The su stances which are to be heated are placed in proximity this conductor. Superposed electric currents are led to t core in such a manner as to increase the current dens along the path of the current, so that finally a point is reached at which the substances react, are fused or become heated to the required temperature. Special mention is made of the production of calcium carbide and the tapping of it, in a molten condition, from the furnace.—R. S. H.



Electric Resistance Furnace. E. F. Price, Assignor to Union Carbide Co., Niagara Falls. U.S. Pat. 757,634, April 19, 1904.

Electric currents are led to a fixed "resistance conductor" n such a manner that the current density increases along it. n this way the conductor is heated ununiformly and the aterial in contact with the conductor is brought to the mperature required for its treatment.—R. S. H.

irculating Liquids [Electrolytes]; Apparatus for —— in Tanks. G. E. Dunton, New York. U.S. Pat. 758,430, April 26, 1904.

iquid is pumped by a centrifugal pump into a casing aced over a tank, from which the liquid is distributed to rions pipes running lengthwise over the tank. The pipes e fitted with nozzles, which are so arranged as to disarge the liquid lengthwise and towards the centre of the nk, each nozzle aiding the preceding one, so that a ntinuous circulation of the liquid in the tank is produced.
—L. F. G.

rculating Liquids [Electrolytes]; Apparatus for —— in Tanks. G. E. Dunton, New York. U.S. Pat. 758,513, April 26, 1904.

es are provided along opposite sides of a tank, and end along its upper portion, the pipes being fitted h nozzles disposed alternately, which discharge liquid ards the centre of the tank. Pumps connected to tion pipes supply liquid to the pipes. The tank may an electrolytic bath. (See also preceding abstract.)
—L. F. G.

French Patents.

ctrolytic Apparatus; Device [Surface Tension Grid] r ——. A. Wright. Fr. Pat. 337,284, Dec. 4, 1903. nder Internat. Conv., Dec. 5, 1902.

S Eng. Pat. 26,868 of 1902; this J., 1903, 703.—T. F. B.

gnesium and Zinc Peroxides; Electrolytic Process for e Manufacture of ——. F. Hinz. Fr. Pat. 337,285, ec. 4, 1903.

T anode compartment of an electrolytic cell is supplied w an aqueous (about 20 per cent.) solution of magnesium o inc chloride, whilst the cathode compartment contains m nesium or zinc chloride solution to which hydrogen p xide has been added; the anode is of platinum or c on, and the cathode platinum. An E.M.F. of 6 or 7 lts is used in preparing magnesium peroxide, and 2·5 to volts for zinc peroxide. Any free acid formed in the cathode compartment is neutralised by the addition of magnesium or zinc oxide or hydroxide.—T. F. B.

Magnesium Carbides; Direct Manufacture of —— from Carbon and Oxides or Carbonates of Magnesium. H. Auziès and A. Ségotlin. Fr. Pat. 337,878, Nov. 11, 1903. II., page 540.

Arc Lamps with Osmium Electrodes. Comp. Générale d'Électricité. Fr. Pat. 337,927, Dec. 22, 1903. II., page 540.

(*B.*)—ELECTRO-METALLURGY.

Metals; Electrolytic Stripping of ——. C. F. Burgess. Electrochem. Ind., 1904, 2, 8—11.

The process of removing the superfluous spelter from brazed bicycle frames (see this J., 1903, 1356) is described in detail. The goods are hung from anode bars in long wooden tanks between alternate sheet-iron cathodes, the electrolyte being a 5 per cent. solution of sodium nitrate. In a freshly made solution the steel anodes fail to become passive for some minutes, unless a little nitrite has been previously added. In time, again, the liquid becomes ammoniacal, the passive condition is lost, and active corrosion of the steel sets in; this is obviated by adding nitric acid day by day so as to preserve a slight acid reaction. The stripped brass settles to the bottom of the tank as a sludge of hydrated copper and zinc oxides. A current-density of 5—15 ampères per square foot may be used, for which 3—5 volts are required. After stripping, the goods are brushed wet, dipped in hot water, and allowed to dry. Many other metals can thus be stripped, and the recovery of tin from tinned iron is merely a question of securing good contact. Nickel cannot be dissolved away, but after continued electrolysis the plating is loosened and may be removed mechanically.—W. A. C.

Aluminium; Protection of —— against Corrosion. W. R. Mott. Electrochem. Ind., 1904, 2, 129—130.

In a solution of acid sodium phosphate a film is deposited on aluminium anodes which is thicker than, and chemically different from, the film due to tarnishing. Plates thus coated are acted on by hydrochloric acid a hundred times more slowly than bright surfaces, though the rate of action becomes identical after a few hours. Potash solutions attack both equally. Experiments made with both direct and alternating currents show that the resistance of the film is proportional to the voltage applied in forming it.
—W. A. C.

Aluminium; Electro-Plating upon ——. C. F. Burgess and C. Hambuechen. Electrochem. Ind., 1904, 2, 85.

The goods are first roughened by immersion in dilute hydrofluoric acid, then cleaned with a mixture of concentrated sulphuric and nitric acids, and covered with a firmly adherent coating of zinc by electrolysis in a bath of zinc and aluminium sulphates containing 1 per cent. of free hydrofluoric acid A current-density of 10—20 ampères per sq. ft. for 15 mins., is prescribed. The goods can then be silver- or copper-plated in the cyanide bath. Gold cannot satisfactorily be deposited directly on the zinc, but must be applied as a third coating upon copper.—W. A. C.

English Patents.

Electro-deposition of Metals; Apparatus for ——. [Agitators.] J. H. and A. Collis, London, and W. Head, St. Albans. Eng. Pat. 15,317, July 10, 1903.

A device for the agitation and circulation of the electrolyte in depositing tanks. The apparatus consists of a series of perforated tubes at the bottom of the tank connected with a supply of electrolyte under pressure. The solution is driven through the perforations and causes agitation of the liquid contents of the vat. It is drawn off at the top by means of a pump.—R. S. H.

Electric Furnaces. C. P. E. Schneider, Le Creusot. Eng. Pat. 28,805, Dec. 31, 1903.

A system of tubes projects from the melting chamber or crucible of an electric or other furnace, "serving as secondary winding for an alternating current transformer." The tubes open into the melting chamber at two points situated at different levels and at an inclination, in order to establish a continuous circulation between the crucible and the tubes, which latter are of relatively small section, so as to impart greater resistance to the circuit. The tubes may be ⊃-shaped, both ends entering the side of the crucible; or separate crucibles, or different chambers in the same furnace, may be connected by pairs of tubes carrying the field magnets. This system of electric heating may be used singly; or as supplementary to the employment of electrodes; or as accessory to the use of fuel in a Siemens' or other regenerative furnace. Reference is made to Eng. Pat. 7338 of 1901.—E. S.

Electric Melting Furnaces. Soc. Anon. l'Industrie Verrière et ses dérivés, Brussels. Eng. Pat. 5921, March 10, 1904. Under Internat. Conv., March 21, 1903.

In a resistance furnace containing a conducting charge, the current conductors or sets of electrodes are arranged at different heights in the wall of the furnace. In this way layers of charge of different thickness can be included in the circuit as desired. The heating action of the current is regulated, movable electrodes are dispensed with, and entrance of air to the furnace is avoided by the above arrangement.—R. S. H.

United States Patent.

Tin; Process of Obtaining —— by Electrolysis. E. Quintaine, Argenteuil. U.S. Pat. 699,012, April 29, 1902. Reissue, No. 12,214, April 26, 1904.

The acid solution of tin nitrate used as electrolyte in the original patent (this J., 1902, 779) is neutralised with ammonium sulphate instead of with ammonium chloride.
—T. F. B.

French Patents.

Monoxide of Nickel; Preparation of a ——, suitable for Reduction in an Electric Furnace. Soc. Siemens und Halske A.-G. Fr. Pat. 337,712, Dec. 12, 1903. VII., page 546.

Ores and Metallic Matters in General; [Electrical] Treatment of ——. M. Perreur-Lloyd. Fr. Pat. 337,763, Dec. 16, 1903.

Ores and metallic matters are digested with suitable solvents of their metals, and the solutions are subjected to electrical action to obtain the crude or spongy metal, which is refined by electrical solution and re-deposition.
—E. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Fats; Enzymic Decomposition of ——. E. Hoyer. Ber., 1904, **37**, 1436—1447. (See also this J., 1902, 1541, and 1903, 428.)

Attempts to Isolate the Enzyme.—No solution of the enzyme could be obtained either by extraction with solvents or by Buchner's method of isolating zymase, the filtrates being inactive or, at most, only slightly active. It was found that in seeds in process of germination the enzymic activity in that portion of the seed adjoining the germ was weaker than in that further removed from the germ. In strongly germinated seeds there was but little enzymic activity either in the seed or in the germ, the amount of hydrolysis effected in 72 hours being only 3 and 1 per cent. respectively. The turbid oil from expressed castor-seeds contained the active agent, and, on dilution with ether or carbon bisulphide, yielded a fine deposit with high enzymic activity. In experiments to determine whether larger quantities of the enzyme could be separated by repeated treatment of the crushed seed with oil, 200 grms. of cotton-seed oil and 100 grms. of crushed decorticated castor-seeds (= 50 per cent. of oil) were rubbed for 30 minutes with 100 grms. of sand, and pressed through linen. The turbid oil expressed effected 81 per cent. of hydrolysis in three hours. On filtration this turbid oil yielded a clear filtrate with no enzymic activity, whilst 0·1 grm. of the white residue on the filter effected the decomposition of 10 grms. of castor-seed oil to the amount of 70 per cent. in 16 hours and 80 per cent. in two days. The trituration and straining through linen was repeated until eventually hardly any solid particles passed through the cloth, and the final residue had then only slight enzymic activity. Instead of oil, acidified water could be used for this treatment with very similar results, a milky emulsion being obtained, which effected the decomposition of 86 to 87 per cent. of oil in two to five days. Quantitative separation of the enzyme by such methods was not effected, but only a certain degree of enriching. Since active particles are simultaneously removed, the value of such enriching from a technical point of view is problematical.

Influence of Time of Trituration.—50 grms. of castor seeds were triturated with 50 grms. of cotton-seed oil or 50 grms. of 0·6 per cent. acetic acid, samples tested under parallel conditions, and the amount of decomposition effected in 24 hours determined, with the following results:—

——	Seeds triturated with Oil.	Seeds triturated with Acidified Water.
	Per Cent.	Per Cent.
5 minutes' triturating	78	78
15 " "	81	83
30 " "	82	84

For technical purposes the author recommends a short vigorous trituration of the decorticated seeds by means of, *e.g.*, a paint-grinding mill. The addition of sand to the mass offers no advantage.

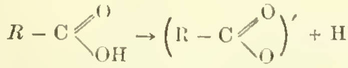
Addition of Acid.—There was found to be a definite relationship between the amount of seeds and the absolute amount of acid required, whilst there was a marked difference between the behaviour of different acids. Thus, in the case of formic acid the optimum concentration was 0·04 per cent., whereas acetic acid required a concentration of 0·06 per cent. under the same conditions as to amount of liquid, &c. But whilst with acetic acid at a concentration of 0·1 per cent., the emulsion obtained, possessed a relatively high degree of activity, formic acid in a concentration of 0·08 per cent. caused marked diminution in the activity of the enzyme. Sulphuric acid and oxalic acid were very similar in their action. With each the maximum decomposition was soon reached (0·08 to 0·1 per cent.), and the further addition of only small quantities of the acids was similarly injurious. Of the two, sulphuric acid gave better results than oxalic acid. To obtain the maximum results with butyric acid a much higher amount of acid was required, but the addition of still more acid had not any pronounced injurious effect. Thus a decomposition of 87 per cent. was effected in the presence of 0·3 to 0·5 per cent. of butyric acid, whilst on increasing the amount of acid to 1 per cent. the decomposition of the oil was 85 per cent. The absolute amount of acid present, and not its concentration, was proved to be the essential factor. Thus in the case of oxalic acid in 30 c.c. of water, a concentration of 0·1 per cent. effected, in presence of the enzyme, the same amount of hydrolysis as a concentration of 0·05 per cent. in 60 c.c. of water. Decomposition can also be effected in the presence of fatty acids, *e.g.*, old linseed oil but a relatively larger amount of acid must be used. Carbonic acid is practically useless for the purpose.
—C. A. M.

Saponification; Theory of ——. F. Goldschmidt. Z. Elektrochem., 1904, **10**, 221—222.

In commonly accepted theories of saponification in the presence of alcohol, the ionisation of the glyceride may be represented by $CH_2.CH.CH_2'''$ / 3(OR)', where represents the fatty acid radicle, whilst it is also assumed that the alcohol is dissociated into (C_2H_5) and (OH). Henriques (this J., 1898, 673) has confirmed the older observations of Duffy (J. Chem. Soc., 1852, 203) and Bouis (Comptes rend., **45**, 35), showing that ethyl esters of fatty acids are formed; and it is thus surprising, assuming the correctness of the ordinary ionisation theory, that a weak base like alcohol should combine with the fatty acid radicle when a strong base like potassium is present. The author explains the formation of soap from the ethyl esters by the assumption that the active groups in the reaction are the acyl group ($(RCO)^{\cdot}$) and the group ($(OC_2H'_5)$), soap ions $K^{\cdot}$ and $(RCOO)'$ and alcohol, being produced. The first step must be an ordinary reaction of the ions, in which the base ($RCO^{\cdot}.OH'$) is liberated by the alkali. Since the ester is undoubtedly only dissociated to a slight extent, undissociated acyl base can only be formed in small proportion, owing to there being no great concentration of acyl cations. The author assumes that there is an intramolecular transformation within this acyl base, which renders possible the formation of fatty acid anions from the acyl cations. For if the acyl group be assumed to have a normal constitution its cationic function appears inexplicable. But if we ascribe to the acyl group a totally different constitution to that of the anion, its basic function can be explained on the assumption that the oxygen atom has become tetravalent. The acyl base could then be assumed to have the following constitution:—

$$R - C \equiv O - OH \rightarrow (R - C \equiv O)^{\cdot} + OH'$$

whilst the constitution of the fatty acid might be represented by—



$$R - C\begin{matrix} \diagup\!\!\diagup O \\ \diagdown OH \end{matrix} \rightarrow \left(R - C\begin{matrix} \diagup\!\!\diagup O \\ \diagdown O \end{matrix}\right)' + H^{\cdot}$$

The transformation of the basic into the acid modification n alkaline medium could be explained by the principle of nstable equilibrium. In the author's opinion the assumpion of a cationic group, $(R - C \equiv O)^{\cdot}$, can also be made he basis of a systematic explanation of the formation of erivatives of carboxylic acids from components of different olarity. (See also Lewkowitsch, this J., 1898, 1107; 899, 1031; 1900, 254; 1903, 596.)—C. A. M.

Leaf Lard; High Iodine Absorption of ——. W. D. Richardson. XVIII. A., page 556.

English Patents.

ats and Waxes; Process of separating liquid Constituents from ——. H. Breda, Charlottenburg. Eng. Pat. 8588, April 15, 1903.

ee Fr. Pat. 327,064 of 1902; this J., 1903, 874.—T. F. B.

ax-like Composition; Manufacture of a ——. J. Lewy, Biebrich. Eng. Pat. 13,747, June 19, 1903.

e U.S. Pat. 735,538 of 1903; this J., 1903, 1006.—T. F. B.

utter Substitute. H. T. Mapleton. Eng. Pat. 12,159, May 28, 1903. XVIII. A., page 556.

Erratum.

This J., 1904, 494, col. 2, five lines from bottom, *for* bout $\alpha_D = - 4°$" *read* "$\alpha_D =$ about $- 4°$"; and four es from bottom, *for* "v_D" *read* "n_D."

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

Ultramarine; Constitution of ——. P. Rohland. Z. angew. Chem., 1904, **17**, 609—616.

E sodium in ultramarine can be replaced in equivalent portions by silver, potassium, and lithium, and as the ult of these experiments the sulpho-silicate formula $2Na_2Al_2Si_2O_8Na_2S_2$ has been proposed for ultramarine. From its isomorphism with the minerals, *Hauyn*, *Sodalite*, and *Nosean*, however, the formula $Na_4[Al(NaS_3)]Al_2SiO_4)_3$ has been deduced. Ultramarine in certain ways also resembles the natural trasses and puzzuolanas; it possesses hydraulic properties, which are increased by the addition of lime. It increases the binding power of Portland cement, even when as much as 40 per cent. of ultramarine is added. It seems possible that the high percentage of soda in ultramarine may be due to a part of the soda existing in a condition which resembles that of the free lime in Portland cement. The author concludes that probably the constituent to which ultramarine owes its colour exists only in comparatively small quantity in the substance, and is evenly disseminated throughout the mass in the state of a solid solution.—A. G. L.

Venetian Red; New Process of Preparing ——. J. G. McIntosh. Chem. News, 1904, **89**, 197.

The process consists in furnacing an intimate mixture of molecular proportions of waste peroxide of lead and dehydrated ferrous sulphate. The reaction takes place according to the equation: $2FeSO_4 + 2PbO_2 = 2PbSO_4 + Fe_2O_3 + O$, and it is claimed that when the proportions of the components of the mixture are correctly adjusted, no fume is produced. If an excess of lead peroxide be used, an equivalent amount of red lead is produced, with escape of oxygen. Manganese peroxide may be substituted for the lead peroxide, and the resulting manganese sulphate removed from the product by washing.—A. S.

English Patent.

White Lead; Manufacture of ——. H. H. Lake, London. From Syndicat pour l'Exploitation des Inventions du Prof. Oettli, Berne. Eng. Pat. 12,713, June 5, 1903.

See Fr. Pat. 328,490 of 1903; this J., 1903, 1006.—T. F. B.

French Patents.

Iron Putty; Preparation of —— to Replace Putties of White or Red Lead. O. E. Picquet and A. Dubosc. Fr. Pat. 337,833, March 2, 1903.

A solution of a soap (an alkali oleate for instance) is precipitated by a ferric salt, such as ferric sulphate, and the washed precipitate is thickened with an oxide or other suitable substance.—E. S.

Azo Dyestuffs, and Lakes produced therefrom; Preparation of New ——. Soc. anon. F. Bayer & Co. Fr. Pat. 337,942, Dec. 22, 1903. IV., page 543.

(*B.*)—RESINS, VARNISHES.

Resin of Hopea Odorata ("Rock Dammar") from Burma. Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, **2**, 23—24.

The specimen consisted of large, irregular tears of a yellow colour. It melted at 115° C. and yielded 0·56 per cent. of ash. Saponification value, 37·1; acid value, 31·5. It was completely soluble in turpentine and partially soluble in alcohol. The resin was valued at 2*l*. 5*s*. per cwt. It may be regarded as a second-quality dammar, and could be used for the preparation of "paper" or "crystal" varnishes.
—A. S.

Gommier Resin from Dominica. Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, **2**, 24—26.

The resin exudes from natural fissures or from cuts in the bark of the gommier tree, in the form of an opaque, viscous liquid, which solidifies eventually into hard, brittle white masses. It is commonly known as "dry" or West Indian elemi, and has been sold in Europe as a substitute for the elemi resin from the tree, *Canarium commune*. The specimen examined consisted principally of large flattened lumps of hard white resin, together with a small amount of lumps of soft, slightly yellow resin. The hard lumps consisted almost entirely of minute needles, but the soft resin was crystalline only on the surface. The following are the results of the chemical examination:—

——	Hard Resin.	Soft Resin.
Saponification value	24·7	41·6
Acid value	14·1	37·3
Ash.	0·08 per cent.	0·36 per cent.
Melting-point	158°—161° C.	Below 100° C.

The hard resin is completely soluble in alcohol and partially so in turpentine, whilst the soft resin is entirely soluble in turpentine oil and only partially so in alcohol. The resin was valued at 17*s.* to 18*s.* per cwt., but it is probable that if it were exported in a fresh and clean condition, it would realise prices more nearly equal to those obtained for true elemi (50*s.* to 55*s.* per cwt.).—A. S.

English Patent.

Gums and Resins; Treatment of ——, and the Preparation of Varnishes. H. Terrisse, Vernier. Eng. Pat. 14,554, June 30, 1903.

Gums and resins, such as copals, are dissolved in phenols or naphthalene, without melting the resin, by heating under pressure to 250—290° C., linseed oil or other drying oil is added to the solution, and the phenol or naphthalene distilled off. For example, 1 kilo. of Zanzibar resin is heated with 3 kilos. of naphthalene, under a pressure of $4\frac{1}{2}$ atmos., at 290° C., for two hours, 250 grms. of linseed oil are added, and the mixture again heated under pressure at 290° C. for 45 minutes, when it is filtered if necessary. 750 grms. of linseed oil, heated to 220° C., are next added, and the mixture is distilled, exhaustion to a partial vacuum being resorted to as the temperature approaches 280° C., at which point distillation will be finished. The varnish is completed by diluting the product with $2\frac{1}{2}$ kilos. of thickened linseed oil and adding the requisite amounts of spirit of turpentine and siccative.—T. F. B.

(*C.*)—INDIA-RUBBER.

Gutta-Perchas from the Straits Settlements. Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, **2**, 16—21.

Six specimens were examined, with the results shown in the accompanying table. The sample of Gutta Taban Merah, No. 6, represents the highest class of gutta-percha. It was far superior to any of the other specimens. Nos. 4 and 5 are not true gutta-perchas, and could not be used for insulating purposes; No. 5 resembles Pontianac. The samples were valued commercially as follows:—No. 1, 2*s.* per lb.; No. 2, 1*s.* 6*d.*; No. 3, 2*s.* 4*d.*; and No. 6, 6*s.* per lb. No. 5 would be of about the same value as Pontianac. (See also this J., 1898, 470.)

No.	Variety of Gutta-percha. Native Name and Botanical Source.	Moisture.	Calculated for Dry Material.				Character of Gutta.	Character of Resin.
			Gutta.	Resin.	Dirt and Insoluble Matter.	Ash (included in Dirt).		
		Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		
1	Gutta Taban Putih (*Palaquium pustulatum?*).	7·5	38·5	53·5	8·0	0·77	Light brown, strong	White, hard.
2	Gutta Sundor (*Palaquium* (*Maingayi*).	1·2	45·5	46·0	8·5	2·16	,, ,,	,,
3	Gutta Taban Chaia (*Palaquium polyanthum?*).	1·2	52·6	44·0	3·4	1·64	Light brown, rather better quality than Nos. 1 and 2.	Yellowish-brown, hard and translucent.
4	Gutta Minjato (*Bassia sp.?*).	2·6	23·0	72·0	5·0	0·7	Light brown, friable, and somewhat waxy.	,,
5	Gutta Susu (*Dyera sp.*)	19·5	2·4	86·7	10·9	0·9	Contained no true gutta.	White, soft.
6	Gutta Taban Merah (*Palaquium gutta*).	10·2	76·0	15·0	9·0	1·0	Light colour, strong, excellent quality.	Yellowish-white, soft.

—A. S.

English Patent.

Rubber; Substance Similar to ——, and Process of Manufacturing same. C. E. Pensa, Paris. Eng. Pat. 14,001, June 23, 1903.

See Fr. Pat. 334,833 of 1903; this J., 1904, 122.—T. F. B.

French Patent.

Caoutchouc Substitute [" Ixophene "]; Process of Manufacturing a ——. E. H. Fayolle. Third Addition, dated Dec. 1, 1903, to Fr. Pat. 335,584 of Sept. 26, 1903. (See this J., 1904, 195 and 448.)

The name Ixophene is adopted for the material obtained by the interaction of glycerin (1 part), strong sulphuric acid (2·2—3·3 parts), 40 per cent. formaldehyde (1 part), water (0·7—1 part), phenol (2—3 parts), or these constituents in various proportions. When the amount of phenol is limited to 1 part, the product is readily obtained (after 15 days' contact) by vigorous stirring with 10—20 per cent. by weight of concentrated sulphuric acid; if more phenol is used it may be necessary to heat on the water-bath, and incorporate 10—20 per cent. of flowers of sulphur, or further to add casein, starch, or other carbohydrate. When only 0·7 part of phenol is employed, the product is a wax-like solid, soluble in alcohol (4 parts), and suitable for varnish-making.—R. L. J.

XIV.—TANNING; LEATHER, GLUE, SIZE.

Water-softening [in Tanneries]; Use of Barium Hydroxide for ——. J. Hülsen. Collegium, 1904, 120.

The usual lime and soda mixture, when employed for softening purposes, leaves sulphates of sodium and calcium in solution, which are objectionable in the case of tannery waters. (See Nihoul and van de Putte, this J., 1904, 122.) Barium hydroxide removes soluble sulphates as well as other compounds, and gives a very soft water.

—R. L. J.

Liquors of Equal Tanning Strength from Various Tanning Materials and Extracts; Composition of ——. J. Paessler. Collegium, 1904, 116—120 and 121—123.

This is an investigation of the meaning of the frequentl employed barkometer—(*i.e.*, density)—readings of tan-liquors, which require some comparative standard such as i given in the following table, which shows the ratios an corresponding densities for most of the usual liquors (arranged in order of tannin strength of liquors of simila density). For similar densities those liquors containing th least non-tannins have the largest amount of total solubl matter and of tannin; and high density is not necessaril associated with high tannin strength (*cf.* myrobalan extrac and quebracho wood). The barkometer gives a false appea ance of strength with liquors rich in non-tannins. This bears on the composition of extracts where, by overheating, &c., the non-tannins are developed at the expense of the tannins. Thus three liquors were found to give the following readings: 20·9°, 50·1°, and 97·1° Bk., and contained 0·1, 1·3, and 4·1 per cent. of tannin respectively.

Table showing Relation between Density and Composition of certain Tanning Liquors.

Materials used for Liquors.	Liquors of same Density, viz., 2° B. = 1·014 sp. gr. = 14° Bk.					Liquors of same Tanning Strength (viz., 2 per cent.)			Densities.		
	Tannins.	Non-Tannins.	Total Soluble.	Ratio of Non-Tannins to Tannins.	Ratio of Tannins to Total Soluble.	Tannins.	Non-Tannins.	Total Soluble Matter.	Beaumé Degrees.	Sp. Gr.	Barkometer Degrees.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.			
Myrobalan extract......	1·8	1·2	3·0	66	60	2·0	1·3	3·3	2·20	1·0152	15·2
Sumach................	1·9	1·4	3·3	74	58	2·0	1·5	3·5	2·10	1·0145	14·5
Pine bark..............	2·1	1·7	3·8	82	55	2·0	1·6	3·6	1·90	1·0131	13·1
Divi divi...............	2·2	1·1	3·3	50	67	2·0	1·0	3·0	1·80	1·0124	12·4
Oak bark..............	2·2	1·2	3·4	55	65	2·0	1·1	3·1	1·80	1·0124	12·4
Oakwood extract........	2·3	1·4	3·7	61	62	2·0	1·2	3·2	1·75	1·0121	12·1
Myrobalans............	2·3	1·0	3·3	44	70	2·0	0·9	2·9	1·70	1·0117	11·7
Valonia...............	2·5	0·9	3·4	36	74	2·0	0·7	2·7	1·60	1·0110	11·0
Trillo.................	2·5	0·8	3·3	32	76	2·0	0·6	2·6	1·60	1·0110	11·0
Chestnut-wood extract..	2·5	1·2	3·7	48	68	2·3	1·0	3·0	1·60	1·0110	11·0
Gall nuts..............	2·5	0·8	3·3	32	76	2·0	0·6	2·6	1·55	1·0107	10·7
Cube gambier..........	2·6	1·0	3·6	39	72	2·0	0·8	2·8	1·55	1·0107	10·7
Mimosa................	2·9	0·6	3·5	21	83	2·0	0·4	2·4	1·40	1·0096	9·6
Quebracho extract (*a*)..	3·1	0·6	3·7	20	84	2·0	0·4	2·4	1·30	1·0089	8·9
„ soluble in cold water, Mark "B" (*b*).	3·1	0·7	3·9	22	82	2·0	0·4	2·4	1·25	1·0096	9·6
Mangrove bark.........	3·4	0·5	3·9	15	87	2·0	0·3	2·3	1·20	1·0082	8·2
Quebracho extract, ordinary..............	3·8	0·3	4·1	8	93	2·0	0·2	2·2	1·05	1·0073	7·3
Quebracho wood........	3·9	0·3	4·2	8	93	2·0	0·2	2·2	1·00	1·0069	6·9

—R. L. J.

Chromic Oxide in Chrome Leather; Determination of ——, and Separation of same from Aluminium Oxide in the presence of Aluminium Salts. W. Appelius. XXIII., page 562.

United States Patents.

lue and Gelatin from Bones; Process of Making ——. H. Hilbert, Heufeld. U.S. Pat. 757,658, April 19, 1904.

EE Eng. Pat. 18,042 of 1902; this J., 1902, 1405.—T. F. B.

asein Composition [Adhesive], and Process of Producing same. W. A. Hall, Bellows Falls, Assignor to Casein Co. of America, N.J. U.S. Pat. 758,064, April 26, 1904.

x adhesive composition is made by mixing a solation of modified" starch with granular casein whilst agitating gorously, until the starch is absorbed by or thoroughly corporated with the particles of casein. The casein is alkalised" during the agitating process by the addition an alkaline solution with the other ingredients.—J. F. B.

French Patents.

lue and Gelatin [Varieties of]; Manufacture of ——. L. Faucheux and A. J. Boissière. Fr. Pat. 337,598, Feb. 25, 1903.

NES, waste pelts, &c., are agitated, with or without addition water, in closed rotating cylinders, whilst sulphur dioxide, re or impure, under pressure or otherwise, is admitted. e flesh, grease, and other impurities, together with the eater part of the mineral matter of the bones, &c., form a dge, which is discharged. The gelatin remaining may be rified by solution in water, settling out impurities, and sequent concentration. To obtain the best quality of atin, the bones, &c., are previously cleansed by petroleum rit, boiling water, &c., and are then subjected to the joint ion of dilute hydrochloric and sulphurous acids in the ating cylinder. The acid liquor separated from the gelatin, taining calcium phosphate and chloride, may be preitated by sulphuric acid, and the cleared solution be in used, in conjunction with sulphurous acid, in the atment of bones as before. The process may be modified treating bones with phosphoric acid, the mineral matter g then removed as a sludge with the impurities. Such udge, on treatment with hot water, gives off sulphurous acid, the grease, which floats, is removed, and, after separation of tricalcium phosphate, the liquor may be used again. —E. S.

Horn, Pearl, Ivory, and other Similar Materials; Preparation of Imitation ——. Soc. anon. La Cornalithe. Fr. Pat. 337,695, Dec. 12, 1903.

Casein, 10 kilos., is macerated for 24 hours in a solution containing 62 grms. of anhydrous sodium sulphite, 625 c.c. of water, 10 litres of 95 per cent. alcohol and 250 c.c. of glycerin. The mass is then milled, alone or with the admixture of colouring or other matters, between hot rolls. The articles so manufactured are finally steeped for 30—60 days in a dilute solution of the bisulphite compound of formaldehyde and dried.—J. F. B.

XV.—MANURES, Etc.

French Patents.

Superphosphate. L. A. Angibaud. First Addition, dated Nov. 26, 1903, to Fr. Pat. 308,298 of Feb. 21, 1901.

Nitre cake (sodium bisulphate) is either melted or used in solution, to attack mineral or other phosphates, bones or the like, for the production of a superphosphate.—E. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Starch prepared from the Bread-Fruit Tree in the Seychelles. Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, 2 28—29.

The first specimen, labelled "Natural state of the powder," consisted of a powder of a white colour, with a faint yellowish tinge, containing numerous small hard lumps, which could, however, be readily reduced to powder. It

——		No. 1.	No. 2.
		Per Cent.	Per Cent.
Moisture..................		17·09	17·13
Calculated for dry material.	Fibre..................	0·15	Trace
	Fat....................	0·21	0·25
	Proteid................	0·58	Nil
	Sugar..................	Trace	Trace
	Starch.................	98·72	99·43
	Ash....................	0·34	0·32
	Phosphoric anhydride in ash	0·10	0·11

possessed a slight odour resembling that of arrowroot. The second specimen, labelled "The same powder sifted," was a fine whitish powder, which also exhibited a faint yellow tinge. It was free from lumps, possessed the same odour as No. 1, and resembled fine wheat flour in appearance. The results of the chemical examination of the two specimens are shown in the foregoing table. The sifted starch (specimen No. 2) is probably worth about 7*l.* per ton c.i.f. London.—A. S.

Saccharimeters ; Determination of the Hundred Point on the Ventzke Scale of ——. O. Schönrock. XXIII., page 561.

Root Blight of the Sugar Beet (Rhizoctonia violacea Tul.) ; Experiments on the Destruction of —— *in the Soil.* F. Bubak. XVIII. C., page 556.

Starch ; Determination of —— *by Hydrolysis with Hydrochloric Acid.* A. Rössing. XXIII., page 563.

UNITED STATES PATENT.

Starch ; Separation of —— *by Centrifugal Action.* R. Schrader, Sierakowo. U.S. Pat. 757,778, April 19, 1904.

CRUDE starch-milk is continuously subjected to a succession of centrifugal actions as it flows in one direction, whilst fresh water is mingled with the starch during the last centrifugal action and the saturated water is passed from one centrifugal treatment to the other in a direction opposite to that of the starch.—J. F. B.

FRENCH PATENT.

Sugar Juices ; Process of Defecating and Decolorising ——. J. A. Besson. Second Addition, dated Feb. 19, 1903, to Fr. Pat. 308,384, Feb. 25, 1901. (See also this J., 1902, 1406 and 1545.)

THE concentration of saccharine juices is conducted in presence of alumina, which may either be added as such or produced in the juice by electrolysis with aluminium electrodes or by the addition of readily decomposable aluminates or aluminium salts.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Enzymes ; Influence of Acidity on ——. P. Petit. Comptes rend., 1904, **138**, 1003—1004.

BARLEY meal was extracted with distilled water, as also with solutions containing 0·2, 0·49, and 0·98 grm. of lactic acid per litre, and filtered. The aqueous extract saccharified, but did not liquefy starch paste. The extracts made with the two more dilute lactic acid solutions saccharified and liquefied starch paste, while the last extract did not liquefy starch paste, and saccharified it to a much smaller extent than did the aqueous extract. On extracting barley meal with ten times its weight of sodium hydroxide solution (0·48 grm. per litre) the extract obtained had no action on starch paste; the addition of lactic acid to this extract gave it the power of liquefying and saccharifying. A solution of lactic acid alone has no liquefying or saccharifying action on starch paste. An extract of barley made by means of a solution containing 0·24 grm. of sodium hydroxide per litre is acid to phenolphthalein, and has a strong saccharifying action. It is concluded that barley contains an enzyme in the form of a compound decomposed by acids, without the aid of germination.—T. F. B.

Barley Corn ; Absorption of Water by the —— *during Steeping.* G. Bode. Woch. f. Brau., 1904, **21**, 267—268.

THE author draws a comparison between the barley corn emerging from its period of rest, whilst it is being steeped, and the vital processes which go on in a green plant or organ such as a leaf. The proportion of water in the latter, in relation to the osmotic pressures under which transference of material takes place, is regulated by the living protoplasm of the cells. Whilst salts may play a very small part in creating these osmotic pressures behind the semi-permeable membranes of the cells, the chief part is played by the carbohydrates which are converted into soluble sugars or insoluble starch by the protoplasm, according to requirement. In the same way, the embryo and endosperm of the corn in the steep are to be regarded as composed of living cells, the protoplasm of which acts as a governor in regulating the osmotic processes. If the corn contained a large quantity of preformed diastase and if the protoplasm were dead, so much sugar would be produced and so much water would be attracted by it that the membranes would burst. Hence it is important, whilst providing sufficient water during steeping, to maintain the vitality of the protoplasm unimpaired, so that it may regulate the production of sugar and the consequent absorption of water by osmotic pressure, in order to avoid the "over-steeped" condition which would result without this check. This vitality of the protoplasm can only be maintained by providing sufficient air to permit of normal respiration.—J. F. B.

Protein in Malt; Digestion of —— *through Moist Storage.* F. Schönfeld. Woch. f. Brau., 1904, **21**, 257—258.

THE use of malt which has become "slack" by storage in a moist atmosphere introduces a bad flavour to the beer, owing to the development of micro-organisms. It also causes bad fermentation, poor yeast, and deficient secondary fermentation; the "head"-retaining properties of the beer are considerably impaired. The extent of such defects depends largely on the quantity and activity of the enzymes present in the malt, and consequently on the treatment during germination and the temperature of kilning. The author divided two samples of high-kilned malt each into two portions, storing one portion in a bag and the other in a bottle closed by a stopper bearing a tube with calcium chloride, so as to permit the access of dry air. At the end of 13 months the nitrogenous constituents were analysed, both by cold extraction and by hot extraction. The following results were obtained :—

	Malt I.		Malt II.	
	Stored dry.	Stored in Bag.	Stored dry.	Stored in Bag.
Moisture in malt (per cent.)	2·6	11·7	2·8	10·7
Total protein on dry substance (per cent.)....................	10·71	10·71	9·7	9·7
Nitrogen per cent. of malt, dry substance :—				
Cold extraction :				
Total soluble..............	2·475	2·648	2·54	2·68
Coagulable..................	0·787	0·654	0·672	0·631
Albumose....................	1·068	0·808	1·117	1·063
Extraction at 50° C. :				
Total soluble..............	3·12	3·12	3·23	3·33
Coagulable..................	0·482	0·396	0·438	0·348
Albumose....................	0·965	0·913	0·957	0·854

The increase in the total soluble nitrogenous matter and the decrease in the coagulable and albumose constituents indicate the activity of the proteolytic enzyme during moist storage, in a manner detrimental to the "head"-retaining properties of the beer; this activity would, moreover, be far more considerable in the case of low-dried malts. —J. F. B.

Malting ; Use of Formaldehyde in ——. H. Tomann. Oesterr. Brauer- u. Hopfen-Zeit., 1904 [7] ; Z. ges. Brauw., 1904, **27**, 297.

BY adding commercial formaldehyde to the steeping water in sufficient quantity to make a solution of about 0·6 per cent. strength, the author obtained a malt of more uniform growth, a fresher and purer aroma, improved modification, and a higher percentage of extract than when the barley was steeped in water only.—C. S.

Barley and Malt; Conversion of Insoluble Protein in —— into the Soluble Form during Growth and Mashing. R. Nilson. Hopfen-Zeit., 1904, [53]; Z. ges. Brauw., 1904, **27**, 297.

This conversion is ascribed to enzyme action, stimulated by the presence of acid bacteria (short rods and cocci), the acid products of which, being liberated in the immediate vicinity of the insoluble protein, act thereon while in the nascent state.—C. S.

"Spring" Mashing Process. A. L. Woch. f. Brau., 1904, **21**, 273.

The writer points out an error into which he fell in his first trials of the "spring" mashing process. He sprung his cool mash into such a large quantity of boiling water that the desired saccharification temperature of 72° C. was only reached when the whole of the cool mash had been "sprung." The result was that the whole of the diastase was so crippled, whilst the temperature of the water was being reduced to the desired point, that saccharification was imperfect. In order to avoid such a crippling of the diastase, he now works with a smaller quantity of hot water at 87·5° C., so that the saccharification temperature of 71·2° C. is reached after one half of the cool mash has been "sprung"; the other half is then run in slowly whilst the requisite temperature is maintained by the application of sufficient heat. The results are in every way satisfactory, the attenuation being less than by the old method of high temperature mashing, and approximating closely, after eight weeks' cellarage, to the maximum attenuation possible in the wort produced.—J. F. B.

Wort; Subsequent Appearance of a Starch Reaction in a Fully Saccharified ——. F. Schönfeld. Woch. f. Brau., 1904, **21**, 225—226.

The author records a case in which the first runnings of wort gave a perfectly normal iodine reaction, indicating complete saccharification, but in which the later runnings showed an ever-increasing blue iodine reaction, indicating the presence of untransformed starch. The whole mashing process only lasted $1\frac{1}{4}$—$1\frac{1}{2}$ hour, and the mash was "struck" at a temperature of 75° C. The malt was a pale variety of poor quality, very steely and very short-grown, the average length of acrospire being one-half to two-thirds the length of the corn. It had been grown with couch and floor temperatures as low as possible, and kilned after 7—8 days' growth. The consequence was a very poor modification; in many cases one-half of the corn was unmodified. In addition to this, the grist-mill was very much worn, so that many large particles of grist would be perfectly raw grain. Owing to the short duration of mashing, these raw particles would be merely gelatinised on the surface, and the result was the presence of apparently fully saccharified wort and raw starch side by side. These lumps of starch would be gradually dissolved under the prolonged action of the hot sparging water, and so entered the wort. Unfortunately the diastase remaining in the wort was so enfeebled, although it had not been heated higher than 75° C., that an hour's rest in the wort copper was not sufficient to saccharify the starch which was washed through. Longer mashing periods rectified the fault.—J. F. B

Beer; Metallic Turbidities in ——. C. F. Gabel. Woch. f. Brau., 1904, **21**, 273—274.

The author disputes the contention that tin, when pure, is nsuitable for the internal coating of beer filters. The very few complaints of metallic turbidities which he has received have been traceable to the use of cheap impure tin for coating the filter parts. The fact that these filters should have been rejected indicates that the majority of filters which are coated with pure tin are perfectly satisfactory. The author states that in dealing with low temperatures, such as hose in the lager cellars, turbidities when employing filters oated with pure tin are not to be feared; but it is otherwise f the beer be filtered at higher temperatures. That warmth ncreases the liability to metal-albuminoid turbidities is shown by the experience of export brewers in their attempts to pasteurise beer in bulk, employing steel casks coated with tin or even with gold or silver. In such vessels, at a pasteurising temperature of 68°—70° C., metallic turbidities invariably appear in the beer.—J. F. B.

Beer; Metallic Turbidities in ——. C. Sellenscheidt. Woch. f. Brau., 1904, **21**, 274.

The author explains that when he stated (this J., 1904, 333) that zinc and lead are the worst metals for the construction of beer filters he referred to their poisonous properties, and not to their liability to cause turbidities, which is small. He repeats that no metallic filter is absolutely indifferent towards beer. Filters constructed of tinned metals are far more liable to cause turbidities than those of solid tin. When several metals are used simultaneously in the construction of a filter, electric currents are set up, the effect of these currents in causing turbidities being greater the greater the differences of potential involved. Turbidities from this cause are least frequent in the case of tin filters and most disastrous in aluminium filters.—J. F. B.

Beer; Carbon Dioxide in ——. T. Langer. Z. ges. Brauw., 1904, **27**, 307—311.

In 1879 Schultze and Langer determined that, within the limits of 0° C. to 5° C., a rise or fall of 1° C. in the temperature of the beer in the lager cellar caused a fall or rise of 0·01 per cent. by weight of the carbon dioxide absorbed by the beer, corresponding to a difference of 50 c.c. per litre per 1° C. The proportion of carbon dioxide in the beer can be increased by increasing the pressure in the cask, but an increase so obtained is not so advantageous as one obtained by lowering the temperature, since the combination is more stable in the latter case. An increase of 50 c.c. of carbon dioxide per litre is obtained by an increase of 31 mm. of mercury in the pressure in the cask. Thorough and long-continued agitation only liberates about three-fourths of the total carbon dioxide absorbed by the beer. Beer with a higher proportion of residual extract retains more carbon dioxide than a weaker beer under the same conditions. The author's experiments have further shown that, owing to the production of a hydrate of alcohol, dilute alcohol absorbs far less carbon dioxide than corresponding quantities of water and absolute alcohol would absorb separately. In spite of this fact, beer absorbs more carbon dioxide than water under the same conditions. From the above facts it must be concluded that the beer-extract plays an important part in the absorption of carbon dioxide. The greatest and most important influence from the brewing point of view is undoubtedly the physical absorption induced by the beer-extract, owing to its viscosity and the surface tension of the emulsified constituents. The sparkle and the fine spongy compact head is to be attributed to the carbon dioxide loosely bound by the physical influence of the extract constituents. But it cannot be denied that unstable chemical compounds, to a less extent, also play a part, which has been demonstrated in the case of the base choline, and in the production of bicarbonates from the secondary phosphates. To the influence of such loose chemical compounds is to be attributed the full round flavour of the beer.--J. F. B.

Matabele Beer. Loir. Brewers' J. Suppl., April 21, 1904, 13.

In a report presented to the Rhodesia Scientific Association, the author describes the method used by the Matabele for the preparation of a kind of beer from raw and malted maize, sorghum or millet, in the proportion of about 3:1. The grain is malted by steeping in water for 24 hours, allowing to germinate in bags for about 48 hours and finally drying in the sun. The ground raw grain is mixed with twice its bulk of water, and boiled; it is then left to cool in open vessels and inoculated with yeast and amylomycetes by means of flies and other insects. At the end of 24 hours, the ground malted grain is added. Vigorous fermentation takes place, and on the third day the beer is passed through a wicker-work rush filter and is ready for drinking. The beer contains 2·9 per cent. of alcohol, 0·35 per cent. of acid (as acetic acid), 4·2 per cent. of dry extract, 0·2 per cent. of maltose and a high proportion of starch. It is stated that with an improved method of manufacture the beer would be highly suitable for the local climatic conditions.—A. S.

Disinfectants in the Brewery; Errors in the Use of ——. P. Lindner. Woch. f. Brau., 1904, **21**, 256—257.

Solutions of calcium bisulphite, if used too strong, are unpleasant in application, but they disinfect efficiently. Very often, however, the solutions are used too dilute, in which state they kill the culture yeast cells without destroying the wild yeasts, especially if the latter be in a sporulating, semi-dry condition. If spores be present, the concentration must be increased beyond that prescribed for vegetative cells. It should never be attempted to reinforce the action of one disinfectant by the subsequent or simultaneous application of another, since the two are liable to neutralise each other. For instance, caustic lime or hypochlorites ["antiformin"] must never be applied in conjunction with bisulphites. A case is quoted also in which a wash of salicylic acid was followed by one of "antiformin," with the result that an odour and flavour of creosote were imparted to the beer. Only one disinfectant should be used in each treatment, and the concentration should be calculated with due regard to the quantity of water already absorbed in the wood of the tun. All residues of disinfectants should be thoroughly removed before the tuns are taken into use again, so as to avoid any influence on the flavour of the beer and on the vigour of the culture yeast.—J. F. B.

Cider Vinegar; Examination of ——. A. E. Leach and H. C. Lythgoe. XXIII., page 563.

English Patent.

Iron Vessels, such as those in which Beer is Prepared or Stored; Providing —— with a Protective Coating. V. Lapp, Leipzig. Eng. Pat. 3682, Feb. 13, 1904.

Iron vessels intended for holding beer, particularly pasteurising vessels, are first treated with tannic acid and then subjected to the action of boiling oil. Linseed, castor and rosin oils are suitable for this purpose, particularly the rosin oil, which distils at temperatures between 450°—500° C. After the vessels have been treated with hot oil for two hours, they may be further subjected to the action of hot air at 350°—400° C. under pressure, whereby the protective layer is hardened.—J. F. B.

United States Patents.

Grain Germinating Apparatus. V. Lapp, Leipzig. U.S. Pat. 758,083, April 26, 1904.

See Fr. Pat. 326,114 of 1902; this J., 1903, 756.—T. F. B.

Air Purifier [for Breweries]. J. St. P. Macardle, Dundalk. U.S. Pat. 757,475, April 19, 1904.

See Eng. Pat. 23,456 of 1902; this J., 1901, 264.—T. F. B.

French Patent.

Malt; Apparatus for Germinating ——. R. Plischke and A. Beschorner. Fr. Pat 337,983, Dec. 23, 1903.

The apparatus consists of a number of endless horizontal bands of wire-netting arranged in a vertical series, and provided with mechanism which enables them to move in alternate opposite directions. Steeped grain is distributed on the uppermost band whilst in motion. After the top band is filled, the apparatus is stopped, and left at rest for 24 hours. It is then started again, and the couch of grain on the top band is broken up by rakes at the end of the apparatus and caused to fall on the second band, travelling in the opposite direction, fresh grain being meanwhile fed upon the top band. The process thus proceeds continuously, and the green malt issues from the lowermost band, one band being provided for each day of germination.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Leaf Lard; High Iodine Absorption of ——. W. D. Richardson. J. Amer. Chem. Soc., 1904, **26**, 372—373.

Samples of leaf lard from individual hogs or droves frequently have an iodine value of 80 to 85. The animals yielding this lard are allowed to run wild in the woods, and are supplied with but little food. Four specimens of leaf lard from different animals gave the following results:—Melting-point, 32° to 37·5° C.; solidification point ("titre"), 27·9° to 30·8° C.; and iodine value, 78·8 to 82·0. The corresponding back fat from the same hogs had the following values:—Melting-point (1) 32° C.; solidification point ("titre"), 24·7 to 27·3; and iodine value, 81·5 to 84·7. Amthor and Zink found a specimen of the fat of a wild boar to have an iodine value of 76·6.—C. A. M.

Milk-Chocolate; Analysis of ——. O. Laxa. XXIII., page 564.

Indicator; New ——. Its application to the Detection of Boric Acid, especially in Foods. L. Robin. XXIII., page 561.

English Patents.

Butter Substitute. H. T. Mapleton, Manchester. Eng. Pat. 12,159, May 28, 1903.

Barcelona, Brazil, walnut or other nuts are thoroughly dried, the skins are removed by rubbing on a sieve, the nuts are then broken and finely ground and suitable proportions of "cokernut fat" and nut oil are added, the whole being incorporated by grinding. When almonds are used they may be "blanched" before treatment as above. —J. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

Manganese; Precipitation of —— from Well Waters. C. A. Neufeld. Z. Untersuch. Nahr. Genussm., 1904, **7**, 478—479.

In a paper which appeared in this Journal (1902, 681) the rapid growth of *Crenothrix* in manganiferous waters was described. The author points out that this growth, attended with deposition of manganese sesquioxide, has been noticed recently by other observers, who ascribed the precipitation to *Crenothrix manganifera*, not to *Crenothrix polyspora*. In one instance cited, where the water first passed through iron mains and then through lead branch pipes, the mains were blocked by a deposit consisting principally of iron oxide, whilst the scale in the lead pipes was composed of manganese sesquioxide. The precipitation of manganese occurs chiefly in waters from deep wells, and not in surface waters.—W. P. S.

French Patent.

Sewage and Water containing Albuminoid Matter; Process and Product called "Phospho-zinco-alumino-magnesien" suitable for the Treatment of ——. J. M. Lallemand and A. Goutierre. Addition, dated March 3, 1903, to Fr. Pat. 323,900, Aug. 14, 1902. (See this J., 1903, 568.)

By treating with sulphuric acid, aluminium or iron phosphate which has previously been strongly heated, and adding a zinc salt to the product, a suitable precipitant for organic matter is obtained.—T. F. B.

(*C.*)—DISINFECTANTS.

Root Blight of the Sugar Beet (Rhizoctonia violacea Tul); Experiments on the Destruction of —— in the Soil. F. Bubák. Z. Zuckerind. Böhm., 1904, **28**, 344—345.

The author proved by field experiments that ferrous sulphate has a very favourable effect on the growth of the sugar-beet, the proportion of infected roots falling from 47·5 per cent. on an untreated plot to 28·75 per cent. on a plot treated with ferrous sulphate. Copper sulphate, on the other hand, caused an increase in the percentage of infected roots, from 68·18 to 97·78. Quicklime also had no injurious effect on the *Rhizoctonia.*—A. S.

United States Patent.

Insecticide [*from Dioxynaphthylmethane*] ; *Process of Making an* ——. P. Bachmann, Cologne. U.S. Pat. 759,208, May 3, 1904.

See Fr. Pat. 323,230 of 1902 ; this J., 1903, 510.—T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

Hydrocellulose. C. F. Cross and E. J. Bevan. Proc. Chem. Soc., 1904, **20**, 90.

The residues described by Stern (Chem. Soc. Trans., 1904, **85**, 336 ; this J., 1904, 264—266) having the empirical composition of cellulose, are no doubt products of hydrolysis and reversion, and are constitutionally different from the original cellulose ; but they are in no case identical with those described by Girard, and therefore this investigator's exhaustive account of the actions of acids on cellulose remains unaffected by the criticisms contained in the above-mentioned paper. The statements (*loc. cit.*) as to the causes of the attendant structural changes are considered improbable. Cellulose is a chemically labile and structurally plastic aggregate, occupying an intermediate position between the two extreme products, formed from ordinary cellulose by the action of (*a*) alkali hydroxides, (*b*) the halogen hydracids, both in presence of water. It is suggested that the terms hydracellulose and hydrocellulose respectively may for the present be retained to designate the two groups of derivatives obtained by the processes (*a*) and (*b*).

"*Crude Fibre*" ; *Preparation* [*Determination*] *of* —— *from Vegetable Fibres containing Lignin, by means of Sodium Peroxide.* A. Duschetschkin. XXIII., page 563.

English Patents.

Acetylised Cellulose Derivatives ; Manufacture of Soluble ——. R. M. Balston and J. F. Briggs, Maidstone. Eng. Pat. 10,243, May 5, 1903.

Dry, fibrous cellulose, 10 parts, is treated with an acetylating mixture composed of acetic anhydride 30 parts, glacial acetic acid 30 parts, and phosphorus oxychloride 1·7 parts. The mixture is maintained at a temperature of 55° C. with occasional stirring until the product is sufficiently soluble in chloroform or phenol. Instead of phosphorus oxychloride, phosphorus pentachloride or anhydrochlorides of other mineral acids may be employed.—J. F. B.

Filters [*for Waste from Paper or Cellulose Factories*]. O. Mehnert and P. Pape, Coethen. Eng. Pat. 8061, April 7, 1903.

A perforated cylinder *c* with open ends is arranged between two annular projections *r r*, of the end pieces *m* and *m'*, in the tank *a* (Fig. 2). The cylinder *c* is surrounded by an endless band of filtering material *g* (Fig. 2). At the upper part of the cylinder, not covered by the band, a tightening arrangement *d*, adjustable by the screws *e* and *f*, is placed. The liquid to be filtered (such as waste from paper or cellulose manufacture) is led through the pipe *a'*, into the tank *a*, filling it to the level W (Fig. 2). Some clean water is led into the interior of the cylinder *c*, and the valve *v*, in the telescopic pipe *n*, which dips into water in a tank below, is opened, and a partial vacuum is thus produced in *c*, causing the liquid in *a* to pass through the filtering band *g* into the cylinder, and leaving the residue behind on the band. The level of liquid in the cylinder is adjusted by the float *z*. The endless band *g* passes between the rollers *p p*, which

Fig. 1.

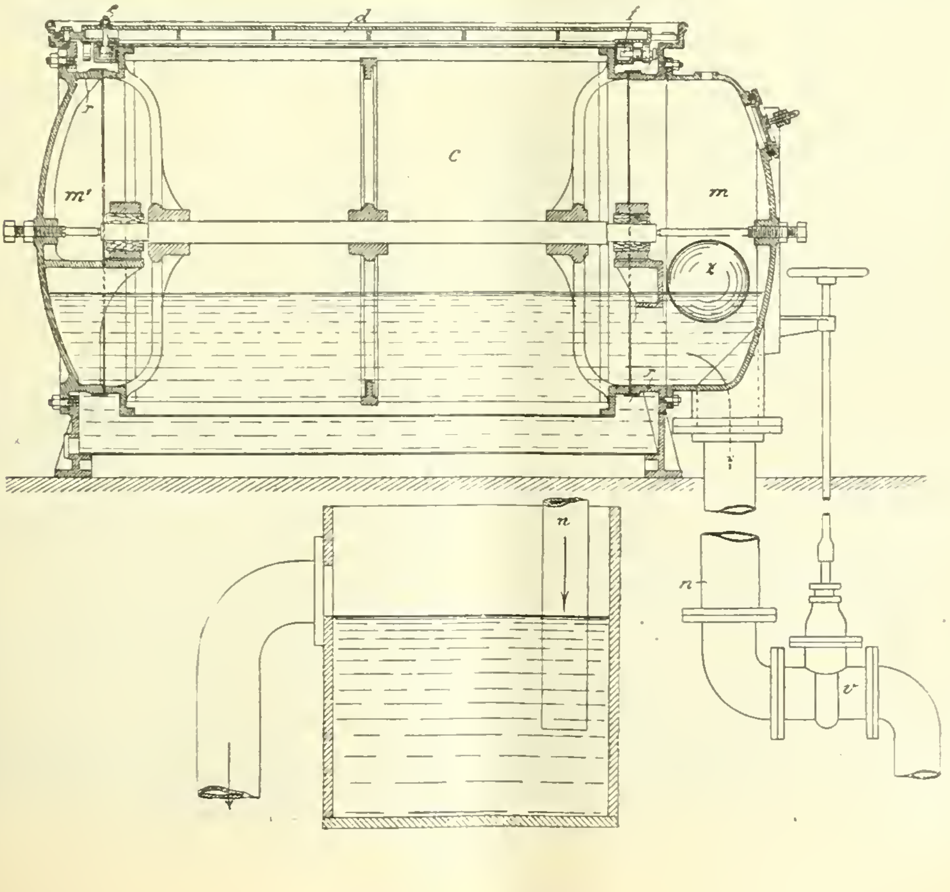
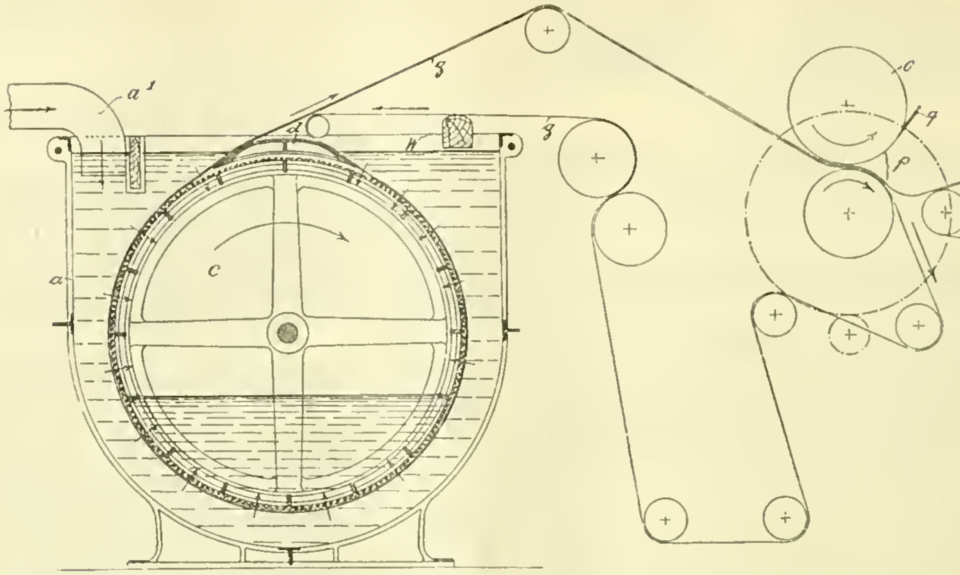


Fig. 2



cause the band to move and so rotate the cylinder c, at the same time pressing the remainder of the water out of the residue on g. The pressed residue is removed by the apron u and the scraper q.—W. H. C.

United States Patent.

Celluloid Compound. A. Schmidt, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Höchst-on-the-Maine. U.S. Pat. 758,335, April 26, 1904.

See Eng. Pat. 25,434 of 1899; this J., 1901, 62.—T. F. B.

French Patents.

Paper-making Machines. L. Tailfer. Fr. Pat. 337,911, Dec. 21, 1903.

The web of paper is passed through a couch press consisting of three rolls. The making wire returns round the bottom roll, whilst a short endless couch-felt encircles the centre roll; the uppermost roll carries a long endless wire cloth which traverses the whole series of drying cylinders and acts as an undeformable drying felt. The paper is transferred from the making wire to the couch-felt, and from the couch-felt to the drying wire by means of the triple press. The drying wire accompanies the paper over the hot cylinders, which are arranged in such a way that direct contact between the paper and hot cylinders does not take place until the paper is partially dry.—J. F. B.

Paper; Process of Making —— from old Printed Matter. W. B. Meixell and T. Holt. Fr. Pat. 337,980, Dec. 23, 1903.

See U.S. Pat. 748,968 of 1904; this J., 1904, 128.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Aucubin. E. Bourquelot and H. Hérissey. Comptes rend., 1904, **138**, 1114—1116.

Aucubin is the name assigned to the glucoside extracted from the seeds of *Aucuba japonica*; it is soluble in water and alcohol, but insoluble in ether or chloroform. It is easily decomposed by dilute acids or emulsin, forming dextrose and a compound $C_7H_9O_3$, which the authors call *aucubiginene*. Aucubin contains water of crystallisation, and its composition is represented by the formula $C_{13}H_{19}O_8,H_2O$.—T. F. B.

Essential Oils of Amorpha Fruticosa. V. Pavesi. Estr. aus Ann. della Soc. Chim. di Milano, 1904, **11**, [1 and 2]; Chem. Centr., 1904, **1**, 1146—1147.

The leguminous plant *Amorpha fruticosa*, of the genus *Galega*, appears to contain different essential oils in its various organs. On distillation with steam, the fruit yielded 1·5—3·5 parts and the leaves 0·5—0·8 part per 1,000 of a clear yellowish oil having a bitter after-taste. The oil from the leaves resinifies more quickly than that from the flowers. The latter distils over mainly between 250° and 270 C., and undergoes slight alteration during distillation. The constants which have been determined up to the present are shown in the following table:—

——		Specific Gravity at 15° C.	Refractive Index in Pulfrich's Refractometer at 17·5° C.
Oil extracted from—			
Leaves	Fresh	..	1·50083
	Sour	..	1·50928
Fruit	Green	0·9019	1·49951
	Ripe	0·9057	1·50036
Oil distilling at—			
230°—250° C.		..	1·50233
250°—270° C.		0·9254	1·50484
Above 270° C.		..	1·51637

The oils are soluble in the usual organic solvents, but almost insoluble in 50 per cent. alcohol. The portion distilling at 250°—270° C. becomes fairly solid at—17 C. The oil from the fruits probably belongs to the class of oils containing hydrocarbons, but it appears to contain also a small quantity of an oxygenated compound.—A. S.

Essential Oils; Two New Algerian [Gouft and Scheih]. P. Jeancard and C. Satie. Bull. Soc. Chim., 1904, **31**, 478–480.

Gouft.—The oil obtained by the distillation of the entire herb is bright yellow in colour and resembles absinthe in odour. It has the following characters: Sp. gr. at 9·5 C., 0·8720; a_D at 10° C.,—15°20′; specific viscosity at 9·5° C., 49; acid value, 1·12; saponification value, 14; saponification value after acetylating, 42; solubility in alcohol (96 per cent.), 2:1, with slight turbidity on further addition of the solvent; 75 per cent. of the oil distils below 170° C. The major fraction distilling between 160°—165° C. contains *l*-pinene; that distilling above 170 C. yields a trace of an alcohol having the odour of geraniol.

Sheih.—The oil obtained by distilling the entire herb is reddish-brown and has a terebinthous odour, recalling that of mastic. Its characters are: sp. gr. at 9·5° C., 0·9540; specific viscosity, 170; acid value, 8·4; saponification value 66·5; saponification value after acetylating, 129·5. The oil contains 15 per cent. of phenols soluble in sodium hydroxide solution, from which the dimethyl ether of pyrogallol was isolated. The nonphenolic portion appears to contain thujone and thujol.—J. O. B.

Californian Laurel; Constituents of the Essential Oil of ——. F. B. Power and F. H. Lees. Proc. Chem. Soc., 1904, **20**, 88.

The Californian laurel, *Umbellularia californica* (Nuttall), a handsome, evergreen tree, occurring in California and Oregon, is also known as "mountain laurel," "cajeput," "spice tree," "California olive," "California bay tree" and "pepper-wood." The essential oil of the leaves has a pale yellow colour and an odour which is at first agreeably aromatic, but when more strongly inhaled becomes exceedingly irritating to the mucous membranes of the nose and eyes. The oil had a sp. gr. 0·9483 at 16°/16° C., and a_D −22° in a 100 mm. tube; it was completely soluble in 1·5 parts of 70 per cent. alcohol. The principal constituents of the oil in their relative proportions are approximately as follows:—umbellulone (a new, unsaturated, cyclic ketone, $C_{10}H_{14}O$), 60; cineol, 20; eugenol methyl ether, 10; *l*-pinene, 6, and eugenol, 1·7 per cent. respectively, together with a very small amount of safrol. Umbellulone is a colourless liquid with a somewhat mint-like odour; it boils at 219°—220° C., has a sp. gr. of 0·9581 at 15°/15° and $[\alpha]_D$ − 37°.

(Compare Ber., 1897, **30**, 230, 251; 1900, **33**, 562, and 1903, **36**, 4377.)

Platinum; Electrolytic Solution of ——. *New Process for preparing Platinocyanides.* A. Brochet and J. Petit. XI. A., page 548.

English Patents.

Ionone; Manufacture of ——. A. Verley, Paris-Neuilly, and L. Givaudan, Vernier. Eng. Pat. 26,089, Nov. 30, 1903.

Cyclo-citrylidene acetic esters (Fr. Pat. 326,774 of 1902; this J., 1903, 819) are converted, by the action of acetone (1 mol.) and sodium ethylate (1 mol.), into the sodium salt of acetyl-ionone, $C_9H_{15}.CH:CH.CO.CHNa.CO.CH_3$, which is converted into acetyl-ionone by addition of acids. Ionone is obtained by boiling this acetyl-ionone with alkalis.
—T. F. B.

Hæmatoxylin and Formaldehyde; Manufacture of a Condensation Product from ——. R. Lepetit, Garessio. Eng. Pat. 6428, March 16, 1904.

See U.S. Pat. 736,529 of 1903; this J., 1903, 1063—T. F. B.

United States Patents.

Dicarbo Acids and Bromated Phthalic Acids with Naphthols; Process of making Condensation Products from ——. A. Denguine and S. Levinsohn. U.S. Pat. 753,372, March 1, 1904.

Hydroxynaphthoylbenzoic acid is obtained by condensing phthalic anhydride with *a*-naphthol in presence of boric acid. Substituted hydroxynaphthoylbenzoic acids are obtained imilarly from hydroxy- or bromo-phthalic acids and naphthols. The hydroxynaphthoylbenzoic acids are onverted into the corresponding hydroxynaphthacenequinones by heating to about 160° C. with concentrated ulphuric acid.—T. F. B.

Sulpho-iodine Compound of Hydrocarbon. F. T. F. Stephenson, Detroit. U.S. Pat. 755,808, March 29, 1904.

Compounds of the general formula R.SI, where R represents an aromatic radical, are prepared from phenols, in alkaline solution, by the action of alkali sulphydrates and iodine in presence of oxidising agents, *e.g.* an alkali hypochlorite. The compounds are insoluble in water, slightly soluble in concentrated alkalis and in absolute alcohol, and soluble in ether and chloroform, and are suitable for medicinal use.—T. F. B.

Ortho-oxy-carbon Acids [Hydroxy-Carboxylic Acids]; Process of Making ——. G. Wichmann, Berlin, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin, and Soc. Chim. des Usines du Rhône, ancien. Gilliard, P. Monnet et Cartier, St. Fons. U.S. Pat. 757,702, April 19, 1904.

See Fr. Pat. 307,186 of 1901; this J., 1902, 68.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photography; Review of ——. A. Granger. Monit. Scient., 1904, **18**, 331—340.

Developers.—Süss has proposed lithium carbamide as substitute for alkalis in developers; it is said to give excellent results with "edinol." Sodium amino-acetate has also been proposed for a similar purpose, and is sold under the name of "pinakol salt." "Adurol" and metol together are said to give a more energetic developer than quinol-metol. Lebreton proposes to use a developer containing only pyrogallol and sodium sulphite for over-exposed negatives: for normal exposures, a few drops of ammonia are added, and for under exposures, acetone.

Negative Processes.—Reiss (Bull. Soc. Franc. Phot., 1903, 273) has used plates which can be developed by 3 per cent. solution of sodium carbonate. These plates are prepared by immersing an ordinary dry plate in a solution of quinol (hydroquinone), 1 grm.; acetone sulphite, 10 grms.; water, 100 c.c.

Positive Processes.—Homolka (Phot. Korr., 1903, 452) finds that bromide papers, exposed to daylight for 15—20 secs., can be developed by immersing for two or three hours in a 0·1 per cent. solution of gold chloride acidified with phosphoric acid. A paper of the same type as platinotype has been prepared by Szigeti (Phot. Ind., 1903, 248) by the use of selenious acid and ferric oxalate; the ferrous salt formed reduces the selenious acid to selenium; the image is intensified by a solution of potassium oxalate. Von Hübl (Bull. Soc. Franc. Phot., 1904, 47) uses a mercury citrate solution for toning platinotype prints sepia. Valenta (Chem. Ind., 1904, 117) gives a process for preparing celloïdin (printing out) papers with a silver chlorocitrate emulsion.

Toning Solutions.—Mercier has obtained good brown and black tones on "printing out" papers by the use of a solution of potassium palladium chloride, citric acid, and sodium chloride, or ammonium molybdate. Aluminium acetate is recommended (Phot. News, 1903, 446) for use in combined toning and fixing solutions containing gold. "Pinakol" (see above) in conjunction with potassium ferricyanide is said to form a powerful reducer.—T. F. B.

Silver Bromide; Centrifugalised —— *for Bromide Emulsions.* L. Backeland. Monit. Scient., 1904, **18**, 362—365.

The centrifugal separator used for filtering silver bromide in gelatin emulsion should have a drum composed entirely of silver, rather than of bronze lined with silver, since the silver is inclined to wear off the latter. The cover of the drum should be clamped on, not screwed, to avoid the introduction of particles of metal into the bromide by the wearing of the thread. In order to obtain uniform preparations, it is necessary to keep the apparatus at approximately the same temperature, about 30°—35° C., and to keep the machine running at a uniform rate, and not too fast, as otherwise the photo-chemical properties of the product will be modified. The liquid to be filtered should be added in small quantities at short intervals, and the total quantity filtered in one operation should not exceed that obtained from 5 kilos. of silver nitrate. The bromide should be washed, on the drum, with a small quantity of warm water, as it is important to remove from it all ammonia and soluble salts. To remove the gelatinous matter which usually accompanies precipitated silver bromide, the product is macerated with hot water and again centrifugalised. Silver bromide prepared in this manner, and stored in a cool place, has been found, after two years, to have increased only very slightly in sensitiveness, the emulsions giving prints of rather less density than originally.—T. F. B.

Photographic Paper ; Influence of Moisture in the Atmosphere in Making [Drying] ——. L. Backeland. Monit. Scient., 1904, **18**, 355—358.

When the emulsion of "developing papers" (*i.e.*, those containing insoluble silver halides) is slowly dried, the papers are more rapid and give flatter prints than those more rapidly dried. Emulsions containing soluble silver salts, when slowly dried in damp air at relatively high temperatures, give reddish coloured prints, difficult to tone, and which deriorate rapidly. These emulsions should, therefore, be rapidly dried, in dry air, at relatively low temperatures. A satisfactory method of preparing the air consists in first lowering the temperature to below 0° C., thus removing the moisture, and then warming it, in another apparatus, to a suitable temperature. If the air be too dry, especially when preparing certain kinds of paper, the friction and pressure of the paper on the drying frame sets up a static electric charge, which attracts dust particles; this inconvenience may be remedied by the use of strips or wires of silver attached to the frame of the machine.—T. F. B.

Photographic Plates ; Some Substances which give Impressions on ——. E. von Aubel. Comptes rend., 1904, **138**, 961—963.

Colophony, copal, Canada balsam, abietic acid, and similar compounds, give impressions on photographic plates, even through black paper, but not through copper, after two days. If, however, the resin has been heated much above its melting point, it has no effect on the plate. An almost saturated solution of phenol in absolute alcohol gives, in a similar manner, a negative after 24 hours.—T. F. B.

Development in Daylight. A. and L. Lumière and A. Seyewetz. Monit. Scient., 1904, **18**, 351—354.

The method recommended is essentially that of Fr. Pat. 334,915 of 1903 (see this J., 1904, 130). The authors give the mixture of sodium sulphite and magnesium picrate the name "chrysosulphite." When working with "metoquinone," metol-quinol, pyrogallol, edinol, eikonogen, quinol, metol, adurol, or ortol developers, it is advisable to use 2 parts of crystallised sodium sulphite and 1 part of magnesium picrate, while, when using "hydramine," "glycine" *p*-aminophenol or diaminophenol, 2 parts of anhydrous sodium sulphite should be mixed with every part of magnesium picrate. Formulæ are given for the use of the method with the various developers, and directions as to use in daylight and different artificial lights.—T. F. B.

Engraving Rollers for Calico and Carpet Printing ; Employment of Photography in ——. P. J. Lamp'l. Z. Farb. Textil-Chem., 1904, **3**, 62—66.

Difficulties are met with in producing, by means of photography, designs of flowers, &c., upon rollers, according to the methods proposed respectively by Rolffs (this J., 1902, 47) and Mertens. The chief of these lies in bringing the negative film, composed as it is of gelatin or indiarubber, without distortion upon the curved surface of the roller (engraving die or printing roller) to be engraved. It is especially great when fine lines are to be reproduced, and when the size of the negative film is relatively large. Another difficulty is caused by the presence of air-bubbles between the negative film and the sensitised film on the roller. This is partly due to the impracticability of applying strong pressure to the negative film, as in the process of photographing upon flat metal surfaces. The exposure to light for the purpose of producing the positive print would, further, appear at present to be carried out without regard to the necessity of causing the rays of light to fall vertically upon the negative film. (See also this J., 1904, 181.)—E. B.

United States Patent.

Photographic Developing Paper. F. Günther, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 758,312, April 26, 1904.

See Fr. Pat. 335,807 of 1903; this J., 1904, 268.—T. F. B.

French Patent.

[Flash Lights] Illuminating Compositions suitable for Photography ; Process for Making ——. G. Krebs. Fr. Pat. 337,901, Oct. 21, 1903.

Compositions suitable for producing "flashlights" consist of a mixture of magnesium or aluminium powder, 100 parts; alkali or alkaline earth nitrate, 200 parts; a metallic silicate, 10 parts; and amorphous phosphorus, 3 to 5 parts. Slow-burning "illuminating cartridges" are prepared by enclosing the above composition in a celluloid casing, and inserting a fuse which has been impregnated with potassium chlorate and perchlorate; the whole is then coated with a mixture of celluloid, collodion, and amyl acetate.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

Explosion ; Circumstances attending an —— *which occurred in the Drying House for Nitrocotton at the Factory of Messrs. Curtis and Harvey, Ltd., at Cliffe, Kent, on Feb. 4, 1904.* By Captain A. P. H. Desborough, H.M. Inspector of Explosives.

Just before the explosion occurred, about 400 lb. of dry collodion cotton were in the stove. The cause of this explosion is attributed to friction set up between the trays and the racks, which approached too near together. Experiments showed that it was not possible to ignite dry guncotton dust by blowing it across the 1-cm. spark-gap of an induction coil, nor by means of a Leyden jar discharge. Recommendation is made that stoves should not be unloaded by artificial light, that the explosive should be cooled down before unloading, and that the clearance between trays and racks should be at least 2 ins. instead of the $\frac{1}{4}$ in. existing hitherto.—G. W. McD.

English Patents.

Nitrocellulose ; Manufacture of ——, *and Apparatus therefor.* J. M. and W. T. Thomson, Waltham Abbey. Eng. Pat. 8278, April 9, 1903.

The acids are removed from the nitrocellulose, without the use of machinery, by means of displacement with water. The charge of mixed acids is introduced into a rectangular vessel of lead or earthenware, provided with a perforated false bottom and a cock at the lowest point. The cellulose is then immersed in the acid in the usual way. A layer of dilute sulphuric acid (for the purpose of preventing nitric acid fumes) is gently run over the surface of the mixed acids, from perforated troughs on the sides of the vessel. When nitration has been completed, water is supplied to the perforated troughs and allowed to float very gently over the surface of the sulphuric acid. The cock at the bottom of the apparatus is then opened, and the acid slowly drawn off, water being supplied to maintain a constant level. A suitable rate of displacement is about 2 ins. per hour.
—G. W. McD.

Nitrated Cellulose ; New Process of Manufacturing —— A. Voigt, Schoaebeck. Eng. Pat. 5126, March 1, 1904.

Cellulose (1 part) is treated with concentrated sulphuri acid (5 parts) at 2° C. until the structure is destroyed an a pulpy mass obtained. Concentrated nitric acid (2 parts is then added, the temperature being kept at 2° C., and the end of 2—3 hours the nitrocellulose is completely pre cipitated, and forms a solid cake. After purification th nitrocellulose is obtained in the form of a very fine powde
—G. W. McD.

Explosives or Blasting Compositions. J. Wetter, Londo From Westfälisch Anhaltische Sprengstoff Act.-Ge Berlin. Eng. Pat. 13,531, June 17, 1903.

See Addition, of June 18, 1903, to Fr. Pat. 316,569 1901; this J., 1903, 1308.—T. F. B.

Explosives; Manufacture of ——. J. Y. Johnson, London. From Soc. Anon. des Poudres et Dynamites, Paris. Eng. Pat. 14,827, July 3, 1903.

See Fr. Pat. 333,502 of 1903; this J., 1903, 1367.—T. F. B.

UNITED STATES PATENT.

Explosive Compound. J. P. Arnold, Colfax. U.S. Pat. 757,713, April 19, 1904.

The composition consists of potassium chlorate, yellow prussiate (ferrocyanide) of potash, sulphur, saltpetre, and tannin, this last existing in the compound as a coating of the insoluble ingredients, "brought to this condition by being dissolved in alcohol, which is afterwards evaporated."
—G. W. McD.

FRENCH PATENTS.

Explosive. J. B. P. Bouthoux. Fr. Pat. 337,638, Sept. 1, 1903.

The explosive consists of sodium nitrate (74 parts), anthracite (12 parts), and sulphur (14 parts).
—G. W. McD.

Explosive. M. Chakoor. Fr. Pat. 337,781, Dec. 16, 1903.

The composition consists of potassium chlorate (100 parts), powdered sugar (45 parts), and grated wax (1·5 parts).
—G. W. McD.

Matches; Manufacture of ——. W. Cernás. Fr. Pat. 337,811, Dec. 17, 1903.

Before dipping, the tips of the match sticks are so opened out that the fibres form a small brush-like end. The advantages claimed are that the match composition penetrates the head more readily, and does not rise between the individual match sticks when the latter are dipped in bundles.—G. W. McD.

Matches without Heads; Process for Making ——. J. H. Christensen. Fr. Pat. 338,128, Dec. 26, 1903. Under Internat. Conv., Jan. 9, 1903.

See Eng. Pat. 11,990 of 1903; this J., 1904, 455.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Saccharimeters; Determination of the Hundred Point on the Ventzke Scale of ——. O. Schönrock. Z. Ver. deutsch. Zuckerind., 1904, 521—558.

HE author's results are briefly as follows:—The differences n the rotations of sugar solutions obtained by different bservers and by the use of different sources of white light, anish when the light is purified by passing through a ·5 cm. layer of 6 per cent. potassium bichromate solution. quartz plate of 100° Ventzke rotation gives, with ectrally purified sodium light, a rotation of 34·657° at ° C. The fact that a substance gives different rotations ith different lights is due to a difference in rotary dis-ersion between the substance and quartz. The rotation, corresponding with the hundred point, increases with the mperature according to the equation: $wt = w_{20} + w_{20} \times$ 000148 $(t - 20)$. The rotation values of the quartz-ates in the saccharimeter are independent of the temperare, if the quartz-plates and wedge-compensator have the me temperature. If S_{20} be the rotation of an approximately rmal sugar solution at 20° in a saccharimeter at 20° C., d St its rotation at $t°$ in the same saccharimeter at $t°$ C., en $S_{20} = St + St \times 0{\cdot}000609\ (t - 20)$. The rotation the normal sugar solution in degrees for spectrally rified sodium light at 20° C. is 0·010° greater than that the normal quartz plate giving a reading of 100° ntzke at 20° C. In all accurate sugar analyses, observa-n tubes should be used which allow of the introduction the solution after the two end-plates are in position. e rotation of the normal sugar solution in a saccharimeter h wedge-compensation is 0·156° Ventzke greater for the low-green mercury light than for sodium light.
—T. H. P.

FRENCH PATENT.

Acidimetry; Process of ——, *and Apparatus for its Application.* A. M. Pereira. Fr. Pat. 337,283, Dec. 1, 1903.

The apparatus consists of a stoppered tube, of which the lower part is of less diameter than the middle or intermediate part, which latter is contracted near the top to a relatively narrow neck, and then widens upwards, to receive a perforated stopper. The lower, more contracted part of the tube has a mark upon it to show the level of the liquid to be tested; and the wider portion of the tube has another mark showing the height to which the liquid used as an indicator reaches. Hermetically closed capsules of thin glass, containing a measured portion of the neutralising liquid are provided, and are placed, one at a time, resting in the contracted neck, the stopper being furnished with a movable piercing rod whereby the capsule may be crushed so as to discharge its contents.—E. S.

INORGANIC—QUALITATIVE.

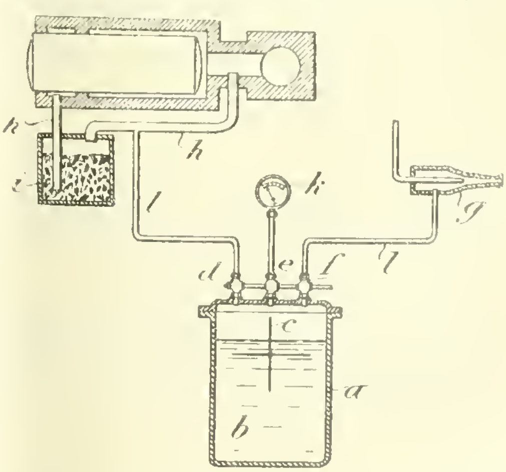
Indicator; New ——. *Its Application to the Detection of Boric Acid, especially in Foods.* L. Robin. Comptes rend., 1904, **138**, 1046—1048.

The indicator is prepared from mimosa flowers, 10 grms. of which are digested with 200 c.c. of water, to which on cooling, 50 c.c. of alcohol are added, and the liquid is filtered after an hour. It is straw-yellow, and has practically no tinctorial power in neutral or acid solution, but is turned bright golden yellow by alkalis. Boric acid turns it yellow, and when alkali is added, the yellow becomes red, and the substance (or paper soaked with it) applied to the ash of wines, milk, &c., forms a delicate test for the presence of boric acid.—J. T. D.

INORGANIC—QUANTITATIVE.

Carbon Dioxide in Furnace Gases; Method and Apparatus for the Determination of ——. A. Schlatter and L. Deutsch. Fr. Pat. 337,992, Dec. 21, 1903.

The method consists in treating a certain volume of the gas with a suitable absorbent (preferably lime water), and noting the diminution in pressure caused by the absorption of the carbon dioxide. The lime-water, *b*, having excess of lime in suspension is contained in the vessel *a*, which is fitted with a paddle-wheel, *c*, and three stop-cocks, the plugs of which are on a single shaft. The plugs are so bored that *d* and *f* are open when *e* is shut off. When a test is to be made, a quantity of the furnace gases is drawn through the pipe *l* into *a* by means of the injector *g*; cocks *d* and *f* are then closed, whilst *e* is opened, and the carbon dioxide is absorbed by the lime. The gauge *k* indicates the reduction in pressure. The filter *i* removes dust and soot from the gases before they reach the pipe *l*.—H. B.



Hydrofluoric Acid and Hydrofluosilicic Acid; Titration of ——. J. Katz. Chem.-Zeit., 1904, **28**, 356—357, 387—389.

Pure hydrofluoric acid can be accurately titrated with sodium, potassium, or barium hydroxide solutions, using phenolphthalein as indicator. Should hydrofluosilicic acid, however, be present, the method is unsatisfactory, since an alkaline reaction is obtained towards the end of the titration, but somewhat rapidly disappears, the final colour change only being reached after a succession of such changes, on the addition of fresh alkali. This is due to the fact that hydrofluosilicic acid does not act as a dibasic acid towards sodium hydroxide, &c., but is gradually decomposed into six equivalents of hydrofluoric acid, the final reaction only being reached when the whole of the hydrofluosilicic acid has been thus changed. It was found that a hydrofluosilicic acid solution containing 50 per cent. of alcohol could be titrated as a dibasic acid with 2N potash. When hydrofluoric acid is also present under these conditions, the precipitated potassium silicofluoride carries down with it a definite amount of hydrofluoric acid, which the author has determined and for which he gives constants of correction. The following method is recommended for the titration of a mixture of hydrofluoric and hydrofluosilicic acids. The sample should be diluted until it contains from 3 to 6 per cent. of acid. 10 grms. are titrated in a platinum basin, at the boiling point with 2N potash, using phenolphthalein as indicator. This gives the total acid in terms of hydrofluoric acid, the whole of the hydrofluosilicic acid being converted into six equivalents of hydrofluoric acid. 10 grms. are then weighed into a paraffined glass beaker, 100 c.c. of 60 per cent. alcohol added, and titrated as before with potash. This gives the hydrofluoric acid present as such and the hydrofluosilicic acid as a dibasic acid. From the difference of these two titrations, the hydrofluosilicic acid can be calculated, after allowing for the constants of correction mentioned above.—G. W. McD.

Calcium, Barium, Strontium, and Potassium; Gasometric Method of Determining ——; also Copper; Gasometric and Gravimetric Method of Determining ——. E. Riegler. Z. anal. Chem., 1904, **43**, 205—214.

The general principle of the method is described and illustrated in this J., 1903, 46, with reference to the determination of phosphoric acid and magnesia. In the present paper further application of the method, with some modifications, is made to the determination of the alkaline-earth metals and copper.

To give the case of calcium as a general example:—(1) Soluble calcium salts form, with iodic acid, calcium iodate, $Ca(IO_3)_2$, but slightly soluble in water and insoluble in dilute alcohol. (2) Calcium iodate with solution of hydrazine sulphate liberates nitrogen. $Ca(IO_3)_2 + 3N_2H_4H_2SO_4 = CaSO_4 + 2H_2SO_4 + 2HI + 6H_2O + 3N_2$.

The nitrogen is collected in a measuring tube, and from its volume the corresponding weight of calcium oxide is calculated.—A. S.

Manganese in presence of Iron [in Iron Ores, &c.]; Volumetric Determination of —— by Potassium Permanganate. Guyart-Volhard-Wolff Method. L. L. de Koninck. Bull. Soc. Chim. Belg., 1904, **18**, 56—62.

The author has proved, by the method described in this J., 1904, 456, that under suitable conditions, and especially by avoiding an excess of zinc oxide for precipitating the iron, quite accurate results can be obtained in the determination of manganese in presence of iron by titration with permanganate, without the use of any arbitrary coefficient for correcting the results.—A. S.

Chromic Oxide in Chrome Leather; Determination of—— and Separation of the same from Aluminium Oxide in the presence of Aluminium Salts. W. Appelius. Collegium, 1904, 124—128.

The following methods are used at the German Leather Industries Research Station.

I. *Determination of Chromic Oxide.*—1 to 2 grms. o leather are incinerated in a platinum dish, 2—3 grms. of mixture of sodium carbonate (60 parts), potassium carbonat (20 parts), and potassium chlorate (4 parts) are added and the dish is heated, at first gently, and finally over th blow-pipe for 10—15 minutes, a further pinch of th mixture being added if required. The contents of the dis are dissolved in hot water, cooled, and the chromic aci titrated by the usual thiosulphate method, and calculated t the sesquioxide. The results are usually slightly unde the weight of real ash.

II. *Separation of Chromium and Aluminium.*—2 to 5 grms of leather are incinerated and fused as in I. The melt is transferred by hot water to a porcelain dish, any barium present being filtered off as carbonate, whilst iron can b determined in the usual manner. The clear solution is now reduced with alcohol and hydrochloric acid, any acetic aci that may be formed by oxidation being expelled by heatin on the water-bath. The oxides of chromium and aluminiu are precipitated together by ammonia, washed, collected ignited in the platinum dish, and weighed. The mixe oxides are now fused with the alkali-chlorate mixture an the chromium determined by titration with thiosulphate as in I.—R. L. J.

ORGANIC—QUALITATIVE.

Aldehydes; General Reaction of ——. L. J. Simon an A. Conduché. Comptes rend., 1904, **138**, 977—980.

Equimolecular weights of oxalacetic ester and an aldehyd are mixed together in alcoholic solution, and a weight o ammonia solution, equal to that of oxalacetic ester used, i added. After standing, an almost colourless crystallin product separates, which is washed with alcohol. I consists of the ammonium salt of an acid, which can b liberated on the addition of mineral acid. The free aci reacts acid to phenolphthalein. The ammonia can b replaced by primary, but not by secondary amines Methyloxalacetic ester will not give the reaction.—T. F. B

Indophenine Reaction. F. W. Bauer. Ber., 1904, **37**, 1244—1245.

This reaction for the presence of thiophene in benzen (shaking with concentrated sulphuric acid and isatin) doe not take place if "chemically pure" sulphuric acid is use unless oxidising agents, such as ferric chloride or nitri acid, are added. It does take place, without addition of a oxidising agent, if ordinary commercial strong sulphuri acid is used.—E. F.

Dyestuffs for Wool; New Classes of —— and New Reactions for Aldehydes. M. Prud'homme. IV., page 54

ORGANIC—QUANTITATIVE.

Sulphur; Accurate Determination of —— in Organ Substances. W. E. Barlow. J. Amer. Chem. Soc., 19 **26**, 311—367.

There is invariably a considerable loss of sulphur calcining organic matter, such as plant substance or co without the addition of alkali. Part of the volatile sulph compounds (dioxide, trioxide, &c.) formed from t organic sulphur is retained by the alkali bases in t ash; but when phosphoric and silicic acids are prese the amount of sulphur compounds retained by the ash may insignificant, since these acids expel sulphuric acid at a heat. The loss is not prevented even when sufficient alk base to combine with all the acid is present. Absolut accurate results for total sulphur can, however, be obtai by combustion in a current of oxygen, with absorption the products of charring and combustion containing sulphur, either in the combustion tube or in a spe apparatus. Details of manipulation are given, and it stated that it is essential to introduce a lateral current oxygen at a certain point in the combustion tube completely burn the escaping gases before absorbing sulphuric acid produced by them.—C. A. M.

Sulphur; Determination of —— in Oils, Bituminous Substances, Coal, and Similar Bodies. E. Graefe. Z. angew. Chem., 1904, **17**, 616—619.

The author recommends the use of Hempel's method for the determination of sulphur (this J., 1893, 181), in which the substance is burnt in a glass bottle in an atmosphere of oxygen under normal pressure. The volatile products of combustion are absorbed by means of sodium peroxide solution. Non-volatile liquids are absorbed directly in cotton wool; coal is used in small pieces or pressed into little blocks. Very volatile liquids are absorbed in cotton-wool contained in a little glass tube closed by pressing paraffin wax against its open end. The tube is placed with the stoppered end downwards in the cone, so that as soon as the paraffin is melted by the heat of the burning cotton in the cone, the substance is vaporised and burnt.

—A. G. L.

"Crude Fibre"; Preparation [Determination] of —— from Vegetable Fibres containing Lignin, by means of Sodium Peroxide. A. Duschetschkin. J. russ. phys.-chem Ges., 1904, **36**, 71—77. Chem. Centr., 1904, **1**, 1227.

For the determination of "crude fibre" in vegetable fibres containing lignin, the author makes use of a reagent consisting of 2 parts of sodium peroxide and 6 parts of magnesium sulphate for 1 part of substance. The duration of the action varies from 1½ to 6 hours, according to the mount of lignin contained in the fibre. If the proportion f lignin be high, a preliminary treatment with a 1 per ent. solution of caustic soda is required, but this is not ecessary in the case of fibres containing a low proportion f lignin, *e.g.*, sulphite-cellulose. With fibres containing a arge percentage of lignin also, the treatment with the odium peroxide reagent must be repeated two or three imes, first over the naked flame, and then on the water-ath. The purity of the "crude fibre" is recognised by neans of a solution of phloroglucinol in concentrated ydrochloric acid. If the lignin is not completely removed y the above treatment, the material may be finally ibjected to the action of a 0·1 per cent. solution of otassium permanganate for a short time (5—10 minutes) nd of sodium bisulphite. The method is stated to be uch more rapid than those of Schulze and other authors.

—A. S.

mmonia and Aliphatic Amines; Determination of Pyridine Bases in ——. J. Milbauer and V. Staněk. Z. anal. Chem., 1904, **43**, 215—222.

a mixture of ammonia and pyridine be treated with lcium chloride, and carbon dioxide be passed through liquid, calcium carbonate and ammonium chloride are rmed, whilst the pyridine, which forms no carbonate, nains free. The reaction proceeds similarly when salts both bases are treated with calcium hydroxide, and bon dioxide is passed through the mixture. The aliphatic ines behave like ammonia. The pyridine is then racted by means of ether. In more precise detail a thod is recommended on the following lines:—

yridine Bases in Ammonia.—100 to 200 c.c. of mercial ammonia are diluted with an equal volume of er and poured into dilute sulphuric acid, to which a drops of a 1 per cent. aqueous solution of "Patent-e V N Superfein" have been added. The strongly solution is evaporated nearly to dryness, brought into parating funnel, a sufficient quantity of a freshly pre-d sodium bicarbonate solution and an equal volume of r, added, and the whole agitated for from 10—15 minutes. ridine forms no carbonate.) After drawing off the layer her, fresh ether is added, and the whole again shaken as re. The united ethereal solutions of the pyridine bases iltered through a filter moistened with ether, the filtrate ed with a few drops of Patent Blue solution, and ughly shaken up with N/10 sulphuric acid. The d thus acquires a yellowish-green tint. Subsequently ss of sodium chloride is added, and the liquid titrated with N/10 sodium hydroxide solution till a blue is produced, the change being distinct and rapid. authors recommend shaking a third time with ether, ove that no more pyridine remains behind.

Pyridine Bases in Ammonium Salts.—50 to 100 grms. of the finely powdered sample are placed in a separating funnel, treated with 25 to 30 c.c. of water, neutralised, a sufficient quantity of solution of sodium bicarbonate added, and the process above described followed.—A. S.

Starch; Determination of —— by Hydrolysis with Hydrochloric Acid. A. Rössing. Z. oeffentl. Chem., **10**, 61—64. Chem. Centr., 1904, **1**, 1177.

The author has previously pointed out (this J., 1904, 386) that Sachsse's inversion method gives low results in the determination of dextrin. The same remark also applies to the determination of starch by this method. The author's method (*loc. cit.*) gives good results if instead of the old factor 0·90, the factor 0·93 be used.—A. S.

Cider Vinegar; Examination of ——. A. E. Leach and H. C. Lythgoe. J. Amer. Chem. Soc., 1904, **26**, 375—382.

Detection of Malic Acid.—The following test for malic acid, devised by the authors, has been used for the last two years in the Massachusetts State Laboratory:—Five c.c. of the vinegar are mixed with about 1 c.c. of a 10 per cent. solution of calcium chloride and rendered alkaline with ammonium hydroxide. The precipitated ferric hydroxide, &c., is filtered off, and the filtrate mixed with three times its volume of 95 per cent. alcohol and heated to the boiling point, a flocculent precipitate of calcium malate being formed in the presence of malic acid. Dextrin or sulphates would also be precipitated, so the absence of these must be assured. As a confirmatory test the precipitate is collected, dried (to remove alcohol), and dissolved in dilute nitric acid, and the solution evaporated to dryness on the water-bath, to convert calcium malate into calcium oxalate. On boiling with sodium carbonate solution, the calcium oxalate is decomposed into calcium carbonate, which is to be separated by filtration. The filtrate is acidified with acetic acid and tested with calcium sulphate solution, a precipitate at this stage confirming the presence of malic acid in the vinegar. Both of these tests should be made.

Determination of Malic Acid: (*a*) *Calcium Chloride Method.*—100 grms. of vinegar are treated with 10 c.c. of 10 per cent. calcium chloride solution and rendered alkaline with ammonium hydroxide. After one hour's standing the liquid is filtered and the precipitate washed with water. The filtrate and washings are evaporated to about 25 c.c., mixed with 3 volumes of 95 per cent. alcohol, heated to the boiling point, and filtered through an ash-free filter. The calcium malate on the filter is washed with hot 75 per cent. alcohol and ignited in a platinum crucible. The ash is dissolved in 35 c.c. of boiling N/10 hydrochloric acid, and the excess of acid determined by titration with N/10 sodium hydroxide solution, phenolphthalein being used as indicator. The number of c.c. of acid consumed by the ash, multiplied by 0·0067, gives the percentage of malic acid in the vinegar.

(*b*) *Lead Acetate Method.*—100 grms. of the vinegar are neutralised with sodium hydroxide and treated with an excess of lead acetate. The lead malate is collected, washed, and suspended in water, which is heated to the boiling point and saturated with hydrogen sulphide. The resulting lead sulphide is filtered off and washed with hot water, and the filtrate evaporated to about 75 c.c., cooled, and mixed with 10 c.c. of 10 per cent. calcium chloride solution and sufficient ammonium hydroxide to render it alkaline. A precipitate occurring at this point indicates the presence of an acid other than malic acid. Such precipitate is removed, and the filtrate treated as in the calcium chloride method. These methods yield results in close agreement.

Total Acids and Solids.—Few of the samples examined by the authors gave results lower than the 4·5 per cent. of acid and 2·0 per cent. of solids required by the Massachusetts standard.

Ash should be about 10 per cent. of the total solids. Less than 8 per cent. rarely occurs in genuine cider vinegar.

Alkalinity of the Ash.—Cider vinegar yields a very alkaline ash. One grm. of the ash should require about 90 c.c. of N/10 acid for neutralisation, and the number of c.c. required for the neutralisation of 100 grms. of the ash will be approximately equal to the percentage of ash, multiplied by 100. If the alkalinity be less than 65 per cent. of this figure (per cent. ash × 100) the sample is suspicious.

Ratio of Soluble to Total Phosphates.—At least half of the total phosphates in cider vinegar are soluble in water.

Reducing Sugars.—The amounts of these should be the same before and after inversion. An increase after inversion points to the presence of cane sugar, or dextrin from glucose, added to increase the solids.

Reducing Sugars in the Solids.—Any samples containing more than 20 to 25 per cent. of reducing sugars in the total solids are suspicious. The highest amount found by the authors was 16·6 per cent.

Polarisation.—Pure cider vinegar is always lævo-rotatory, and vinegars behaving differently may at once be condemned. Excessive lævo-rotation points to the addition of invert sugar or incomplete acetification of the vinegar. Dextro-rotation before and lævo-rotation after inversion indicate added cane sugar, whilst dextro-rotation before and after inversion points to the presence of glucose. It is suggested as a standard that the polarisation (in a 200 mm. tube) of undiluted vinegar should lie between − 0·1° and − 4·0° (Ventzke).—C. A. M.

Milk-Chocolate; Analysis of ——. O. Laxa. Z. Untersuch. Nahr. Genuss-m., 1904, **7**, 471—477.

The results of the analyses of various makes of milk chocolate are given in the following table :—

Kind.	Moisture.	Total Proteids.	Casein.	Other Proteids.	Fat.	Lactose.	Saccharose.	Other Non-Nitrogenous Substances.	Ash.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent
1. Gala (Peter)	0·77	9·66	..	..	31·47	7·32	27·51	21·40	1·87
2. Delta (Peter)	0·54	9·86	5·16	4·70	10·11	8·02	48·25	20·89	2·32
3. Croquettes (Peter)	1·79	9·15	3·86	5·29	31·91	7·42	39·42	8·37	1·96
4. Milka (Suchard)	1·22	8·13	4·43	3·70	32·33	8·70	35·93	11·87	1·82
5. Croquettes (Cailleur)	2·26	10·94	4·36	6·58	31·12	7·84	33·68	11·88	2·28
6. Croquettes crémant (Cailleur).	0·99	6·89	0·67	6·22	31·37	2·24	33·14	23·86	1·51
7. Villards	1·00	6·83	4·46	2·37	33·12	8·00	45·22	4·28	1·55
8. Alpina (Sprüngli)	0·72	9·73	3·10	6·63	33·11	8·76	37·25	8·47	1·96
9. Marsner	0·23	5·02	0·40	4·62	35·25	1·46	46·46	10·31	1·27
10. Rigi (Hartwig and Vogel)	2·03	6·98	1·43	5·55	33·67	9·14	38·87	7·82	1·49

The casein was determined by heating the milk-chocolate on a water-bath with a quantity of 1 per cent. ammonium oxalate solution for 30 minutes, with frequent agitation. After cooling, the volume was made up to 250 c.c., filtered, and 150 c.c. of the filtrate precipitated with acetic acid. The precipitate was collected on a filter, washed, and the nitrogen determined in it by Kjeldahl's method, the factor 6·37 being used to convert the nitrogen found into proteids. The difference between the total amount of nitrogen and the casein-nitrogen was multiplied by 6·25 to give the quantity of other proteids present. The lactose was determined by Kjeldahl's copper reduction process and the saccharose either by polarisation or by Rüber's method (Z. anal. Chem., 1901, **40**, 97), the latter being preferred. Taking the ratio of proteids to lactose and ash in milk as 10:13:2 (Vieth), it will be seen from the above table that samples 3, 4, 5, 8, and 10 contain an undue amount of lactose, this being due to the fact that milk-sugar has been added to the milk before condensation. The Reichert-Meissl value of the fat extract from the sample affords evidence as to whether whole or skimmed milk has been employed. Milk-chocolate prepared by the simple addition of dry casein and lactose cannot be distinguished by analysis from that made with skimmed milk, unless the quantity of casein be disproportionately high, but the author considers that these products should not be called "milk-chocolate."
—W. P. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Silicon; Action of —— *on Water at Temperatures near* 100° *C.* H. Moissan and F. Siemens. Comptes rend., 1904, **138**, 939—941.

When silicon is heated with water in a test-tube to 95°—98° C., hydrogen is evolved and hydrated silica is formed. The reaction is considerably increased by the addition of small quantities of alkali. The experiment was repeated in a vessel made of silica, using water which had been distilled in a platinum still; no reaction was observed in this case, showing that the reaction first noted was caused by traces of alkali from the glass of the test-tube.—T. F. B.

Argon; Presence of —— *in the Gases from Smoke-Fissures in Guadeloupe.* H. Moissan. Comptes rend., 1904, **138**, 936—938.

Two samples of gas from smoke-fissures in Guadeloupe contained respectively 0·68 and 0·73 per cent. of argon.
—T. F. B.

Gold; Colloidal ——. Hanriot. Comptes rend., 1904, **138**, 1044—1046.

The author has prepared colloidal gold by Henrich's method: 1 litre of water containing 1 grm. of auric chloride, and rendered just alkaline with sodium carbonate, is boiled and then poured into 300 c.c. of a cold solution of catechol (pyrocatechin) containing 11 grms. per litre. A red coloration is produced, turning to violet. On mixing ten such preparations and just acidifying with sulphuric acid, the liquid becomes blue, and soon deposits a blue powder, which is washed with water and then with 70 per cent. alcohol, dissolved in ammonia, and reprecipitated by sulphuric acid. This solution and reprecipitation can be many times repeated, so that the solution is not simply the suspension of very fine particles. The substance manifest acid properties, forming salts with some of the heavy metal some soluble and others insoluble.—J. T. D.

Gases; Expansibility of —— *between* 0° *and* 1000° *C* A. Jacquerod and F. L. Perrot. Comptes rend., 1904 **138**, 1032—1034.

The gases were heated in a platinum resistance furnace i a bulb of fused silica, and the increase of pressure betwee 0° C. and the melting point of gold was determined. It i established that (1) the coefficients between 0° and 1000° (of nitrogen, air, oxygen, and carbon monoxide are closel alike; (2) that of carbon dioxide is distinctly higher tha those of the gases just enumerated, though lower than th of carbon dioxide between 0° and 100° C.—J. T. D.

Diazobenzene Chloride on Diphenylamine; Action of — L. Vignon and A. Simonet. Comptes rend., 1904, **13** 1104—1105.

An alcoholic solution of 1 mol. of aniline hydrochlori containing rather less that 1 mol. of diphenylamine w diazotised by the addition of an aqueous solution of 1 mol. sodium nitrite, the temperature was kept at 18°—20° C. (15 minutes, and the product precipitated by ice-cold wat On drying, a yellow crystalline compound was obtained m. pt. 47° C., rather unstable in air; it had feeble basic p perties, giving a violet, unstable hydrochloride. On heat with acids the compound was decomposed into phen diphenylamine, and nitrogen, whence the authors regar as phenyldiazo-aminobenzene.—T. F. B.

Uranium Pitchblende Ore. U.S. Cons. Reps., No. 19 April 25, 1904.

The *Neue Wiener Tagblatt*, of Vienna, reports that a meeting of the Mineralogical Society, Dr. F. J. Becke, P fessor of mineralogy, mentioned experiments which were made with uranium pitchblende ores at the Imperial Museum of Natural History. These ores have been in the possession of the museum since 1806. The experiments demonstrated that they have lost none of their intensity of radio-activity and of the energy of their electric properties. They do not differ in any way from the ores now taken at Joachimsthal.

New Books.

Gold Assaying : A Practical Handbook giving the *Modus Operandi* for the Accurate Assay of Auriferous Ores and Bullion and the Chemical Tests required in the Processes of Extraction by Amalgamation, Cyanidation, and Chlorination, with an Appendix of Tables and Statistics. By H. Joshua Phillips, A. Inst. C.E., &c. Crosby Lockwood and Son, 7, Stationers' Hall Court, Ludgate Hill, London, 1904. Price 7*s.* 6*d.* net.

Small 8vo volume containing 85 pages of subject-matter, with 62 illustrations, followed by an appendix of 46 pages, chiefly tabular matter, and the alphabetical index. The subjects are subdivided as follows :—I. Natural Occurrence and Forms of Gold. II. Physical Characters of Gold. III. Chemical Properties of Gold. IV. Sampling of Gold Ore. V. Fusion. VI. Cupellation. VII. Parting. VIII. Scorification. IX. Assay of Bullion. X. Assays in Cyanidation, Chlorination, and Amalgamation Processes.

Chapters on Papermaking, comprising a series of lectures delivered on behalf of the Battersea Polytechnic Institute in 1902, by Clayton Beadle. H. H. Grafton, 17, The Borough, London Bridge, S.E. Price 5*s.* nett.

Small 8vo volume containing 145 pages of subject-matter nd the alphabetical index. The text is subdivided according to the lectures delivered, which are as follows :—

Lecture I.—Examination of Fibrous Raw Materials for aper Making. II.—Art Papers as applied to Process rinting. III.—Bleaching. IV.—Chemistry of Bleaching. .—Influences of Moisture on Paper. VI. and VII.—hemical Residues in Paper. VIII.—Function of Water the Formation of a Web of Paper. IX.—Permanence Paper. X. and XI.—Sundry Physical Qualities of aper.

nnual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions, 1903. Volume I. [Cd. 2043.] Price 7*s.* 1*d.*

us is the first volume of the statement of the foreign de of the United Kingdom for the year 1903, and contains stract tables showing the total imports and exports of ry article enumerated, as well as detailed figures of the ports and exports of each article from and to each ntry. A new feature of the present issue is the inclusion tables showing the imports and exports of the United gdom classified in the same manner as in the tables fixed to the "Monthly Accounts of Trade," but distinshing the trade with foreign countries from that with tish Colonies ; statements are added showing the articles uded under each of the categories exhibited in these es.

everal alterations have been made in the classification of orts and exports in the present volume, and new headings ear for glycerine, electrical machinery, white lead, ain classes of skin and furs, soap, &c. The imports of rent kinds of petroleum are now distinguished, whilst e export returns coal is subdivided into various classes. headings for "iron and steel" in the statistics both of rts and exports have been re-classified.

R ort to the Board of Trade by the Advisory mmittee on Commercial Intelligence, with ference to their Proceedings. [Cd. 2044.] ice 4½*d.*

publication contains a history of the work accomed by the Commercial Intelligence Committee since its pointment in May, 1900.

e steps which have been taken to bring the existence of e Commercial Intelligence Branch and the scope of its rk under the notice of the commercial community, both in this country and in India and the Colonies, are recorded.

A short account is given of the work of the Commercial Intelligence Branch, regarding the business of which the statistics show that the number of annual inquiries has risen from 1,244 in 1900 to 3,599 in 1903.

The objects of the Commercial Missions despatched by the Committee to Siberia and Persia are detailed, and an account is also given of the other purposes to which, up to the present, the "grant in aid" of 1,000*l.* per annum has been allocated.

The appendices to the report include copies of the Notice sent to Mayors of Boroughs, Chambers of Commerce, &c., respecting the establishment of a Commercial Intelligence Branch, and of the circular sent by the Colonial Office to Colonial Governments on the same subject ; a list of British Commercial Attachés and Commercial Agents in Foreign Countries, and of the Correspondents of the Commercial Intelligence Branch in the Colonies ; and the Reports by the Committee to the Board of Trade respecting the German Tariff, the new Russian Tariff, and the proposed new Austro-Hungarian Tariff.

Trade Report.

I.—GENERAL.

Germany ; Trade of ——.

Foreign Office Annual Series, No. 3153.

The following tables show the values of imports and exports of chemical interest during the last three years :—

Imports.

Articles.	Value in 1,000,000 Marks.		
	1901.	1902.	1903.
Drugs, dyestuffs, &c.	267·61	263·39	267·41
Iron and ironware	66·56	51·83	57·22
Earths, ores, precious metals, &c.	498·52	355·66	522·90
Hides and skins	213·82	259·00	292·28
Copper and copper goods	113·55	109·01	120·63
Caoutchouc and gutta percha	60·02	73·26	76·25
Leather and leather goods	56·20	64·38	66·54
Oils and fats	249·83	261·10	285·29
Petroleum	91·98	93·11	101·23
Stone and stoneware	45·01	45·15	44·72
Coal, coke, and other fuel	179·97	163·23	1[illegible]0·39
Tar, pitch, resin, and asphalt	32·41	31·83	36·30
Zinc and zincware	30·60	34·05	34·[illegible]

Exports.

Articles.	Value in 1,000,000 Marks.		
	1901.	1902.	1903.
Drugs, dyestuffs, &c.	361·78	380·63	400·15
Iron and ironware	517·26	603·38	658·25
Earths, ores, precious metals, &c.	156·23	206·27	192·85
Glass and glassware	43·18	48·01	52·01
Hides and skins	120·31	137·40	122·47
Hops	14·60	25·46	24·65
Caoutchouc and guttapercha	44·77	50·00	52·82
Copper and copper goods	123·79	120·24	142·41
Leather and leather goods	137·15	153·37	164·85
Oils and fats	42·30	47·19	50·12
Paper and paste goods	108·78	109·32	129·42
Soap and perfumery	17·02	17·05	20·36
Coal, coke, and other fuel	272·76	267·53	295·89
Stone and stoneware	36·80	38·05	39·71
Potteryware	75·63	77·87	85·25
Zinc and zincware	31·01	39·65	38·29

Chemical Industries in Italy.

Bd. of Trade J., May 5, 1904.

Among the chemical industries a great number are foreign concerns ; their aggregate capital in 1892 was about 800,000*l.*, while it is now over 4,000,000*l.*, showing an extraordinary development in less than 10 years. This industry is the one that has made the greatest progress in Italy, and yet there is still much to be accomplished. Aside from the manufacture of soda ash, for instance, made impossible by the high taxation of salt and the cost of coal, there are a number of other chemical products that might profitably be manufactured locally. Among the principal ones might be mentioned citric and tartaric acid, the raw material thereof being grown in Italy in greater quantities than elsewhere. Over 3,000 tons of lemon juice are annually exported and manufactured abroad into calcium citrate and citric acid, while in Italy the production of the manufactured article does not exceed 400 tons, which is far from supplying the local demand, thus necessitating the importation of large quantities. In the last few years the local manufacture of calcium citrate has somewhat increased, but the crude material is still largely exported.

In 1902 Italy exported 16,200 tons of tartar and wine dregs, importing at the same time 100 tons of tartaric acid. The production of cream of tartar is, however, increasing, 600 tons being exported in 1901 and 12,000 tons in 1902. The manufacture of tartaric acid has also increased in recent years, and 600 tons thereof were exported in 1902; but the manufacture of this product is still out of proportion to the production of the crude material. Such an industry, intelligently established and conducted, would undoubtedly prove very profitable, the local conditions being so favourable.

Another lucrative industry would be found in the extraction, by improved methods, of the resin from the larch-fir tree, of which enormous quantities exist in Calabria. Although very rich in this product, Italy imported 13,400 tons of colophony and green resin and 1,000 tons of copal and oil varnish in 1902.

Bilbao, Spain; Chemical Industry of ——.

Foreign Office Annual Series, No. 3152.

Two ironworks, manufacturing coke by the Simon-Carvès and Semet-Solvay processes, produced in 1903 5,017 tons of tar, which were sold to the distilleries at Elorrieta. These distilled 6,194 tons of tar, producing 2,141 tons of creosote and 3,832 tons of pitch. 836 tons of creosote were used in the country, 1,094 tons were shipped to France, and 209 tons to Algiers. The whole of the pitch produced was taken up by native requirements.

The above-mentioned ironworks also produce 1,753 tons of ammonium sulphate, which is principally sent to Southern Spain, although a portion is used in this district.

For the production of the ammonium sulphate, sulphuric acid was obtained from the two important works existing here, which likewise supply the soap factories, petroleum refineries, and superphosphate and nitro-glycerin works.

Large quantities of superphosphates are taken inland, as farmers are awakening to its usefulness.

Twenty tons of carbolic acid were produced and exported last year to Germany.

A private monopoly exists in Spain in regard to explosives and loaded cartridges, the Government, however, reserving its right to import ammunition for military purposes.

In 1902 the exploitation of turpentine, resins, &c., was warmly taken up by Bilbao enterprise, a company being formed which bought up all the small pine tree holdings.

The pine plantations are situated in Old Castile, and there are some 6,000,000 trees in cultivation. In that year 2,540 tons of turpentine and 1,706 tons of colophony, besides important quantities of resins and resinous oils, were produced.

Last year the output of 17 factories was 3,146 tons of turpentine and 10,825 tons of colophony. The sales during the same period were: turpentine, 2,868 tons; colophony, 9,524 tons. The best quality of this last product is exported, whilst turpentine is used in the country, where the demand exceeds the supply. Prices generally follow the foreign markets.

The cultivation of beetroot and the manufacture of beet-sugar was begun in the provinces of Santander, Burgos, and Logroño after the loss of the Spanish colonies. So many factories were opened and provided with expensive machinery, that the supply soon outran the demand, and disaster followed in many cases. Trusts were then formed in order to maintain the price of sugar, which is high. The sugar cane growers in Southern Spain did not join these trusts, but they eventually came to terms, by which the beet sugar producers engaged to supply 80,500 tons annually, whilst the others were to put out 9,500 tons, thus making between them a production of 90,000 tons, an amount estimated to cover the consumption of sugar in Spain.

Jamaica Exports in 1902–3.

Bd. of Trade J., May 5, 1904.

The following are statistics of some of the chief articles of export from Jamaica:—

Article.	Quantity.		Value.		Price.	
	1901–2.	1902–3.	1901–2.	1902–3.	1901–2.	1902–3.
			£	£	s. d.	s. d.
Logwood	41,107 tons	37,895 tons	103,796	97,106	50 6 per ton	51 3 per ton
Rum	1,422,010 galls.	1,927,150 galls.	124,426	156,581	1 9 „ gall.	1 7½ „ gall.
Sugar	321,659 cwt.	408,455 cwt.	136,705	167,663	8 6 „ cwt.	8 3 „ cwt.

III.—TAR PRODUCTS, PETROLEUM, Etc.

Mineral Wax: German Tariff Classification.

Bd. of Trade J., May 12, 1901.

Mineral wax, bitumen, and black wax (which is obtained in the course of the process of purifying mineral wax), are to pay duty under No. 26*m* of the Customs Tariff at the "conventional" rate of 10 marks per 100 kilos. (5*s*. 1*d*. per cwt.).

Petroleum Refining in France.

Bd. of Trade J., May 12, 1904.

H.M. Consul at Calais reports that the petroleum refining industry of that district is increasing largely, as shown in the practical cessation of importation of refined petroleum. The refineries are situated at Douai, production 200,000 casks; Lomme, 80,000 casks; Le Cateau, 20,000 casks; Croix, 50,000 casks; and Dunkirk, 40,000 casks. The price of the cask, which contains about 40 galls., c
$1\frac{1}{2}$ cwts., is quoted at 2*l*. 8*s*.

Petroleum Exports from Russia.

Eng. and Mining J., April 21, 1904.

Exports of crude and refined petroleum from Russia
1903 are estimated at 80,000,000 poods, or 1,310,400 metr
tons, an increase of 8 per cent. over 1902. Part of t
gain was in exports to Europe, which were 27,000,000 pood
and part in exports to the East, chiefly China.

Petroleum Production of Roumania.

Bd. of Trade J., May 12, 1904.

Thirty-four companies have been formed in Rouma
since 1868 for the extraction of petroleum, and t
number of wells exploited in the districts of Praho,
Dambovitza, Buzen, and Bacau amounted to 105 at
end of 1903; 83 of these were in the district of Prahova

The petroleum is still extracted in the most rudimentary fashion, with wells worked by hand, or borings. The production for the last three years was: 1901, 270,000 tons; 1902, 310,000 tons; 1903, 384,303 tons.

CARBOLINEUM: U.S. CUSTOMS DECISION.

April 7, 1904.

Carbolineum used as a wood preservative is dutiable at 20 per cent. *ad valorem* under paragraph 15 of the present Tariff Act, as a "coal tar preparation, not a colour or dye," and not free of duty as "dead or creosote oil" under paragraph 524 as claimed.—R. W. M.

RESORCINOL; PURE ——. U.S. CUSTOMS DECISION.

April 18, 1904.

It was held that pure resorcinol, differing only from the forms used in the manufacture of dyes in purity and cost, is dutiable as a "medicinal coal tar preparation," at 25 per cent. *ad valorem*, under paragraph 59 of the Tariff Act.

—R. W. M.

X.—*METALLURGY.*

IRON AND STEEL PRODUCTION OF GREAT BRITAIN.

Eng. and Mining J., April 21, 1904.

The report of the British Iron Trade Association for the ear 1903, just issued, gives the production of pig iron in he United Kingdom as follows, in long tons:—

——	1902.		1903.	
	Tons.	Per Cent.	Tons.	Per Cent.
orge and foundry	3,860,494	45·0	3,875,826	44·0
essemer pig	3,648,948	42·5	3,760,422	42·7
asic pig	892,218	10·4	991,610	11·3
piegeleisen	185,033	2·1	183,346	2·0
Totals	8,586,693	100·0	8,811,204	100·0

The total production for 1903 is slightly greater than any the estimates heretofore published.

The increase was chiefly in pig iron intended for conver- on into steel; forge and foundry iron production being most stationary.

The production of steel in the United Kingdom was as follows, in long tons:—

——	1902.		1903.	
	Tons.	Per Cent.	Tons.	Per Cent.
Bessemer	1,825,779	37·2	1,910,018	38·0
Open-hearth	3,083,288	62·8	3,124,083	62·0
Totals	4,909,067	100·0	5,034,101	100·0

The proportions of steel made by the acid and basic processes during 1903 were as follows:—

——	Acid.		Basic.	
	Tons.	Per Cent.	Tons.	Per Cent.
Converter	1,316,915	26·2	593,103	11·8
Open-hearth	2,613,274	51·9	510,809	10·1
Totals	3,930,189	78·1	1,103,912	21·9

The acid process continues to predominate in British practice, and will continue to do so as long as the present sources of ore supply continue to furnish the raw material.

The proportions of finished steel made by the two processes are as follows, in long tons:—

——	Bessemer.	Open-hearth.	Total.
Blooms and billets	239,119	400,664	639,783
Rails	1,061,441	84,942	1,146,383
Bars	221,283	537,745	759,028
Merchant steel	125,444	169,394	294,838
Plates and angles	21,840	1,248,079	1,269,919
Totals	1,669,127	2,440,824	4,109,951

QUEENSLAND; MINERAL PRODUCTION OF —— IN 1903.

Bd. of Trade J., May 12, 1904.

The following table shows the quantity and value of minerals produced in Queensland during the year 1903, comparative figures for 1902 being added:—

Mineral.	1902.			1903.		
	Ozs.	Tons.	Value.	Ozs.	Tons.	Value.
			£			£
ld	640,463	..	2,720,639	668,546	..	2,839,813
n	..	2,085	116,171	..	3,708½	243,149
ver	701,312	..	70,145	642,125	..	65,538
d	..	267	2,706	..	3,795	43,639
l	..	501,531	172,286	..	507,801	164,798
pper	..	3,784	189,203	..	4,916	285,122
l	..	..	7,000	..	..	7,300
lfram	..	55	1,167	..	197	7,870
nganese	..	4,600	16,989	..	1,320	5,332
muth	..	1	123	..	11	2,523
muth, wolfram, and molybdenite	..	41	5,502	..	24	2,100
e	..	4,743	3,672	..	13,612	8,060
ns	..	..	5,000	..	..	7,000
	..	..	..	..	9,808	3,852
Total	1,351,775	517,107	3,310,600	1,310,671	545,192½	3,686,096

LATINUM INDUSTRY IN THE NINETEENTH CENTURY [IN RUSSIA].

W. Schneider. Chem.-Zeit., 1904, **28**, 359—360.

he history of the development of the platinum industry o he last century may be divided into four periods:— (1 From the beginning of the century to 1828, when the co ng of platinum money was begun in Russia; (2) from 18 to 1845, when coining was stopped; (3) from 1845 to 18 , when the platinum refining industry was made free, *i.e.*, the obligatory refining of all platinum in the mint was stopped; (4) from 1867 to the present time. Platinum was first discovered in the Urals, accompanying gold in 1819, in the districts of Nishneturinsk and Nishnetagilsk in 1824, and in Bissertsk in 1830. The first attempts to bring Ural platinum on the market were attended with difficulty and consequently the production remained small. The total amount produced in Russia up to 1828 was about 40 poods, and the demand was mainly supplied by South American platinum. In 1829 the cost of refining platinum was from three to four times as great as that of the raw material. In consequence of the difficulties attending the sale of Ural platinum, Count Krankin, the Russian Minister of Finance, conceived the idea of coining platinum money. This was begun in 1828, and in the period 1828 to 1845, 1,201,838 roubles (metal) worth of platinum money was coined. The amount of platinum mineral produced in this period was about 2,000 poods, of which 1,900 poods came from Nishnetagilsk. The experiment of coining platinum money was not attended with success, and, in fact, only the Nishnetagilsk works reaped any advantage from it. It was discontinued in 1845, and about the same time a tax was levied on platinum mineral according to its content of metal, and the refining of platinum in the Royal Mint was made obligatory. By the discontinuance of the platinum coinage, the Nishnetagilsk works lost their chief customer, the Crown; the works were shut down temporarily, and only gradually resumed work again later. In the period 1845 to 1867 the works of Schuwalow, in Krestowosdwishensk were developed; the total production of platinum mineral in Russia was 1,391 poods, of which 1,284 poods came from Nishnetagilsk. In this period the Crown, which had a large stock of refined platinum to dispose of, sought foreign customers, the chief ones being Quenessen and Co., in Paris, and Johnson, Matthey, and Co., in London; the price fell continuously, being 3,071 to 3,199 roubles per pood in 1846 to 1850, 2,941 to 3,077 in 1859, and 1,877 to 2,253 roubles per pood in 1866. In 1867 the compulsory refining of platinum in the Royal Mint was no longer enforced, the importation and exportation of platinum in any form was permitted, and a tax of 4½ to 3 per cent. *in natura* (on the crude platinum) was levied. Neither the producers nor outside firms in Russia availed themselves of the permission to refine the crude platinum, consequently large stocks were sent abroad, and the predominance thus secured by the foreign refiners has been retained up to the present time. From 1867 to 1901, 7,142 poods of platinum were produced, and in the whole period 1826 to 1901, 9,860 poods, or according to other statements, 10,429 poods. The increase of price of crude platinum in the seventies led to the establishment of refineries in Russia. The first was the firm of Kolbe and Lindfors, which subsequently passed into foreign hands, whilst in 1879 the Tentelewsche Chem. Fabr. entered the business. These two firms competed with the foreign refiners in the purchase of crude platinum in the Urals. In the eighties some small refineries were established in foreign countries which also competed. The development of the Goroblagodat works by small producers also tended to keep up the price of the crude platinum, as also does the increased demand for the metal. The average price of crude platinum per pood since 1870 is shown in the following table :—

Year.	Price.	Year.	Price.
	Roubles (metal).		Roubles (metal).
1870	1.248	1896	5,628
1880	1,932	1897	6,700
1888	2,915	1898	7,370
1889	4.326		
1890	6,171		Price in St. Petersburg.
1891	4.141	1899	8,609
1892	3.717	1900	10,050
1893	4,571	1901	10,050
1894	4,690		
1895	4.690		

The fluctuations of price in the period 1889 to 1892 were due to the struggle between the foreign refiners and the Russian producers.—A. S.

IRON ORE IN BILBAO, SPAIN.

Foreign Office Annual Series, No. 3152.

4,085,438 tons of iron ore were exported from the Bilbao River in 1903, as compared with 4,196,851 tons in 1902 and 4,056,710 tons in 1901. Of these amounts, the exports to the United Kingdom were 2,649,004 tons, 2,996,908 tons, and 2,281,198 tons respectively. The total quantity of all ores exported from the districts of Biscay, Guipuzcoa, and Santander in 1903 was 5,662,071 tons. Average prices per ton during the year were, for limonite, 1st quality, 10*s.* to 11*s.*; 2nd quality, 8*s.* to 8*s.* 6*d.*; hæmatite, 10*s.* 6*d.* to 11*s.* 3*d.*; siderite, 1st quality, 11*s.* 6*d.* to 12*s.*; 2nd quality, 10*s.* 6*d.* to 11*s.*

ONTARIO; MINERAL PRODUCTION OF ——.

Eng. and Mining J., April 21, 1904.

The following table shows the mineral production of the province of Ontario for the year 1903. The tons used are short tons of 2,000 lb. :—

Product.		Quantity.	Value.
			Dols.
Metallic :—			
Gold	Oz.	10,383	188,036
Silver	"	16,688	8,949
Copper	Tons	5,331	716,726
Nickel	"	6,998	2,499,068
Iron ore	"	268,154	450,099
Pig iron	"	87,004	1,491,696
Steel	"	15,229	304,580
Lead	"	..	1,500
Molybdenite	"	85	1,275
Zinc ore	"	1,150	17,000
			5,678,929
Less value of iron ore smelted into pig iron and pig iron converted into steel		..	436,354
Net value metallic production		..	5,242,575
Non-metallic :—			
Actinolite	Tons	550	1,650
Arsenic	"	257	15,420
Tile, drain	No.	18,200,000	227,000
Brick, common	"	230,000,000	1,561,709
" paving	"	3,788,800	45,288
" pressed and terra-cotta	"	23,702,610	218,550
Building and crushed stone	..	..	845,000
Calcium carbide	Tons	2,507	141,000
Cement, natural rock	Bbl.	89,549	69,319
" Portland	"	695,260	1,182,799
Corundum, grain	Tons	849	84,900
" cobbed	"	270	2,700
Felspar	"	15,296	20,046
Graphite	"	4,490	20,659
Gypsum	"	4,520	7,910
Iron pyrites	"	7,469	21,693
Lime	Bushels	3,499,000	320,000
Mica	Tons	948	102,205
Natural gas	..	..	196,535
Peat fuel	Tons	1,100	3,300
Petroleum	Imp. Gall.	16,610,338	..
Illuminating oil	"	7,096,073	1,586,674
Lubricating oil	"	2,614,312	
Benzine and naphtha	"	832,153	
Gas and fuel oils and tar	"	1,968,172	
Paraffin wax and candles	Lb.	2,673,806	
Pottery	..	..	160,000
Salt	Tons	58,274	388,097
Sewer pipe	..	..	199,951
Talc	Tons	920	2,625
			7,628,018
Total non-metallic production		..	7,628,018
Total production		..	12,870,593

LEAD DROSS: U.S. CUSTOMS DECISION.

April 12, 1904.

Dross containing 37·63 per cent. of lead and 51·65 p cent. of tin was held not to be free of duty as "tin dross" or "tin grain" under paragraph 683 of the Tariff Act, b dutiable at 2½ cents per pound as "lead dross," und paragraph 182.—R. W. M.

XII.—FATS, FATTY OILS, Etc.

WHALE OIL.

C. H. Stevenson. U.S. Fish Commission Report for 19 *Scient. Amer. Suppl.*, 1904, **57**, 23,549—23,552; 23,566—23,568.

The total annual production of whale oil at the prese time is about 3,000,000 galls., of which 750,000 galls. co from the United States, 900,000 from Norway, and remainder principally from Scotland, Russia, Japan, Newfoundland. The yield of oil from the various kinds whales is shown in the following table.

	Yield of Oil in Barrels of 31½ Galls.		
	Minimum.	Maximum.	Average.
Right whale, Pacific	25	250	90
„ Atlantic	25	150	75
Bowhead	30	250	100
Sperm whale, cows	5	145	25—30
„ bulls			75—90
Humpback, Pacific	10	110	42
„ Atlantic	10	100	10
Finback, Pacific*	10	70	35
„ Atlantic*	20	60	38
California grey whale	15	60	30
Bottle-nose whale†	4	25	12
Orca or killer whale	1	6	2½
Beluga or white whale‡	¾	3	1½
Black-fish	⅓	4	1⅓

* Oil inferior to that from right whales.

† Next in quality to sperm oil; gives no residuum, and is thus useful for lubricating small machines, &c.

‡ Excellent lubricating oil.

The principal seats of the whale-oil refining trade in the United States are at New Bedford, Mass., and San Francisco, Cal. At the latter port, 20 per cent. of the sperm oil and 60 per cent. of the whale oil are refined. The oil is of two chief kinds, *viz.*, sperm oil, from sperm whales, and whale oil, from all other varieties of whales, and also from walrus, black-fish, sea elephant, &c. The crude product ranges in colour from clear amber to very dark brown. A considerable amount of whale oil is used, in the crude state, by steel-workers, miners, and cordage manufacturers. The crude sperm oil is separated, by processes of refrigeration and pressing, into (1) "winter sperm oil," congealing below 38° F., about 75 per cent.; (2) "spring sperm oil," congealing at 50°—60° F., 9 per cent.; (3) "taut-pressed oil," melting at 90°—95° F., 5 per cent.; and (4) "crude spermaceti," melting at 110°—115° F., 11 per cent. The crude whale oil is separated, by similar methods, into (1) "winter whale oil," congealing at 36°—40° F., and (2) "whale-foots," or stearine. Occasionally, "spring" and "summer" whale oils are also prepared. By the usual method of pressing, the oil of the right whale, taken in high northern latitudes, gives about 8 per cent. of "foots" or stearine; if taken in the vicinity of the equator, or south of it, about 15 per cent; humpback or finback whale oils, 12 per cent.; menhaden oil, 5—10 per cent,: sea-elephant oil, 5—6 per cent.; and seal oil, 3—4 per cent of stearine.—A. S.

WAX; CHINESE ——. U.S. CUSTOMS DECISION.

April 14, 1904.

Merchandise invoiced as Chinese wax, composed of 70 per cent. of cerotic acid, 15 per cent. of ceryl alcohol, and 15 per cent. of wax, was assessed for duty at 20 per cent. *ad valorem* as a "manufactured article unenumerated," under section 6 of the present tariff. The Board of General Appraisers held that it was free of duty as "vegetable wax," under paragraph 695. The evidence is not conclusive whether it is the secretion of the wax insect or is produced from the sap of the tree under the influence of animal life. Similar natural products, such as lac and beeswax, are provided for by name in the tariff, and the element of doubt in this case is resolved in favour of the importer. The unusual composition of the sample does not govern, for the reason that the nature of the article has not been altered sufficiently to make it anything other than wax in its physical properties and technical uses.—R. W. M.

XIII. C.—INDIA-RUBBER, Etc.

GUTTA-PERCHA: U.S. CUSTOMS DECISION.

April 9, 1904.

Gutta-percha moulded into cylindrical rods and partly freed from impurities, was held to be free of duty as "crude gutta-percha," under paragraph 570 of the present Tariff Act.
—R. W. M.

XVI.—SUGAR, STARCH, Etc.

BEET-SUGAR STATISTICS.

U.S. Cons. Reps., No. 1936, *April* 25, 1904.

The following tables are largely based upon the reports of Mr. Otto Licht, the sugar statistician, of Magdeburg.

Production of Beet Sugar.—The following is a comparative statement showing production of beet sugar in European countries during the last three years:—

Country.	1901-2.	1902-3.	1903-4.
	Met. Tons.	Met. Tons.	Met. Tons.
Germany	2,304,923	1,762,461	1,960,000
Austria	1,301,549	1,057,692	1,175,000
France	1,123,533	833,210	810,000
Russia	1,098,983	1,251,311	1,200,000
Belgium	331,960	225,696	220,000
Holland	203,172	102,411	125,000
Sweden	125,948	72,444	108,500
Denmark	55,132	37,067	49,000
Italy	74,299	95,191	120,000
Roumania	20,844	16,381	18,000
Spain	73,576	96,160	116,000
Other countries	15,329	13,919	10,500
Total	6,752,218	5,573,943	5,910,000

Average Consumption.—The following is a comparative statement showing how much sugar was consumed by each inhabitant of European countries and of the United States during the last two years:—

Country.	1901-2.	1902-3.	Number of Inhabitants in 1903.
	Pounds.	Pounds.	
Germany	30·07	28·31	58,512,000
Austria	18·34	17·86	47,600,000
France	25·13	23·56	39,000,000
Russia	17·44	17·88	109,000,000
Belgium	24·88	22·37	6,800,000
Holland	46·66	30·55	5,270,000
Sweden and Norway	45·51	39·57	7,450,000
Denmark	53·94	51·97	2,500,000
Italy	7·19	7·37	33,000,000
Spain	9·32	10·91	18,650,000
Roumania	6·27	6·73	6,100,000
Bulgaria	6·16	6·11	3,780,000
Greece	8·07	8·53	2,500,000
Servia	6·88	7·83	2,550,000
Turkey, including Asia	8·05	7·96	24,000,000
Portugal and Madeira	14·1	14·41	5,600,000
Switzerland	61·05	62·83	3,450,000
England	97·83	89·8	41,900,000
United States	70·44	66·39	78,700,000

Acreage and Crop Yield.—The following is a comparative statement showing the acreage sown to beets, the total beet crop, the crop yields per acre, and the amount of sugar per acre, during the past two years, and also the percentage of sugar in the beets:—

Country.	Area sown to Beets.		Total Beet Crop.		Yield per Acre.		Amount of Sugar per Acre.		Percentage of Sugar in Beets.	
	1902-3.	1903-4.	1902-3.	1903-4.	1902-3.	1903-4.	1902-3.	1903-4.	1902-3.	1903-4.
	Acres.	Acres.	Met. Tons.	Met. Tons.	Met. Tons.	Met. Tons.	Met. Tons.	Met. Tons.	Per Cent.	Per Cent.
Germany	1,056,708	1,027,580	11,270,978	12,700,000	10·66	12·36	1·668	1·9	15·64	15·48
Austria	751,011	757,633	7,130,600	7,775,000	9·49	10·26	1·408	1·597	14·83	15·56
France	551,774	553,998	6,263,946	6,441,509	11·36	11·63	1·51	1·444	13·29	12·49
Russia	1,482,116	1,395,801	9,161,000	7,712,000	6·18	5·52	0·851	0·859	13·77	15·56
Belgium	129,480	142,083	1,441,000	1,546,000	11·13	10·88	1·743	1·583	15·66	14·46
Holland	78,084	99,688	771,900	935,800	9·12	9·39	1·312	1·254	14·58	13·25
Sweden	59,798	70,997	505,018	746,800	8·45	10·51	1·211	1·5	14·34	14·26
Denmark	38,795	38,795	303,800	386,000	7·89	9·95	0·955	1·263	12·19	12·68
Italy	111,195	123,550	1,000,000	1,050,000	8·99	8·5	0·856	1·012	9·52	11·9
Spain	83,485	85,250	670,479	975,000	8·03	8·71	0·83	1·15	10·35	9·9
Roumania	15,355	16,062	130,000	180,000	8·54	11·21	1·069	1·124	12·52	10·0
United States	259,418	292,277	1,686,368	1,850,000	6·5	6·33	0·753	0·718	9·9	10·5
Other countries	7,413	7,413	140,000	100,400	12·58	10·15	0·252	1·062	9·91	10·46

Production and Consumption.—The following table for year 1903–4 shows that most beet-growing countries have sugar to sell, after supplying their own wants :—

Country.	Stock on Hand Sept. 1, 1903.	Production.	Consumption.
	Met. Tons.	Met. Tons.	Met. Tons.
Germany	320,880	1,960,000	970,000
Austria	63,959	1,175,000	450,000
France	635,322	810,000	690,000
Russia	239,881	1,200,000	925,000
Belgium	104,370	220,000	90,000
Holland	23,175	125,000	100,000
Sweden and Norway	5,000	106,500	150,000
Denmark	2,250	49,000	60,000
Italy	19,200	120,000	115,000
Spain	18,552	116,000	95,000
Roumania	..	18,000	19,000
Switzerland	6,000	10,500	256,000
England	138,724	..	1,870,000
United States (beet and cane)	260,411	530,000	2,570,000
Total	1,837,724	6,110,000	8,270,000
Previous year	1,573,637	5,995,217	7,339,122

Production of Sugar-cane.—The following is a comparative statement showing production in cane-sugar countries during the past three years. Of course the figures for 1903–4 can only be approximate estimates, as the harvesting in some of the cane-producing countries, according to the latest advices, has just begun, and the results had to be anticipated :—

Country.	1901–2.	1902–3.	1903–4.
	Met. Tons.	Met. Tons.	Met. Tons.
Cuba	683,312	943,500	1,150,000
Porto Rico	82,179	77,737	125,000
Trinidad	44,918	38,804	40,000
Barbados	46,314	29,786	35,000
Martinique	31,733	33,107	35,000
Guadeloupe	40,576	38,828	35,000
Demerara	118,193	122,357	110,000
Brazil	268,000	139,000	150,000
Java	749,814	784,169	850,000
Philippines	67,331	114,343	110,000
Mauritius	145,268	147,630	180,000
Réunion	30,120	40,962	35,000
Jamaica	16,242	14,916	20,000
Lesser Antilles	95,000	80,000	80,000
Peru	100,000	110,000	100,000
Egypt	96,000	90,000	85,000
Hawaiian Islands	322,590	397,319	395,000
Total	2,907,586	3,202,158	3,535,000

World's Production and Consumption of Sugar.—It is expected that the decrease in sowings in Europe will be moderate, and that the acreage will be about 308,000 acres less. On the other hand, the production of cane-sugar will be increased by at least 150,000 tons. The world's consumption will increase about 500,000 tons.

XVII.—BREWING, WINES, SPIRITS, Etc.

ALCOHOL; DUTY-FREE —— IN POLAND.

Pharm. J., May 7, 1904.

The year 1903 was a bad one for Polish spirit distilleries on account of the failure of the potato crop. Large quantities of maize, according to the consular report, were imported from Bessarabia and the Caucasus to replace potatoes, but were of course much dearer. According to the law of 1903, permission was granted for the use of denatured spirits, free of excise, for industrial and technical purposes, but little advantage was taken of it on account of the shortness of spirits and the low price paid by the monopoly (4*d.* per gallon) for spirits to be denatured, which did not encourage distilleries to sell spirits to the monopoly for that purpose. Denatured spirits were sold by the monopoly only at Warsaw at 6*d.* per gallon. The consumption of denatured spirit was small, as special permission to use it has to be obtained from the Ministry in each case, even for a single lamp.

SPIRIT; PRODUCTION OF —— IN POLAND.

Pharm. J., May 7, 1904.

According to the law of June 12, 1900, which was in force till the end of 1903, Poland was allowed to produce 22,500,000 gallons of spirit a year. The production of spirits in 1903 was 17,517,558 gallons, of which 13,160,835 gallons were sold to the monopoly for export to other parts of Russia, and the remainder, together with the balance from 1902, covered the consumption of spirits in Poland, which annually is about 10,000,000 gallons. The consumption of spirits in Poland is yearly decreasing, whereas in Russia it is increasing. A new law, which came into force in January 1904, does not restrict in any way the production of spirits in Poland, and the annual requirements of the monopoly have been fixed by the Ministry at 18,191,355 gallons for the period 1903–07, the monopoly taking this quantity at a fixed rate.

SPIRIT; MANUFACTURE OF —— FROM PEAT.

Bd. of Trade J., May 12, 1904.

According to the *Neue Hamburgische Börsen-Halle* of 29th April, a company has been formed in Rendsburg with a capital of 1,500,000 marks to undertake the manufacture of spirit from peat. The factory will be built in the neighbourhood of Aalborg, and will at first have a capacity for producing 50 hectols. (hectolitre = 22 imperial gallons) daily. It is stated that it is intended in the first place to find a market in the free port district of Hamburg, where there are several large establishments using spirit, and at the same time export the product abroad from Hamburg. It is anticipated that the spirit produced will be especially suited for heating purposes. The company is to commence operations in July.

XIX.—PAPER, PASTEBOARD, Etc.

PAPER MANUFACTURE IN ALGERIA.

Dépêche Coloniale, May 2, 1904; *Bd. of Trade J., May* 12, 1904.

At the present time, the greater portion of the alfa cultivated in Algeria is sent to the United Kingdom; the amount imported into this country during 1903 being 63,974 tons. All this alfa is utilised in the manufacture of paper: the better quality for high-class paper and cigarette papers; the inferior quality for the manufacture of ordinary paper.

If account is taken of the cost of carriage to the factories and of the fact that nearly $2\frac{1}{4}$ tons of alfa are used in the manufacture of one ton of pulp, an idea is obtained of the advantage to be gained by dealing with the alfa on the spot.

A company has been formed with a view to working a patent for the manufacture of paper from fresh alfa. A factory has been established at Bou-Jaffar, and several others are about to be erected in the heart of the alfa-growing districts.

XX.—FINE CHEMICALS, Etc.

ETHER FOR MANUFACTURING PURPOSES.

Times, May 14, 1904.

Mr. Gray having asked whether his attention had been drawn to the fact that ether from pure spirit should be used in the manufacture of certain articles required by the War Office; that this spirit was subject to a heavy duty, and hence, if the article was to be manufactured at a reasonable price, methylated ether must be substituted for the pure, or the contract sent abroad where manufacturers obtain spirit duty free for manufacturing purposes; and whether, under these circumstances, he would consider the desirability of permitting the manufacture of such goods in bond under practicable conditions, or of allowing in the price paid by the War Office for the duty received by the Excise, the Chancellor of the Exchequer says: "Section 8 of the Finance Act of 1902 appears to cover such cases as the hon. member has in view. Manufacturers desiring to be allowed the benefit of that section should address an application to the Board of Inland Revenue, by whom it will be carefully considered."

Cocaine Manufacture in Peru.

Bulletin Commercial (Brussels), April 30, 1904 ; *Bd. of Trade J., May* 12, 1904.

Peru is the only South American country in which cocaine manufactories have been established. At the present time there are two in Lima, one at Callao, two in the Province of Cuzco, one at Catamarca, two in the Department of La Libertad, and about a dozen more or less important ones in the district of Huanuco. The quantity exported in 1901 amounted to about 210 cwts., nearly the whole of which was sent to Hamburg, the principal market for this product. The demand for cocaine is continually increasing. The subjoined figures show how largely the xportation of this article has developed :—

Year.	Coca Leaves.	Cocaine.
	Kilos.	Kilos.
1897	494,000	4,200
1898	408,000	4,350
1899	312,000	4,500
1900	566,000	7,750
1901	610,000	10,688

As the average price of cocaine in 1901 was 30*l.* per ilo., the value of the amount exported was more than 20,000*l.*

Antipyrine : U.S. Customs Decision.

April 12, 1904.

Following previous decisions on similar goods, the Board f General Appraisers held that antipyrine is dutiable at cents per lb. under paragraph 67 of the present tariff, a "medicinal preparation in the preparation of which cohol is used."—R. W. M.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and .S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an erisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of mplete Specifications Accepted, those of the Official Journals which acceptances of the Complete Specifications are advertised. omplete Specifications thus advertised as accepted are open to pection at the Patent Office immediately, and to opposition thin two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

A.] 10,007. Kugel. *See under* X.
,, 10,059. Ransome. Mixing machines.* May 2.
,, 10,093. Reese. Heating pipes, ducts, &c., containing fluid to be heated by gas. May 3.
,, 10,094. Reese. Heating solid materials, or crucibles, pans, &c., containing solid or liquid materials, by gas. May 3.
,, 10,148. Honeywood. Machinery for crushing or grinding ore, rock, cement, and the like. May 3.
, 10,157. Forbes. Distilling and condensing apparatus.* May 3.
, 10,225. Wilkinson. Means for and method of carrying out secret manufacturing processes of chemical treatment. May 4.
10,422. Christenson. Liners for centrifugal separators. [Appl. in Sweden, May 16, 1903.]* May 6.
[A.] 10,468. Mayer. Grinding apparatus.* May 6.
,, 10,612. Christenson. Inlet-pipe for centrifugal separators. [Appl. in Sweden, May 16, 1903.]* May 9.
,, 10,682. Heberlein and Hommel. Rotary furnace applicable for use in roasting ores and for other purposes. May 9.
,, 10,753. Johnson, and S. H. Johnson and Co., Ltd. Process and apparatus for filtering liquids.* May 10.
,, 10,797. Van der Heyden. Solidification of fluids. May 10.
,, 10,881. Carolan (Gen. Electric Co.). Methods of conducting chemical reactions. May 11.
,, 11,186. Lockwood. Grinding mills. May 14.
[C.S.] 11,549 (1903). Johnson (Badische Anilin und Soda Fabrik). Purification of gases. May 18.
,, 12,347 (1903). Brooks and Clarkson. Furnace for heating purposes. May 11.
,, 14,105 (1903). Loison. Centrifugal separators for dry materials of different densities. May 18.
,, 15,108 (1903). Haas (Haas). Apparatus for treating materials with air, or other gases or vapours, for drying, bleaching, or other purposes. May 18.
,, 16,815 (1903). Branget. Apparatus for separating or grading ground or other pulverised materials. May 18.
,, 6444 (1904). Ancel. Crushing and pulverising machine. May 18.
,, 7204 (1904). Bokelberg and Sachse. *See under* XII.
,, 7210 (1904). Justice (Telluride Reduction Co.). System of and apparatus for filtering liquids. May 18.

II.—FUEL, GAS, AND LIGHT.

[A.] 10,123. Addicks. Apparatus for the manufacture of carburetted water-gas.* May 3.
,, 10,344. Gerdes. Gas producers. [Ger. Appl., May 6, 1903.]* May 5.
,, 10,476. Claudel et Cie. Gasification of liquid fuel. [Fr. Appl., March 24, 1904.]* May 6.
,, 10,480. Eveno. Vapourising liquid fuel. [Fr. Appl., Oct. 20, 1903.]* May 6.
,, 10,538. Alsop. Method of generating a gaseous medium from air. [U.S. Appl., May 29, 1903.]* May 7.
,, 10,607. Kennedy. Gas producers. May 9.
,, 10,620. Wilshere. Manufacture of artificial fuel. May 9.
,, 10,733. Hills and Lane. Gas-producing apparatus for use with fuels of a bituminous nature. May 10.
,, 10,734. Hills and Lane. Production of producer gas. May 10.
,, 10,873. Voelker. Manufacture of electric incandescent bodies. May 11.
,, 10,926. Dempster and Sons, Ltd., and Scott. Gas retorts. May 12.
,, 11,101. Roux and Gonin. Ovens for the carbonisation of peat and other carbonaceous materials. May 13.
,, 11,105. Guénot. Manufacture of water-gas. [Fr. Appl., May 14, 1903.]* May 13.
[C.S.] 11,827 (1903). Lake (Selas Ges.). Apparatus for producing mixtures of gas and air. May 18.
,, 13,047 (1903). Beaven. Treatment of coke. May 18.
,, 14,893 (1903). Paul. Gas producers. May 11.

[C.S.] 15,147 (1903). Johnson (Deuts. Continental Gas-ges., and Bueb). Manufacture of gas. May 11.

„ 27,579 (1903). Delassue. Gas producers and purifying apparatus for use with gas engines. May 11.

„ 5015 (1904). Myers. Furnaces specially applicable for burning tan and like fuel. May 18.

„ 6527 (1904). Thompson (Moore). Process and apparatus for quenching and bleaching coke. May 11.

„ 6718 (1904). West. Construction of regenerator furnaces. May 11.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[C.S.] 6891 (1904). Zimpell. Saturator for the recovery of sulphate of ammonia from ammonia gases. May 11.

„ 7204 (1904). Bokelberg and Sachse. *See under* XII.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 10,235. Shillito (Aniline Colour and Extract Works, formerly J. R. Geigy). Manufacture of 1-diazo-2-oxy- and 2-diazo-1-oxy-naphthalene mono-, di-, and tri-sulphonic acids. May 4.

„ 10,678. Lake (Oehler). Halogenised nitro compounds.* May 9.

„ 10,895. Johnson (Badische Anilin und Soda Fabrik). *See under* XIII. A.

„ 10,925. Lilienfeld. Manufacture of indigo or homologues or derivatives thereof. May 12.

[C.S.] 13,192 (1903). Newton (F. Bayer and Co.). Manufacture of new dyestuffs of the triphenylmethane series. May 11.

„ 15,493 (1903). Johnson (Badische Anilin und Soda Fabrik). *See under* XIII. A.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 10,005. McNaught. Machinery for scouring and washing wool and other fibrous materials. May 2.

„ 10,156. Hall. Method and means of removing oil and grease from sponge cloths, cotton waste, and all kinds of grease-laden textile material. May 3.

„ 10,272. Kellner. Process and means for washing textile fabric.* May 4.

„ 10,499. Brandt. Process for producing figured patterns upon velveteens, plushes, and other pile goods. May 7.

„ 10,617. Waddelow. Process for making fabrics highly combustible. May 9.

„ 10,918. Roberts, Taylor, and Taylor. Carbonising or completely destroying all vegetable matter and silk in wool or rags automatically. May 12.

[C.S.] 10,255 (1903). Crompton and Horrocks. Machines for mercerising, scouring, bleaching, dyeing, washing, and like treatment of yarn in hank form. May 18.

„ 5201 (1904). Lesenne. Wool-washing machinery. May 18.

„ 8433 (1904). Serkowski. Waterproofing of materials, such as tissues, fabrics, paper, leather, and cords. May 18.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 10,232. MacIvor and Barnett. Apparatus for the manufacture of oxide lead. May 4.

„ 10,360. Johnson (Badische Anilin und Soda Fabrik.). Manufacture and application of reducing agents, and of intermediate products relating thereto. May 5.

„ 10,897. Bloxam (Neue Photographische Ges. Act.-Ges.). Manufacture of stable mangane salt solutions. May 11.

„ 11,172. Cie. Française de l'Acétylène Dissous. Manufacture of oxygen. [Fr. Appl., May 15, 1903.]* May 14.

[C.S.] 12,719 (1903). Lake (Synd. pour l'Exploitation des Inventions du Prof. Oettli). Manufacture of oxide of zinc. May 11.

„ 14,749 (1903). Davis. Utilisation of nitre cake and the manufacture of useful products therefrom. May 11.

„ 17,588 (1903). Johnson (Chem. Fabr. Griesheim Elektron). Treatment of alkali chromates for the production of bichromates and alkali therefrom. May 18.

„ 17,589 (1903). Johnson (Chem. Fabr. Griesheim Elektron). Treatment of chrome ironstone for the production of potassium chromate. May 18.

„ 6891 (1904). Zimpell. *See under* III.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 10,670. Bottomley, Hutton, and Paget. Manufacture of silica glass. May 9.

[C.S.] 13,046 (1903). Dausette. Manufacture of ceramic articles. May 18.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 10,170. Grau. Manufacture of cement. May 3.

„ 10,275. Schmidt and Unger. Coloured cement, and the process of manufacturing the same. May 4.

„ 10,496. Hadlington. Brick kilns, &c. May 6.

„ 10,650. Blakeslee. Building blocks.* May 9.

„ 11,151. Hamblet. Brick kilns, &c. May 14.

[C.S.] 11,324 (1903). Thum. Manufacture of Portland cement. May 18.

„ 16,125 (1903). Sandwith and Rayner. Lubricating substance for use in the manufacture of bricks, tiles, pottery, and the like. May 18.

„ 24,911 (1903). Earle (Traschler). Manufactur of white cement. May 18.

„ 3760 (1904). Perkiewicz. Coating bricks, an apparatus therefor. May 18.

„ 4478 (1904). Bach. Manufacture of refractory articles. May 11.

„ 4939 (1904). Weiss. Process of making a bindin agent or cement. May 11.

X.—METALLURGY.

[A.] 10,007. Kugel. Heating furnace for the continuo heating of metals without oxidation.* May 2.

„ 10,241. Bailey. Extraction of gold from refracto ores. May 4.

„ 10,682. Heberlein and Hommel. *See under* I.

„ 10,902. Imray (Soc. Anon. pour l'Industrie l'Aluminium). Process for the deoxidation ingot iron, ingot steel, and the like. May 11.

„ 10,976. Dake. Aluminium alloys. May 12.

[A.] 11,019. Brand. Apparatus for and methods of precipitating zinc from solutions of the same. May 13.

,, 11,123. MacArthur. Treatment of ores containing antimony. May 14.

,, 11,164. Wheatley. Metallic alloy. May 14.

[C.S.] 14,731 (1903). Willis (Shields). *See under* XI.

,, 15,032 (1903). Spencer. Manufacture of steel. May 18.

,, 15,188 (1903). Rouse and Cohn. Method of hardening lumps artificially agglomerated, of iron sand, or of concentrated powdered iron ore for transport and for reduction in furnaces. May 18.

,, 25,032 (1903). Galbraith and Steuart. Method of and apparatus for the reduction of iron sand, iron oxides, and other suitable substances. May 11.

,, 25,033 (1903). Galbraith and Steuart. Method and apparatus for the reduction of iron sand, iron oxides, and other suitable substances. May 11.

,, 26,292 (1903). Ellis and Flanigan. Flux for soldering aluminium. May 18.

,, 27,516 (1903). Jacobsen. Metallic alloys or compounds. May 11.

,, 2273 (1904). Hadfield. Manufacture of magnetic material. May 18.

,, 5671 (1904). Lake (Bassett, Parker, and Strout). Brazing of metals, and fluxes for use therein. May 18.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 10,559. Siemens Bros. and Co., Ltd., and Eichenauer. Galvanic batteries. May 7.

,, 10,709. Stöckigt. Dry cells.* May 10.

,, 10,794. Blackmore and Byrnes. Electrolytic apparatus. May 10.

[C.S.] 14,731 (1903). Willis (Shields). Electrolytic separation of copper and nickel from mattes and ores. May 18.

,, 14,963 (1903). Willis (Sjösted). Electric furnace. May 18.

,, 17,587 (1903). Johnson (Chem. Fabr. Griesheim Elektron). Manufacture of electrodes for electrolytic purposes. May 18.

,, 28,782 (1903). Eimer. Electric sectional furnaces. May 11.

,, 4866 (1904). Frick. Electric furnaces. May 18.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 10,011. Galloway. Scrubbing or combination soaps, &c. May 2.

,, 10,350. Klopfer. Process for producing soap.* May 5.

,, 10,466. Dreymann. Process for manufacturing candles, lamp-oils, cooking fats, ointments, soaps, &c.* May 6.

,, 10,536. Haase. Candles.* May 7.

[C.S.] 7204 (1904). Bokelberg and Sachse. Continuous vacuum distillation of fats, oils, tars, and the like. May 11.

III.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

[A.] 10,895. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring-matter lakes. May 11.

[C.S.] 15,493 (1903). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring-matter lakes. May 18.

(*C.*)—India-Rubber.

[A.] 10,004. Rath. Method for reclaiming vulcanised india-rubber. May 6.

[C.S.] 13,306 (1903). Velvril Co., Ltd., and Howkins. Manufacture of india-rubber substitutes. May 11.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

[A.] 11,094. Lewis. Process of manufacturing soluble albumen from milk.* May 13.

[C.S.] 10,615 (1903). Union de la Boucherie en Gros de Paris. Process and apparatus for the preparation of desiccated blood. May 18.

,, 8433 (1904). Serkowski. *See under* V.

XVI.—SUGAR, STARCH, GUM, Etc.

[A.] 10,586. Humphreys and Harrison. Manufacture of starch, glazing materials, and like substances, for laundry purposes. May 9.

,, 10,664. Ewen and Tomlinson. Process of converting wood cellulose into sugar.* May 9.

,, 11,113. Wheatley (Internat. Spiritus - Industrie Ges. m. b. H.). *See under* XVII.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 10,320. Vignier. Distillation of whiskey and brandy. May 5.

,, 10,361. Aspinall and Cannon. Treatment of wort. May 5.

,, 10,489. Hunt. Maturing and improving the aroma of raw whiskey and other spirits and also certain wines. May 6.

,, 10,490. Lustig. Process for preserving hops.* May 6.

,, 10,893. Hunt. Maturing and improving the aroma of raw whiskey and other spirits and also certain wines. May 11.

,, 11,113. Wheatley (Internat. Spiritus - Industrie Ges. m. b. H.). Method of preparing must for the manufacture of spirits of wine, the feeding of cattle, and the manufacture of dextrose.* May 13.

,, 11,174. Dorn. Process for the maturing of wines and spirits as well as for the sterilisation of liquids. May 14.

[C.S.] 21,580 (1903). Hewer. Apparatus and process for infusing and extracting hops. May 11.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—Foods.

[A.] 10,030. Von Behring. Sterilising and preserving process. May 2.

,, 10,211. Lawson. Process of bleaching grain and rice. May 4.

,, 10,651. Baumann. Preparation of milk. May 9.

,, 10,758. Dunne. Means for preserving food and the like. May 10.

,, 11,094. Lewis. *See under* XIV.

,, 11,174. Dorn. *See under* XVII.

[C.S.] 12,046 (1903). Leetham. Process and apparatus for bleaching wheat, flour, and the like. May 11.

,, 7895 (1904). Braga. Process for the manufacture of extract of meat. May 11

(*B.*)—Sanitation; Water Purification.

[A.] 10,539. Stringfellow. Treatment and utilisation of sewage and other refuse. May 7.

„ 10,867. Peschges. Purification of sewage and the like. May 11.

[C.S.] 11,073 (1903). Travis and Ault. Purification of sewage or other liquids, and means therefor. May 18.

„ 7383 (1904). Porion. Process and apparatus for disinfecting sewage and like waters. May 11.

„ 8461 (1904). Street and Street. Purification or filtration of liquid refuse discharged from distilleries, breweries, paper works, and other places. May 18.

(*C.*)—Disinfectants.

[A.] 10,030. Von Behring. Disinfectants. May 2.

XIX.—PAPER, PASTEBOARD, Etc.

[C.S.] 25,075 (1903). Busbridge. Straining apparatus suitable for straining paper pulp. May 18.

„ 8433 (1904). Serkowski. *See under* V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[C.S.] 16,299 (1903). Imray (Fabr. Prod. Chimiques de Thann et de Mulhouse). Manufacture of orthotoluene sulphonic acid. May 18.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 10,898. Bloxam (Neue Photographische Ges., Act.-Ges.). Method of toning silver pictures. May 11.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 10,366. Guthridge. Explosive. May 5.

„ 10,540. Reichwald (F. Krupp Akt.-Ges.). Cartridges. May 7.

„ 11,000. Steele. Explosive.* May 12.

„ 11,066. Brodie and The British Moss Litter Co., Ltd. Manufacture of explosives. May 18.

[C.S.] 10,789 (1903). Fischer. Explosive mixture. May 18.

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Notices.

ANNUAL GENERAL MEETING, NEW YORK, 1904.

The Annual General Meeting will be held in New York City on Thursday, Sept. 8th, and following days. Members who propose to attend the meeting are requested to inform the General Secretary, as soon as possible, by what steamer they will travel. Each boat will be met on arrival at New York by a representative of the Reception Committee, with a list of apartments, at various prices, which have been reserved for the Society. The same system will be observed at all the other cities visited by the special train. A revised programme appeared in the March 31st issue.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Mr. Wm. H. Nichols has been nominated to the office of President under Rule 8; Dr. Edw. Divers, Prof. W. R. Eaton Hodgkinson, Mr. Max Muspratt, and Mr. T. J. Parker have been nominated Vice-Presidents under Rule 8; and Sir Wm. Ramsay has been nominated a Vice-President under Rule 11.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the ordinary members of the Council. Forms for this purpose can be obtained, on application, from the General Secretary, or from the Hon. Local Secretaries of the Canadian, New York, and Sydney Sections.

Extract from Rule 18:—"No such nomination shall be valid unless it be signed by at least ten members of the Society who are not in arrear with their subscriptions, nor unless it be received by the General Secretary, at the Society's Office, at least one month before the date of the Annual General Meeting at which the election to which it refers takes place. Nor shall any such nomination be valid if the person nominated be ineligible for election under Rules 12 or 15. No member shall sign more than one nomination form."

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

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ERRATA.

THE IMPROVEMENT OF BOILER FEED WATER

BY A. McGILL, M.A., F.R.C.S.

(This J., April 15, 1904, pp. 351—358.)

Page 357. *Table of Formulæ*, under No. 11 for "P. 7 read "F. 7" or "No. 7" above.

Page 358. Last 8 lines of paper. For "pages 21, 22 read page 355, col. 2.

Liverpool Section.

Meeting held at the University, on Wednesday, April 27th, 1904.

MR. FRANK TATE IN THE CHAIR.

STUDIES ON THE CLAUS REACTION.
PART II.

BY R. FORBES CARPENTER AND S. E. LINDER, B.Sc.

In the paper read before this section in March, 1903 (this J., 1903, pages 457—464), we said, page 460: "We are not able to present any figures of sulphur loss corresponding to those in Table II. for ordinary gasworks Claus plants (composition of gases, 20—25 per cent. sulphuretted hydrogen to 80—75 per cent. carbon dioxide); but such figures as are contained in the Alkali Reports from 1884 onwards indicate that the losses are lower, especially in sulphur as sulphur dioxide. Probably the counter reaction between water vapour and sulphur is much less active at the lower temperatures induced by presence of so much carbon dioxide." During the past twelvemonth opportunities for more exact research have presented themselves, enabling us to conduct some fairly exact experiments on the question of sulphur loss, based on examination of the inlet and outlet gases, to compare with the results of similar losses as ascertained by the practice in the Chance-Claus process, where routine testing of both inlet and outlet gases is regularly practised. Early in the year, as indicated in the above quotation, it had been somewhat anticipated that in the former process, where the amount of carbonic acid bears such large proportion to the total volume of gases passing through the kiln, the lower resulting temperature would tend to diminish loss of sulphur resulting from the operation of a counter reaction, hitherto supposed to take place, to a certain extent, in the kiln at high temperatures—

*(2) $3S + 2H_2O = 2H_2S + SO_2$ For net calories evolved see (1) (i.), (4) (ii.) below; (2) being (4) reversed,

by which the concurrence of these two gases in the exit gases from the kiln has been explained. Some later experiments, however, directed to this point, have not confirmed the probability that this equation exclusively represents what occurs in the kiln after the supposed primary reaction—

*(1) $H_2S + O = H_2O + S$ At 316° C. (600° F.) if sulphur is vaporised net calories evolved 38,890,

has operated in the upper active layer of contact substance.

There are, however, considerations based on thermochemical data, which suggest that the kiln reactions may proceed on less simple lines than those represented by the wo equations (1), (2), above, both of which have a ositive value when expressed thermochemically, and lead o the adoption of the alternative equations—

*(3) $3H_2S + 3O = 2H_2S + SO_2 + H_2O$ At 316° C. net calories evolved, 124,450.

*(4) $2H_2S + SO_2 = 3S + 2H_2O$ At 316° C. (600° F.)
i. If sulphur is not vaporised, net calories *evolved*, 26,860.
ii. If sulphur is vaporised, net calories *absorbed*, 7,890,

affording a better explanation of the observed facts, ggesting that what actually takes place is not so simple (1), but that the same end result is reached in *two* ages.

In the first of these, (3), only 45,180 calories are generated per 32 of sulphur; but very little of this is rendered latent in the form of water vapour, in fact, only about one-sixth part of that in the direct reaction (1), where under kiln conditions more than one-third (about 22,500 calories) passes into the potential form as vapour of water and sulphur; hence this reaction (3) is the one giving the highest *temperature* to the resultant gases (see p. 587). It is possible, therefore, that the *whole* of the oxygen present goes to complete the oxidation of one-third of the sulphur present to sulphur dioxide (excluding from consideration the possible presence of sulphuric acid), the energy developed by the action of the chemical forces proceeding on the lines of highest temperature, *i.e.*, of greatest kinetic heat energy, before expending itself, in part, by assuming the latent or potential form. On this latter hypothesis at temperatures not less than 316° C. (600° F.), at which we may reasonably assume that all the sulphur will be in a state of vapour under kiln conditions (and with gases of 20 per cent. sulphuretted hydrogen and upwards, the boiling point of sulphur, 440 C. (824° F.) will be far exceeded), reactions will proceed on the lines of highest temperature — (3) having a positive value—(4, ii.), a negative, when expressed thermochemically—the temperature intensity of (3) being more or less modified by the heat *absorbed* in (4, ii.).

The residual sulphuretted hydrogen and sulphurous acid in the exit gases must, on this hypothesis, be regarded as due, partly to the incomplete operation of (4, ii.) and partly to the action of steam on sulphur vapour (2), a reaction which has been proved to take place within the range of temperature conditions existing in the Claus kiln (Watts' Dictionary of Chemistry, Vol. II., p. 725).

In view, however, of the difficulty of effecting an exact analysis of gaseous mixtures of SO_2, H_2S, H_2O, vapour of S, and possibly also SO_3, existing at a high temperature in a kiln, from which it is impossible to withdraw a sample without effecting some change in the proportion of the various constituents present, it is desirable to accept any hypothesis based on such analyses with considerable reserve. While it is not difficult to find equations which quantitatively express the kiln reaction when *solely* viewed in the light of the final products condensed in the sulphur chamber, and carried away in the exit gases, it would appear to be a matter of the greatest possible difficulty to determine the stages followed by the reactions within the kiln itself, operating, as they do, usually within a range of temperature exceeding that (400° C.) at which sulphuretted hydrogen wholly dissociates into its elements, and at which, therefore, such reactions as—

(*a*) $H_2S = H_2 + S$
(*b*) $SO_2 + 2H_2 = 2H_2O + S$

cannot be wholly disregarded.

The conditions for reaction (4, i.) seem to be more favourable in the case of kiln gases weak in sulphuretted hydrogen, such as those in Table I. of our paper of last year (this J., 1903, p. 458), where, in the lower part of the kiln, sufficient heat would not be present to maintain sulphur entirely in the form of vapour.

Nor is there evidence lacking that at the top of the kiln in the gas space above the contact-material, temperature is extremely high, as the result of chemical reaction in this space, as it is not of infrequent occurrence, even in Claus plants connected with gas liquor works, where carbonic acid is present to absorb heat, to find the wrought iron top of the kiln subjected to such heavy wear and tear as to necessitate renewal after a few years' working, no other part of the kiln bearing evidence of like stress. Such evidence points to intensity of reaction in this gas space.

If (3) is the first and primary reaction there may be means of inferring that sulphurous acid is in marked predominance at this particular point, and whether in lower zones of the kiln it suffers a progressive reduction. At this stage of the inquiry it is only possible to set out the theoretical considerations which have led to this hypothesis, which it is now sought to put to the test of experimental research.

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* For the sake of simplicity, nitrogen is excluded from the ations under discussion here.

In the Appendix, pp. 586 *seq.*, later, are given the calculations in detail, based on thermochemical data showing that the governing factor for conditions suitable for reversing reaction (2) is the large amount of heat required to vaporise the sulphur.

Conditions of investigation, as will be seen later, are somewhat more complex in the sulphur recovery plants attached to processes where gas liquor is distilled than in those attached to the Chance process of treatment of alkali waste.

It was during the research at Work B. (p. 582) that the disturbing influence of ammonia, already thought possible, in examining results in Work C. (p. 582), made itself distinctly felt, and this proved a subject of interest in itself, as evidence was obtained that there was a greater proportion of ammonia in the outlet than in the inlet gases. This led to the following up of a suggestion that this increase might be due to the conversion of volatile cyanogen compounds into ammonia in the kiln. As indicated later, p. 584, direct laboratory experiments confirm the actual possibility of this reaction.

Determination of the "Efficiency" of the Claus Kiln and Chamber.

(*Gas Liquor Processes.*)

The "efficiency" of any given Claus kiln—as measured by the amount of free sulphur produced per 100 parts of sulphur as sulphuretted hydrogen entering—is governed by the nature and volume of the contact-material, and by the composition and rate of flow of the reacting mixture. Theoretically speaking, the effect of any of these factors upon the efficiency can be ascertained by varying one of the conditions while maintaining the others constant. Similarly, the efficiencies of different types of plant may be compared by measuring the yield of free sulphur obtained under corresponding conditions of working.

These ideal conditions are very difficult to approach in actual practice, but the results already obtained will serve to illustrate some of the general principles that govern a high yield of sulphur under the conditions of working imposed by the obligation to remove both sulphurous acid and sulphuretted hydrogen from the exit gases, before their discharge into the atmosphere, by means of limestone tower and oxide purifier. A *direct* determination of the free sulphur produced has not been found practicable owing to the difficulty of collecting that body without promoting decomposition of the residual sulphurous acid and sulphuretted hydrogen accompanying it. Moreover, it would provide us with no data for ascertaining the total efficiency of the *plant*, *i.e.*, the efficiency of kiln *plus* chambers—as the sulphur is almost entirely deposited before the exit is reached. We are compelled to rely, therefore, upon an *indirect* method of estimation by which the "free sulphur" is got by subtracting the sum of the sulphurs leaving as SO_2 and H_2S in a given volume of gas from the sulphur entering as sulphuretted hydrogen in an equivalent volume of saturator gas, or of reacting mixture.

As will appear later, this method is open to possibly serious error in cases where ammonia is present or is formed as a product of reaction in the kiln gases. Correctly speaking, the difference figure is sulphur "free and in other forms." We give examples later, based on actual works tests, showing how the efficiency measured as a difference figure departs very widely from that as measured by examination of the sulphur yield on emptying the "flowers" chamber in respect of sulphur combined with ammonia in the form of ammonium sulphate. On the other hand, when ammonia is absent, analysis of the sulphur for sulphuric acid and other free sulphur acids shows these to be present in such small quantities as not materially to affect the accuracy of measuring the efficiency by the difference method above.

The following description will, it is hoped, make clear the application of the methods of analysis adopted and means of calculation employed to reach the desired end.

Measurement of Gaseous Volumes.—It is of importance, if time is to be saved and accuracy ensured, that the water used in the aspirators and gas burettes should all be o approximately the same (air) temperature. If this conditio is observed, and if the analyses are further conducted a temperatures not much exceeding 10° C., corrections for temperature are rendered unnecessary in any of the gaseous volumes other than that of the H_2S in the inlet gas determined by iodine titration. Corrections for pressure also are unnecessary, save in exceptional cases.

This procedure is of special importance in the case of the exit gases, where residual H_2S and SO_2 are liable to react upon one another in the burette unless soda be promptly added to fix these compounds as alkaline salts. Rapid addition of soda must be preceded by prompt adjustment of water level for reading off the gaseous volume in the burette, and this again is only possible when apparatus and contained water are at air temperature to enable the reading to be made at the sampling hole.

Inlet Gas.

Apparatus consists of Bunte burette, graduated throughout, with levelling vessel.

Volume of gas is read off at once at air temperature, followed by removal of water from the burette by suction.

Volume taken = $CO_2 + H_2S$ + residual air * = 100 c.c.

Add 10 c.c. of 20 per cent. caustic soda (free from nitrites), then distilled water;

$CO_2 + H_2S$ = contraction observed.

Run the solution slowly from the burette into N/10 iodine, diluted to about 300 c.c. with distilled water and sufficiently acidified with hydrochloric acid, the flask being constantly shaken to ensure complete oxidation of the liberated H_2S, addition of further iodine being made from time to time, if necessary, to ensure a slight excess throughout. Wash out the burette with some of the solution and finish with N/10 thiosulphate, starch indicator.

H_2S at 0° C., 760 mm. = 1·12 × c.c. N/10 iodine.

Multiply H_2S found by suitable factor to reduce to air temperature and pressure—

CO_2 = contraction observed less corrected H_2S.

Exit Gases.

(i.) By burette method.

The analysis is carried out exactly in the same way as with the inlet gases.

Volume taken = 100 c.c.

Reduction of the volume of residual nitrogen, left after addition of soda, to air temperature is conveniently made by immersion of the burette in a cylinder of water.

Then, as before, we have—

$CO_2 + H_2S + SO_2$ + residual nitrogen† = 100 c.c.

And after soda absorption,

$CO_2 + H_2S + SO_2$ = contraction observed.

After titration with N/10 iodine,

$H_2S + SO_2$ = 1·12 × c.c. N/10 iodine, 0° C. 760 mm.

No correction is necessary to air temperature and pressur unless the volume exceeds 5 per cent.

(ii.) *Aspiration Method.*

Apparatus consists of Winchester quart aspirator wit 10 mm. layer of cylinder oil above the water to preve solution of CO_2. An 800-c.c. flask with small bore inl tube with its end sealed half an inch in 10 c.c. N/10 iodi + 10 c.c. N/10 $NaHCO_3$ and *not more than* 40—50 c.c. water. The water run from the aspirator is measured in

---

* It is assumed throughout that the small volume of residual left in the burette after treatment of the inlet gas with soda is a it may well be nitrogen. Except in the case of the Granton sampl the volume is too small to materially affect the calculations, and attempt has been made, therefore, to determine its exact co position.

† Oxygen is absent from the exit gases or present only exceptional cases, *e.g.*, as at Granton, where gases were weak a kiln temperature low; negligible traces only have been detected gasworks kilns, even when excess of air in the reacting mixture been large.

1,000-c.c. graduated cylinder; 11 c.c. is added to the water run to make up for volume of $H_2S + SO_2$ absorbed = 10 × 1·12 c.c.

It was proved by independent research on special mixtures of air, CO_2 and H_2S, that the errors introduced by solution of CO_2 in the absorbing liquid far exceed those resulting from volatilisation of traces of iodine from the solution, and that if the above procedure is followed the errors due to solution of CO_2 and loss of iodine and acid are all reduced to negligible amount, exact agreement being established between the results yielded by the burette and aspiration methods (i) and (ii).

The rate of aspiration should not exceed 100 c.c. of gas per minute (much slower at finish) and, if the highest degree of accuracy is desired, aspiration should be stopped before the last traces of iodine have been destroyed, and the excess allowed for by titration with N/10 thiosulphate and starch indicator.

Volume of water run + 11 c.c. = volume of gas aspirated, measured at air temperature and pressure.

Volume of $H_2S + SO_2$ in above = 1·12 × c.c. N/10 iodine. (0° C. 760 mm.)

Volume of N/10 bicarbonate needed to neutralise the reduced solution × 1·12 = volume of SO_2. (0° C. 760 mm.)

The results obtained by methods (i) and (ii) are combined, as shown in the worked example given below, to arrive at the correct average.

It should be pointed out that this method of differentiating between sulphur as H_2S and SO_2 is only *strictly* accurate when both these bodies enter the absorbing solution (N/10 odine *plus* equivalent of N/10 sodium bicarbonate) in the *ree* state, *i.e.*, uncombined with ammonia as sulphide or ulphite, as the equations upon which the method is based, amely:—

(*a*) $H_2S + I_2 = S + 2HI$ (*b*) $SO_2 + I_2 + H_2O = SO_3 + 2HI.$ } (In absorbing flask.) (*c*) $4HI + 4NaHCO_3 = 4NaI + 4CO_2 + 4H_2O.$

(*d*) $SO_3 + 2NaHCO_3 = Na_2SO_4 + 2CO_2 + H_2O.$ (In final acidimetric titration)

ssume that the *full* equivalent of hydriodic acid is formed both reactions (*a*) and (*b*), to be neutralised (*c*) by the quivalent of sodium bicarbonate present in the absorbing olution. The corresponding equations for the ammonium alts—

(*e*) $(NH_4)_2S + I_2 = S + 2NH_4I.$

(*f*) $(NH_4)_2SO_3 + I_2 + H_2O = (NH_4)_2SO_4 + 2HI,$ or, $= H_2SO_4 + 2NH_4I,$

early indicate that while the total amount of iodine reduced the same whether H_2S and SO_2 enter in the free state or ammonium salts, the acidimetric titration for SO_2 will be w in proportion as reactions (*e*), (*f*) replace reactions), (*b*).

Viewed thus, the figures for sulphur as SO_2 given in the bles must in every case be regarded as *minimum* figures, ose for sulphur as H_2S as *maximum* ones, the total sulphur gure for $SO_2 + H_2S$ (deduced from the total iodine reduced) ing alone *strictly* accurate. On the other hand, the esence of free sulphuric acid in the sample aspirated ould affect the SO_2 figure in the opposite direction, that of monium sulphate, of course, would not affect the test.

While ammonium sulphide can hardly be present under y circumstances, ammonium sulphite is undoubtedly ind in the exit gases under certain conditions of working, p. 584, while the existence of sulphuric acid in certain ns may be inferred from the fact that ammonium sulphate undoubtedly a product of the kiln reaction in some works e pp. 582–3). The presence of thiosulphuric and polyonic acids, also, must not be entirely overlooked in any ict discussion of the results, though the amounts found insignificant. As regards the origin of the sulphuric d found, finally, in combination with ammonia in the exit gases (almost the sole acid in some cases), we make ne remarks later. It has an important bearing on the ctions that take place in the Claus kiln.

Calculation of Efficiency of Claus Plant (= Kiln + Sulphur Chamber) in Gas Liquor Works.

Example.

Temperature of atmosphere, burette and aspirators approximately 10° C.

Inlet test—

Gas taken = 100·0 c.c.
$CO_2 + H_2S$ = 99·2 c.c.
Residual air* = 0·8

H_2S 0° C. 760 mm. = 1·12 × 27·1 c.c. (N/10 iodine).
dry = 30·3 c.c.
Corrected to 10° C. moist } = $\frac{30{\cdot}3}{0{\cdot}953}$ = 31·8 c.c.

Whence, saturator gas, per 100 vols.—

CO_2 = 67·4
H_2S = 31·8 × 6·25 × 0·953 = sulphur per cb. ft. of saturator
Air = 0·8 gas (10° C.) entering kiln = 189·7 grains.

Exit chamber test—

(i) Burette method—

Gas taken .... = 100·0
$CO_2 + H_2S + SO_2$ .... = 36·7
Residual nitrogen................. = 63·3
$H_2S + SO_2$ (0° C. 760 mm.) = 1·12 × 2·95 c.c. (N/10 iodine) = 3·28 c.c.

(ii) Aspiration method—

N/10 iodine reduced .. = 10·0 c.c.
Total N/10 bicarbonate = 18·9

SO_2 = 8·9 }
H_2S = 1·1 }

Water run = 330 c.c.
Add H_2S, SO_2 absorbed = 11 c.c.
Total gas aspirated = 341 c.c.

Whence—

$$SO_2 \text{ per 100 c.c.} = \frac{8{\cdot}9 \times 1{\cdot}12 \times 100}{341} = 2{\cdot}92 \text{ c.c.}$$

$$H_2S \text{ per 100 c.c.} = \frac{1{\cdot}1 \times 1{\cdot}12 \times 100}{341} = 0{\cdot}36 \text{ c.c.}$$

$H_2S + SO_2$ = 3·28 c.c. (0° C. 760 mm.)

Combining methods (i.) and (ii.) we have—

Mean $H_2S + SO_2$ = 3·28 = 3·3 approx.
SO_2 = 2·92
Correct H_2S = 0·36

Whence, exit chamber gases, per 100 vols.—

CO_2 = 33·4 and sulphur leaving per cb. ft. of gases (10° C.)
H_2S } = 3·3 as H_2S = 0·36 × 6·26 = 2·25 grains.
SO_2 } SO_2 = 2·92 × 6·26 = 18·28 „
N = 63·3 Total = 20·53 „

Also, 1 cb. ft. of saturator gas entering (10° C.) becomes 1 × $\frac{67{\cdot}4}{33{\cdot}4}$ cb. ft., leaving, since the percentage of CO_2 in the inlet gas (67·4) is reduced to 33·4 in the exit gases as the net result of dilution by residual nitrogen from air supply and reduction of volume due to chemical reactions in the kiln and chamber.

We have, therefore, per 1 cb. ft. of saturator gas entering at 100° C.

Sulphur entering, see above = 189·7 grs.

Leaving as $H_2S = \frac{67{\cdot}4}{33{\cdot}4} \times 2{\cdot}25 = 4{\cdot}5$

$SO = \frac{67{\cdot}4}{33{\cdot}4} \times 18{\cdot}28 = 36{\cdot}9$ = 41·4 „

"Free sulphur" (including sulphur in other forms) by difference........................ } = 118·3 „

Whence, per 100 parts of sulphur as H_2S entering

"Free sulphur" = 78·1 = "Efficiency of plant."†
As H_2S = 2·4 } = "Loss."
As SO_2 = 19·5 }
100·0

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* See footnote, p. 578, col. 2. † See p. 578, col. 1.

Calculation of Air Supply.

Volume of air entering per 100 volumes of saturator gas—

$$V = 100\frac{(x - x')}{x'} + 1{\cdot}5\frac{(x'y - xy')}{x'}$$: for proof, see p. 589, col. 2.

Where, x = per cent. CO_2 in saturator gas = 67·4
x' = per cent. CO_2 in exit gases = 33·4

$x - x'$ = 34·0

y = per cent. H_2S in saturator gas = 31·8
y' = per cent. H_2S in exit gases = 0·36

$$\text{Whence, } V = \frac{100\,(34)}{33{\cdot}4} + 1{\cdot}5\,\frac{(33{\cdot}4 \times 31{\cdot}8 - 67{\cdot}4 \times 0{\cdot}36)}{33{\cdot}4} = 148{\cdot}4$$

Now, theoretical air required for reaction $H_2S + O = H_2O + S$ per 100 vols. saturator gas entering kiln = 31·8 × 2·5 = 79·5.

Air admitted = 148·4
*Add air in gas = 0·8

Total air in reacting mixture .... } = 149·2 − 79·5 = 69·7 air in excess of theoretical required.

$$\text{Whence, excess air, per cent. of theoretical required} = \frac{69{\cdot}7 \times 100}{79{\cdot}5} = 87{\cdot}7 \text{ per cent.}$$

* See footnote, p. 578.

TABLE I.

Efficiency of various Types of Claus Kiln compared, together with Heats of Reaction, calculated and observed.

Plant.	Rate of Flow. Of Reacting Mixture through Packing Cubic Feet (15·6)° C. per Minute per 1 Cb. Ft. Packing.	Excess Air. Per Cent. of that required by Theory for Oxidation to Sulphur and Water.	Saturator Gas. H_2S.	Saturator Gas. CO_2.	Reacting Mixture—per 100 Volumes. H_2S.	CO_2.	O.	N.	Aqueous Vapour.
A. Packing.	Mean of 10 series of *ex hot-chamber tests.								
3 ft. oxide of iron .... 1 ft. firebrick.	0·31	23	18·41	79·66	11·7	50·5	7·2	28·9	1·7
B. Packing.	Mean of 2 series of *ex-kiln tests.								
2 ft. 9 ins. firebrick .... (Gases pass *upwards.*)	0·30	25	33·7	65·5	16·1	31·5	10·1	40·6	1·7
C. Packing.	Mean of 5 series of *ex-chamber tests.								
3 ft. oxide of iron	0·31 (approx.)	57	21·64	75·04	11·7	40·5	9·2	36·9	1·7
D. (Jacketed Kiln). Packing.	*See* Table, p. 149, Annual Report, 1901, No. 2 series.								
2 ft. oxide of iron. 6 ins. Weldon mud.	(i) 0·17 (ii) ..	190 236	7·6 11·0	83·4 87·0	5·1 5·7	56·2 44·9	7·4 9·5	29·7 38·2	1·6 1·7

Plant.	"Efficiency" = (†Free Sulphur). *In Exit Gases, Grains Sulphur per Cubic Foot of Permanent Gases. 15·6° C. As H_2S.	As SO_2.	Per Cent. of Total Sulphur entering the Kiln as H_2S. $H_2S + SO_2$	†Free S. (by Diff.).	Temperature of Reaction. Calculated. ° C.	Calculated. ° F.	Observed. ° F.	Remarks.
A. Packing								
3 ft. oxide of iron .... 1 ft. firebrick.	3·60	8·35	14·0	86·0	508	946	(1) 805 (2) 670	(1) 1 ft. down. (2) 2 ft. down.
B. Packing.								
2 ft. 9 ins. firebrick .... (Gases pass *upwards.*)	15·08	6·82	17·1	82·9	640	1,185	940	6 ins. down = 2 ft. 3 i *above* point where ga enter contact substanc
C. Packing.								
3 ft. oxide of iron.	0·30	12·64	14·5	85·5	588	1,090	850	——
D. (Jacketed Kiln.) Packing.	* Ex-chamber tests = ex-kiln tests } No action takes place after gases leave kiln as temperature is low.							
2 ft. oxide of iron	7·2	5·6	36·3	63·7	(*a*)285 (*b*)232	545 450	(*c*)570	(*a*) Sulphur liquid. (*b*) Sulphur vapour. (*c*) 1 ft. down.
6 ins. Weldon mud............	Nil	5·6	14·2	85·8	(*a*)377 (*b*)331	710 630	—	Feb. 1904.

* The "efficiencies" of various types of *kiln* are only strictly comparable when based on *ex-kiln* tests, as reactions continue to so extent in the hot end of the sulphur chamber (see Table III.). Opportunity did not occur to sample the ex-kiln gases at Works A. an on the occasions when plant was tested.

† See remarks, p. 578, col. 1.

Calculation of the Efficiency of Claus Kilns, taking Chance Process Gases.

As before, the efficiency of the kiln is defined to be the amount of "free sulphur" produced per 100 parts of sulphur as sulphuretted hydrogen entering.

The absence of all but traces of carbon dioxide in the holder gas, and the practice of intimately mixing gas and air before admission to the kiln necessitates some modification in the calculation given for gasworks plant.

The data required are as follows:—

(*a*) Volume per cent. of H_2S in the reacting mixture.
(*b*) „ „ H_2S in exit gases.
(*c*) „ „ SO_2 in exit gases.
(*d*) Relation of volume of exit gases to the equivalent volume of reacting mixture entering.

(*a*), (*b*), and (*c*) are obtained by the methods of analysis usual in such works: temperature and pressure considerations govern the results in the same way as indicated in the calculation on p. 579.

(*d*) is shown in the Appendix, p. 586 *seq.*, to take the form of the equation—

$$v'' = \frac{(100 - 1{\cdot}5y)}{(100 - 1{\cdot}5y')}$$

where—

v'' is the volume of exit gases leaving per 1 cb. ft. of reacting mixture entering.

y and y' are the volumes per cent. of H_2S in the reacting mixture and exit gases respectively.

The "free sulphur" is then obtained, as before, by subtracting from the weight of sulphur entering per 1 cb. ft. of reacting mixture the sum of the sulphurs leaving as H_2S and SO_2 in an equivalent volume of exit gases; and the "free sulphur," calculated as a percentage figure on the total sulphur entering as H_2S, will be the "*Efficiency.*" In this case, ammonia being absent, the qualification mentioned, p. 578, col. 2, does not apply.

Works Tests.

In Tables I. to III. are set out the results of actual tests at the works mentioned, p. 582. They largely explain themselves.

Table I. is comparable with Tables I. and II. of last year's paper, J. 1903, pp. 458, 459, but is more elaborated, as the rate of flow of gases through a cubic foot of contact-material, and the excess of air per cent. over that required by theory, are both given as the second and third columns of the table.

On p. 583 are set out the analyses of the liquors employed at Works A. and B. The presence of cyanide in the latter should be noted; it forms the subject of remarks later, in which the possibility of conversion of a large proportion of the cyanogen into ammonia is discussed.

From the particulars of plant at Works A. to D. that follow the tables, it will be seen that at Work A. the sulphur flowers chamber is divided into two parts, of a hot and cold section respectively. It will be noted, Work A.,

TABLE II.

Conditions affecting Yield of Free Sulphur, and Relation of H_2S to SO_2 in Exit Gases.

Work A.

Controlling Factors.	Reacting Mixture.		Efficiency of Plant.			Relation H_2S : SO_2 in Gases leaving Chamber.	
	Air.	Gas.	Per Cent. of Total H_2S entering Kiln.				
	Excess admitted per Cent. of that required by Theory.	H_2S.	Oxidised to Free Sulphur.	Escapes. As H_2S.	Escapes. As SO_2.	H_2S = 1.	SO_2.
Per Cent. H_2S in Gas:—		Per Cent.					
Series 1	18·6	**17·0**	84·9	4·3	10·8	1	2·5
„ 2	19·0	**20·7**	90·0	3·0	7·0	1	2·3
Air Supply:—							
Series 3	**24·9**	18·3	86·6	2·9	10·5	1	3·6
„ 4	**37·1**	18·2	84·2	3·1	12·7	1	4·1
„ 5	**13·2**	20·5	90·0	3·9	6·1	1	1·6
„ 6	**21·2**	20·2	87·7	3·3	9·0	1	2·9

TABLE III.

Reaction between SO_2, H_2S in Cold Sulphur Chamber.

Works A., B.

Work.	Saturator Gas.	Gas entering Cold Sulphur Chamber.					Gases leaving Cold Chamber.					Reaction in Cold Chamber.		
				Sulphur, Grains per Cubic Foot.					Sulphur, Grains per Cubic Foot.			Capacity of Chamber.		
	H_2S.	Temperature.	CO_2.	H_2S.	SO_2.	Total.	Temperature.	CO_2.	H_2S.	SO_2.	Total.	Volume.	Volume per 1 cb. ft. of Exit Gases (16° C.) per minute.	Sulphur as H_2S + SO_2 removed per Cent. of Total entering from Hot Chamber.
												Cb. Ft.	Cb. Ft.	
A., mean 0 series).	..	52° (126° F.)	62·2	3·60	8·35	11·95	6° to 12° (48° F.)	62·1	3·15	8·45	11·60	6,720	145	3·0 (= 0·4 per cent. of total sulphur as H_2S entering kiln).
B., mean series).	..	Over 300° (570° F.)	41·9	15·08	6·82	21·90	33° (91° F.)	41·6	8·48	4·87	13·35	2,920	82	39 (= 6·7 per cent. of total sulphur as H_2S entering kiln).

NOTE.—Work A—Gases enter cold chamber from hot section. Work B—Gases enter cold chamber from kiln direct.

Table III., that when the temperature drops, as it does, to 52° C. at the point where the residual gases enter the cold chamber, extremely little further interaction takes place, only 0·4 per cent. of the whole sulphur entering the kiln being formed in this chamber. At Work B. there is no subdivision, but it may be safely inferred that the bulk of the reaction whose extent is indicated in the last column has taken place in the first few bays of the chamber where the gases are still very hot, entering from the kiln at over 300° C.

At Work A. nothing could be more satisfactory than the regularity of the air supply attained by the simple means to be immediately described. At Work B., on the other hand, considerable trouble was caused by the difficulty in getting desired regulation of air supply with the means at command. (These latter are now to be modified and improved.) This is a reason for regarding with some reserve the results in the sulphur chamber in this case. At Work C. the same difficulty existed as one of those experienced. At Work D. it will be noticed how enormous was the excess of air at time of experiments. Here, too, proper control of supply has been followed by improvement in results obtained.

Description of Claus Plants tested in various Works.

Works A.

Gas Liquor.—1,514 gallons per hour of average strength and composition as shown below.

Air Supply.—The necessary pressure for supplying the kiln is obtained by allowing water from the tubular cooler to fall down one limb of a ∩-shaped pipe, air being sucked in through a hole at the bend and delivered by the falling water into a box provided with blow-off cock and feed valve.

Great regularity of feed is secured by this simple means.

Reacting Mixture.—Air and gas mix in an iron box before admission to the kiln.

Claus Kiln.—Dimensions: 7 ft. 7 ins. internal diameter with 4 ft. of contact material graded in 6-in. layers from the bottom upwards as follows:—

6-in. iron oxide (4-in. cube).
6 „ fire brick (3 „). Total depth iron oxide = 3 ft.
6 „ iron oxide (2½ „). Total depth fire brick = 1 ft.
6 „ „ (2 „).
6 „ fire brick (1½ „).
6 „ oxide (1½ „).
6 „ „ (1 „).
6 „ „ (¾ „), with two bucketfuls of fine oxide to finish.

Area of contact material = 45 sq. ft superficies.
Volume „ „ = 180 cb. ft.

Sulphur Chambers.—Hot end (built separately), 12 ft. wide × 14 ft. long × 11 ft. high (outside).
Volume = 1,310 cb. ft. (approx.).

Cold End.—12 ft. wide × 65½ ft. long × 11 ft. high (outside).
Volume = 6,720 cb. ft. (approx.).
Total volume = 8,030 cb. ft.
Chamber space, cubic feet per 1 cubic foot exit gases per minute,

$$(15\cdot6^\circ\text{ C., }760\text{ mm.}) = \frac{8{,}030}{46\cdot41} = 173\text{ cb. ft.}$$

Exit Gases.—To two limestone towers in sequence, each 5 ft. square (inside) × 15 ft. high, thence to one of two oxide purifiers, in alternate use, with hydraulic valve.

Gas pressure was positive throughout the plant, varying from $\frac{3}{10}$ in. water at the inlet to kiln, to $\frac{1}{10}$ in. water at limestone towers.

Works B (one unit of plant tested).

Gas Liquor.—750 galls. per hour (approx.) of average strength and composition as shown below.

Air Supply.—From a Donkin's exhauster, which maintains a pressure of about 30 ins. of water in the air vessel (8 ft. diameter × 6 ft. 4 ins. high), from which the kiln is fed by 6-in. pipe. The delivery end of the air pipe is surrounded by that supplying saturator gas on the blowpipe principle; air and gas thus discharge together, in intimate contact, into a brick chamber (6 ft. 10 ins. × 22 ins. high at the centre) placed *below* the contact material, the reacting mixture passing *upwards* through the brick packing and leaving the kiln near the top of one side.

Kiln.—Dimensions: 8 feet internal diameter, with 2 ft. 9 ins. depth of fire brick packing measured from the surface to the centre of the chamber arch.
Area of contact material = 50·3 sq. ft. superficies.
Volume (corrected for curvature of arch) = 156·9 cb. ft.

Sulphur Chamber.—10 ft. 3 ins. wide × 10 ft. high × 39 ft. 3 ins. long (outside), divided into 10 compartments by 9-in. baffle walls.
Volume = 2,920 cb. ft. (approx.).
Chamber space, cubic feet per cubic foot exit gases per minute,

$$(15\cdot6^\circ\text{ C., }760\text{ mm.}) = \frac{2{,}920}{35\cdot58} = 82\text{ cb. ft. (approx.).}$$

Exit Gases.—To limestone tower 4 ft. diameter × 26 ft. high (outside), thence to oxide purifier, 20 ft. × 22 ft. × 3 ft. oxide (inside).

Gas pressure had a slight positive value throughout the plant.

Gas Liquor used at	Ammonia. Total, per 100 c.c.	Ammonia. Fixed, per 100 c.c.	Ammonia. Free. Per 100 c.c.	Ammonia. Free. A. H.E.	Carbonic Acid. Per 100 c.c.	Carbonic Acid. B. H.E.	Sulphuretted Hydrogen. Per 100 c.c.	Sulphuretted Hydrogen. C. H.E.	Total Acids. (B + C); H.E.	Difference of Acids. (B + C − A): H.E.	Difference of Acids. (B + C − A) NH_3. H.E. = 100.	Per Cent. of Total Acids as H_2S.
	Grms.	Grms.	Grms.		Grms.		Grms.					
Works A. (cyanide absent).	1·728	0·453	1·275	75·0	1·307	59·4	0·2287	13·45	72·85	− 2·15	− 2·87	18·5
					Average per cent.		H_2S calculated (allowing for associated air)				= 18·1.	
					„	„	found in saturator gas by Bunte burette				= 18·4.	
Works B. (cyanide present).	1·972	0·365	1·607	94·5	1·375	62·5	0·522	30·7	93·2	− 1·3	− 1·4	32·6
					Average per cent.		H_2S calculated (allowing for associated air)				= 32·3.	
					„	„	found by Bunte burette				= 32·9.	

Works C.

Gas Liquor.—1,667 galls. per hour.

Kiln.—Internal diameter, 6 ft. 9 ins.; depth of packing, 3 ft.

Contact Material.—Oxide of iron.
Volume = 107·3 cb. ft.
Area = 35·76 sq. ft.

Works D.

Gas Liquor.—1,867 galls. per hour.

Kiln.—Cross section an annulus; large diameter 17 ft., smaller 5 ft. (inside measurements); depth of packing. 2 ft. 6 ins.

Contact Material.—2 ft. of oxide of iron, 6 ins. of Weldon mud.
Volume = 517·5 cb. ft.
Area = 207 sq. ft.

Ammonia in Recovered Sulphur from Claus Kilns attached to Gas Liquor Processes.

It is a well-established fact that ammonium salts are found in some sulphur chambers attached to Claus kilns taking saturator gases:—samples of recovered sulphur are occasionally picked out containing a high percentage of ammonia, while at one works the amount has been such as to pay for its recovery by washing, having regard to the destructive action of ammonia on the nitrous compounds used in sulphuric acid manufacture. Moreover, tubes employed for sampling the exit gases from the kiln frequently become blocked with a white deposit which proves upon analysis to contain sulphite and sulphate of ammonia in notable amount. The effect of this ammonium sulphite upon the iodine aspiration test for estimating H_2S and SO_2 in exit gases has already been considered. Analyses of a few samples of sulphur from Claus kilns and Chance process kilns are given in the following table:—

TABLE IV.

Ammonium Salts in Recovered Sulphur from Claus Kilns and Chance-Claus Process Kilns.

Per 100 parts.

	Claus Kilns in Gas Liquor Works.						Chance-Claus Process Kiln.
		2.			3.		
	1.	Selected Lump.	Stalactite from Hot Chamber.	Representative Bulk Sample.	Selected as "Rich in Ammonia."	Selected as "Poor in Ammonia."	4.
Appearance	Dirty yellow with blue patches.	Clean, pale yellow.	Clean, dark yellow.	Dirty, pale yellow.	Dirty yellow	Dirty yellow	Pure yellow
Moisture, loss at 95° to 100° C.	13·95	7·90	..	3·40	..	..	..
Sulphate of ammonia $(NH_4)_2SO_4$	4·80	72·00	1·20	22·45	1·95	0·12	..
contains NH_3	1·23	18·55	0·31	5·78	0·50	0·03	Nil (confirmed by Nessler's test).
Sulphur, extracted by carbon bisulphide.	73·05	17·50	..	60·75	..	..	..
Free acid, in terms of H_2SO_4	0·35	0·40	Nil	0·95	..	..	..
Soluble sulphur, in forms other than above, in terms of sulphur.	0·75	1·20	..	0·95	..	..	..
Non-volatile, at red heat	4·75	0·40	..	8·35	..	..	..
Difference	2·35	0·60	.	3·15	..	..	..
	100·00	100·00	..	100·00	..	..	..
Hydrocyanic acid	absent	absent	..	absent	absent	absent	..
Sulphocyanide	traces	„	absent	„	„	..	..
Sulphurous acid	„	traces	„	traces	..	..	..
Thiosulphuric acid	„	„	„	absent	..	..	..
Pentathionic acid	„	absent	„	traces	..	..	..
Hydrocyanic acid in gas liquor used—							
In terms of the ammonia (NH_3) equivalent of hydrocyanic acid (HCN). Grams per 100 c.c.	0·038	0·031	0·031	0·031	..	..	..
In terms of the ammonium sulphate $((NH_4)_2SO_4)$ equivalent of 100 parts of sulphur as sulphide.	..	54	54	54	..	.	..

The presence of some of this ammonia, perhaps a large roportion, may frequently be attributed to imperfect bsorption in the saturator. In some cases saturators have een found designed with so steep an angle in the bottom rom back to front that when there is ample depth of acid u the front or fishing part of the saturator, where the alphate formed is withdrawn from time to time, either echanically or by hand, the ammonia-distributing pipe in he closed portion at the back is either unsealed or has too mall a layer of acid liquor above it to ensure neutralisation f the ammonia passing in bubbles of greater or less imensions. This defect, in one instance, has led to the iscarding of a new and expensively constructed saturator. imilar losses may occur from neglect of the attendant to aintain sufficiency of acid at any period, especially when e level of liquor in the saturator is being lowered by withrawal of the salt, also from gradual enlargement of the oles in the ammonia-distributing pipe above referred to, ter the lapse of time, causing the vapours to issue rough the acid in too great volume at particular points, that acid and ammonia are not in actual contact. In me works the liability to losses of this character is cognised, and provision is made for scrubbing the gases ter leaving the saturator with fresh sulphuric acid flowing the saturator in a suitably-devised arrangement for inging the gases into close contact with thin films of acid. The point concerns the manufacturer from the economic point of view. The presence of escaping ammonia, however, does not add any difficulty to the problem of dealing with the residual noxious gases escaping from the process.

Study of the preceding table, however, shows that the hydrocyanic acid present in certain gas liquors may bear such a considerable proportion to the sulphur present as sulphide that, were the whole of the former converted into ammonia in the kiln, the yield of sulphur would be most materially diminished. In example 2 in the above table as much as 13 per cent. of the sulphur in the gases might appear as ammonium sulphate in the sulphur "flowers" chamber, the available sulphur only amounting to 87 per cent. of that possible had cyanide been absent.

It became of interest, therefore, to ascertain by concurrent inlet and outlet tests, extending over several hours (to cover all periods of working) the exact relation existing between the amounts of ammonia in equivalent volumes of gases entering and leaving the kiln at a works where the presence of ammonium salts in the recovered sulphur was an undoubted fact.

This it was possible to do at Works B. The following method was adopted:—

(1) *Inlet Gases.*—3·1 cb. ft. of saturator gases were slowly aspirated (4½-hour test) through a bottle containing

dilute acid to decompose the volatile ammonia compounds —sulphide, carbonate, cyanide, &c.—and fix the ammonia.

(2) *Exit Gases.*—1·508 cb. ft. of exit kiln gases (= approximately 1 cb. ft. of saturator gases entering) were similarly aspirated through 200 c.c. of water over the same period.

Analysis of Resulting Solutions.—The ammonia in both samples was determined by distillation with excess of caustic soda. The results are fully set out in Table V. immediately following.

The behaviour of the two solutions under distillation at once indicated a striking difference in the character of the ammonia-yielding contents: the inlet gas sample evolved only 25 per cent. of the total ammonia obtained from it in the first 150 c.c. distillate, while evolution continued regular and with no appearance of coming to an end throughout the whole period of distillation—4½ hours—with a total distillate of 1,150 c.c. The exit gas sample, on the other hand, yielded the whole of its ammonia in the first 150 c.c.

TABLE V.

Ammonia-yielding Compounds in Equivalent Volumes of Inlet and Exit Gases to Claus Kiln.

Works B.

Description of Sample.	Volume of Distillate.	N/2 H_2SO_4 Neutralised (1 c.c. = 0·131 grains NH_3).	Ammonia obtained by Distillation. Ammonia, Grains per 1 cb. ft. entering (= 1·5 leaving Kiln). Evolved in first 150 c.c.* Distillate.	Evolved subsequently.
Inlet Gases.	c.c.	c.c.		
3·1 cb. ft. of gas aspirated through 200 c.c. of water acidulated with hydrochloric acid. Volume made up to 250 c.c. and 100 c.c. distilled with caustic soda, water being added from time to time as required to maintain contents of flask.	150	8·1	0·856	= 25 per cent. of total NH_3 evolved.
	150 150 120 100 80 100 100 100	4·2 6·55 3·2 2·3 1·7 2·4 1·8 2·1	..	2·565
Total time of distillation about 4½ hours.	distillation stopped.	Ammonia still coming over.		
Total...........	1,150	32·35	=3·421 (minimum).	
Exit Gases.				
1·508 cb. ft. (approximately 1 cb. ft. gases entering the kiln) aspirated through 200 c.c. of water. The inlet tube gradually blocked with white deposit. Analysis results calculated to 1·508 cb. ft. of gas:—				
(1.) White deposit from inlet-tube (neutral) made up to 100 c.c., 50 c.c. distilled with soda	150 50	5·6 Nil	1·467 ..	.. Nil
(2.) Solution in absorbing bottle made up to 250 c.c. as above, 100 c.c. distilled with soda	150 50	11·4 Nil	3·734 ..	.. Nil
Total...........	..	..	5·201	Nil

---

* NOTE.—The first 150 c.c. of distillate may be considered to include the whole of the ammonia existing as such in the solution; that yielded by subsequent distillation is derived from the decomposition of nitrogenous bodies, *e.g.*, cyanides, &c.

Analysis of White Deposit (1) in Tube per 1·508 cb. ft. of Gases leaving.

Sulphur, not estimated (large amount).

Ammonium carbonate	Absent.
„ sulphide.........................	Absent.
„ sulphite	0·475
„ sulphate (by difference).........	0·992
Total ammonia (grains)....	1·467

For the suggestion that the source of the additional ammonia in the exit gases might be found in volatile cyanogen compounds in the foul gases, and originating in the gas liquor used, we are indebted to Mr. F. N. Suttoo, then assisting in the conduct of the experiments at Works B.

It is quite obvious from these results that the amount of ammonia entering the kiln as cyanide and carbonate (not exceeding 0·856 grains NH_3 per cubic foot of saturator gases) is insufficient to account for the ammonia as sulphite and sulphate in an equivalent volume of the gases leaving (5·201 grains NH_3), and that the inlet sample must have contained, in addition to the comparatively small proportion of volatile ammonia compounds (carbonate, &c.), nitrogenous compounds that slowly yield ammonia on distillation with soda, *e.g.*, hydrocyanic acid which yields sodium formate and ammonia under these conditions.

$$HCN + NaHO + H_2O = NH_3 + HCOONa.$$

Analysis of inlet sample (1) showed that it contained hydrocyanic acid equivalent to—

8·81 grains HCN per cubic foot of saturator gases
= 5·57 „ NH_3 „ „ „

an amount more than sufficient to account for the whole of the ammonia leaving the kiln, even if we disregard the fact that the tension of hydrocyanic acid is such as to render it probable that only a portion of this body actually present in the saturator gases was retained in the acid absorbent used.

This interesting result led to the working hypothesis that the ammonia found in these exit gases is in large measure due to the decomposition of cyanogen compounds in the kiln by steam resulting from oxidation of the sulphuretted hydrogen by air—

$$HCN + H_2O = NH_3 + CO,$$

a reaction analogous to the formation of ammonia from metallic cyanides when heated with steam. (*Vide* Watts' Dictionary, Vol. I., p. 197; also, Lunge's "Coal Tar and Ammonia" (3rd Edition), pp. 674–682).

This hypothesis has been put to experimental proof, and sufficient evidence has been already obtained to justify its adoption, as the results of experiments given below indicate that very substantial conversion of hydrocyanic acid into ammonia takes place when a mixture of that gas and carbon dioxide is passed through a highly heated contact material, *e.g.*, broken brick, with excess of steam, and that this percentage was increased when sulphuretted hydrogen was added to the carbon dioxide and water vapour.

The apparatus employed in the preliminary work was on the lines of that adopted for the laboratory Claus kiln experiments described in 36th Alkali Report, 1899, pp. 181–184:—

The contact material was broken brick, graded in two layers, the upper being in a state of fine powder, to ensure intimate contact with the reacting mixture. Temperatures were approximately determined by means of the Siemens calorimeter in exactly the same manner as in the works' tests, the lid of the small iron kiln being modified to allow of the insertion of a thin steel tube with closed end surrounded by the contact material, to protect the copper bolt from corrosion by the reacting gases.

A suitable reacting mixture was obtained by passing a rapid stream of washed carbon dioxide from a Kipp's apparatus through a decomposing flask containing dilute sulphuric acid (1 acid to 10 of water) into which a solution of potassium cyanide of determined strength was allowed to slowly drop from the end of a capillary tube coupled to a burette. The acid in this "decomposer" was maintained throughout the "run" at a temperature somewhat below 100° C., so as to ensure a sufficient volume of steam in the reacting mixture. An approximate estimate of the weight of steam used is deduced from the weights of reacting solutions before and after passage of the gas, and its volume is included in the total volume of the exit gases leaving the kiln.

The exit gases passed, first, through a glass retort to condense the ammoniacal liquor, the last traces of ammonia being retained by an acid catch placed on the exit of the retort, thence through a small Drechsel's bottle containing water, to a large aspirator with a layer of cylinder oil above the water to prevent solution of carbon dioxide. A small T-tube inserted between the acid catch and water seal enabled samples of the residual gases to be withdrawn from time to time for analysis by Bunte burette. A blank run was first undertaken to test the apparatus, in which a slight insuck of air was noted. This leakage increased markedly during progress of experiment D, which concluded the series.

The results obtained are set out below in parallel column to facilitate comparison. The yield of ammonia in experiment A is very satisfactory, considering the fact that this body commences to dissociate into its elements at a temperature of 500° C. (see Watts' Dictionary, Vol. I., p. 198, and especially Ramsay and Young, Journ. Chem. Soc., 1884), and also that no special precautions were taken to exclude the oxygen of residual air (5 to 8 per cent.), which can hardly fail to have some destructive action on ammonia at the high temperature employed, and in addition reacts with hydrocyanic acid itself to form carbonic acid, water, and nitrogen. It is not desired at this stage to attempt to draw any conclusions from these experiments as to the conditions most favourable for a high yield of ammonia; but it is hoped that opportunity will be found during 1904 to determine the data required to decide the exact limits of the reaction under a range of conditions inclusive of those operating in the Claus kiln, where vapour of sulphur, sulphuretted hydrogen, and sulphurous acid are present to modify the reaction, and also to ascertain whether other nitrogenous bodies, *e.g.*, pyridine and other bases, are contributing factors to the yield. The possible influence of this reaction on the yield of ammoniacal liquor from gas retorts, coke ovens, and especially from producer gas processes where large quantities of steam are admitted, is one that is not lost sight of; the conversion of cyanogen into ammonia has indeed from time to time engaged the interest and attention of many technological chemists. (*Cf.* Lunge, "Coal Tar and Ammonia," 3rd Edition, pp. 675–682.)

Another modern instance in which both hydrocyanic acid and ammonia are products in a high temperature reaction is the treatment of "Schlempe" (the waste product of refining the molasses of beetroot sugar) by the Bueb process at Dessau. (*Cf.* G. T. Beilby, "Advances in Chemical Industry during the Nineteenth Century," pp. 27–29, Roy. Phil. Soc., Glasgow, 1904.)

Table VI.

	Sulphuretted Hydrogen Absent.				Sulphuretted Hydrogen Present.
	Blank.	1.	2.	3.	4.
Apparatus:—					
Laboratory jacketed Claus kiln 13 ins. deep by 6 ins. diameter.					
Contact Material:—					
Broken brick, half small pieces, half powder; depth, 4·38 cm., about 1·72 ins.; area, 182·6 sq. cm., about 28·3 sq. ins.; volume, 800 c.c., about 48·8 cb. ins.; weight, 800 grms., about 1¾ lb.					
Conditions of Working:—					
Temperature of contact material by Siemens calorimeter ... ° C.	565	565	395	305	390
" ° F.	1,050	1,050	745	580	735
Rate of flow of exit gases (approx.), 16° C. 760 mm. (including steam)—					
c.c. per minute	460	660	590	610	820
" " per c.c. packing	0·58	0·82	0·74	0·76	1·02
Total steam present in reacting mixture ... Grms.	1·0	8·5	9·0	7·0	11·0*
Potassium cyanide taken ... "	Nil	2·203	2·203	2·368	2·203
Equivalent to hydrocyanic acid ... "	..	0·913	0·913	0·982	0·913
" to ammonia ... "	..	0·5752	0·5752	0·6183	0·5752
Ammonia recovered ... "	Nil	0·2593	0·3443	0·3081	0·3783
" per cent. of total as cyanide taken	..	45·0	60·0	50·0	66·0
Gas analysis, during run—					
Entering decomposer ... CO_2 per cent.	98·5	98·5	98·5	98·5	98·5
Leaving ammonia catch ... " "	..	..	..	90·0	70·4
" O per cent.	..	..	..	..	0·2

* Note.—The conditions of the experiment rendered it impossible to determine the amount of steam resulting from partial oxidation of the sulphuretted hydrogen admitted to the decomposer by adventitious air. Analysis proves that sulphurous acid, free sulphur, and sulphuretted hydrogen, were all present in the gases leaving the kiln, thus closely imitating actual Claus kiln conditions of working on the manufacturing scale.

Estimation of Cyanide in Ammoniacal Liquors.

The method devised in this research for the estimation of hydrocyanic acid in the ammoniacal liquors examined consisted in distilling the liquor with excess of tartaric acid into caustic soda in an apparatus provided with receiver and Liebig's condenser similar to that employed for the estimation of fixed ammonia, lead nitrate being added in excess to retain the sulphide, and ferric chloride to convert any ferrocyanide present into Prussian blue, a substance which evolves no hydrocyanic acid under the observed conditions. The cyanide obtained in the distillate was determined by titration with N/10 silver nitrate or N/10 iodine in the usual way.

The methods of W. Feld—"Jour. für Gasbeleuchtung," 1903, **46**, (29) to (33), pp. 561 to 666—were unknown to us when the above procedure was elaborated. The omission of tartaric acid by Feld is a distinct simplification, as he shows that not only is completeness of evolution of hydrocyanic acid attained, but that risk of concurrent decomposition of sulphide, evolving sulphuretted hydrogen, is also entirely obviated by employing lead nitrate as the sole reagent.

The results in Table VI. above clearly prove that a large conversion of hydrocyanic acid into ammonia is effected by the agency of steam in presence of a catalytic substance maintained at a temperature of 300°—600° C.

and that Claus-kiln conditions *quâ* sulphuretted hydrogen are specially favourable to a high yield. We have now to enquire how far such a reaction as $HCN + H_2O = NH_3 + CO$ is likely to affect the kiln reaction itself in gas-liquor works, where cyanides are not infrequently present in the reacting mixture.

No complete data are yet available for tracing the kiln reactions by quantitative estimation of the gaseous constituents at various stages in their descent through the kiln. We are compelled to rely, therefore, in this preliminary inquiry upon analyses of the final gaseous mixture leaving the kiln and chamber, and of the solid and liquid products that separate. The limitations of the methods for analysing exit-kiln and chamber gases have been already discussed, and need not be rehearsed; methods for the direct estimation of SO_3 and other constituents in addition to H_2S and SO_2 are now under consideration. Analysis of the recovered sulphur from the chamber, though presenting less difficulty in itself than that of the gaseous products, is unfortunately complicated by the impossibility of exactly determining how far the chamber product obtained is the result of the high temperature reactions in the kiln itself, and how far of the low temperature reactions that subsequently proceed to a limited extent in the chamber; *e.g.*, interaction of residual H_2S and SO_2, in presence of moisture, to form free sulphur and thionic and thiosulphuric acids, see Table III., while a further factor is introduced by reason of the oxidising action of air on the recovered product when withdrawn from the chamber. Analysis indicates, however, that we may regard the recovered product of the Chance-Claus process as consisting essentially of pure sulphur, and that of the Claus process in gas-liquor works as a mixture of free sulphur and ammonium sulphate with more or less associated moisture, in proportions determined almost entirely by the reactions in the kiln itself, the low temperature products of the chamber reaction being present only in insignificant amount.

The kiln reactions yielding free sulphur have been already fully discussed; it remains only to consider those responsible for the presence of ammonium sulphate in gas-liquor works kilns the amount of which on occasions approaches, and even exceeds, that of the free sulphur itself. See Table IV.

As regards the base, ammonia, the tests at Works B. indicate that a large proportion of that found in the exit gases from the kiln—certainly not less than 85 per cent. of the total amount found on the occasion of our tests—was derived from the decomposition of cyanides by steam. It is impossible to state the exact proportion in any given instance, because there exist no means of ascertaining how far the ammonia entering the kiln as such, during periods of irregular working of the saturator, survives the high temperature in what we may call the oxidising zone of the kiln, where oxygen is present in large excess over that required for the simple reaction $H_2S + O = H_2O + S$ (the excess amounting in one case to over 200 per cent.), and where steam is at a minimum. Whatever its previous history, however, ammonia is undoubtedly present in the exit kiln gases, mainly in combination with sulphuric acid as ammonium sulphate, but in lesser degree also with sulphurous acid as ammonium sulphite (see analysis, p. 584); the latter body would, of course, rapidly suffer oxidation to sulphate when the recovered product is exposed to the air on opening the chambers.

The origin of the sulphuric acid found in combination with ammonia in the exit kiln gases has an important bearing on the Claus-kiln reactions; *free* sulphuric acid does not appear as a final product of the kiln reaction in normal working, either in the Chance-Claus process or in the Claus process as applied in gas-liquor works, the small traces of that acid found in the recovered sulphur in certain parts of the chamber being attributed entirely to the oxidation of occluded sulphurous acid on exposure to air. The presence of combined sulphuric acid in the latter class of works appears to be governed entirely by the presence of ammonia in the reacting mixture in actual or potential form (as hydrocyanic acid), and under such conditions sulphuric acid must be regarded as much a product of the kiln reaction as sulphurous acid itself. Whether it is formed in the upper and oxidising zone of the kiln in normal working, to be subsequently reduced by vapour of sulphur and sulphuretted hydrogen in the lower zones, when ammonia is not present to combine with it, is a question that can only be decided by a complete analysis of the gases, extending to an estimation of all its constituents. Indirect evidence, however, in the case of Works B. does exist—suggesting this formation and survival—in the fact that the oxygen deduced from the products of the kiln reaction (water and free sulphur) shows a marked divergence, 2·6 grms. (on 11 grms. per 100 litres of reacting mixture) in place of 13·6 grms. entering the kiln as deduced from gas analysis, while in the case of Works A., where no cyanogen is present, the amounts were 9·1 and 9·7 grms. respectively (see example, Works A., p. 582). Analysis does prove, however, that sulphuric acid and ammonia are ultimately present in the recovered sulphur in *equivalent* proportions, and that we may take the amount of ammonia as governing the amount of sulphuric acid that survives. We have shown that the amount of ammonia itself in normal working is controlled by the hydrocyanic acid present in the reacting mixture, and the conclusion is reached, therefore, that this latter body is a factor that governs the character of the recovered sulphur to a very material extent. Given the amount of cyanide and sulphide in the gas liquor, we can calculate the percentage amounts of free sulphur and ammonium sulphate in the recovered sulphur. The result is both interesting and instructive.

Thus, taking works B, C, we have per 100 parts of gas liquor used :—

——	Works B.	Works C.
Total H_2S entering kiln in terms of sulphur	0·362	0·220
Less sulphur combined with NH_3 as $(NH_4)_2SO_4$	0·033	0·029
Net free sulphur by difference	0·329	0·191
Ammonium sulphate equivalent of HCN entering kiln	0·135	0·119
Total product recovered	0·464	0·310

Whence, per 100 parts of dry recovered product :—

——	Works B.	Works C.	
	Calculated.	Calculated.	Found.
Free sulphur	71	62	63
Ammonium sulphate	29	38	23

Note.—The above calculations are entirely theoretical. They indicate the percentage composition of the recovered sulphur on the assumption that the ammonium sulphide and cyanide in the gas liquor yield the full equivalents of sulphuretted hydrogen and hydrocyanic acid respectively in the reacting mixture and that reactions proceed to completion to free sulphur and ammonium sulphate. No exact data yet exist for attempting a solution based on practical working.

Appendix.

Calculation of Theoretical Temperature attained in Claus Kiln by Products of Reactions.

Data for Calculation.—See Jour., 1903, pp. 462, 463.

Discussion of the Thermal Effect of the Reversible Reactions (2), (4), p. 577, *on their simplest basis, excluding Nitrogen.*

(4) $2H_2S + SO_2 = 3S + 2H_2O$; *i.e.* (2) reversed.

Temperature of reaction assumed to be 316° C. (= 601° F.).

(4) i. Sulphur entirely in the form of liquid.
(4) ii. „ „ „ vapour.

(4) ii—Available heat—

Brought in by reacting gases — Total.

SO_2 = 0·1544 × 316 × 64 = 3,123

$2H_2S$ = 0·2423 × 316 × 68 = 5,206

$2H_2 + O_2$ (water vapour) = 114,800 = + 123,129

Heat absorbed—

To decompose $2H_2S$ = 9,480

" SO_2 = 71,970

To raise products to 316° C. and vaporise the sulphur—

$2H_2O$ = 0·54 × 36 × 316 = 6,143

3S (as below, vapour) = 43,430 = − 131,023

Net heat (absorbed) = − 7,894

To raise 3S (96 grms.) from 0° C. to 316° C., and vaporise, we have—

(*a*) Solid to 115° C. = 96 × 20·7

(*b*) To melt at 115° C. = 96 × 9·4

(*c*) Liquid to 316° C. = 96 × 60·3

(*d*) To vaporise at 316° C. = 96 × 362·0

96 × 452·4 = 43,430

(4) i. Available heat—

Total as above.................. = + 123,129

Heat absorbed—

To decompose H_2S, SO_2 as above = 81,450

To raise products to 316° C., sulphur assumed to remain liquid—

$2H_2O$, as above = 6,143

3S (as below, liquid) = 8,678 = − 96,271

Net heat (evolved) = + 26,858

To raise 3S (96 grms.) from 0° C. to 316° C., we have—

Total heat = 96 [20·7 + 9·4 + 60·3]

= 96 (90·4) = 8,678

Theoretical Maximum Temperature attainable in the Claus Kiln with Sulphuretted Hydrogen, 100 per cent., proceeding on the assumption that Reaction occurs in two Stages (3) and (4). See p. 577, col. I. Nitrogen included.

(3) $3H_2S + 3O + 12N = 2H_2S + SO_2 + H_2O + 12N$.

(4) $2H_2S + SO_2 + H_2O + 12N = 3S + 3H_2O + 12N$.

Reaction (3) is assumed to take place at 16° C. 760 mm. (moist gases).

Reaction (4) is assumed to take place at the temperature theoretically attained in (3) 1,330° C.

(*c*) Air for the purpose of all these calculations is assumed to have the composition, *by volume*, 1 of oxygen to 4 of nitrogen.

Reacting mixture per 100 volumes (moist 16·0° C. 60 mm.).

Sulphuretted hydrogen	= 28·1	= 40·4 grms.	per	100	litres.
Oxygen	= 14·0	= 19·0	"	"	"
Nitrogen	= 56·2	= 66·6	"	"	"
Aqueous vapour	= 1·7	= 1·3	"	"	"
	100·0				

Assuming that of every three atoms of oxygen reacting, wo form sulphur dioxide and one forms water, we have r 100 litres—

Sulphur dioxide produced = 2/3 × $\frac{64}{32}$ × 19 grms.

= 25·33 grms.

	Grms.
Total sulphuretted hydrogen entering	= 40·40
1/3rd reacting to sulphur dioxide	= 13·46
Sulphuretted hydrogen available for reaction (4)	= 26·94

Whence, per combustion of 100 litres of moist reacting mixture (15·6° C.).

Heat evolved by (3)—

Sulphur dioxide produced yields—

71,970 × $\frac{25·33}{64}$ = 28,400

less sulphuretted hydrogen decomposed = 4,740 × $\frac{13·46}{34}$ = − 1,876 26,614

Water vapour produced yields —

57,400 × $\frac{13·46}{34}$ = 22,724

Total heat evolved = 49,338

Products :—

	Grms.
Sulphur dioxide	= 25·33
Sulphuretted hydrogen	= 26·94
Aqueous vapour	= 8·42 (= 18 × $\frac{13·46}{34}$ + 1·3 carried)
Nitrogen	= 66·6

Then—

Rise of temperature = (t − 16°) C.

Sulphur dioxide absorbs—

25·33 × 0·1544 × (t − 16) = (t − 16) × 3·91

Sulphuretted hydrogen—

26·94 × 0·2423 × (t − 16) = (t − 16) × 6·53

Aqueous vapour—

8·42 × 0·92 × (t − 16) = (t − 16) × 7·75

Nitrogen—

66·6 × 0·29 × (t − 16) = (t − 16) × 19·32

Total heat absorbed = (t − 16) × 37·51

Equating, we get—

(t − 16) 37·51 = 49,338

t = 1,330° C. { = Maximum temperature attainable, if reaction (4) = 0.

Stage (4).—Reaction proceeding (at 1,330° C.) on the lines of the equation—

$$2H_2S + SO_2 + H_2O + 12N = 3S + 3H_2O + 12N.$$

Sulphuretted hydrogen = 26·94 grms.

= 26·94 × $\frac{32}{34}$ = 25·35 grms. sulphur.

Sulphur dioxide = 25·33 grms.

= 25·33 × $\frac{1}{2}$ = 12·66 " "

38·01 Total.

Aqueous vapour from (3) = 8·42

Add ditto produced (4) = 26·94 × $\frac{18}{34}$ = 14·26 } = 22·68 total.

Then, we have for reaction at 1,330° C.—

Heat brought in by reacting gases— Calories.

Sulphur dioxide .. = 25·33 × 0·1544 × 1,330 = 3·91 × 1,330

Sulphuretted hydrogen .... = 26·94 × 0·2123 × 1,330 = 6·53 × 1,330

Aqueous vapour .. = 8·42 × 0·92 × 1,330 = 7·75 × 1,330

Nitrogen .... = 66·6 × 0·29 × 1,330 = 19·32 × 1,330

Total = 37·51 × 1,330

Heat produced by oxidation of the sulphuretted hydrogen to water vapour .... = 49,888 calories

water vapour = 57,400 × $\frac{26·94}{34}$ = 45,480 "

+ 95,368 "

Less heat required to decompose the sulphuretted hydrogen—

= 4,740 × $\frac{26·94}{34}$ = 3,756

Ditto sulphurous acid...... } = 71,970 × $\frac{25·33}{64}$ = 28,490 = − 32,246

Net heat evolved = 63,122

As before, let t' be final temperature,
Then—

To raise aqueous vapour from 0° C. to t' heat required—
$= t' \times 0·84 \times 22·68$ .... $= t' \times 19·05$

Ditto nitrogen—
$= t' \times 0·283 \times 66·6$ .... $= t' \times 18·85$

Ditto sulphur—
To raise from 0° C. to 316° C. and vaporise....... $= 452 \times 38·01 =$ $+ 17,200$
Vapour to $t'°$ from 316°
$= (t' - 316) \times 38·01 \times 0·08 = t' \times 3·04 - 960$

Total heat required $= t' \times 40·94 + 16,240$

Equating, we get—

$$t' \times 40·94 + 16,240 = 63,122$$

$$t' = \frac{46,882}{40·94} = 1,150° \text{ C.*} \quad 2,100° \text{ F.}$$

Maximum temperature attained if (3), (4) occur simultaneously.

The calculations in Table I. proceed entirely on the lines of practical working; the following example is given to illustrate the method by which the results are reached, see also J., 1903, page 464 :—

EXAMPLE.—TABLE I., WORK A.

1. On the lines of equation (1), p. 577.
2. On the lines of equations (3), (4), p. 577.

1. Reacting mixture (16° C. moist)—

		Permanent Gases.	
H_2S	= 11·7		
CO_2	= 50·5	CO_2	= 50·5
O	= 7·2	N	= 28·9
N	= 28·9	Aqueous vapour	= 1·4
Aqueous vapour......	= 1·7		80·8
Entering......	= 100·0		

Whence, per 100 litres of reacting mixture (16° C. 766 mm.)—

Entering—

Grms.

$$\text{Nitrogen} \ldots = 28·9 \times 1·255 \times \frac{273}{289} = 34·3$$

$$\text{Oxygen} \ldots = 7·2 \times 1·430 \times \frac{273}{289} = 9·7$$

$$\text{Carbon dioxide} \ldots = 50·5 \times 1·966 \times \frac{273}{289} = 93·8$$

$$\text{Sulphuretted hydrogen} \ldots\ 11·7 \times 1·523 \times \frac{273}{289} = 16·8$$

$$\text{Water vapour} \ldots = 1·7 \times 0·805 \times \frac{273}{289} = 1·3$$

Leaving (hot chamber)—

$$\text{Sulphur as } H_2S = \frac{3·6}{15·432} \times \frac{1}{28·32} \times 80·8 = 0·67$$

Calculated as H_2S = 0·71

$$\text{Sulphur as } SO_2 = \frac{8·35}{15·432} \times \frac{1}{28·32} \times 80·8 = 1·54$$

Calculated as SO_2 = 3·08

And sulphuretted hydrogen—
Entering................. = 16·80
Leaving................. = 0·71

$$\text{Reacting to free sulphur} = 16·09 \times \frac{16}{34} = 7·6 \text{ grms. oxygen.}$$

Calculated as sulphur...	= 15·15		
Reacting to SO_2.........	= 1·54	= 1·5	
Net free sulphur........	= 13·61	9·1	calculated from products.†
		9·7	entering kiln, see above.

Whence, per combustion of 100 litres of moist reacting mixture (16° C.)—

Heat evolved—

$$\text{Sulphuretted hydrogen to free sulphur} \ldots = \frac{16·09}{34} \cdot 52,660 = 24,920$$

$$\text{Free sulphur to sulphur dioxide} = \frac{1·54}{32} \times 71,970 = 3,464$$

Total.............. 28,384

Products—
Free sulphur......... = 13·6 grms.
Sulphur dioxide....... = 3·1 „
Sulphuretted hydrogen = 0·7 „

$$\text{Water} = \frac{16·1}{34} \times 18 = 8·5 + 1·3 \text{ carried} = 9·8 \text{ grms. total.}$$

Assume that the whole of the sulphur is in the form of vapour—

Then—

Rise of temperature $= (t - 16)°$ C.

Nitrogen absorbs $= (t - 16) \times 34·3 \times 0·259 = (t - 16) \times 8·88$.

Carbon dioxide absorbs $= (t - 16) \times 93·8 \times 0·313 = (t - 16) \times 29·36$.

Water absorbs $= (t - 16) \times 9·8 \times 0·604 = (t - 16) \times 5·92$.

Sulphur—

	Per Grm.
To heat solid from 16° to 115° = 0·18 × 100 =	18·0
To melt to liquid at 115°................. =	9·4
To heat liquid to 316° = 30 × 201......... =	60·3
To vaporise liquid at 316° .... =	362·0
	450 approx.

Whence, in converting 13·6 grms. of solid sulphur at 15·6° into vapour at 316, 450 × 13·6 = 6,120 calories are absorbed.

To raise 13·6 grms. of sulphur vapours from 316° to $t°$ $= (t - 316) \times 0·08 \times 13·6 = (t - 316) \times 1·09 = (t - 16) \times 1·09 - 344$.

Sulphur dioxide absorbs $(t - 16) \times 0·1544 \times 3·1 = (t - 16) \times 0·48$.

Sulphuretted hydrogen absorbs $(t - 16) \times 0·2423 \times 0·7 = (t - 16) \times 0·17$.

Equating, we get—

$$(t - 16)\{8·88 + 29·36 + 5·92 + 1·09 + 0·48 + 0·17\} + 6,120 - 344 = 28,384.$$

$$t = 508° \text{ C.} \quad 916° \text{ F.}$$

2. Maximum temperature attained in kiln calculated, on the lines of the equations (3), (4). p. 577.

(3) $3H_2S + 3O + 12N = 2H_2S + SO_2 + H_2O + 12N$
(Evolution of heat).

(4) $2H_2S + SO_2 + H_2O + 12N = 3S + 3H_2O + 12N$
(Absorption of heat).

It is assumed first, that (3) proceeds to completion, the oxygen in the reacting mixture reacting to form the full equivalent of SO_2, further, that no free sulphur is produced at this stage of the kiln reaction; secondly, that residual H_2S and SO_2 in the exit gases result from the failure of reaction (4) to complete itself.

Stage (3).

Assuming that the oxygen present produces its full equivalent of sulphur dioxide, we have (see above)—

$$\text{Sulphur dioxide produced} = \frac{2}{3} \times 9·7 \times \frac{64}{32} = 12·93 \text{ grms}$$

$$\text{equivalent to } \frac{34}{64} \times 12·93 = 6·87 \text{ grms. } H_2S.$$

	Grms.
Total sulphuretted hydrogen entering	= 16·80
Reacting to sulphur dioxide............	= 6·87
Sulphuretted hydrogen available for reaction (4) =	9·93

---

* NOTE.—The same final temperature (1150° C.) is reached if the calculation is made on the lines of equation (1), see p. 577, in which oxidation to sulphur and water is represented as occurring in one stage.

† See remarks, p. 586.

Whence, per combustion of 100 litres of moist reacting mixture (15·6° C.).

Heat evolved by reaction (3)—

Sulphur dioxide produced yields $71{,}970 \times \frac{12{\cdot}93}{64} = 14{,}540$ calories.

Less sulphuretted hydrogen decomposed

$= 4{,}740 \times \frac{6{\cdot}87}{34} = 957 - 13{,}583$

Water vapour produced yields $57{,}400 \times \frac{6{\cdot}87}{34} = 11{,}595$

Total heat evolved................. = 25,178

Products—

	Grms.
Sulphur dioxide.......	12·93
Sulphuretted hydrogen	9·93
Aqueous vapour.......	4·93 ($= 18 \times \frac{6{\cdot}87}{34} + 1{\cdot}3$ carried).

Then—

Rise of temperature = $(t - 16)$ C.

Sulphur dioxide absorbs	$12{\cdot}93 \times 0{\cdot}1544 \times (t - 16)$	$= (t - 16) \times 1{\cdot}99$
Sulphuretted hydrogen	$9{\cdot}93 \times 0{\cdot}2423 \times (t - 16)$	$= (t - 16) \times 2{\cdot}40$
Aqueous vapour ..	$4{\cdot}93 \times 0{\cdot}62 \times (t - 16)$	$= (t - 16) \times 3{\cdot}06$
Carbon dioxide....	$93{\cdot}8 \times 0{\cdot}322 \times (t - 16)$	$= (t - 16) \times 30{\cdot}20$
Nitrogen..........	$34{\cdot}3 \times 0{\cdot}261 \times (t - 16)$	$= (t - 16) \times 8{\cdot}95$
		$(t - 16) \times 46{\cdot}60$

Equating, we get—

$$(t - 16) \times 46{\cdot}60 = 25{,}178$$

$$\left.\begin{aligned} t &= 556^{\circ}\ \text{C.} \\ &\ \ 1{,}033^{\circ}\ \text{F.} \end{aligned}\right\} = \text{Maximum attainable if reaction (4)} = 0.$$

Stage (4) $2H_2S + SO_2 + H_2O + 12N = 3S + 3H_2O + 12N$.

Sulphuretted hydrogen available from (3)........................ = 9·93 grms.
Less ditto escaping in exit gases — 0·71 „

Net reacting = 9·22 = 8·7 grms. sulphur.

Sulphur dioxide available from (3) = 12·93 grms.
Less ditto escaping = 3·08 „

Net reacting = 9·85 = 4·9 grms. sulphur.

Total sulphur = 13·6 „ „

Water from (3) $4{\cdot}9 +$ water produced $\frac{18}{34} \times 9{\cdot}2 = 9{\cdot}8$ grms. total.

Then we have for reaction (4) at 556° C.

Heat brought in by reacting gases—

Sulphur dioxide	$= 12{\cdot}93 \times 0{\cdot}1544 \times 556.$
Sulphuretted hydrogen	$= 9{\cdot}93 \times 0{\cdot}2423 \times 556.$
Aqueous vapour	$= 4{\cdot}9 \times 0{\cdot}62 \times 556.$
Carbon dioxide	$= 93{\cdot}8 \times 0{\cdot}322 \times 556.$
Nitrogen	$= 34{\cdot}3 \times 0{\cdot}261 \times 556.$

Total $= 556 \times 46{\cdot}60 = 25{,}910$

Heat produced by oxidation of hydrogen to water vapour $= 57{,}400 \times \frac{9{\cdot}22}{34} = 15{,}565 = +\ 41{,}475$

Heat required to decompose the sulphuretted hydrogen $= 4{,}740 \times \frac{9{\cdot}22}{34} = 1{,}285$

Ditto sulphurous acid $= 71{,}970 \times \frac{9{\cdot}85}{64} = 11{,}080 = -\ 12{,}365$

Net heat evolved = 29,110

As before, let t' = final temperature.

Then—

To raise residual sulphuretted hydrogen to t'...............	$= t' \times 0{\cdot}2423 \times 0{\cdot}7 = 0{\cdot}17t'$
Ditto sulphur dioxide	$= t' \times 0{\cdot}1544 \times 3{\cdot}1 = 0{\cdot}48t'$
To raise aqueous vapour to t'	$= t' \times 0{\cdot}604 \times 9{\cdot}8 = 5{\cdot}92t'$
Do. carbon dioxide	$= t' \times 0{\cdot}313 \times 93{\cdot}8 = 29{\cdot}36t'$
Do. nitrogen	$= t' \times 0{\cdot}259 \times 34{\cdot}3 = 8{\cdot}88t'$
To raise sulphur to 316° C. and vaporise	$= 13{\cdot}6 \times 450 = 6.120$

To raise sulphur vapour from 316° C. to t'

$= (t' - 316) \times 0{\cdot}08 \times 13{\cdot}6 = -\ 0{\cdot}344 + 1{\cdot}09t'$

Total heat required $= 5{,}776 + 45{\cdot}90t'$

Equating, we get—

$$t' \times 45{\cdot}90 + 5{,}776 = 29{,}110$$

$$t' \times 45{\cdot}90 = 23{,}334$$

$$\left.\begin{aligned} t' &= 508^{\circ}\ \text{C.} \\ &\ \ 946^{\circ}\ \text{F.} \end{aligned}\right\} = \text{Maximum temperature if equations (3), (4) occur simultaneously.}$$

The theoretical maximum temperature according to this hypothesis must lie between the values 508° C. and 556° C. = 946° F. and 1,033° F.

Calculation of Air Supply to Claus Kiln treating Saturator Gases.

Let saturator gas entering kiln contain, per 100 volumes

$$\begin{cases} CO_2 = x. \\ H_2S = y. \\ \text{Air} = 100 - (x + y).^{*} \end{cases}$$

Let V volumes of air enter kiln per 100 volumes of saturator gas;

V′ = volume of exit gases after reaction has spent itself.

Let 100 volumes of exit gases contain

$$\begin{cases} CO_2 = x' \\ H_2S = y' \\ SO_2 = z' \\ N = 100 - (x' + y' + z'). \end{cases}$$

Suppose y (the volume of H_2S entering per 100 volumes of gas) to consist of three parts—

y_1 = volume of H_2S that passes through the kiln unchanged.

y_2 = volume of H_2S that reacts with half its volume of oxygen to form sulphur and water. Thus—

$H_2S + O = H_2O + S$, where decrease in volume due to reaction $= 1{\cdot}5y_2$.

y_3 = volume of H_2S that reacts with one and a half times its volume of oxygen to form SO_2 and water. Thus—

$H_2S + O_3 = H_2O + SO_2$, where decrease of volume due to reaction $= 1{\cdot}5y_3$.

Now,

$$V' + 1{\cdot}5y_2 + 1{\cdot}5y_3 = 100 + V.$$

$$\therefore V = V' - 100 + 1{\cdot}5\,(y_2 + y_3).$$

Further,

Since CO_2 is unchanged in its absolute amount in passing through the kiln—

$$\frac{x}{x'} = \frac{V'}{100},\ \text{whence}\ V' = 100\,\frac{x}{x'}$$

Further, we have—

$$y = y_1 + y_2 + y_3,\ \text{whence}\ (y_2 + y_3) = y - y_1,$$

and—

$$\frac{y_1}{y'} = \frac{V'}{100}\ \text{because}\ y_1\ \text{passes unchanged through the kiln.}$$

Replacing $\frac{V'}{100}$ by $\frac{x}{x'}$, we get $y_1 = y'\frac{x}{x'}$

and—

$$(y_2 + y_3) = y - y'\frac{x}{x'}.$$

Finally, replacing V′ by $100\frac{x}{x'}$, and $(y_2 + y_3)$ by $y - y'\frac{x}{x'}$, in the general equation, we get—

$$V = \frac{x}{x'}100 - 100 + 1{\cdot}5\left(y - y'\frac{x}{x'}\right).$$

$$= 100\left(\frac{x - x'}{x'}\right) + 1{\cdot}5\left(\frac{x'y - xy'}{x'}\right).$$

In this equation—

$$1{\cdot}5\left(\frac{x'y - xy'}{x'}\right)$$

represents the reduction of volume due to chemical reaction, while

$$100\left(\frac{x - x'}{x'}\right)$$

is the expression for the volume of air admitted to the kiln per 100 volumes of gas, if such reduction of volume be

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[*] See footnote, p. 578.

neglected, which may be done when saturator gas is very weak, as in the Granton experiments, mentioned in our paper in 1903.

Calculation of the Relation of the Volume of Reacting Mixture entering to that of the Exit Gases leaving the Chance-Claus Process Kiln, both measured at Atmospheric Pressure and Temperature.

Let v' volumes leave per 100 volumes of reacting mixture entering.

y = volume per cent. of H_2S in ditto.

y' = volume per cent. of H_2S in the exit gases.

As before, we suppose y to consist of 3 parts $= y_1 + y_2 + y_3$, where—

y_1 = residual H_2S leaving in exit gases;

y_2 = volume of H_2S reacting to form sulphur and water:—

$H_2S + O = H_2O + S$; reduction of volume $= 1\cdot5y_2$.

y_3 = volume of H_2S reacting to form sulphur dioxide and water:—

$H_2S + O_3 = H_2O + SO_2$; reduction of volume $= 1\cdot5y_3$.

Then we have—

$$y_1 : y' :: v' : 100, \text{ whence } y_1 = \frac{v' \times y'}{100}.$$

Now volume of gases entering = volume of gases leaving + reduction due to reaction,

Hence—

$$100 = v' + 1\cdot5\,(y_2 + y_3).$$

Also—

$$y = y_1 + y_2 + y_3 \text{ and } (y_2 + y_3) = y - y_1.$$

Wherefore—

$$100 = v' + 1\cdot5\,(y - y_1).$$

Replacing in the equation, y_1 by $\frac{v'\,y'}{100}$,

We have—

$$100 = v' + 1\cdot5\left(y - \frac{v'\,y'}{100}\right).$$

Whence—

$$v'\left(1 - \frac{1\cdot5y'}{100}\right) = 100 - 1\cdot5y$$

$$v' = 100\,\frac{(100 - 1\cdot5y)}{(100 - 1\cdot5y')}$$

Or, if v'' leave per 1 cb. ft. entering, the equation becomes—

$$v'' = \frac{(100 - 1\cdot5y)}{(100 - 1\cdot5y')}$$

In conclusion, we desire to acknowledge the advantage we have received from discussion of the thermochemical reactions with Dr. Affleck, who has been of great assistance, by reason of the independent investigations on which he is indeed still engaged, not only in developing, but in initiating the hypothesis set out on page 577.

ERRATUM.

STUDIES ON THE CLAUS REACTION, PART I.

—Journal, 1903, page 464, right column, Work C. Column Holder Gas—Reacting Mixture, for Air—

$$43\cdot8\begin{cases}O = 8\cdot8\\N = 35\cdot0\end{cases}, \text{ read } 50\cdot2\begin{cases}O = 10\cdot2\\N = 40\cdot0\end{cases}, \text{ and}$$

for 146·4, read 152·8.

Discussion.

Mr. J. **Haydn Morris** said that in quite a number of different Claus kilns he had found a considerable quantity of ammonia in the shape of sulphate and sulphite of ammonia, and it was very interesting to him to know that it was due in many cases to conversion of the hydrocyanic acid into ammonia. It had struck him that it might be possible to construct a Claus kiln in which the formation of ammonia would be impossible—a kiln in which the contact substance and the temperature could be regulated so that the cyanide would be completely decomposed into nitrogen and there would be no ammonia formed at all. He had also found in the Claus kilns a considerable amount of sulphur which was insoluble in carbon bisulphide, and it would be interesting to know under what conditions this amorphous sulphur was formed and how the condition of the sulphur varied. In some cases he had found as much as 15 per cent. of amorphous sulphur in the product. He further wished to know whether Mr. Carpenter had had results from two different works where Claus kilns had been in operation, whether in each case the cyanides had been proved to be going in, and whether in both cases the ammonia had been formed. It seemed to him that if the results of several works were taken, and the cyanides were proved to be going in, it would then show that they all worked in the same way, and in each case were converted into ammonia.

Mr. **Arthur Carey** asked, in reference to the very small yield of flowers of sulphur in the chamber in the instance he had quoted, *viz.* 4 per cent., whether the 4 per cent. of the total sulphur was collected in the chamber, or was the sulphur which was supposed to be made in the chamber and deposited there. It was a very difficult matter to determine whether the sulphur which was deposited from these gases was really carried in the form of vapour from the Claus kiln itself, or was formed by the continued reaction between the residual sulphur dioxide and hydrogen sulphide. He had seen a number of analyses from time to time of the exit gases from Claus kilns both before and after they had travelled a long distance in flues. They knew from the necessity for periodical cleaning that sulphur was deposited in those flues, but there was a very small drop, if any, to be noticed in the sulphur content of the gases as shown by analysis.

Mr. **Herbert Potter** inquired whether, in the experiments mentioned with the small kiln in regard to the mixture of cyanides and sulphuretted hydrogen, varying quantities of air were used. In some works the kiln was too big for the work, and he had noticed considerable difference in the smell of the exit gasea from the oxide purifier; in one or two cases the smell of cyanides was noticeable. He wondered if the quantity of air would materially affect the conversion of the cyanide, for when the kiln was too large more air was admitted in order to maintain the heat.

Mr. R. H. **Clayton** inquired whether Mr. Carpenter had any experience of Walter Feld's method of analysis for cyanides in gas liquors. It was a simple method, and he had found it give good and accurate results. As regards the practical working of the Claus kilns, what had been the highest maximum yield that had been obtained from the hydrogen sulphide in the waste gases from ammonia plant?

Mr. **Eustace Carey** asked if the author, in his allusion to pyrometers, was referring to electrical pyrometers, where heat was measured by the resistance to an electric current. His experience some years ago with electrical pyrometers was not fortunate, but probably they were much improved now, and he would be glad to know if they were reliable and lasting.

Mr. W. H. **Coleman** asked if Mr. Carpenter found that the condensing space required for the Claus process in a gas works was very much greater than at alkali works. The large proportion of carbon dioxide would seem to demand it.

Mr. R. **Forbes Carpenter**, in answer to Mr. Morris, said that the influence upon conversion of cyanogen into ammonia of different contact materials in the Claus kiln was a subject on which the authors were not yet in a position to speak; the apparatus for the trials had had to be specially made. No experiments had as yet been made. As regards the works tests, experiments in Works A. and C. had been concluded before the gas liquor used had been tested for cyanide; in Work A. this was absent; its amount in the liquor used at Work C. was ascertained only after the conclusion of experiments at Work B. In reply to Mr. Arthur Carey, the reaction among the gases in the cool sulphur chamber, which he would fin described in the text of the paper, was ascertained by series of concurrent inlet and exit tests corrected to standar volume as compared with that of inlet gases to the kiln. While in a vitriol chamber it was impossible, as Dr. Hunter had shown, to accurately determine by such analysis what amount of acid was actually made in that chamber, in the present case it was possible, by filtering out the sulphur suspended in the gases, to arrive at correct figures for sulphuretted hydrogen and sulphur dioxide (in the absence of ammoniacal compounds), and so to reach a figure for work done in the cool chamber. In the small Claus kiln experiments they had not desired the presence of air; it was impossible entirely to exclude it, and, as explained, the in-leakage of air in the last experiment had markedly increased the rate of flow of gases through the contact material; but in this last experiment, where sulphuretted hydrogen was present, as in Claus kiln conditions, they could see by the jump up in percentage conversion the protective effect of this gas on hydrocyanic acid and ammonia, both of which air would tend to destroy at the temperature used. As explained to Mr. Morris, fresh apparatus was being prepared. They had not tried the Feld method of estimating cyanides mentioned by Mr. Clayton. They had no figures to communicate as to highest yield of sulphur in gas liquor works plants, nor could they give figures as to comparative condensing space required in these and Chance-Claus plants.

London Section.

Meeting held at Burlington House, on Monday, May 2nd, 1904.

MR. WALTER F. REID IN THE CHAIR.

THE OLDEST DOCUMENT IN THE HISTORY OF GUNPOWDER.

BY OSCAR GUTTMANN, M.INST.C.E., F.I.C., F.C.S.

The so-called ancient records concerning the invention of gunpowder should be approached with great caution, since manuscripts of doubtful date and origin which had been nadequately translated were used to serve various nations nd individuals as proofs of their claim to this invention. Only such documents present a special interest, which urnish information about the time preceding 1354, and as here is no doubt that even the Arabs did not shoot up to 1313, although they knew gunpowder-like mixtures since 280, we are limited in our investigation to within a eriod of 40 years.

I have shown in another place, that an Arabian manucript in the St. Petersburg Library, which was published y Reinaud and Favé, is of no importance, since, apart rom other objections, its date is very doubtful. The oftited passage in the Indian "Gentoo Laws" also becomes alueless when correctly translated, and the description of ities and of the composition and manufacture of gunowder, as published by Prof. Gustav Oppert from the Sukraniti,"* is doubtless of more recent origin than he upposes. Oppert had before him only copies 200 years ld of a lost original, and the learned Indian, Praphulla handra Ray, peremptorily denies† that the Indians knew unpowder in the 14th century.

The following are the only existing unimpeachable ocuments:—

1. The accounts of King Edward III's private wardrobe om 1344 to 1347, and the accounts of the same King's great wardrobe from 1345 to 1349, in both of which there are entries of payments for gunpowder, and also sulphur and saltpetre for the King's guns.

2. The accounts of the town of Aix-la-Chapelle of 1346, showing some expenditure for an iron gun and saltpetre for same.

3. A document at the town library of Tournay, giving an account of experiments with a gun in 1346 by Pierre de Bruges.

4. The accounts, published in Muratori, Vol. 24, of Aimone di Challant, Sire di Fenis, Guardian of Lanzo in Northern Italy from 1347 to 1348, according to which Master Hugonino di Chatillon in 1347 made 4 bronze guns for the Marquess of Monferrato, in the Aosta valley, each of which weighed about 45 lbs., was fired by means of gunpowder, and threw leaden balls with large, iron-bound arrows.

5. The accounts dating 1342 for the artillery of Rihoult Castle, published in the "Mémoires de la Société des Antiquaires de la Morinie," tome 5. The guns threw wooden arrows, bound with iron, and centred by means of copper discs. The price of the powder was about 30*s.* per pound.

6. A document in the Paris National Library, according to which 5 iron and 5 bronze cannon were bought in 1339 for the defence of the town of Cambray, for which Estienne Marel supplied saltpetre and sulphur, but in such small quantities only (for the sum of 11 livres 4 sous) that at the existing prices of that time barely 3 pounds of powder would work out per cannon.

7. A document in the same library, according to which Guillaume du Moulin from Boulogne acknowledges the receipt on the 11th July 1338 from Thomas Fouque-, guardian of the galley-house at Rouen, of "one iron pot for shooting fire-arrows, 48 iron-bound and feathered arrows, one pound of saltpetre, and half-a-pound of live sulphur for making powder for shooting the said arrows." This would hardly give 20 grms. of powder to each arrow. Hitherto there was a general disinclination to regard these arrow-shooting guns favourably, but I am now in a position to give a picture of one.

In Prof. Oppert's above-mentioned book I found a footnote, which drew attention to a manuscript in Oxford dating from 1336, and I therefore endeavoured to get particulars and later on to inspect it myself. To my surprise the manuscript proved to bear the date 1326. It is written by Walter de Millemete, is entitled "De Officiis Regum," and is kept in Christchurch library. It is beautifully illuminated. I have only been able to obtain the right of reproduction for the new edition of my book on Explosives, the authorities of Christchurch jealously guarding any further publication. The manuscript begins as follows:—

"Hic incipiunt rubrice capitulorum huius libri de nobilitatibus sapienciis et prudenciis regum editi ad honorem illustris domini Edwardi dei gracia Regis anglie incipientis regnare Anno domini ab incarnacione Milesimo Tricentesimo Vicesimo Sexto."

Translation.—"Here begin the lists of the chapters of this book about the noble origin and the prudence of kings, edited in honour of the illustrious Lord Edward, by God's grace King of England, who began to reign in the year of our Lord, 1326." (This is old reckoning; King Edward entered his reign in the year 1327 of the new.)

The contents of the book in no way refer to the history of the invention of gunpowder, but only deal with the duties and qualities of kings. It must have been begun in the reign of Edward II., because it contains pictures of him as king, and no doubt it was originally intended as a present to him. The very elaborate and rich illuminations must have taken a long time, probably more than a year, since such fine work could only be done in the summer months, so that it was very likely already begun in 1325.

There is on the last page of the manuscript a richly adorned frame surrounding the text, and on its lower part the reproduction of a bottle-shaped gun resting on a wooden

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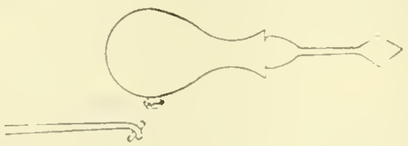
[*] On the Weapons, Army Organization, and Political Maxims of e Ancient Hindus. Madras, 1880.

[†] Praphulla Chandra Ray, History of Hindu Chemistry. London, 03.

trestle. The shape of the bottle resembles an antique urn (see sketch). It is closed by means of an arrow, which has a ball on its lower extremity, and a warrior in full armour is in the act of firing this gun by means of an



incandescent rod, intending to burst the lock of a castle-gate. This gives us on the one hand an authentic and the oldest date for the use of gunpowder, and on the other hand, it is a most interesting illustration of the earliest guns, and the manner in which they were used. The gradual progress towards the use of the ball from the end of the arrow, only, and as is known, in the way of ball-shaped common stones, is so far only conjecture.

I am indebted for the photograph of this interesting page to the kindness of the trustees of the Wake Trust, and for the information concerning it to the late Prof. York Powell and Prof. Webb, to whom I herewith tender my sincere thanks.

Now only we can believe a passage in John Barbour's life of Robert Bruce, King of Scotland, which was written in 1375, and has hitherto been considered a fable. Barbour wrote of the year 1327 :—

> "Twa noweltys that dai thai saw,
> That forouth in Scotland had bene nane.
> Tymmris for helmys war the tane,
> That thaim thoucht than off grete bewte,
> And alsua wondre for to se;
> The tothyr *crakys* war *off wer*,
> That thai befor herd nevir er."

So much appears now certain, that the knowledge of the propelling force of gunpowder-like mixtures must have come about between 1313 and 1325. I am of opinion that Berthold Schwarz invented the guns, only the date of their invention must be put back much further than 1353, as written on his monument at Freiburg.

Manchester Section.

Meeting held on Friday, March 4th, 1904.

MR. J. CARTER BELL IN THE CHAIR.

THE IGNITION OF CLAYS IN KILN GASES.

BY ARTHUR HOPWOOD, A.R.C.Sc., A.I.C.

Introduction.—In view of the importance of the behaviour on ignition of clays and clayey mixtures in the manufacture of ceramic bodies, it is necessary to have the fullest possible knowledge of the deportment of clays when ignited in the presence and absence of the various gases which result from the combustion of fuel and pass through the ovens, or kilns, during the firing process. The combustion of fuel in clayware kilns being variable and always imperfect, it follows that the gaseous product derived from the fuel and air is a variable mixture of nitrogen, oxygen, carbon dioxide, carbon monoxide, hydrogen, steam, ammonia, and hydrocarbons more or less contaminated with sulphur and compounds of sulphur derived from the impurities present in the fuel. (*Cf.* E. Orton, Transactions of the American Ceramic Society, Volume V., page 405, 1903.) In consequence, this paper deals with the behaviour of clays of known nature when ignited alone, and in presence of the principal gases which pass through clayware kilns.

Occurrence and Nature of the Clays.—Thirty clays were selected for investigation which occur at the various places mentioned below, the figures indicating the number of different kinds taken from each place :—

Red Tile Clays.—Tunstall, 6; Ruabon, 2; Accrington, 1.

Common Brick Clays.—Burslem, 1; Hanley, 1; Tunstall 1.

Fireclays.—Ruabon, 3; Stourbridge, 2; Burslem, 1; Hanley, 1; Goldendale, 1; Tunstall, 1; Coatbridge, 1.

Stoneware Clays.—Burslem, 1; Ruabon, 1.

Ball Clays.—Newton Abbot, 1; Torrington, 1; Corfe Castle, 1.

China Clays.—St. Austell, 3.

The Tunstall and Ruabon red tile clays are red bodies; the Accrington shale clay and all the common brick, fire, stoneware, and ball clays are grey bodies; while the Cornish china clays are white in colour. On analysis, the Cornish china clays and the Tunstall red tile clays were found to contain only traces of organic matter; while the Accrington, common brick, fire, stoneware, and ball clays were found to contain moderate or large amounts. The china and ball clays contain small, the fireclays and stoneware clays moderate, and the red tile and common brick clays large amounts of iron. The china clays and the Tunstall red tile clays are the only ones which are free from sulphides.

Behaviour of the Clays on Ignition.—The behaviour of the clays on ignition was ascertained by heating the coarsely powdered clays to a bright red heat for three hours in a combustion tube 30 inches long. When the clays were being heated in absence of external gases the tube was closed at one end, and when in the presence of one of the kiln gases one of the open ends was connected with a gasholder, or generating apparatus, supplying a current of the requisite gas.

The behaviour of the clays was studied in the following gases, *viz.*, nitrogen, carbon dioxide, steam, air (limited supply and in excess), oxygen, hydrogen, carbon monoxide, ammonia, marsh, and olefiant gases.

The china clays and the Tunstall and Ruabon red tile clays when ignited alone, or in presence of nitrogen, carbon dioxide, and steam, left dark white or brown residues respectively; while the common brick, stoneware, ball, fire, and Accrington clays left greyish black residues. The darkening or blackening was found to be largely due to carbon modified more or less by ferrous oxide, magnetite, and occasionally ferrous sulphide. The residues on being refired in a muffle furnace became lighter in colour, leaving white, ivory, stone-yellow, buff, pale red, or bright red bodies in accordance with their derivation from china, ball, stoneware, fire, common brick, or red tile clays. We therefore observe that all clays darken when heated alone, or in presence of nitrogen, carbon dioxide, and steam, but they only blacken when they contain moderate or large amounts of organic matter. This darkening, or blackening, disappears on oxidation, and consequently clay burners can convert bricks having black carbonaceous interiors into good normal bricks by refiring them in a kiln freely supplied with air.

The china clays and the Tunstall and Ruabon red tile clays when heated in a *limited supply* of air left white and bright red bodies respectively along the whole length of the tube; while the commom brick, stoneware, ball, fire, and Accrington clays left residues differently coloured in different parts of the tube: the residues at the end of the tube where the air entered were ivory, stone-yellow, buff, pale red, or bright red bodies in accordance with their derivation from ball, stoneware, fire, common brick, or Accrington clays: the residues at the middle of the tube were always dark grey bodies; while those at the end farthest away from the entering air were always black bodies identical with those obtained from the corresponding clays by ignition in absence of external gases. The china, ball, stoneware, fire, common brick, and red tile clays when ignited in *excess* of air or oxygen left white, ivory, stone-yellow, buff, pale red, and bright red bodies respectively along the whole length of the tube. It follows that white, ivory, yellow, and red claywares made from clays containing little organic matter do not require much air for the development of their normal colorations, but more air is required as the percentage of organic matter is greater. In consequence, clay-burners should observe that highly carbonaceous clays are liable to yield claywares having black interiors unless a liberal supply of air passes through the kiln during the firing process.

The china clays when heated in hydrogen, carbon monoxide, ammonia, methane, and ethylene left dark white bodies; the Tunstall and Ruabon red tile clays left dark blue bodies; while the common brick, stoneware, ball, fire, and Accrington clays left greyish black bodies. The darkening or blackening was found to be mainly due to carbon, ferrous oxide, and magnetite, occasionally modified by ferrous sulphide and finely divided iron. The residues obtained by igniting the clays in marsh and olefiant gases were darker in colour and contained a little more carbon than the corresponding ones obtained by ignition in hydrogen: indicating partial decomposition of the marsh and olefiant gases and subsequent deposition of carbon in the mass of the clay. The residues on being refired in a muffle furnace became gradually lighter in colour, eventually leaving white, ivory, stone-yellow, buff, pale red, or bright red bodies in accordance with their derivation from china, ball, stoneware, fire, common brick, or red tile clays. It follows that all clays darken when heated in reducing clayware kilns, but the darkening is only appreciable when they contain considerable quantities of iron, or organic matter. The blue or black colorations readily change on oxidation, and consequently clay-burners making blue bricks must not allow air to enter their kilns in the last stage of the process, as the bricks would acquire an undesirable brown tinge.

Conclusion.—Dr. H. A. Seger (Notizblatt, 1876, page 278) ascertained the colour of the residues left by four German clays when ignited in a Roses' crucible in currents of several of the gases present in clayware kilns. The residues obtained by Seger from these German clays were similar to those I obtained from similar English clays containing little carbonaceous matter; so that the behaviour on ignition of different varieties of the same kind of clay appears to be universally uniform.

New York Section.

Meeting held at Chemists' Club, on April 22nd, 1904.

DR. VIRGIL COBLENTZ IN THE CHAIR.

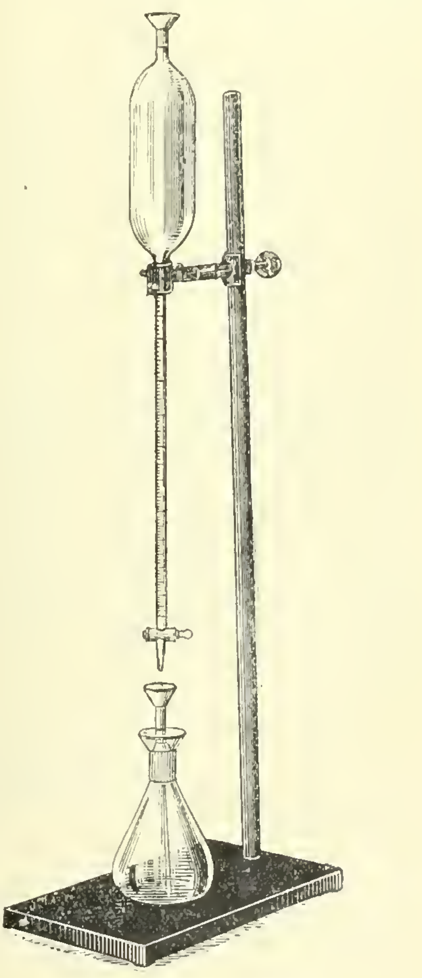
AN APPARATUS FOR THE DIRECT DETERMINATION OF THE SPECIFIC GRAVITY OF CEMENT.

BY DANIEL D. JACKSON.

It is a well-known fact among chemists who have had extensive work to do in connection with the specific gravity of cement that the test as ordinarily applied is subject to grave inaccuracy and is consequently of doubtful value. Accurate determinations with the pyknometer or specific gravity bottle are more troublesome and time consuming than is practical for routine work. Le Chatelier's apparatus, which is the one most extensively used, has of necessity a graduated tube of such large calibre that an accurate reading is impossible. It is also very difficult to work with this instrument under even conditions of temperature without consuming a large amount of time for each determination. This same objection holds true with all the other forms of apparatus employed for this purpose.

There is apparently little appreciation of the fact that even slight changes in temperature make a very considerable error in the result and, that whatever instrument is used, if the temperature of the liquid changes more than half a degree F. during the determination, it must be brought back to its original point before making the reading, or a temperature correction must be employed. The use of the temperature correction is decidedly to be preferred as it is fully as accurate and much more rapid. This conclusion being granted, it is then not necessary that the instrument should be one connected piece of glassware. By making it in two separate parts we are allowed a graduated tube of much smaller calibre, thus greatly increasing the accuracy of the determination.

Description of New Apparatus.—In the accompanying illustration is shown a simple form of apparatus designed by the author for the accurate and rapid determination of the specific gravity of cement. Above is suspended a burette, with graduations, about 9 in. (23 cm.) long and with an inside diameter of about $\frac{1}{4}$ in. (0·6 cm.). This is connected with a glass bulb, approximately $5\frac{1}{2}$ in. (13 cm.) long and $1\frac{3}{4}$ in. (4·5 cm.) in diameter. The Erlenmeyer flask below is of heavy glass, and contains a ground-glass stopper which is hollow, and has a neck of the same bore as the burette. The flask has a capacity of exactly 200 c.c. up to the graduation on the neck of the stopper.



SPECIFIC GRAVITY APPARATUS.

In order that the work may be more rapid, the burette is not graduated in c.c., as in other instruments of this nature, but is made to read directly in specific gravity. The manufacturer* of the instrument makes the glass bulb of such a size that from the mark on the neck at the top to the mark on the burette just below the bulb, the capacity is exactly

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* Emil Greiner, 78, John Street, N.Y. City.

180 c.c. If 50 grms. of cement are taken, this mark represents a sp. gr. of 2·50—

$$\begin{array}{rll} & 200 & \text{(capacity of flask).} \\ - & 180 & \quad ,, \quad \text{bulb to first graduation.} \\ \hline = & 20 & \text{volume displaced by 50 grms. of cement.} \end{array}$$

$$\frac{50}{20} = 2 \cdot 50 \text{ sp. gr.}$$

The burette is graduated for every 0·05 in sp. gr., and five equidistant marks are placed between each of these accurate graduations. In this way the instrument is made to read with accuracy to 0·01 in sp. gr.

The following table gives the calculations used in the original graduation of the instrument :—

Table for Graduating Apparatus for the Determination of the Specific Gravity of Cement.

Specific Gravity.	Reading.	Displacement.	Specific Gravity.	Reading.	Displacement.
	c.c.			c.c.	
2·50	180·00	20·00	2·86	182·52	17·48
2·51	180·08	19·92	2·87	182·58	17·42
2·52	180·16	19·84	2·88	182·64	17·36
2·53	180·24	19·76	2·89	182·70	17·30
2·54	180·31	19·69	2·90	182·76	17·24
2·55	180·39	19·61	2·91	182·82	17·18
2·56	180·47	19·53	2·92	182·88	17·12
2·57	180·54	19·46	2·93	182·94	17·06
2·58	180·62	19·38	2·94	182·99	17·01
2·59	180·69	19·31	2·95	183·05	16·95
2·60	180·77	19·23	2·96	183·11	16·89
2·61	180·84	19·16	2·97	183·16	16·84
2·62	180·92	19·08	2·98	183·22	16·78
2·63	180·99	19·01	2·99	183·28	16·72
2·64	181·06	18·94	3·00	183·33	16·67
2·65	181·13	18·87	3·01	183·39	16·61
2·66	181·20	18·80	3·02	183·44	16·56
2·67	181·27	18·73	3·03	183·50	16·50
2·68	181·34	18·66	3·04	183·55	16·45
2·69	181·41	18·59	3·05	183·61	16·39
2·70	181·48	18·52	3·06	183·66	16·34
2·71	181·55	18·45	3·07	183·71	16·29
2·72	181·62	18·38	3·08	183·77	16·23
2·73	181·69	18·31	3·09	183·82	16·18
2·74	181·75	18·25	3·10	183·87	16·13
2·75	181·82	18·18	3·11	183·92	16·08
2·76	181·88	18·12	3·12	183·97	16·03
2·77	181·95	18·05	3·13	184·03	15·97
2·78	182·01	17·99	3·14	184·08	15·92
2·79	182·08	17·92	3·15	184·13	15·87
2·80	182·14	17·86	3·16	184·18	15·82
2·81	182·21	17·79	3·17	184·23	15·77
2·82	182·27	17·73	3·18	184·28	15·72
2·83	182·33	17·67	3·19	184·33	15·67
2·84	182·39	17·61	3·20	184·37	15·63
2·85	182·46	17·54	3·21	184·42	15·58

Table for Graduating Apparatus, &c.—cont.

Specific Gravity.	Reading.	Displacement.	Specific Gravity.	Reading.	Displacement.
	c.c.			c.c.	
3·22	184·47	15·53	3·37	185·16	14·84
3·23	184·52	15·48	3·38	185·21	14·79
3·24	184·57	15·43	3·39	185·25	14·75
3·25	184·62	15·38	3·40	185·29	14·71
3·26	184·66	15·34	3·41	185·34	14·66
3·27	184·71	15·29	3·42	185·38	14·62
3·28	184·76	15·24	3·43	185·42	14·58
3·29	184·80	15·20	3·44	185·47	14·53
3·30	184·85	15·15	3·45	185·51	14·49
3·31	184·89	15·11	3·46	185·55	14·45
3·32	184·94	15·06	3·47	185·59	14·41
3·33	184·98	15·02	3·48	185·63	14·37
3·34	185·03	14·97	3·49	185·67	14·33
3·35	185·07	14·93	3·50	185·71	14·29
3·36	185·12	14·88			

Method of Determination.—To determine the specific gravity of a cement by means of this instrument—

1. Weigh out accurately, to 0·1 grm., 50 grms. of the dry sample and pour it into the unstoppered Erlenmeyer flask.

2. Fill the bulb and burette with kerosene, leaving just space enough to take the temperature by introducing a thermometer through the neck. Remove the thermometer and add sufficient kerosene to fill exactly to the mark on the neck, drawing off any excess by means of the burette.

3. Run into the flask about one-half of the kerosene in the bulb to remove air bubbles. Run in more kerosene until any adhering cement is carefully washed from the neck of the flask and the liquid is just below the ground glass.

4. Place the hollow ground-glass stopper in position and turn it to fit tightly. Run in kerosene exactly to the 200-c.c. graduation on the neck, making sure that no air bubbles remain in the flask.

5. Read the specific gravity from the graduation on the burette and then the temperature of the oil in the flask, noting the difference between the temperature of the oil in the bulb before the determination and the temperature of the oil in the flask after the determination.

6. Make a temperature correction to the reading of the specific gravity by the use of the subjoined table. For the convenience of those using the centigrade thermometer the table of corrections on next page has been compiled.

It was thought possible that the variation in the different brands of kerosene might be sufficient to cause an error in the determination. A collection of various good and bad

Correction in Specific Gravity in Various Portions of the Graduated Scale due to Change in Temperature (Fahrenheit) during the Determination.

Read the Temperature of the *Oil* in the *Bulb before* the *Determination*, and of the *Oil* in the *Flask after* the *Determination*. *Add* the *Correction*, if the *Temperature* of the *Oil increases*, and *subtract* it if it decreases.

Change in Temperature—Fahrenheit.	2·50–2·60	2·60–2·70	2·70–2·80	2·80–2·90	2·90–3·00	3·00–3·10	3·10–3.20	3·20–3·30	3·30–3·40	3·40–3·50
0·5	0·01	0·01	0·01	0·01	0·01	0·01	0·01	0·01	0·01	0·01
1·0	0·01	0·01	0·02	0·02	0·02	0·02	0·02	0·02	0·02	0·02
1·5	0·02	0·02	0·02	0·02	0·03	0·03	0·03	0·03	0·03	0·03
2·0	0·03	0·03	0·03	0·03	0·03	0·04	0·04	0·04	0·04	0·05
2·5	0·03	0·04	0·04	0·04	0·04	0·05	0·05	0·05	0·06	0·06
3·0	0·04	0·04	0·05	0·05	0·05	0·05	0·06	0·06	0·07	0·07
3·5	0·05	0·05	0·05	0·06	0·06	0·06	0·07	0·07	0·08	0·08
4·0	0·05	0·06	0·06	0·06	0·07	0·07	0·08	0·08	0·09	0·09
4·5	0·06	0·06	0·07	0·07	0·08	0·08	0·09	0·09	0·10	0·10
5·0	0·07	0·07	0·08	0·08	0·09	0·09	0·10	0·10	0·11	0·12
5·5	0·07	0·08	0·08	0·09	0·09	0·10	0·10	0·11	0·12	0·13
6·0	0·08	0·08	0·09	0·10	0·10	0·11	0·11	0·12	0·13	0·14
6·5	0·08	0·09	0·10	0·10	0·11	0·12	0·12	0·13	0·14	0·15
7·0	0·09	0·10	0·11	0·11	0·12	0·13	0·13	0·14	0·15	0·16
7·5	0·10	0·11	0·11	0·12	0·13	0·14	0·14	0·15	0·17	0·17
8·0	0·10	0·11	0·12	0·13	0·14	0·14	0·15	0·16	0·18	0·18
8·5	0·11	0·12	0·13	0·14	0·14	0·15	0·16	0·17	0·19	0·20
9·0	0·12	0·13	0·14	0·14	0·15	0·16	0·17	0·18	0·20	0·21
9·5	0·12	0·13	0·14	0·15	0·16	0·17	0·18	0·19	0·21	0·22
10·0	0·13	0·14	0·15	0·16	0·17	0·18	0·19	0·20	0·22	0·32

kerosenes was made and the co-efficient of expansion of each sample was determined. The differences in expansion found were entirely within the limit of error of the determination.

With the instrument herein described the time required to make a determination is about ten minutes, and the accuracy is to 0·01. No Portland cement should be accepted which is below 3·05 in specific gravity.

Correction in Specific Gravity in Various Portions of the Graduated Scale due to Change in Temperature (Centigrade) during the Determination.

Read the Temperature of the *Oil* in the *Bulb before* the *Determination*, and of the *Oil* in the *Flask after* the *Determination*. *Add* the *Correction*, if the *Temperature* of the *Oil increases*, and *subtract* it if it decreases.

—	Change in Temperature—Centigrade.									
	2·50—2·60	2·60—2·70	2·70—2·80	2·80—2·90	2·90—3·00	3·00—3·10	3·10—3·20	3·20—3·30	3·30—3·40	3·40—3·50
0·2	0·00	0·01	0·01	0·01	0·01	0·01	0·01	0·01	0·01	0·01
0·4	0·01	0·01	0·01	0·01	0·01	0·01	0·01	0·01	0·02	0·02
0·6	0·01	0·02	0·02	0·02	0·02	0·02	0·02	0·02	0·02	0·02
0·8	0·02	0·02	0·02	0·02	0·02	0·03	0·03	0·03	0·03	0·03
1·0	0·02	0·03	0·03	0·03	0·03	0·03	0·03	0·04	0·04	0·04
1·2	0·03	0·03	0·03	0·03	0·04	0·04	0·04	0·04	0·05	0·05
1·4	0·03	0·04	0·04	0·04	0·04	0·05	0·05	0·05	0·06	0·06
1·6	0·04	0·04	0·04	0·05	0·05	0·05	0·05	0·06	0·06	0·07
1·8	0·04	0·05	0·05	0·05	0·06	0·06	0·06	0·06	0·07	0·07
2·0	0·05	0·05	0·05	0·06	0·06	0·06	0·07	0·07	0·08	0·08
2·2	0·05	0·06	0·05	0·06	0·07	0·07	0·08	0·08	0·09	0·09
2·4	0·06	0·06	0·06	0·07	0·07	0·08	0·08	0·09	0·10	0·10
2·6	0·06	0·07	0·07	0·07	0·08	0·08	0·09	0·09	0·10	0·11
2·8	0·07	0·07	0·08	0·08	0·09	0·09	0·10	0·10	0·11	0·12
3·0	0·07	0·08	0·08	0·09	0·09	0·10	0·10	0·11	0·12	0·12
3·2	0·07	0·08	0·09	0·09	0·10	0·10	0·11	0·12	0·13	0·13
3·4	0·08	0·09	0·09	0·10	0·10	0·11	0·12	0·12	0·13	0·14
3·6	0·08	0·09	0·10	0·10	0·11	0·12	0·12	0·13	0·14	0·15
3·8	0·09	0·10	0·10	0·11	0·12	0·12	0·13	0·14	0·15	0·16
4·0	0·09	0·10	0·11	0·12	0·12	0·13	0·14	0·14	0·16	0·17
4·2	0·10	0·11	0·11	0·12	0·13	0·14	0·14	0·15	0·17	0·17
4·4	0·10	0·11	0·12	0·13	0·13	0·14	0·15	0·16	0·17	0·18
4·6	0·11	0·12	0·12	0·13	0·14	0·15	0·16	0·17	0·18	0·19
4·8	0·11	0·12	0·13	0·14	0·15	0·16	0·16	0·17	0·19	0·20
5·0	0·12	0·13	0·14	0·14	0·15	0·16	0·17	0·18	0·20	0·21

Nottingham Section.

Meeting held at Burton-on-Trent, on April 27th, 1904.

MR. J. T. WOOD IN THE CHAIR.

THE GLAZING OF CERTAIN KINDS OF SILICIOUS PIG IRON, AND ITS CAUSE.

BY O. F. HUDSON, A.R.C.S.,

Lecturer in Metallurgy in the University of Birmingham.

Cast iron is, essentially, iron containing more than 2 per ent. of carbon, but, as made in the blast furnace, it contains n addition to the carbon varying, and often considerable, mounts of other impurities. Commercial cast iron, howver, although it cannot be considered as simply an alloy f iron and carbon, depends for its characteristic properties pon the amount and mode of existence of the carbon, the ther impurities being of importance principally according o their influence on the relation between the iron and the arbon. Carbon exists in cast iron mainly in two forms, s graphite, or combined with iron as the carbide Fe_3C. Vhen the carbon is all or almost all present as graphite the on is soft and grey, and when it is all or almost all resent in the combined state the iron is hard and white. n their effect upon the condition of the carbon in cast iron licon and sulphur are of the utmost importance in deterining the grade and quality of the iron. The effect of licon is to produce a grey soft iron by its tendency to use the separation of graphite and to reduce the amount f combined carbon. Sulphur, on the other hand, tends to ake the iron white, because it has the effect of keeping e carbon in the combined state (Turner, J. I. & S. I., 886, p. 163). In ordinary cases the silicon in pig iron aries from 0·5 per cent. to 4 per cent., but silicon pig is ade in the blast furnace with as much as 10—18 per cent. licon. Pig iron with 4—5 per cent. silicon is widely used the foundry as a "softener," and is preferred, at any rate this country, to ferrosilicons with higher percentages of silicon for this purpose (Turner, Metallurgy Iron and Steel, p. 196). Such silicious iron was, however, looked upon by many with suspicion, as it did not give uniformly satisfactory results, and was in consequence not recommended for use in mixtures intended to give iron of the best quality (Gjers, in discussion on paper by C. Wood, J. I. & S. I., 1885, p. 464).

It is well known that some kinds of silicious pig iron frequently have a peculiar, glistening, and close-grained fracture, and in that condition is known as "glazed" pig. It is also a matter of common knowledge that two samples of silicious iron may be obtained of approximately the same composition, but the one open grained and the other glazed, the difference being due apparently to no well-defined cause. In addition the glazed iron is of less value than the opened grained variety, especially as a softener in the foundry. In view, therefore, of these facts it was thought that some attempt to explain the cause of this glazing of silicious pig iron would be of interest.

It is stated in Phillips and Bauerman's "Treatise on Metallurgy" that (p. 127) "glazy" or "glazed" iron is metal containing 5—7 per cent. silicon. Also (p. 225) "that such iron is produced when the furnace is in the highest working condition, i.e., when lightly burdened, and developing a maximum temperature in the hearth with highly heated blast." Sir Lowthian Bell ("Manufacture of Iron and Steel," pp. 162—163) gives the following analyses of glazed Cleveland pig:—

—	I.	II.
Silicon	5·13	5·13
Sulphur	0·17	0·23
Phosphorus	1·12	1·12
Manganese	0·77	0·56
Combined carbon	0·79	0·71
Graphite	2·59	2·68

and states that it is generally due to excessive heat in the furnace, and that raising the burden or lowering the temperature of the blast, preferably the latter, prevents its formation.

In Turner's "Metallurgy of Iron and Steel," p. 197, it is pointed out that silicious irons with upwards of 4 per cent. silicon, although of the same ultimate chemical composition, may be obtained sometimes grey and soft, and at others glazed and brittle. It is mentioned that it has been suggested that the glazed appearance may be due to some variation in the condition of the silicon. It is also stated (p. 105) that glazed iron is commonly made in blowing in the furnace when the first few charges are of light burden.

The peculiar fracture of glazed iron is explained in Sexton's "Metallurgy of Iron and Steel," p. 537, on the authority of Stead, as being due to the fact that "in high silicon irons the metal between the graphite flakes is easily fractured, the lines of weakness being the cleavage planes of the crystal grains." It is also stated that the larger the percentage of phosphorus the less silicon is required to make the iron glazed, instancing the fact that Cleveland iron with 1·5 per cent. P is glazed with 4 per cent. silicon, while hematite iron requires as much as 7 per cent. silicon to make it glazed. The reasons for this action of phosphorus are given as :—

(1) 1·5 per cent. phosphorus combines with 8·5 per cent. iron which cannot combine with carbon, and the graphite is therefore less than in hematite metal.

(2) The phosphorus compound is itself brittle, and the fracture has a more easy track through it.

The experiments described in this paper were made on samples of Northamptonshire pig iron kindly supplied by Mr. J. N. Kidner of the Islip Iron Co., Thrapston, Northamptonshire. Four pieces of pig iron were supplied, in the first place, of which the following are the descriptions :—

1. Ordinary, No. 2 Foundry : A good iron.
2. Silicious Foundry : A good iron.
3. Glazed iron : Not satisfactory.
4. Silicious iron, not glazed : Not satisfactory.

Samples 1 and 2 had coarse, open, grey fractures, while samples 3 and 4 had close-grained grey fractures. The fractures of samples 3 and 4 were, to the unpractised eye, almost identical, although only sample 3 was described as "glazed." Analyses were made of the four samples with the following results :—

——	1.	2.	3.	4.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Silicon	3·81	4·48	4·01	3·87
Sulphur	0·054	0·048	0·14	0·14
Manganese	0·66	0·45	0·64	0·45
Phosphorus	1·26	1·212	1·64	1·59
Combined carbon	0·07	0·07	0·16	0·20
Graphite	2·69	2·68	2·54	2·56

Three other samples of pig-iron were subsequently supplied by Mr. Kidner, and they were analysed for silicon and sulphur.

——	I.	II.	III.
	Per Cent.	Per Cent.	Per Cent.
Silicon	4·10	3·98	4·15
Sulphur	0·060	0·033	0·122

Samples I. and II. were open grained, and sample III. was glazed.

Mr. Kidner, some 10 years ago, when a student at Mason College, Birmingham, made analyses of samples of open and glazed Northampton iron, of which the following record has been kept :—

——	Open.	Glazed.
	Per Cent.	Per Cent.
Silicon	4·2	4·2
Sulphur	0·05	0·10
Manganese	0·40	0·38
Phosphorus	1·42	1·48
Combined carbon	0·03	0·03
Graphite	2·82	2·57

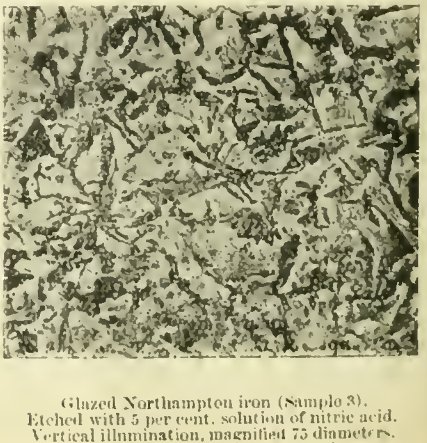
No conclusions, however, were drawn from these results at the time.

On considering these analyses it will be seen that glazed iron contains from two to three times the amount of sulphur that is present in the similar open-grained irons, a fact that would account for the unsatisfactory properties of the glazed iron. That the combined carbon is not appreciably increased in amount is due to the very high percentage of silicon in these irons. In a foundry mixture, however, where the percentage of silicon would be only, say, 1·5 per cent. a small increase in sulphur would cause a marked increase in the amount of combined carbon, with a corresponding difference in the expected properties of the casting.

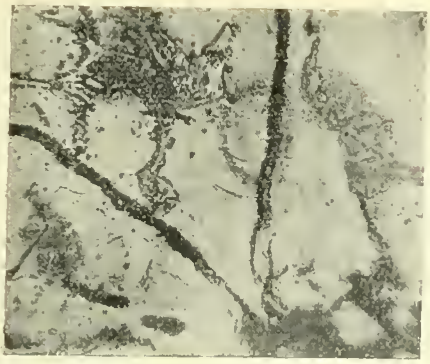
As an extreme example of glazing accompanied by high sulphur, Prof. Turner in his paper on "Silicon and Sulphur in Cast Iron" (J. I. & S. I., 1888, I., 41) refers to a specimen of glazy white iron which contained : silicon, 4·17 per cent. ; sulphur, 0·446 per cent. ; and which on remelting with blast furnace slag parted with more than half its sulphur, and gave silicon, 3·94 per cent. ; sulphur, 0·186 per cent.

The samples from the Islip Iron Co. were examined microscopically. The structure in all cases consists of three distinct constituents—graphite, silico-ferrite, *i.e.*, iron containing silicon, and phosphide eutectic or the eutectic of iron and phosphide of iron (Stead, "Iron and Phosphorus," J. I. & S. I., 1900, II., p. 120). The structures of samples 1 and 2 are similar to each other, but distinct from those of samples 3 and 4, which are also in themselves alike.

Open-grain Northampton iron (Sample 1).
Etched with 5 per cent. solution of nitric acid.
Vertical illumination, magnified 75 diameters.
Reduced by about one-third in reproduction.

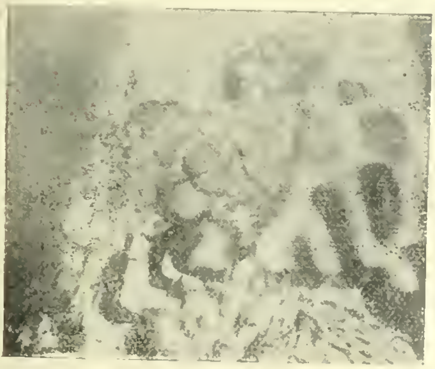


Glazed Northampton iron (Sample 3).
Etched with 5 per cent. solution of nitric acid.
Vertical illumination, magnified 75 diameters.
Reduced by about one third in reproduction.



Open-grained Northampton iron (Sample 1).
Etched with 5 per cent. solution of nitric acid.
Vertical illumination, magnified 300 diameters.
Reduced by about one-third in reproduction.

Glazed Northampton iron (Sample 3).
Etched with 5 per cent. solution of nitric acid.
Vertical illumination, magnified 300 diameters.
Reduced by about one-third in reproduction.



Open-grained Northampton iron (Sample 1), showing the ultimate cubical structure of the silico-ferrite.
Etched with 5 per cent. solution of nitric acid.
Vertical illumination, magnified 1,800 diameters.
Reduced by about one-third in reproduction.

amples 1 and 2 show large plates of graphite surrounded y silico-ferrite, and enclosing large areas, usually discon-ected, of phosphide eutectic. In samples 3 and 4 the raphite plates are much smaller, while the phosphide utectic appears to have a somewhat greater tendency to orm a continuous network. As has been pointed out, all ne analyses show that glazing is accompanied by high ulphur, and the microscope shows in addition that the raphite in glazed iron is very much smaller than in iron which is not glazed. The effect of sulphur in cast iron is to cause an increase in the amount of combined carbon, and to prevent the separation of graphite; but, as is seen from the analyses, the high percentage of silicon very nearly neutralises the effect of the sulphur as far as the amount of combined carbon is concerned. It is quite conceivable, however, that the sulphur may be the cause of the smallness of the graphite in glazed pig. Under favourable conditions a flake of graphite once formed continues to rapidly grow in size by further deposition of graphite on the small flake as nucleus, so that such an iron contains very coarse graphite. Under less favourable conditions when the iron is subject to some influence restraining the formation of graphite, *i.e.*, the influence of sulphur, the graphite, although it may be formed in equal quantity, will be of smaller size. In the same way the restraining influence of quick cooling leads to the formation of small graphite and in consequence a fine-grained fracture.

In some of the analyses given there is distinctly more phosphorus in the glazed than in the open samples. This increase of phosphorus in itself would probably have very little effect on the separation of the graphite (Stead, "Iron and Phosphorus," J. I. & S. I., 1900, II.), but the phosphorus compound being white and brittle might very well have an important influence in giving the distinctive fracture of glazed iron. It would seem probable, however, that the size of the graphite flakes is the determining factor in producing the glazed appearance, as in an open-grained iron with coarse graphite the fracture would have a greater tendency to pass along the large graphite plates instead of through the other part of the metal, whether silico-ferrite or phosphorus eutectic.

In a paper read before the Staffordshire Iron and Steel Institute in January 1904, Professor Turner describes some experiments made to determine the size of the graphite in cast iron. A comparatively large quantity (about 250 grms.) in the form of small lumps was taken in each case. The iron was then completely dissolved by hydrochloric acid and the residue oxidised with hot dilute nitric acid and extracted with caustic potash to remove silica. The graphite after being completely freed from iron and silica was then dried at 120° C., weighed and subdivided according to size by sieving.

The following results were obtained with No. 1 Northampton iron and with glazed Northampton iron.

—	No. 1.		Glazed.	
	Per Cent. of Original Pig.	Per Cent. of Total Graphite.	Per Cent. of Original Pig.	Per Cent. of Total Graphite.
Graphite left on 30 sieve.......	0·83	27·6	0·095	4·87
Graphite left on 60 sieve.......	1·37	45·5	0·341	17·23
Graphite left on 90 sieve.......	0·28	9·3	0·726	36·70
Passed through 90 sieve.......	0·53	17·6	0·815	41·20
	3·01	100·0	1·978	100·0

It will be noted that in the case of No. 1 Northampton iron, 73·1 per cent. of the graphite was too coarse to pass through the 60 sieve, while 77·9 per cent. of the graphite from the glazed iron was fine enough to do so—facts which very clearly illustrate the difference in size.

Cooling curves of the four samples from the Islip Iron Company were also taken (by the kind permission of Dr. T. K. Rose) in the laboratory of the Royal Mint. The curves gave four points of retardation of cooling, thus:—

—	R. I.	R. II.	R. III.	R. IV.
	° C.	° C.	° C.	° C.
Sampl 1	1128	1113	946	840(?)
" 2	1122	1114	935	868
" 3	1115	1091	955	852
" 4	1107	1093	935	837

Retardation I. is small and represents the commencement of solidification. Retardation II. is large and extends through a comparatively wide range of temperature (40 — 50° C.) It represents the solidification of the eutectic of graphite and iron (with silicon). Retardation III. is very sharp and distinct, and represents the solidification of the phosphide eutectic (Stead, J. I. & S. I., 1900, II., p. 116). Retardation IV. is faint in all cases.

Pure alloys of iron and carbon have an eutectic of 4·3 per cent. carbon with a melting point of 1130° C., but the irons examined, although only containing some 2·75 per cent. carbon are seen from the cooling curves to be of practically the eutectic composition. This, as is pointed out by Howe ("Iron and Steel and Other Alloys," p. 216), is the effect of silicon, and silicon in this respect may be considered as being equivalent to a certain amount of carbon (1 per cent. Si = 0·43 per cent. C). In the two close-grained irons (samples 3 and 4), the second retardation occurs at a distinctly lower temperature than in the open grained irons. This may be due to increase in phosphorus and sulphur as it is only in these two constituents that important differences are noted. In this connection it is interesting to note that Osmond and Werth, in a sample of Thomas pig iron containing 1·98 per cent of phosphorus, found that a retardation of cooling occurred at 1060°—1070° C. (Annales des Mines, 1888, July—Aug.).

The conclusions that may be drawn from the results given are :—

(1) The glazing of certain kinds of silicious irons is caused principally by an increase in the percentage of sulphur.

(2) The difference in the appearance of the fractures is due to the small size of the graphite plates in the case of glazed iron.

The author wishes to record his thanks to Prof. Turner for advice and suggestions in connection with this paper.

DISCUSSION.

Mr. G. J. **Ward** demurred to the statement that glazed iron was of less value than grey. It had given satisfactory results when the silicon was not used in excessive quantities. A badly grained glazed pig was invariably fine, but No. 2 iron might show signs of glazing. As to the effect of the sulphur in the case of the glazing, he was inclined to think that the author had confused cause and effect. Wedding, in his standard book on iron, said on page 171, "It seems certain that free SiO_2, when accompanied by no other mineral which can form slag with it, such as $CaCO_3$, tends to the production of iron rich in silicon, especially when the temperature is very high and there is much carbon present." The glazed iron was made when they had too high a burden, when the temperature of the blast was high, and by excess of fuel, and when they had got an acid slag. There was undoubtedly a tendency for the sulphur to get into the iron when the slag was acid, and these high sulphurs were due to the same cause as the glazing, and not the glazing due to the extra sulphur. Allen, of Sheffield, had given the following figures for Stanton glazed iron, silicon 4·50 per cent., sulphur 0·046 per cent. Percy in his experiments remelted pure kidney ore (69 per cent. Fe) with fine sand charcoal, heating strongly in covered crucible for 1½ hours. The resultant iron was hard, brittle, light grey, strongly crystalline, with aggregates of light flakes, in other words glazed iron. Turner, on page 198 "Metallurgy" expressed the opinion that bright crystals were silicides of carbon or of iron, and Carnot and Goutal (this J., 1898, 1150) said silicon irons containing a little manganese treated with 5 per cent. cold sulphuric acid leave a residue which consists of carbon, silicon hydroxide, and different combinations of iron and silicon. The hydroxides of iron and silicon are removed by potassium hydroxide. The manganese and iron are removed by sulphuric acid. The residue contains 19·75 to 19·86 per cent. of silicon and 79·63 to 79·84 per cent. of iron. $SiFe_2$ was a compound prepared by Moissan in an electric furnace. Glazed iron was, of course, rotten, and quickly broken, but he did not understand the argument that this was due to the smallness of the graphite flakes; No. 1 iron with large graphite was not nearly so strong as No. 4 with fine graphite. As to the effect of the phosphorus, if foundry iron were made in a blast furnace, all the phosphorus went into the pig, and the two samples of No. 1 iron must have been made from a somewhat different ore to the glazed. Whether this would increase the tendency to make glazed iron he did not know, but the author's statement about hæmatite iron pointed in that direction. His personal opinion was that glazed iron was due to the presence of $FeSi_2$, not to sulphur.

Mr. F. J. R. **Carulla** commented on the lightness of the samples of graphite extracted from pig iron which were exhibited. Including graphite, pig iron contained not far from 10 per cent. of substances other than iron, and taking into account their much lower specific gravity than that of iron, the volume of these impurities might be as much as 20 per cent. This fact might help one to understand the apparently great amount of impurity made visible by the photo-micrographs. The circumstance that sulphur influenced the size of the graphite in cast iron would seem an interesting point in connection with large castings, in which, owing to the necessarily slow cooling, the graphite would in any case be present in the large form. The small form of the graphite in chilled castings would possibly explain their being so much stronger than those that were not chilled.

Mr. O. F. **Hudson**, replying to the discussion, said that, so far as he had had to do with it, close-grained glazed iron such as was examined in connection with this paper always contained high sulphur. That glazing occurred with an acid slag was a fact worth noting, as such a slag favoured the production of iron high in sulphur. With regard to the weakness of glazed iron it was true that strong iron also contained low graphite, but in that case the metallic portion of the iron was comparatively strong, whereas in glazed iron it was brittle. He could throw very little light upon the question of the solubility of carbon in the sulphur in iron. The influence of sulphur on the carbon in cast iron was very powerful; it might be considered as having from 10 to 15 times the effect of silicon, and hence the importance that must be attached to small variations in the percentage of sulphur.

Yorkshire Section.

Meeting held at Bradford, on January 25th, 1904.

MR. JAS. E. BEDFORD IN THE CHAIR.

THE "DALITE" LAMP FOR COLOUR-MATCHING.

BY WALTER M. GARDNER AND A. DUFTON.

A new form of colour-matching lamp, the joint invention of Mr. A. Dufton and himself, was shown by Prof. Walter M. Gardner. It consists of an electric arc lamp surrounded by glass specially prepared to absorb the rays which the lamp emits in excess of those present in normal daylight. The variation in the apparent hues of objects due to illumination by lights of varying character is well known, and is of particular importance in connection with the accurate matching of colours, such as is required in dyeing, printing, painting, &c. The generally flat and lifeless appearance of pictures in artificial light is also due to this cause. In connection with chemical work the difficulty of performing, in artificial light, titrations in which coloured indicators are used is a matter of common experience. Hitherto no artificial light has been available in which all colours have the same appearance as when viewed in daylight, though the different forms of artificial light vary greatly in this respect. The greatest colour changes are brought about by ordinary gas or lamp light, or the incandescent electric light, all of which contain a large excess of yellow rays. while the violet end of the spectrum is almost entirely absent. The incandescent oil and incandescent gas light contain all the spectral rays, but the yellow is in considerable excess. The acetylene light is somewhat similar in character, the statement that this light affords a perfect colour-matching illumination being quite erroneous. The light produced by burning magnesium ribbon has a spectrum more nearly approximating to that of daylight. The light from electric arc lamps varies considerably in character, according to the kind of lamp used. In each case a portion of the light emanates from the glowing carbons, and this portion contains a considerable excess of red and yellow rays. Another portion of the light emanates from the arc itself, and this contains a considerable excess of violet and ultra-violet rays. The proper balancing of these separate portions of an electric arc light is of great importance in view of the production of a true artificial daylight effect, but in any case the light will contain an excess of rays from the red end of the spectrum. The problem involved in the production of a light suitable for colour work of all kinds does not consist merely in the production of a white light; such, of course, could be obtained by a combination of any two complementary lights, *e.g.*, red and green, but it s obvious that when viewed by a white light thus con-tituted many colours would appear unreal. For example, a blue or violet would appear black.

A perfect colour-matching light must contain all the pectral hues which are present in daylight, and in the same roportion. Taking an electric arc lamp of a special type s the most convenient basis, the spectrum of the light was carefully compared with that of normal daylight, and it was thus determined what rays were in excess. Means were hen devised for cutting off these rays, and eventually he problem was solved by the production of a special lass having the necessary absorption. The light of this olour-matching lamp, which is known as the "Dalite" amp, is precisely of the same character as that of good aylight from a north sky, and has the advantage over rdinary daylight of being perfectly uniform and unchangeble; whereas daylight itself varies not only from day to ay but frequently from minute to minute.

The lecture was illustrated by means of a set of coloured ntern slides; absorption spectra and many other colour fects being shown on the screen.

Meeting held at Bradford on April 18th, 1904.

MR. JAMES E. BEDFORD IN THE CHAIR.

STABILITY OF STANDARD SOLUTIONS OF POTASSIUM PERMANGANATE AND AMMONIUM OXALATE.

BY WALTER M. GARDNER AND E. NORTH.

A statement is often found in standard text books on analysis that a solution of potassium permanganate gradually becomes weaker on exposure to light, by slow decomposition of the salt; and that it is necessary on this account to re-standardise the solution at frequent intervals. In the course of some recent work involving the use of this reagent (see this J., 1903, 731), we found occasion to doubt the accuracy of this statement, and have, therefore, made experiments extending over a period of twelve months. These have established the fact that, both in the solid state and in solution, pure permanganate retains its strength if kept in well-stoppered bottles, even when exposed to light.

On March 30th, 1904, a solution of permanganate prepared from the specially purified salt described in the paper above referred to, was made decinormal by weighing, and the accuracy of the solution was confirmed by titration of pure ammonium oxalate and pure ferrous ammonium sulphate. On October 28th, 1903, *i.e.*, seven months afterwards, the factor of the solution was found by titration to be 0·997, and on April 15th, 1904, the same solution gave precisely the same factor. A similar N/10 solution of permanganate was prepared on October 28th, 1903, from the same lot of solid recrystallised permanganate of potash preserved during the seven months in a closely stoppered bottle. The solid permanganate had retained its original strength, and the second solution restandardised on April 15th, 1904, after an interval of six months, was again found to have the factor 0·997. The above results show that a solution of pure permanganate may be considered to retain its original strength for all practical purposes for at least 12 months if pure water is used in its preparation and the solution kept in a closely stoppered bottle; and it is not necessary to keep such a solution in the dark.

Similar experiments to test the stability of solutions of ammonium oxalate showed that in seven months in a closely stoppered bottle, the strength had diminished from 100 per cent. to 86·28 per cent., which agrees closely with the result previously obtained, and noted in our previous paper, that such a solution may be considered for practical purposes to be permanent for about a week, as it deteriorates at the rate of about 1 per cent. per fortnight. In the solid condition, we have determined that pure ammonium oxalate and pure ferrous ammonium sulphate retain their original strength undiminished for at least 12 months.

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Patent Specifications may be obtained by post by remitting as follows:—

English.—8*d.* each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois Paris (3ᵉ).

I.—PLANT, APPARATUS AND MACHINERY.

Air Compressors; Causes of Explosions in ——. E. Goffe. J. Mech. Eng. Assoc., Witwatersrand, 1904; through Eng. and Mining J., 1904, **77**, 686—687.

The author gives a detailed description of two cases of explosions in two-stage air compressors. He concludes that the principal cause of such explosions is the accumulation of dust in the interior of the valve-chambers, pipes, and receivers, which dust absorbs the excess of lubricating oil. The mixture produced in decomposing gives off explosive gases, which, under favourable circumstances, become ignited.—A. S.

English Patents.

Drying Machines; Cylindrical ——. J. R. Hatmaker, London. From J. A. Merrett, Paris. Eng. Pat. 13,907, June 22, 1903.

The invention refers to machines composed of one or more revolving heated cylinders upon which liquid materials are distributed in a layer or film, for the purpose of evaporating their contained water. The special improvement consists in the arrangement of the stripping knife, by means of which materials which are injured by overheating can be quickly and entirely removed from the surface of the cylinder. Parallel with the smooth drying cylinder of the machine a pivoted back-plate is arranged to serve as support to the stripping knife. This back-plate is mounted in bearings adjustable to the exact distance desired from the axis of the cylinder, and is held in position by means of screw-bolts freely attached to a fixed bar which forms part of the framework of the machine. The stripping edge of the knife is adjusted by set-screws arranged in a cover-plate, which is itself secured to the back-plate by which the stripping knife is carried.—A. G. L.

Filters. F. D. Marshall, Copenhagen. Eng. Pat. 15,948, July 18, 1903.

Rows of solid bars with doubly-inclined upper surfaces are arranged in the filtering mass, to divide it into prismatic layers, which become arched between two laterally adjacent supporting bars.—W. H. C.

Heating Substances in Retorts; Apparatus for Use in ——. C. W. Stanton, Mobile. Eng. Pat. 4139, Feb. 18, 1904

Describes the application of the device of Eng. Pat. 5791 of March 9, 1904 (this J., 1904, 538), to stills or metallurgical retorts.—W. H. C.

Furnaces. P. Jensen, London. From the White-Mylin Furnace Co., Brooklyn. Eng. Pat. 6855, March 21, 1904.

An outer horizontal metal cylinder, provided with a water jacket and a refractory lining is combined with an inner concentric cylinder of refractory material, perforated on its lower side and forming the combustion chamber. On the top of the outer cylinder is a circular opening, with sheet-iron covers, through which the fuel and air are fed to the furnace, and at one end of the cylinder is a door for the purpose of cleaning out ashes, &c. The inner chamber has an outlet for the hot gases at one end and a jet for producing and regulating the draught at the other. The heat generated in the combustion chamber can either be utilised there for heating crucibles, &c., or can be led to a steam boiler or other external means of utilisation.—W. H. C.

French Patents.

Minerals [Coal, &c.]; Washing of ——. M. Evrard. Fr. Pat. 337,234, Dec. 5, 1903.

The minerals are fed from a chute on to a bed, along which they are moved by an endless chain provided with scoops and passing over two rollers. Underneath the bed are a number of semi-cylindrical hollow cells, standing in the wash water, and connected through their lower ends with a pipe leading to a pump. Air is forced from the pump into the cells, and projected into the wash water, producing efficient stirring.—L. F. G.

Liquids under Pressure; Bottling ——. Filter u. Brautech. Masch. Fab. vorm. L. A. Enzinger. Fr. Pat. 338,188, Oct. 29, 1903.

A containing vessel is filled, half with the liquid and half with compressed air; at the bottom of the vessel is a tubular orifice, which fits over the neck of the bottle to be filled. A sliding tube works up and down vertically through this orifice, and is provided with openings in such positions that, when the tube is first depressed, compressed air is admitted to the bottle, and when it is lowered still further, the liquid runs into the bottle until it covers the opening by which the air has escaped. The sliding tube is then raised, thereby delivering the liquid which remains in it into the bottle until, at the highest point, all orifices are closed and the bottle can be removed.—J. F. B.

Hydraulic Press for Pasty Masses. Maschinenfabrik St. Georgen b. St. Gallen. L. von Süsskind, Ltd. Fr. Pat. 338,287, Dec. 3, 1903.

The mass to be compressed is placed in a chamber provided with a removable bottom, and pressed by the actio of a hydraulic press into a mould co-axial with it, latera motion being prevented by causing projections of the chamber to engage in guides fixed to the mould. The hydraulic press is single acting, the return stroke bein accomplished by the weight of the ram and platform whilst the mould is moved into position by means of a bel and screw-gearing.—L. F. G.

Calcium Chloride; Process and Apparatus for Employing —— *as a Drying Agent.* Comp. des Usines Nouvelle J. Yberty et Cie. Fr. Pat. 338,133, Dec. 28, 1903.

Mountain-flax, pumice-stone, or coke, is impregnate with calcium chloride and dried. The lumps are the placed on shelves arranged in parallel rows in a cupboar the substances to be dried being placed on similar parall shelves placed between the calcium chloride shelves. A is circulated over the calcium chloride, and then over t substances, drying them. The calcium chloride trays c be readily removed to be reheated when necessary.
—L. F. G.

Condensing and Aspirating Fumes; Apparatus for ——. R. McKnight. Fr. Pat. 338,154, Dec. 29, 1903. Under Internat. Conv., Jan. 5, 1903.

See U.S. Pat. 737,003 of 1903; this J., 1903, 1038.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Sulphur; Forms in which —— *occurs in Coal; their Calorific Values and their Effects upon the Accuracy of the Heating Powers, Calculated by Dulong's Formula.* E. E. Somermeier. J. Amer. Chem. Soc., 1904, **26**, 555—568.

By a number of determinations with two samples of pyrites, each containing 53·2 per cent. of sulphur, the author found that the calorific value of pyrites as determined in the Mahler calorimeter is 2637 cals. per grm., which is equivalent to 4957 cals. per grm. of sulphur as pyrites. Owing, however, to the different products of combustion of pyrites when burnt in a calorimeter and when burnt in air, 2042 cals. per grm. of sulphur must be deducted from the value found by means of the calorimeter. Thus, 4957—2042 or 2915 cals. represents the heat of combustion in air of 1 grm. of sulphur as pyrites, and consequently the value given in Dulong's formula, 2250 cals., is about 665 cals. too low, or 6·6 cals. for each 1 per cent. of sulphur present as pyrites. The oxygen being determined by difference in the ultimate analysis of the coal, the author calculates that if no allowance be made for the oxygen taken from the air to form ferric oxide with the iron of the pyrites, the results for hydrogen given by Dulong's formula will be 16·2 cals. too high for each 1 per cent. of sulphur as pyrites. Thus by applying Dulong's formula in the usual way, the net error will be 16·2 cals. − 6·6 cals., or 9·6 cals. too high for each 1 per cent. of sulphur as pyrites.—A. S.

Ethane; The Slow Combustion of ——. W. A. Bone and W. E. Stockings. Proc. Chem. Soc., 1904, **20**, 106—107.

(1) The proportions of ethane and oxygen most favourable to chemical change are equimolecular (1 : 1), although interaction takes place nearly as rapidly in mixtures containing ethane and oxygen in the ratio of 2 : 1. At all temperatures, ethane is oxidised much more rapidly than is methane, other conditions being equal.

(2) When ethane is treated with proportions of oxygen insufficient to oxidise the whole to carbon monoxide and steam, there is no preferential combustion either of hydrogen or carbon. In the absence of secondary phenomena, the interaction is always marked by a diminution in the pressure of the cold products without any deposition of carbon or liberation of free hydrogen.

(3) The combustion proceeds in several well-defined stages, among which the following have been distinguished:

(i) A primary oxidation to acetaldehyde and steam.

(ii) A further rapid oxidation of the acetaldehyde to formaldehyde, carbon monoxide, and steam.

(iii) The final oxidation of formaldehyde to carbon monoxide, carbon dioxide, and steam, which may best be considered as due to two simultaneous interactions (i) $CH_2O + O_2 = CO_2 + H_2O$, (ii) $2CH_2O + O_2 = 2CO + 2H_2O$.

(4) The combustion of the hydrocarbon may be accompanied by the following secondary phenomena:

(i) Hydrogen or methane, or both, may appear in the products without any liberation of carbon, as the result of he purely thermal decompositions of formaldehyde and cetaldehyde vapours respectively, the latter giving rise to methane and carbon monoxide, whilst the former yields ydrogen and carbon monoxide, although its decomposition s a more complex process than that of acetaldehyde.

(ii) Small quantities of ethylene and hydrogen may ppear in the products as the result of the thermal decomposition of ethane.

(iii) If the heat liberated during the initial stages of oxidation is sufficient to raise the temperature of the intercting gases to the ignition point, an explosion takes ace, during which the excess of hydrocarbon, and probably so of aldehyde vapours, is decomposed, carbon and hydrogen being liberated together with some acetylene and ethylene. There is no liberation of carbon below the ignition point.

(5) Although ethyl alcohol has not been detected among the oxidation products of ethane, its absence may be explained by the fact that it is oxidised far more rapidly than is ethane under similar conditions.

(6) The view taken of the mechanism of the combustion of ethane is supported by the experiments on ethyl alcohol and acetaldehyde.

English Patents.

Fuels; Artificial or Composite ——. G. C. Marks, London. From The International Fuel Co., Rutland. Eng. Pat. 3781, Feb. 15, 1904.

A mixture is made of coal dust or waste (bituminous or anthracite) with hydraulic cement and sea-water or a solution of common salt. Potassium carbonate and sodium benzoate may be added. It is claimed that the chlorine renders the combustion complete.—W. H. C.

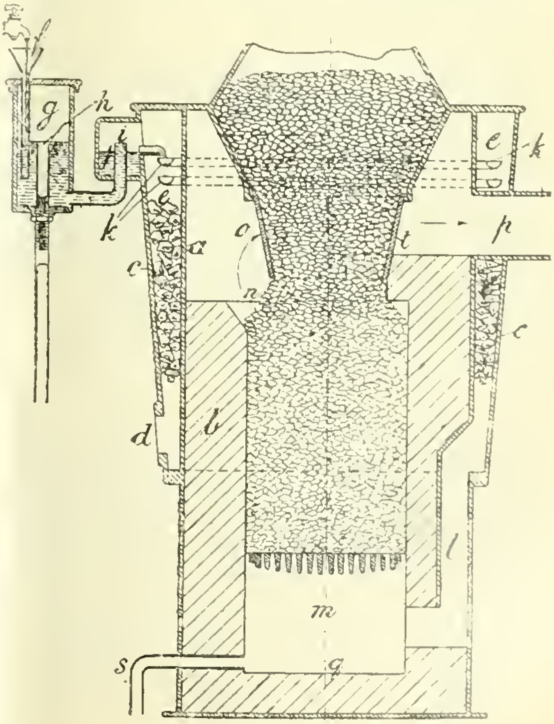
Cement [for Coal Briquettes]; Process of Making a Binding Agent or ——. L. Weiss. Eng. Pat. 4939, Feb. 29, 1904. IX., page 607.

Coke; Process and Apparatus for Quenching and "Bleaching" ——. W. P. Thompson, Liverpool. From E. A. Moore, Philadelphia. Eng. Pat. 6527, March 17, 1904.

See U.S. Pats. 755,154 and 755,155 of 1904; this J., 1904, 436.—T. F. B.

[Suction] Gas Generators. J. E. Dowson, London. Eng. Pat. 13,476, June 16, 1903.

The generator has two concentric casings, *a* and *c*, the space between which may be filled with pieces of iron or the like, which serve to heat the air supply drawn in at *d* by the suction of the gas engine. Water enters the chamber *g*, which has an adjustable overflow *h* and outlet *i*. The level in *g* can be regulated so that no water flows from *i* until the engine sucks. At each suction, water flows from



i into j, and then into gutters k or the like arranged in the upper part of the space e. By this means the quantities of air and steam drawn into the producer are regulated automatically by the requirements of the gas engine. The hot air, mixed with the steam, flows down the passage l to the space m, and thence up through the fuel, the gas produced being drawn off from n through the circular passage o and the pipe p. Any excess of water flowing on to the floor q is drawn off by the pipe s. The lower part of the fuel container, t, may be formed of a loose piece, to facilitate renewals.—H. B.

Gas-Retort Furnace. A. Deegen, Wittstock. Eng. Pat. 22,946, Oct. 23, 1903.

By means of flues arranged in the bottom part of the furnace, the lower air current required for the combustion is heated; and for the upper air supply, horizontal zigzag passages are formed in the pillars which support the arch of the furnace. These passages may be lined with boxes or pipes to prevent the access of cold air through cracks in the setting.—H. B.

Gas Producers. F. W. Paul, Harrogate. Eng. Pat. 14,893, July 4, 1903.

The producer is provided with orifices at different heights, throug hwhich the fuel is fed, and with blast-inlet and gas-outlet pipes both at top and bottom, to enable the direction of the blast to be reversed at will. In addition to the usual water-sealed ash-pit below, the producer is fitted at its upper end with a luted discharge, formed by a dome-shaped top, the lower edge of which rests in an annular water-pan surrounding the upper part of the producer. Thus the ashes which are carried up by the feeding of fuel from below fall over into the water-pan.—H. B.

Gas; Manufacture of ——. J. Y. Johnson, London. From Deutsche Continental Gasgesellschaft, and J. Bueb, Dessau. Eng. Pat. 15,147, July 8, 1903.

To obtain a higher yield of gas and a better utilisation of the heat in the distillation of coal, the carbonisation is conducted in vertical retorts and in two stages, during the first of which the distillation is effected as usual until the greater part of the coal has been carbonised, whereupon steam is passed up in a vertical direction from the bottom of the retort.—H. B.

Wood-Gas; Manufacturing ——. B. Loomis and H. Pettibone, New York. Eng. Pat. 6302, March 15, 1904.

A layer of coke is placed on the grate of a gas generator, which has a valved outlet pipe at its base. A charge of wood is placed on top of the coke and ignited, air being drawn downwards through the generator, so that the coke is brought to incandescence, and effects the reduction of the steam and carbon dioxide formed. In practice it is well to have two generators connected together by a pipe at the top. In order to prevent the coke from becoming choked with ash, &c., the outlet valve and the air inlet at the top of the generator are shut, and a blast of steam is injected upwards through the coke, thus cleaning it; the resulting gases are then drawn down through the incandescent fuel in the second producer, water-gas being thus produced.
—T. F. B.

Producer-Gas; Manufacturing ——. B. Loomis and H. Pettibone, New York. Eng. Pat. 6303, March 15, 1904.

Low-grade producer gas, obtained from peat, sawdust, garbage, pulverised fuel, or the like, is passed through a body of incandescent coal or coke, whereby a high-grade gas is produced. Steam, generated by the waste heat of the gases, is blown occasionally through the incandescent coal or coke to break up the clinker, the water-gas formed being mixed with the high-grade gas. The apparatus consists preferably of two generators, charged with the superior fuel, connected with each other and with two generators or fire-boxes, in which the inferior fuel is burned, the rich gas being cooled in a tubular economiser.
—H. B.

United States Patents.

Fuel; Smokeless ——. T. Weeple, Oakland. U.S. Pat. 759,783, May 10, 1904.

Soft coal is boiled with water in a tank, whereby it disintegrates and volatile matters are eliminated; it is then drained and dried.—L. F. G.

Carburetted Water-Gas; Apparatus for Manufacturing ——. W. R. Addicks, Brookline. U.S. Pat. 758,882, May 3, 1904.

The apparatus consists of a generator, a carburetter, and a fixing chamber arranged in series as usual. The oil supply for the carburetter is heated by flowing through a horizontal zigzag pipe, arranged within the pipe or flue which conducts the carburetted gas from the fixing chamber to the hydraulic main.—H. B.

Gas-Producer; Water-Seal ——. W. H. Holcroft, Assignor to E. V. Holcroft, Chester. U.S. Pat. 759,179, May 3, 1904.

A water-sealed producer is provided, within the ash-pit, with a blast-box having a closed top and sides, and having channels, open at the bottom, for the passage of the blast, the channels being submerged in the water of the seal.
—H. B.

Gas Condensing [Catalytic] Bodies; Process of Producing ——. A. Tissier, Paris. U.S. Pat. 759,406, May 10, 1904.

See Eng. Pat. 18,035 of 1900; this J., 1901, 1100.—T. F. B.

French Patent.

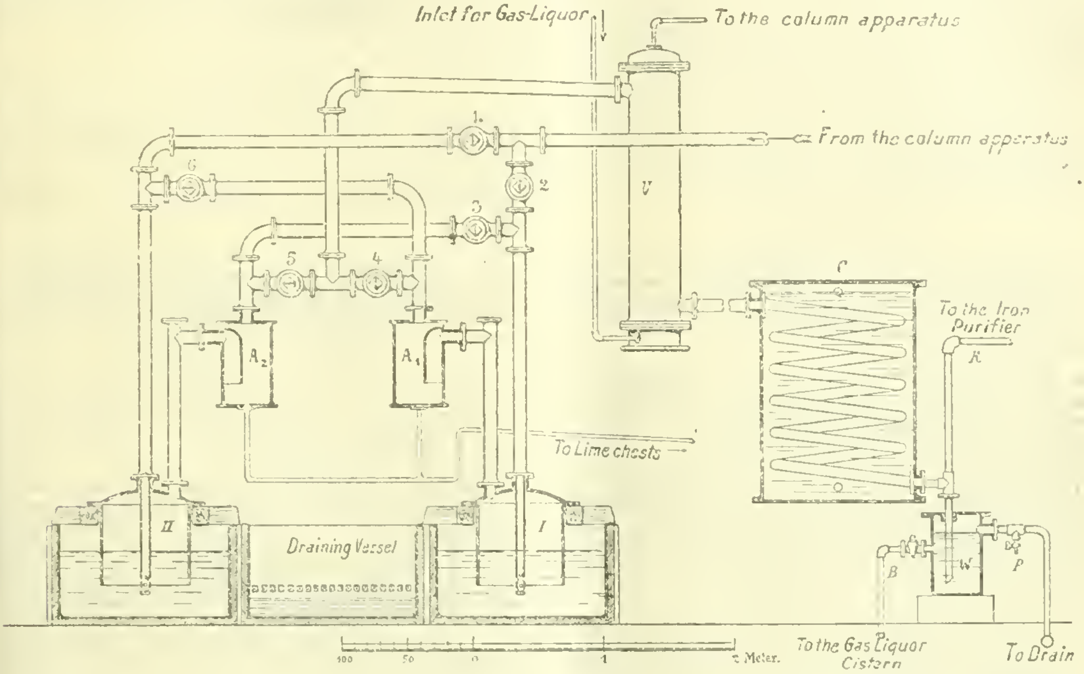
Alcohol; Carburisation of ——. F. Hache. First Addition, dated Dec. 18, 1903, to Fr. Pat. 334,783 of Aug. 22, 1903 (this J., 1904, 112).

Alcohol is mixed with the light hydrocarbons obtained by distilling crude petroleum, and with a smaller quantity of crude petroleum, and distilled, a little toluene or similar hydrocarbon being first added to the mixture. An alcohol of higher calorific power is thus obtained.—L. F. G.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Ammonium Sulphate [from Gas-Liquor]; Continuous Apparatus for the Manufacture of ——. M. Rosenkranz. J. Gasbeleucht., 1904, **47**, 459—460.

The accompanying diagram represents an apparatus for the manufacture of ammonium sulphate which has the advantage of being continuous in operation, and of retaining the last traces of ammonia in the gas coming from the liquor stills. The saturators are in duplicate, and the arrangement of cocks is such that either can be used alone or both employed in series. Starting with fresh acid in I and II, all the cocks are shut except 2 and 4; the ga then passes from I to the catch-vessel A_1, direct to th liquor heater V, &c. But as soon as a sample taken at I shows that some ammonia is escaping retention, cock 4 i shut, 5 and 6 opened (in the method actually shown by th sketch), so that the gas is compelled to bubble through th fresh acid in II. This goes on till the liquid in I is con pletely neutralised, when the cocks are altered to bring I alone into service. The crystals in I are then taken o and thrown into the common drainer; a new charge o acid is introduced, and I becomes ready to follow II by th time that the latter is approaching exhaustion. Thus th liquor distillation does not have to be interrupted every ti a saturator needs refilling. Should either I or II requ repair, any ammonia passing W may be recovered b causing the gas to pass through B into the liquor sto The number of cast-iron cocks in the apparatus is a defe for they become corroded and need frequent lubrication; but the economy in ammonia compensates for this. The author states that by the use of this plant he has increased his output from 0·63 or 0·65 kilo. of ammonium sulphate per 100 kilos. of coal to over 0·85 kilo.; while his daily make has increased from 312 to 502 kilos. per 24 hours.



he apparatus described by Feldmann (this J., 1903, 206) s mentioned.—F. H. L.

Distillation of Immiscible Liquids. E. Charabot and J. Kocherolles. XXIV., page 628.

English Patent.

eating Substances in Retorts; Apparatus for Use in ——. C. W. Stanton. Eng. Pat. 4139, Feb. 18, 1904. I., page 600.

IV.—COLOURING MATTERS AND DYESTUFFS.

-Substituted o-Nitrobenzaldehydes [*Indigo Derivatives*]. F. Sachs and E. Sichel. Ber., 1904, **37**, 1861—1874.

.4-Dinitrobenzaldehyde was converted by the authors
to its oxime, which yields on reduction *p*-amino-*o*-nitro-
nzaldoxime. F. Sachs and R. Kempf have already
own (this J., 1903, 1238) that on treatment with iron
loride and hydrochloric acid this yields *p*-chloro-*o*-nitro-
nzaldehyde. The authors obtain the hitherto unknown
romo-*o*-nitrobenzaldehyde in a similar manner by treat-
p-amino-*o*-nitrobenzaldoxime with ferric sulphate and
drobromic acid. They also obtain substituted indigos
m both the *p*-chloro- and *p*-bromo-*o*-nitrobenzaldehydes
condensing with acetone in presence of trisodium phos-
ate and heating the lactic-acid ketone so obtained with
lium carbonate solution. The dibromo-indigo obtained
this way closely resembles the similarly prepared
hloro derivative, and is much less blue than the product
ained by brominating indigo. Both *p*-chloro- and
romo-*o*-nitrobenzaldehyde are converted by the action
ight into the corresponding nitrosobenzoic acids. They
reduced by titanium chloride in hydrochloric acid
tion to the corresponding halogenaminobenzaldehydes.
-Dinitrobenzaldehyde yields with the same reagent
nino-*p*-nitrobenzaldehyde.—E. F.

Dinitrophenylethers of 3-chloro-4-aminophenol and of 4-aminophenol. F. Reverdin and A. Dressel. Ber., 1904, **37**, 1516—1519.

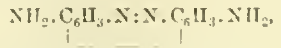
1.2.4-Chlorodinitrobenzene and 3.4-chloroaminophenol react in alcoholic solution in presence of sodium acetate to form the dinitrophenylether of *m*-chloro-*p*-aminophenol $C_6H_3(NH_2)Cl.O.C_6H_3(NO_2)_2$. In absence of sodium acetate chlorohydroxydinitrodiphenylamine is formed. If the 3.4-chloroaminophenol be replaced by its isomeride, the 2.4-derivative, a chlorohydroxydinitrodiphenylamine, is formed, whether sodium acetate is present or not. The dinitrophenyl ether of *m*-chloro-*p*-aminophenol is readily diazotised, and can then be coupled with the ordinary components, forming dyestuffs which are bright in shade but not fast to alkali. Dyestuffs of similar character are obtained from a sulphonated derivative of the dinitrophenyl ether. The dinitrophenyl ether of *p*-aminophenol was obtained by acting on acetylaminophenol with chlorodinitrobenzene and saponifying the product. This substance can be diazotised in the usual manner, and then yields azo-dyestuffs which are rather more stable to alkali than those obtained from the dinitrophenyl ether of *m*-chloro-*p*-aminophenol, but not sufficiently so to be of practical interest. Azo dyestuffs obtained from the sulphonic acid of this dinitrophenyl ether are quite unstable to alkali.
—E. F.

Triphenylmethane Dyestuffs, fast to Alkalis. C. Lauth. Comptes rend., 1904, **138**, 1220—1221.

The leuco bases obtained by the reduction of the products of condensation of *m*-nitro-benzaldehyde with dimethyl- or diethylaniline were heated with various reagents capable of substituting an acidic group for one of the hydrogen atoms of the amino group. The products obtained by the action of acetyl chloride or acetic anhydride and of benzene sulphonic chloride are described. These products, when converted into disulphonic acids and oxidised, yield blue dyestuffs fast to alkalis, similar to "Patent Blue."
—J. F. B.

3.8-Diaminodiphenazone. F. Fichter and P. Dieterle. Z. Farben- u. Textil-Chem., 1904, **3**, 157.

This compound is produced by the electrolytic reduction of dinitrobenzidine. If the latter be reduced with sodium sulphide, the phenazone-oxide is formed, which, on treatment with stannous chloride and hydrochloric acid, yields the diaminodiphenazone,



$$NH_2.C_6H_3.N:N.C_6H_3.NH_2,$$

which crystallises from water and alcohol in red needles. It combines readily with aldehydes; *e.g.*, heated with benzaldehyde in alcoholic solution, it gives dibenzylidenediaminodiphenazone, yellow plates m.p. 210° C. If the phenazone be diazotised and treated with sodium naphthionate, a dark red precipitate is formed which dyes cotton from a bath containing sodium carbonate in a shade of a more carmine colour than Congo Red. The nitrogen bridge in the ortho position to the bond coupling the two benzene nuclei increases the substantive character no more than the sulphone, imino, or methylene groups.—A. B. S.

English Patents.

Phenyl-glycine-carboxylic Acid Nitrile, and Intermediate Products relating thereto; Manufacture of—— [*Indigo*]. J. Y. Johnson. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. Eng. Pat. 14,676, July 1, 1903.

Anthranilic acid is warmed with aqueous formaldehyde solution. Equimolecular proportions of the two substances react to form a solid which is insoluble in dilute sodium carbonate solution. On treating this compound with hydrocyanic acid or a metallic cyanide, the nitrile of phenylglycinecarboxylic acid is formed. On treating the above-described solid condensation product of anthranilic acid and formaldehyde with a sulphite or bisulphite, the so-called bisulphite compound of methylene-anthranilic acid is formed, and can be converted, by treatment with a cyanide, into the nitrile of phenylglycinecarboxylic acid.—E. F.

Disazo Colouring Matters [*Azo Dyestuffs*]; *Manufacture of* ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. Eng. Pat. 10,536, May 8, 1903.

See U.S. Pat. 741,936 of 1903; this J., 1903, 1241.—T. F. B.

Dyestuffs of the Triphenylmethane Series; Manufacture of ——. H. E. Newton, London. From The Farbenfabr. vorm. F. Bayer and Co., Elberfeld. Eng. Pat. 13,192, June 12, 1903.

See U.S. Pat. 738,227 and Fr. Pat. 332,926 of 1903; this J., 1903, 1125 and 1290.—T. F. B.

United States Patents.

Glucoside Dye, and Process of Making same. F. J. Oakes, New York. U.S. Pat. 759,008, May 3, 1904.

Vegetable matter containing glucosides is extracted with water, carbon dioxide being injected "under such conditions as to ensure chemical combination." When logwood is thus extracted, haematoxylin carbonate is obtained as a reddish-brown crystalline substance, soluble in water, giving a neutral solution. It is oxidised to haematin carbonate "by application of atmospheric air."—T. F. B.

Azo Dye; Blue ——, *and Process of Making same.* K. Jagerspacher and T. Kröber, Assignors to Soc. Chem. Ind. in Basle, Basle. U.S. Pat. 759,284, May 10, 1904.

See Eng. Pat. 14,113 of 1903; this J., 1903, 1051.—T. F. B.

Tetrazo Dye [*Azo Dyestuff*]; *Violet* ——, *and Process of Making same.* K. Jedlicka, Assignor to Soc. Chem. Ind. in Basle. U.S. Pat. 759,613, May 10, 1904.

See Eng. Pat. 28,033 of 1903; this J., 1904, 319.—T. F. B.

Rhodamine Dye [*Pyrone Dyestuff*]; *Red Basic* ——, *and Process of Making same.* A. Bischler, Assignor to Basle Chemical Works, Basle. U.S. Pat. 759,657, May 10, 1904.

See Eng. Pat. 2738 of 1904; this J., 1904, 367.—T. F. B.

Azo Dyestuff; Red ——. P. Julius, Ludwigshafen, and S. Haeckel, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. U.S. Pat. 759,716, May 10, 1904.

By diazotising *o*-chloro-*p*-toluidine sulphonic acid and coupling with β-naphthol, a red dyestuff is obtained. Its sodium salt is soluble with difficulty in hot water, and its barium, calcium, aluminium, and lead salts are scarlet insoluble powders.—T. F. B.

French Patent.

Indigo; Purification of Natural or Synthetic ——. Badische Anilin und Soda Fabrik. Fr. Pat. 338,311, March 16, 1903.

See Eng. Pat. 7395 of 1903; this J., 1904, 248.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Mercerised Cotton; Increased Affinity of —— *for Dyestuffs and Mordants.* W. Schaposchnikoff and W. Minajeff. Z. Farben- u. Textil-Chem., 1904, **3**, 163—167. (See also this J., 1903, 903.)

Pieces of mercerised and unmercerised cotton were dyed in the same bath with a direct dyestuff containing several sulphonic groups, *e.g.*, Diamine Blue 3 B. The amount of dyestuff taken up was found by means of a sulphur estimation of the dyed patterns. The result showed that the unmercerised cotton required about 50 per cent. more dyestuff than the mercerised in order to dye it the same depth. Mercerised cotton absorbs about 40 per cent. more tannic acid than unmercerised. The results with chrome mordants were contradictory, but in the case of iron and manganese the unmercerised cotton took up more mordant than the mercerised.—A. B. S.

Calico Printing; Photographic Preparation of Rollers for ——. J. Wolkoff. Z. Farben- u. Textil-Chem., 1904, **3**, 158—163.

The photographs which have been taken through a ruled screen or grating are printed on to a chrome-gelatin paper which is then transferred to a carefully cleaned metal roller (molette). The paper and unaltered gelatin are removed by washing, which leaves the gelatin, rendered insoluble by exposure, on the roller. The latter is then etched with weak solution of ferric chloride until the weakest shadow are engraved to the correct depth. The roller is then wel cleaned, and the portions sufficiently engraved are coate with a varnish to protect them from further action. Th engraving process is repeated until the various shadows ar etched to their proper depth. In working with the three colour process it is important that the engraving on th three rollers be in the correct proportions to one anothe It is also possible that the three rollers may wear awa unevenly during the printing, and so alter the relativ amounts of the different colours in the picture.—A. B. S.

Hyposulphites [*Hydrosulphites*]: *Electrochemical Prep ration of* ——. K. Elbs and K. Becker. XI. A., page 61

English Patents.

Silk, Artificial; Manufacture of ——. E. Thiele, Barme Eng. Pat. 16,588, July 28, 1903.

See Fr. Pat. 334,507 of 1903; this J., 1901, 59.—T. F. B.

Dyeing under Pressure, Apparatus for ——. L. Dé Reims. Eng. Pat. 25,555, Nov. 23, 1903. Und Internat. Conv., Dec. 2, 1902.

See Fr. Pat. 326,806 of 1902; this J., 1903, 905.—T. F.

Printing Patterns upon Piece Goods, Paper, and the like. E. Schoening and The Carl Schoening Eisengiesserei und Werkzeugmaschinenfabrik Act.-Ges., Berlin. Eng. Pat. 10,802, May 12, 1903.

A "PATTERNING" roller serves to remove in parts the uniformly-spread layer of colour or ink from a smooth-surfaced printing roller. The two rollers then print upon the webs of tissue or sheets of paper which are continuously passed round the printing cylinders with which they are in contact. The "patterning" roller may be employed to transfer colour or ink to the colour- or ink-coated printing roller, and thus to modify in parts the intensity or shade of colour applied by the latter.—E. B.

White Discharges in Printing Fabrics and Discharges therefor; Process for Producing ——. O. Imray. From Farbw. vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine. Eng. Pat. 13,827, June 20, 1903.

A MIXTURE of a hydrosulphite-aldehyde compound as described in Eng. Pat. 5867 of 1903 (this Journal, 1904, 369), strong caustic alkali and a thickening agent is applied to the fabric. On steaming the fabric this acts as a powerful discharge, even towards mordant and basic dyestuffs such as Alizarin Red or a Safranine-azo-dyestuff.—E. F.

United States Patent.

Cotton-Seed Hulls or Cotton Waste; Process of Treating ——. H. F. Bockmeyer, Assignor to A. O. Granger, Cartersville. U.S. Pat. 759,800, May 10, 1904.

COTTON-SEED hulls, ground to a comminuted condition, cotton waste, &c., are first treated with a one to two per cent. solution of an alkali with live steam passing through the mixture. The material is drained, washed, and treated with chlorine gas in the presence of a one per cent. solution of a free alkali, until the agitated mass is decolorised and bleached. The material, after draining and washing, is subjected to the action of oxalic acid, or a reagent capable of reacting with the excess of chlorine present, and is then given a final washing.—B. N.

French Patents.

Hydrosulphite Compounds [with Aldehydes]; Process for Making ——, and their Use in Dyeing and Printing. Cie. Paris. Coul. d'Aniline. Fr. Pat. 338,385, March 20, 1903.

EE Eng. Pat. 5687 of 1903; this J., 1904, 369.—T. F. B.

Dyeing; New Process and Apparatus for ——. H. L'Huillier. Fr. Pat. 338,113, Dec. 12, 1903.

ULPHIDE dyestuffs which easily oxidise in the air, thus iving uneven results, are dyed in an atmosphere of some iert gas. The apparatus consists of a closed dye vessel onnected at the top with a gas generator, and at the bottom ith a reservoir which contains the dye solution. Steam used to clear the apparatus of air, and to force the dye olution from the reservoir into the dye vat. The gas to be ed is then drawn into the vat and remains there until the eration is finished. Indigo and similar dyestuffs can be ed by this process. The air is displaced by coal gas ring the dyeing, then oxygen is passed in to oxidise the ıcindigo.—R. S.

yeing Cotton Thread Several Colours; Process for ——. Soc. Anon. Teinturerie Clément Marot. Addition, dated Dec. 22, 1903, to Fr. Pat. 337,027, Nov. 26, 1903; this J., 1904, 440.

us addition states that first the outside only of the bbin is dyed with a mordant dyestuff and then the inside h a direct dyestuff, the latter being partially bleached l reduced as before. Textile fibres other than cotton, h as wool, silk, jute, ramie, &c., can also be dyed by this thod.—R. S.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

English Patent.

Printing Patterns upon Piece Goods, Paper, and the like. S. Schoening and The Carl Schoening Eisengiesserei u. Werkzeugmaschinenfabrik Act.-Ges. Eng. Pat. 10,802, May 12, 1903. V., next col.

VII.—ACIDS, ALKALIS, AND SALTS.

Hypophosphorous Acid; Preparation and Properties of ——. C. Marie. Comptes rend., 1904, **138**, 1216—1217.

Two methods of preparation are described:—(1) A solution of 300 grms. of barium hypophosphite, purified by precipitation by alcohol, are dissolved in 2 litres of boiling water and treated with a slight excess of boiling dilute sulphuric acid. The clear liquid is separated and the exact point of complete precipitation is established. The liquid is rapidly concentrated down to about 25 per cent. of acid by boiling, it is then filtered, and evaporation is continued under decreased pressure at 80°—90° C. in an atmosphere of carbon dioxide until the weight remains practically constant. The acid solidifies in a freezing mixture and melts at 12°—15° C.

(2) Sodium hypophosphite is powdered, dried at 100° C., and treated in a dry flask with the calculated quantity of concentrated sulphuric acid whilst cooling. After two days the mixture is treated with absolute alcohol (about 2 litres for 300 grms. of sodium salt), the sodium sulphate is filtered off and the solution is evaporated as above. By fractional crystallisations and thorough drying over phosphoric anhydride, the melting point of hypophosphorous acid may be raised to 26·5° C. The decomposition of hypophosphorous acid by heat takes place in two stages: At 130°—140° C. it is rapidly decomposed, forming phosphorous acid and phosphoretted hydrogen $3H_3PO_2 = 2H_3PO_3 + PH_3$. Towards 160°—170° C. the phosphorous acid is itself decomposed into phosphoric acid and phosphoretted hydrogen.—J. F. B.

Sodium Thiosulphate; Oxidation of ——. E. Sedlaczek. Phot. Corr., 1904, **41**, 158; Chem.-Zeit., 1904, **28**, Rep. 144.

POTASSIUM permanganate oxidises sodium thiosulphate to polythionic acids; whether in acid, neutral, or alkaline solution, the same amount of permanganate is used, but the nature of the ultimate products depends on the time during which they remain in contact with the precipitated manganese peroxide. Sodium silver thiosulphate gives with permanganate in neutral solution neither silver sulphide nor sulphate; in acid solution the silver is completely oxidised to sulphate.—J. T. D.

Potassium Thiocyanate; Action of ——, on Metallic Oxides at a high Temperature. J. Milbauer. Listy chemické, 1904, **5**, 113; Chem.-Zeit., 1904, **28**, Rep. 130.

THE following compounds were obtained by heating metallic oxides with pure potassium thiocyanate to temperatures between 200° and 1,200° C.:—From lead oxide: crystalline lead sulphide. Cupric oxide: crystalline cuprous oxide and $K_2Cu_8S_6$. Bismuth oxide: bismuth sulphide and $K_2Bi_2S_4$. Cadmium oxide: amorphous cadmium sulphide, and pearly flakes, probably $K_2Cd_3S_4$. Stannic oxide: stannic sulphide and potassium thiostannate. Molybdic oxide: molybdenum sulphide and potassium thiomolybdate. Trimanganic tetroxide: amorphous green manganous sulphide; once, at a very high temperature, flesh-coloured $K_2Mn_3S_4$. Chromic oxide: crystallised Cr_2S_3 and $K_2Cr_2S_4$. Ferric oxide: crystallised ferrous sulphide and $K_2Fe_2S_4$. Nickel oxide: $K_2Ni_{11}S_{16}$. Cobalt oxide: $K_2Co_{11}S_{10}$. Uranium oxide: uranium oxysulphide.—J. T. D.

Bleaching Powder; New Method for Technical Analysis of ——. U. Roberto and F. Roncali. XXIII., page 623.

Ammonium Sulphate [from Gas Liquor]; Continuous Apparatus for the Manufacture of ——. M. Rosenkranz, III., page 602.

Ferrous Salts; Conversion of —— into Ferric Salts for Volumetric Determination, or for Separation of Iron with Manganese. L. L. de Koninck. XXIII., page 624.

Carbon Dioxide; Rapid Method for the Volumetric Determination of ——. T. Macara. XXIII., page 625.

English Patents.

Zinc Hydrosulphite Difficultly Soluble in Water; Process for Producing Solid ——. C. Bollé, Manchester. From Chem. Fabr. Grünau, Landshoff und Meyer, Act.-Ges., Grünau. Eng. Pat. 9360, April 25, 1903.

See Fr. Pat. 331,095 of 1903; this J., 1903, 1130.—T. F. B.

Nitre-Cake; Utilisation of ——, and the Manufacture of Useful Products therefrom. G. E. Davis, Salford. Eng. Pat. 14,749, July 2, 1903.

Aluminous material, such as clay or bauxite, is added to a hot concentrated solution of nitre-cake, and the mixture is heated and agitated by high pressure steam. On cooling, a solid mass is formed, suitable for use in sewage precipitation, &c. But usually, the product is purified by solution filtration, and separation of the excess of sodium sulphate by crystallisation, after which, by suitable treatment, sodium alum is obtained.—E. S.

Magnetic Oxide of Iron; Production of Black ——. C. L. Parker, London. Eng. Pat. 6775, March 21, 1904.

Ferrous carbonate, in the form of spathic iron ore or otherwise, is subjected to a low red heat in air-tight vessels furnished with safety valves, for from 12 to 24 hours, when the vessels are allowed to cool thoroughly before being opened. The product is stated to be black magnetic iron oxide intimately mixed with carbon.—E. S.

Oxygen; Manufacture of —— by Means of Liquid Air. G. Claude, Paris. Eng. Pat. 16,298, July 23, 1903.

See Fr. Pat. 328,245 of 1903; this J., 1903, 950.—T. F. B.

United States Patent.

Sulphuric anhydride; Process of making [Contact Substance] ——. G. Lunge, Zurich, and G. T. Pollitt, Stanford le Hope, Assignors to Ver. Chem. Fabr. in Mannheim. U.S. Pat. 758,844, May 3, 1904.

The gases derived from roasting pyrites are passed, with air, over burnt pyrites, for which is afterwards substituted "new contact substance containing throughout a greater percentage of arsenic than fresh-burnt ore, formed by mixing the contact substance removed with fresh-burnt pyrites." The use of a contact substance consisting of a "metallic oxide" or of ferric oxide containing "5 per cent. or more of arsenic in all its parts" is also claimed.
—E. S.

French Patents.

Hydrochloric Acid and Sulphuric Acid; Process for the Production and Simultaneous Separation of ——. Consortium fur Elektrochem. Ind. First Addition, dated Dec. 16, 1903, to Fr. Pat. 335,496 of Aug. 24, 1903. See this J., 1904, 252.

Correction of a verbal error in the main patent.—E. S.

[Aluminous] Ores; Utilising Natural —— [for Production of Aluminium Sulphate]. F. Jooss. Fr. Pat. 338,387, March 21, 1903.

Certain more or less complex native aluminium silicates, which may contain calcium and magnesium, &c., but are practically free from iron, are digested with (for instance) sulphuric acid at a temperature above 125°—130° C. in order to dissolve the bases whilst leaving the silica in an insoluble condition. The solution of aluminium sulphate obtained may be purified by known means.—E. S.

Zinc Waste containing Ammonium Chloride; Utilising ——, Enriching such Waste, and Recovering the Ammonium Chloride. J. Celak and L. de Szczytnicki. Fr. Pat. 338,221, Nov. 26, 1903.

The zinc waste, containing, besides impurities, zinc oxide and zinc and ammonium chlorides, is powdered, mixed with milk of lime, and heated in a vessel with a condenser attached. The ammonia expelled is, preferably, conducted into solution of calcium chloride, which solution, when saturated, is treated with carbon dioxide under pressure. The solution of ammonium chloride thus obtained is freed from calcium carbonate, and is concentrated to obtain the crystallised salt. The zinc waste, deprived of ammonium salts as described, and now associated with calcium chloride, is washed free from the latter (which is utilised as stated) and dried for extraction of zinc metallurgically.—E. S.

Alkali Sulphates; Treatment of Native ——. E. Hildt. Fr. Pat. 338,328, Dec. 18, 1903.

The native sodium sulphate usually associated with calcium sulphate is dried, powdered, mixed with coke dust, and heated for some hours to about 800° C. in special inclined steel retorts fitted with travelling screws and various adjuncts, with arrangements for collection of the volatile products. Calcium and sodium sulphides are thus produced, with evolution of carbon dioxide. The double sodium and calcium sulphate similarly heated, but not mixed with carbon, is exposed to the passage of sulphuretted hydrogen, and yields the same fixed products, but with evolution of sulphur vapour and of sulphur dioxide, which are collected. The sodium and calcium sulphides produced by either or both of these processes, treated with water and carbon dioxide under pressure (obtained as described) supplies the hydrogen sulphide which is utilised in the second process; and the sodium bicarbonate obtained as one of the main products of the present process may be transformed into sodium carbonate by known methods.—E. S.

Zinc Sulphide; Chemical Production of ——, and Electro-Chemical Formation of Barium Hydroxide by the Simultaneous Regeneration of the Soluble Salt of Zinc. J. B. and A. Candau, jun. Fr. Pat. 338,322, Dec. 21, 1903.

Solution of barium sulphide is treated with zinc chloride to obtain barium chloride in solution and a precipitate of zinc sulphide. The filtered solution of barium chloride is electrolysed with the use of zinc anodes, to obtain in the anode compartments solution of zinc chloride, and in the cathode compartments, of barium hydroxide. The process is claimed for obtaining "all the metallic sulphides."
—E. S

Chloride of Calcium; Process and Apparatus for Employing —— as a Drying Agent. Comp. des Usines Nouvelle J. Yberty et Cie. Fr. Pat. 338,133, Dec. 28, 1903. I page 600.

VIII.—GLASS, POTTERY, ENAMELS.

Crystalline Glazes and their Application to the Decorati of Pottery. W. Burton. J. Soc. Arts, 1904, **52**, 595-601.

The author regards a glaze as a mixture in which th various silicates present play much the same part as th separate metals in a metallic alloy. With the same ultima composition, however, the particular silicates form depend largely on the temperature and duration of firin The glaze is also capable of acting on the material of t pottery, dissolving certain constituents; in any piece pottery there is an intermediate layer between the glaze a the clay, formed by their interaction. The more strong marked this layer is the less is the glaze liable to the defect known as "crazing" or cracking. If, during the firing, the glaze has become saturated with certain substances, *e.g.*, ferric oxide, either present in the clay or intentionally added to the glaze, these will tend to crystallise out on cooling, giving rise to crystalline glazes resembling the mineral aventurine. By allowing suitably shaped vessels to cool slowly, the natural flow of the glaze tends to arrange the crystals in lines, with their long axes in the direction of the lines of flow, a striated effect being produced. Similar effects are also produced with chromium and uranium oxides, the crystals produced being small hexagonal plates. The crystalline glazes produced on the hard-fired porcelains and stonewares made on the Continent, on the other hand, consist of ordinary felspathic glazes to which frits, consisting of trisilicates of zinc, or of zinc and potassium, have been added. On cooling, some of the silicates formed during the firing at approximately 1350° C., probably silicates of zinc, or of zinc and aluminium, separate out as radiating needle-like or starry groups of different colours. By adding copper oxide to the glaze, white effects are produced; cobalt oxide gives a "Cyanine" blue, and ferric oxide a yellow bronze colour, to the crystals. The author has applied the well-known property of leadless glazes of becoming opalescent or milky to the manufacture, at the comparatively low temperature of 1000° C. to 1030° C., of opalescent glazes of all colours and showing different striations; a certain amount of lead frit is added, as otherwise these glazes tend to bubble and blister in the fire. By combining these opalescent glazes with the crystalline glazes of the Continental type, he has also been able to obtain groups of starry crystals on a finely streaked, opalescent, and coloured background.—A. G. L.

English Patents.

Regenerative Steel Furnaces, Glass and Heating Furnaces, and the like. H. W. Henderson. Eng. Pat. 10,866, May 13, 1903, X., page 609.

Glass; Furnaces for the Manufacture of ——. R. W. Orrock, Hackney Wick. Eng. Pat. 13,110, June 11, 1903.

For finishing the necks of glass bottles and the like, a small fire-clay crucible is fitted to a glass tank furnace in any part where it will get sufficiently hot. One end of the crucible is built into a hole made in the side wall of the furnace or in the flues, and in this end of the crucible two small holes are left, into which is placed the neck of the bottle to be finished. Two separate flues are also constructed, one of which is brought over, and the other under, or one on each side of, an annealing chamber attached to the furnace.
—A. G. L.

Glass-ware; Manufacturing ——. J. I., C. V., F. J., P. R. and F. L. Arbogast, all of Pittsburgh. Eng. Pat. 20,679, Sept. 25, 1903. Under Internat. Conv., Sept. 30, 1902.

See U.S. Pat. 756,558; this J., 1904, 490.—A. G. L.

Earthenware Bodies, Hollow; Process of, and Hydraulic Appliances for, Producing ——. E. D. Delattre, Budel. Eng. Pat. 7766, April 2, 1904.

Earthenware crucibles, retorts, &c., are made by subjectng the clay to a preliminary compression within a suitable ylinder or vessel, whereby air is completely excluded from he cylinder and all fissures in the material are closed, after hich the said material is perforated by a compressor iston whilst still under the maximum pressure to which it as subjected during the preliminary compression. For rticles, such as zinc retorts, which are made from two ifferent superimposed materials, two concentric cylinders re employed, an annular space being provided between the vo cylinders to contain the one material, whilst the other placed inside the inner cylinder. The press for carrying at the process is also claimed.—A. G. L.

Enamelling Metallic Articles [Electro-plating]. W. Kenyon and S. Hobson, Sheffield. Eng. Pat. 14,219, June 27, 1903.

The interior surface of a hollow article is first electroplated with copper or gold, after which the enamel is applied as usual.—A. G. L.

Gilding [Glass, Porcelain, &c.] Surfaces. F. Herrmann, Rheingau. Eng. Pat. 14,910, July 4, 1903.

Coherent and reflecting layers of gold are produced on glass, porcelain and like surfaces by first covering the surface with a dilute alkaline solution of a gold salt containing a feeble organic reducing agent, to deposit an extremely thin and invisible film; and afterwards, by means of a gold solution and a strong reducing agent, depositing the final reflecting layer. A design may be formed by removing parts of the first very thin film of gold deposited, before depositing the second layer. The layer of gold produced as described may be transferred by aid of an adhesive material.
—E. S.

United States Patent.

Glass; Method of Blowing ——. M. J. Owen, Assignor to The Toledo Glass Co., both of Toledo. U.S. Pat. 759,742, May 10, 1904.

A mould is inserted into the molten glass, which is drawn into the mould by suction so as to form a finished portion and a body or blank, which is then blown in a mould to the finished shape whilst still plastic from its initial heat.—A. G. L.

French Patent.

Filter-Press Applicable to Earths and Clays. Mme. Vivien (*née* C. M. L. C. C. Forest). Fr. Pat. 338,176, Aug. 18, 1903.

The wet mass is placed on a fine cloth, metallic or otherwise, which is supported on a metal or wooden grating, and the air is exhausted underneath the cloth. A number of such filters may be combined, in any position, after the manner of a filter-press.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

English Patents.

Refractory Articles; Manufacture of ——. J. Bach, Riga. Eng. Pat. 4478, Feb. 23, 1904.

Pure aluminium hydroxide is mixed with 12 per cent. of quartz or 8 per cent. of fire-clay. The mixture is moulded, pressed, and burnt.—A. G. L.

Cement [for Coal Briquettes, Artificial Stone, &c.]; Process of Making a Binding Agent or ——. L. Weiss, Buda-Pesth. Eng. Pat. 4939, Feb. 29, 1904.

The binding agent, which is to be used for making coal-briquettes, artificial stone, &c., is made by decomposing mixed salts of calcium and magnesium in about equal proportions with sulphuric acid, or using the waste sulphates of calcium and magnesium produced in the carbonic acid industry, separating the solid from the liquid portions by pressing, drying the solid residue, igniting a portion of it at a red heat, grinding the ignited and the unignited portions together, and then mixing the product either with the liquid pressed out from the mixed sulphates, or with water or steam. This cement hardens within a few hours. The mixed sulphates may also be mixed with water and burnt magnesia or burnt dolomite added without any further treatment. Or a very thin solution of the mixed sulphates may be used alone as a binding agent.—A. G. L.

Cement and other Analogous Materials; Preparing and Burning ——. Levie Frères, Cronfestu. Eng. Pat. 7028, Mar. 23, 1904. Under Internat. Conv., March 30, 1903.

An intimate mixture is made of the material to be burnt with an inexpensive fuel, such as inferior coal-dust. The mixture may be directly placed in the kiln after drying, without other fuel if a "running" kiln is used; with an "intermittent" kiln a layer of large coal is first placed on the floor of the kiln.—A. G. L.

United States Patents.

Portland Cement Clinker, &c.; Method of Burning ——. T. A. Edison, Llewellyn Park. U.S. Pat. 759,356, May 10, 1904.

See Eng. Pat. 1404 of 1903; this J., 1903, 555.—T. F. B.

Portland Cement Clinker, &c.; Apparatus for Burning ——. T. A. Edison, Llewellyn Park. U.S. Pat. 759,357, May 10, 1904.

See Eng. Pat. 4735 of 1902; this J., 1903, 367.—T. F. B.

French Patent.

Drying Apparatus [Bricks, &c.] J. W. Aregood. Fr. Pat. 338,203, Nov. 17, 1903.

The bricks are placed on trucks standing on rails inside the drying chambers. These are provided with sliding doors at the back, and hinged doors in front, and communicate by channels in the sole, with a main air channel, constructed so as to decrease in width from the first to the last chamber. Hot air from the brick furnace, mingled with fresh air, is blown into the main air channel, the admission into each drying chamber being regulated by a damper.—L. F. G.

X.—METALLURGY.

Steel and Iron Castings; Influence of Varying Casting Temperatures on the Properties of ——. P. Longmuir. Iron and Steel Inst., May 1904.

Cast-Iron.—Preliminary experiments showed the great influence which casting temperature exercised on the tenacity of cast-iron. Starting with a metal cast at a very high temperature, the tenacity gradually rises as the temperature falls, until a "fair" casting temperature is reached; from this point the tenacity falls with the casting temperature. The influence of casting temperature remains very clearly marked after annealing. The following were some results obtained with iron as cast:—

Iron.	Casting Temperature.	Max. stress in Tons per Sq. In.
	° C.	
White	1,320	10·7
	1,230	15·9
	1,120	12·1
Grey	1,400	9·7
	1,350	14·1
	1,245	10·6

Other specimens of cast-iron of varying compositions gave similar results to the above.

Steel.—Mild steels are not easily overheated in the crucible furnace, and no striking example of excessive casting temperature was obtained, although the influence is quite apparent, and similar to that in the case of cast-iron. Steel poured at "fair" to "low" temperatures showed a decrease of elasticity as the casting temperature decreased, and very large decreases in the elongation and contraction of area. A sample of steel high in sulphur gave results quite comparable with those from a steel of normal composition. No correlation has at present been established between casting temperature and density of iron and steel. The results of a microscopic examination tend to show that the influence of casting temperature is exerted on the crystal junctions, since a "fair" casting temperature favours a stronger type of internal cohesion. (See also this J., 1903, 1089.)—T. F. B.

Pig-Iron; Manufacture of —— from Briquettes at Herräng. H. Louis. Iron and Steel Inst., May 1904.

The Herrang mining property is situated on the Baltic coast of Sweden, about 60 miles north of Stockholm. The ore consists of a somewhat granular magnetite, containing 35 to 40 per cent. of iron as magnetite, 1 to 1·5 per cent. of sulphur, and usually less than 0·005 per cent. of phosphorus. The ore is broken, crushed wet, and the magnetite removed in a magnetic concentrator; it is then stored for a week, and stamped into briquettes of 6 × 6 × 3 ins., and weighing about 10 lb. each, in drop presses. There are two such presses, requiring 3 h.p. each, and turning out 8—12 briquettes per minute. The briquettes are loaded on cars, which hold about 15 cwt. each, and are then burnt in a long horizontal furnace. This process has the result of removing practically all of the sulphur, the finished briquettes containing about 63 per cent. of iron, 0·01 per cent. of sulphur, and 0·002 per cent. of phosphorus. The briquettes are then broken into pieces of a size convenient for the blast furnace, where they are smelted for high-class pig-iron, charcoal being the fuel used. The waste gases from the blast furnace fire the briquetting furnace, and supply gas engines which furnish the blast and also drive dynamos, which furnish the power for the concentrating works and for the mines.—T. F. B.

Iron-Carbon Alloys; Range of Solidification and Critical Ranges of ——. H. C. H. Carpenter and B. F. E Keeling. Iron and Steel Inst., May 1904.

The authors determined the exact melting points of iron and iron-carbon alloys, ranging from pure iron to white iron containing 4·5 per cent. of carbon; and also investigated all the evolutions of heat in the alloys from the beginning of solidification down to 500° C. The results obtained confirm, broadly speaking, those set out in Bakhuis-Roozeboom's paper (this J., 1900, 1016, 1154), but indicate that Roozeboom's diagram (this J., 1900, 1017, Fig. 2) should be modified as follows:—(1) The melting point of iron is about 1,505° C.; (2) A B is a smooth curve, slightly convex upwards; (3) *a* B is not a horizontal line, but rises from *a* to B; (4) S E may be represented quite as well by a straight line as by a curve; (5) P K is not a straight line, but rises from P to K. The authors also state that probably the diagram will be amplified in certain parts when the equilibrium between the various phases has been more fully studied, *viz.*, on account of:—(1) The small evolutions of heat observed at about 796° C. with alloys containing from 0·8 to 4·5 per cent. of carbon; (2) The slow thermal change at about 600° C. found over the whole range of alloys; (3) The evolutions of heat observed at about 900° C. with the alloys containing 3·87 and 4·50 per cent. respectively of carbon.—A. S.

Troostite. H. C. Boynton. Iron and Steel Inst., May 1904.

The view most generally held as to the nature of troostite appears to be that it is an intermediate or transitory form between martensite and pearlite. The author concludes, however, from a micrographic examination of a steel containing 0·51 per cent. of carbon, that troostite is a form of iron, free from carbon, probably β-iron, which separates from the martensite on cooling, and which, during the retardation, is converted into ordinary ferrite or α-iron. The fact that in the slow cooling of over-saturated carbon steel, the author could detect no formation of troostite is in accord with this view. Osmond and Le Chatelier have stated that troostite may be found in an over-saturated steel but in the author's opinion they have mistaken sorbite for troostite.—A. S.

Constituents of Steels; Classification in Chemistry, an its Application to the ——. H. Le Chatelier. Rev Metall., 1904, **1**, 207—225.

The author shows that, apart from chemical compositio the constituents of steels may be regarded from thre quite distinct points of view, and allow of three differe methods of classification:—(1) The homogeneous constituents or phases, corresponding to the minerals containe in rocks; (2) the constituents of aggregation, correspondin to the rocks themselves; and (3) the constituents structure, corresponding to the somewhat vague distinctio sometimes drawn between rocks of amorphous, crystalli and schistose texture.—A. S.

Irons and Mild Steels; Modes of Deformation and of Rupture of ——. F. Osmond and C. Frémont. Rev. Metall., 1904, **1**, 198—206.

The authors discuss the practical conclusions to be deduced from their previous work on this subject (this J., 1903, 1350).
—A. S.

Gold; Melting Point of ——. D. Berthelot. Comptes rend., 1904, **138**, 1153—1156.

By the help of formulæ which he had previously worked out, the author has calculated the values on the absolute scale of temperature of the determinations of the melting point of gold made by himself (1898), Holborn and Day (1900), and Jacquerod and Perrot (1904). They work out respectively to 1065°·6, 1064°·3, and 1067°·4 C. The two later determinations do not differ from the author's figure by so much as the probable error ($\pm$ 2°) which he estimated at the time to attach to his determination.
—J. T. D.

Copper Ores; Smelting of poor —— containing Sulphur, Arsenic, and Antimony by the Bessemer Process, without Fuel. A. Torkar. Oesterr. Z. Berg- u. Hüttenw., 1904, **52**, 175. Chem.-Zeit., 1904, **28**, Rep. 142.

A basic-lined cylindrical furnace is used, into which the ore, mixed with acid flux, is continually fed through a rotating cylinder, in which it undergoes preliminary heating by the waste gases of the furnace. The slag is removed continuously through an overflow pipe, and the enriched ore also overflows continuously into a smelting hearth adjoining the cylindrical converter. Provision is made for a thick covering of slag above the bath, and the wind is brought in underneath this slag over the surface of the bath. The heat generated by the combustion of the ore is then sufficient to keep the process going, even with ores so poor that they will not pay for any preliminary preparation.
—J. T. D.

Tin-Aluminium Alloys. H. Pécheux. Comptes rend., 1904, **138**, 1170—1171.

A filed rod of tin-aluminium alloy, plunged in cold water, gives off for some minutes bubbles of gas, composed of hydrogen and oxygen in explosive proportions. An unfiled od, or a filed rod of either component, is without action, hough the unfiled rod of alloy will act on boiling water. The filed rod of alloy, in faintly acid solution of copper r zinc sulphate, becomes covered with a deposit of copper r zinc, whilst bubbles of oxygen are given off. The author upposes that the metals are truly alloyed only at the urface, and that filing lays bare an almost infinitely umerous series of junctions of the two metals, which, eated by the filing, act as thermo-couples.—J. T. D.

Pyrometers suitable for Metallurgical Work. Report by R. A. Hadfield, J. E. Stead, and B. H. Brough. XXIII., page 623.

Explosions produced by Ferro-Silicon. A. Dupré and M. B. Lloyd. XXII., page 622.

yanogen [Cyanides for Gold Extraction]; Volumetric Determination of ——. J. McDowall. XXIII., page 624.

ilver [in Silver Alloys]; Proposed Modification of Volhard's Method of Determining ——. C. Hoitsema. XXIII., page 624.

Tin; Assay of ——, and Solubility of Cassiterite. J. H. Collins. XXIII., page 624.

English Patents.

rmour Plates and Projectiles; Manufacture of ——. F. C. Fairholme and J. E. Fletcher, Sheffield. Eng. Pat. 1850, Jan. 26, 1903.

he object of the invention is to produce armour plate and er steel articles having one side or portion very hard, d the other side or portion of a softer or tougher character. Articles made of certain steel alloys, such as those with chromium and tungsten, are strongly heated, cooled rapidly, as by an air-blast, re-heated to a certain lower temperature than before, and cooled more slowly; in this condition they can be readily worked. Then the face or side of the shaped article to be hardened is strongly heated and rapidly cooled, as in the preceding first operation, whilst the other face or side is treated as in the second operation. In some cases the face or portion of the article to be hardened is heated in contact with carbon, boron, tungsten, molybdenum, or vanadium; or with an alloy of chromium, molybdenum, and carbon, followed by the described treatment.—E. S.

Steel; Manufacture of ——. J. Vernon, Newton Stewart. Eng. Pat. 1966, Jan. 27, 1903.

A mixture of ferro-manganese with small proportions of aluminium, broken glass, porous earth, and kelp, is placed in the ladle before the steel is tapped into it, the object being to act on the steel mechanically and chemically, to increase its density, and remove impurities.—E. S.

Regenerative Steel Furnaces, Glass and Heating Furnaces, and the like. H. W. Henderson, Glasgow. Eng. Pat. 10,866, May 13, 1903.

The invention relates to means for the admission and regulation of gas and air to furnaces in such manner as to be capable of alternate reversal. The entering gas passes through a mushroom or similar lift valve (having spindle and counterpoise) into a chamber, the top of which is fitted with two semicircular hinged lids, provided with fire-clay flanges. The chamber has a hinged lower door and a side trap-door for the removal of soot, and the gas passing these traverses one or other of a pair of oppositely inclined flues, into a vertical chamber, having hinged soot-doors, which also act as safety-valves for exit of air, the chamber being provided with a "duplex mushroom valve," covering a port in a lower casing to the main gas flue. Air is admitted through another similar valve, suitably placed in reference to the gas and regenerative chambers. The duplex-shaped mushroom valves may be formed hollow, means for filling them with water or other liquid being described. Dampers are also made hollow and are similarly cooled. The arrangements for the circulation of the gases throughout, and for discharge of the waste gases, after utilising their heat, are described and shown in detail, as well as means to prevent destruction of the gas-valves when the furnaces are not working.—E. S.

Iron and Steel; Manufacture of —— from Chromic Pig Iron or the like. O. Massenez, Wiesbaden. Eng. Pat. 14,361, June 27, 1903.

See Addition, of July 1, 1903, to Fr. Pat. 329,132 of 1903; this J., 1903, 1353.—T. F. B.

Scrap Sheet Steel; Treating ——, and Recarbonising the same. H. B. Atha, East Orange. Eng. Pat. 2187, Jan. 28, 1904.

Scrap sheet steel is prepared for remelting in an open-hearth furnace, by intimately mixing it with finely-divided carbon, and making up the mixture into bundles or sacks; or the carbon is placed in bags, which are compressed into bundles with the steel; or the scrap is treated with the carbon diffused in a liquid, so that the carbon may adhere to the scrap on withdrawing the liquid; or the scrap and carbon are combined in other ways. The mixture of steel scrap and carbon thus formed into bundles or parcels, is heated, with or without additional unprepared steel scrap, to a sufficiently high temperature to occasion absorption of the carbon.—E. S.

Furnaces for Melting Metal. A. H. Oakley, Millbury. Eng. Pat. 14,646, July 1, 1903.

The crucibles containing the metal to be melted are set in covered ovens placed in succession on the same level, and communicating with one another and with a horizontal flue leading to the stack. In a recess in the transverse wall in front of the ovens a combination of open, triangular, superposed iron troughs is placed, communicating by vertical overflow pipes, into which troughs oil, or other liquid fuel, is fed in regulated quantity. The oil is ignited in the troughs, and the flames are carried by the air draught into a mixing chamber, from the top of which additional air is admitted, regulated by a sliding cover, and the heated gases pass downward into the lower part of the first oven, thence into the upper part of the second oven, and downwards from the same into the flue.—E. S.

Zinc and other Sulphides; Extracting —— from their Ores. G. C. Marks, London. From G. D. Delprat, Broken Hill. Eng. Pat. 27,132, Dec. 11, 1903.

Ores of zinc, lead, and silver sulphides, in a finely-divided state, are fed into a bath of solution of sodium chloride, to which a certain small proportion, varying according to the nature of the ore, of dilute sulphuric acid is added. The scum, carrying sulphides, which rises to the surface, is skimmed, or brushed, or arranged to flow off. Compare Eng. Pat. 19,783 of 1903; this J., 1903, 1247.—E. S.

Alloys or Compounds; Metallic ——. A. Jacobsen, Hamburg. Eng. Pat. 27,516, Dec. 15, 1903.

See Fr. Pat. 338,415 of 1903; following these.—T. F. B.

Cupels; Manufacture of ——. The Morgan Crucible Co., Ltd., and J. C. Fox. Eng. Pat. 1695, Jan. 22, 1904. XXIII., page 623.

Heating Substances in Retorts: Apparatus for use in ——. C. W. Stanton. Eng. Pat. 4139, Feb. 18, 1904. I., page 600.

United States Patents.

Iron or Steel; Process of Producing —— direct from Ore. W. M. Brown and D. Reynolds, Albany. U.S. Pat. 759,590, May 10, 1904.

A mixture of granulated iron oxide with granulated carbonaceous matter, is heated, with continuous agitation, by waste products of combustion only, until the ore is reduced and the iron carbonised. A flux is then added, and the mixture is heated "from an initial source of heat," until the iron is fused. The "waste products of combustion" used in the first part of the process are derived from the "initial source of heat."—E. S.

[Precious] Metals; Method of Recovering —— from Solutions. J. Anderson, Prescott, Assignor to M. Scanlan, Whitehills. U.S. Pat. 759,493, May 10, 1904.

Gold and silver are recovered from solutions containing iron or copper by addition of lime, with thorough agitation. —E. S.

Copper Ores; Process of Treating ——. C. H. Rider, St. Louis. U.S. Pat. 759,191, May 3, 1904.

Crushed copper ore and a solvent (which may be composed of water, sodium chloride, and nitric acid) are placed in a series of closed vessels, so connected that the gases liberated may pass from the top of each vessel to the bottom of the next vessel of the series, and the last vessel is connected to the first of a second series of similar connected vessels on a lower level, charged with the clear solution of the ore derived from the former vessels, the copper from such solutions being precipitated, for instance, by metallic iron, the operation being aided by the continuous passage of the gases therethrough, and back, through valved connections, to the first series of vessels. —E. S.

Copper-bearing Ores; Method of Treating —— with Cyanide Solutions. L. E. Porter, Los Angeles, Assignor to J. J. Seeman, Barstow. U.S. Pat. 759,220, May 3, 1904.

The ore is subjected to the action of an alkaline cyanide solution, and in case precious metals are present, these are precipitated by zinc, and separated from the solution, which is then treated with an acid. The copper cyanide thus precipitated is removed, and the solution of hydrocyanic acid is neutralised by an alkaline hydroxide, to produce an alkali cyanide for re-use. The copper cyanide precipitate, mixed with solution of an alkaline hydroxide, is electrolysed to recover an alkaline cyanide solution, with separation of metallic copper.—E. S.

Copper Ores; Reduction of ——. E. P. Clark, New York, Assignor to E. Baltzley, Glen Echo. U.S. Pat. 759,670, May 10, 1904.

The powdered ore is washed with water containing sulphuric acid and ferrous sulphate, to extract the soluble contents. The residue is then "oxidised," after which it is leached as before.—E. S.

Lead-bearing Ores; Process of Treating ——. C. H. Rider, St. Louis. U.S. Pat. 759,192, May 3, 1904.

The apparatus used is identical with that described in U.S. Pat. 759,191 (see preceding abstract but two). "Water and nitric acid" are named as used to act upon the finely-divided lead ore. The precipitating agent specified is sodium bicarbonate; and the gases generated are circulated as in the previous case. White lead is precipitated in the second series of receptacles.—E. S.

Separating Apparatus [for Ores] Magnetic ——. T. A. Edison, Llewellyn Park. U.S. Pat. 759,358, May 10, 1904.

See Eng. Pat. 14,355 of 1900; this J., 1901, 998.—T. F. B.

Metallic Chromium; Method of Making ——. A. K. Eaton, Assignor to H. M. Eaton, New York. U.S. Pat. 759,424, May 10, 1904.

A reducing agent, such as powdered animal charcoal, and a suitable binding substance, are made up into solid cakes with "the chromite of a readily volatilisable base," such as zinc chromite, and the cakes are heated so as to volatilise the zinc or other volatile base and leave metallic chromium.—E. S.

Alloy. S. Kneppel, Scranton. U.S. Pat. 759,617, May 10, 1904.

The alloy is composed of from 5 to 7 parts of aluminium, 1 part of zinc, and 2 parts of "Babbitt" metal; the latter containing 96 parts of tin to 8 parts of antimony and 4 parts of copper, all by weight.—E. S.

Metals; Apparatus for Separating —— from their Crushed Ores or Materials containing same. W. N. Turner, Ipswich. U.S. Pat. 759,775, May 10, 1904.

See Eng. Pat. 12,778 of 1903; this J., 1904, 493.—T. F. B.

French Patents.

Steel and Iron; Manufacture of ——. B. Talbot and P. Gredt. Second Addition, dated Dec. 1, 1903, to Fr. Pat. 324,448 of Sept. 15, 1902. See this J., 1903, 559 and 634.

Pig iron containing too much phosphorus for the Bessemer process, and insufficient phosphorus for the Thomas basic treatment, is not completely removed after each treatment in the converter, but to the phosphatic slag there is added a new portion of the ore to be converted. Thus, the silicon in the cast-iron is, to a certain extent, replaced by phosphorus from the slag, whereby the metal becomes fitted for the Thomas process. The yield of steel is increased by the presence of iron oxide in the slag. (See also U.S. Pat. 747,662 of Dec. 22, 1903; and U.S. Pat. 749,115 of Jan. 5, 1904; this J., 1904, 66 and 119.)—E. S.

Cementation; Processes of ——. C. Lamargese. Fr. Pat. 338,199, Nov. 16, 1903.

Plates or other articles of iron or steel are cemented by heating them in contact with a mixture of carbon produced from the bark of the wild pine tree (or from other resinous substances) and of finely-divided silica. Or, less advantageously, a mixture of ordinary wood charcoal with lamp black and silica may be used.—E. S.

Metals; Obtaining New Combinations of ——. A. Jacobsen. Fr. Pat. 338,415, Dec. 21, 1903.

An alloy is formed by fusing together, in quantities proportional to their atomic weights, copper, aluminium, zin and silicon. The silicon may be replaced by nickel or by silicious earth. To form a bronze, variable proportions of either of the stated combinations is fused with copper and aluminium.—E. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Anodes of Tin, Antimony, and Bismuth; Behaviour of ——. K. Elbs and H. Thümmel. Z. Elektrochem., 1904, **10**, 364—367.

Tin, when used as anode in solutions of sodium chloride, sodium sulphate, hydrochloric and sulphuric acids under varying conditions of temperature, concentration, and current density, always enters into solution chiefly as the divalent salt. With antimony, only sodium chloride and hydrochloric acid are suitable electrolytes, and in these cases the metal passes in the trivalent form into solution. Bismuth behaves similarly to antimony and gives trivalent salts.—R. S. H.

Hyposulphites [*Hydrosulphites*]; *Electrochemical Preparation of* ——. K. Elbs and K. Becker. Z. Elecktrochem., 1904, **10**, 361—364.

The authors have attempted to make use of electrolysis for the reduction of bisulphites—

$$2NaHSO_3 + 2H = Na_2S_2O_4 + 2H_2O.$$

Dilute solutions can be prepared with a good yield, but for concentrated solutions the chemical reduction with zinc is preferred. The chief cause of the low yield with more concentrated solutions is ascribed to the formation of thiosulphates, $Na_2S_2O_4 + 2H = Na_2S_2O_3 + H_2O$. The claims of A. R. Frank (Ger. Pat. 125,207; this J., 1902, 51), are said to be incorrect, since neither the calcium nor magnesium salts could be prepared in the solid state by electrolysis as proposed. The electrolytic process for hyposulphites, when applied directly to the indigo vat, is said to be advantageous, since here the hyposulphite, as soon as formed, reduces the indigo, and can be constantly regenerated at the cathode. —R. S. H.

Copper; Quantitative Electrolytic Precipitation of ——. T. W. Richards and H. Bisbee. XXIII., page 624.

Chloroform; Electrolytic Preparation of —— *from Acetone.* J. E. Teeple. XX., page 621.

English Patents.

Oxide of Zinc; [*Electrolytic*] *Manufacture of* ——. H. H. Lake, London. From Synd. pour l'Exploitation des Inventions du Prof. Oettli. Eng. Pat. 12,719, June 5, 1903.

See Fr. Pat. 328,491 of 1903; this J., 1903, 1007.—T. F. B.

Electrode Mass; Process for the Production of a Porous, Hard ——, *Insoluble in Alkalis, from Metallic Oxides, or Metallic Powders.* G. A. Wedekind and H. P. R. L. Pörschke, Hamburg. Eng. Pat. 20,313, Sept. 21, 1903.

See Fr. Pat. 337,276 of 1903; following these.—T. F. B.

Generation of Electric Energy; Process of and Apparatus for the ——. H. J. Keyzer, Amsterdam. Eng. Pat. 3913, Feb. 16, 1904.

An iron vessel is provided with several vertical iron partitions, between which porous carbon electrodes are supported. The latter have flanged heads, which abut against each other and are insulated from the iron portion of the apparatus. Openings in the lower parts of the iron partitions allow of the circulation of the electrolyte, the latter consisting of a saturated solution of potassium or sodium hydroxide or carbonate, preferably mixed with about 1 per cent. of a metallic salt, such as ferrous or ferric chloride. The cell is closed by a lead ring, cast round the heads of the carbon electrodes, and an insulated hood-like cover, the ring and outer iron vessel being connected to binding screws for the transmission of the current. In the middle of the covering hood is an admission pipe for Dowson gas, or other suitable gas containing hydrocarbons, mixed with about 95 per cent. of air or oxygen, and admitted sufficiently hot to boil the electrolyte. The gas passes down vertical channels in the carbon electrodes, permeates the pores, and meets there the electrolyte, which enters from the outer surface of the carbon. The resulting oxidation of the hydrocarbons generates electric energy, and the products of the oxidation, principally steam, are again introduced, after condensation, into the electrolyte.—B. N.

United States Patents.

Accumulating and Using Electrical Energy; Method of ——. A. G. Betts, Troy. U.S. Pat. 759,065, May 3, 1904.

Lead peroxide and lead are deposited respectively on the two electrodes from an electrolyte consisting of a solution of a readily soluble lead salt of a non-oxidising and non-oxidisable acid, such as lead fluosilicate, electrical energy being subsequently generated by redissolving the active materials in the electrolyte. The electrodes are of insoluble material, one or both of which may be of graphite or artificial graphite. The charging current may be passed at certain times in one direction, and at other times in the opposite direction, and air or oxygen is introduced into the electrolyte from time to time.—B. N.

Battery; Electric Storage ——. A. G. Betts, Troy. U.S. Pat. 759,066, May 3, 1904.

The electrolyte consists of a solution of lead fluosilicate with or without copper fluosilicate, and the electrodes are of graphite with numerous small surfaces arranged at angles one to another, or with laterally-extending surfaces arranged to catch and hold any detached active material. A conductive receptacle may also be arranged for this purpose, and the receptacle maintained in circuit during the discharge of the battery; or the electrode may comprise a plate of insoluble conductive material between plates of insulating material, each plate having apertures corresponding in location but smaller in the insulating plates, so as to form pockets for the purpose of retaining the active material. Air is introduced into the electrolyte near the bottom of the cell.—B. N.

Battery. J. Noble and E. L. Anderson, St. Louis. U.S. Pat. 759,740, May 10, 1904.

The battery consists of a carbon cathode, a non-decomposable or aluminium anode, an electrolyte evolving nitrogen peroxide, such as nitric acid, and a condenser containing coke or similar material to receive the gases evolved in the cell. Means may be provided for heating the battery. —A. G. L.

Gases; [*Electrical*] *Apparatus for the Treatment of* ——. H. Pauling, Gelsenkirchen. U.S. Pat. 758,775, May 3, 1904.

A hollow rotating shaft, forming one of the electrodes, projects into a funnel-shaped electrode, which communicates at one end with a means for sucking air through the funnel, the other end of the latter being closed by a lid which embraces the shaft. The portion of the shaft enclosed in the funnel is covered with insulating material, and a tubular projection is attached at right angles to one end of the shaft and passes through to the outer surface of the insulating material.—B. N.

Gaseous Media from Air; [*Electrical*] *Method of Generating* ——. J. N. Alsop, Owensboro. U.S. Pat. 758,883, May 3, 1904.

The invention relates to a method of generating gases from air, by continuously and alternately bringing into contact and separating two electrodes connected with a source of electricity. The electrodes are worked in two sets, the arc in one set being short-circuited at predetermined intervals by the contact of the electrodes of the second set. Simultaneously with the separation of the electrodes, the potential of the current is automatically increased, and each is short-circuited while at its maximum density and before the same is appreciably diminished.—B. N.

Gaseous Mediums from Air; [Electrical] Apparatus for Generating ——. J. N. Alsop, Owensboro. U.S. Pat. 758,884, May 3, 1904.

On a frame is mounted a "walking-beam," to each end of which is attached a "pitman" carrying one or more vertical electrodes, and so arranged that the movement of the beam gives a reciprocating motion to the electrodes. The electrodes in each set are connected in series, and the two sets in parallel, so that the contact of one set of electrodes with the lower stationary electrodes short-circuits the other set. Each movable electrode is capable of automatic adjustment, the electrodes being attached by a piston rod to a piston, and the latter is surrounded by a movable cylinder attached to the "pitman." Oil passes from the under to the upper side of the piston and thus permits the piston to settle in the cylinder for the purpose of making contact as the carbon is consumed. A self-induction coil is interposed in the circuit of the electrodes, and each pair of electrodes is surrounded by a casing provided with an air inlet, the casings being connected to a conduit leading to an air pump for withdrawing the gases.—B. N.

French Patents.

Solutions for Two-Fluid Electric Cells; Active ——. Atwood Electric Co. Fr. Pat. 338,414, Dec. 21, 1903.

See Eng. Pat. 28,057 of 1903; this J., 1904, 377.—T. F. B.

Electrodes [Accumulator Plates]; Treatment of Metallic Oxides for the Manufacture of Durable ——. G. A. Wedekind. Fr. Pat. 337,276, Dec. 3, 1903.

To obtain accumulator plates which are not attacked by an alkaline solution, copper oxide, or fine copper powder, is made into a paste with a solution of copper chloride, to which fine copper turnings may be added; the paste is placed in moulds, or spread upon plates or supports which have been provided electrolytically with a rough coating of copper; and the paste is converted into a solid porous mass by drying at 100° C. The chlorine and oxygen are next expelled electrolytically by employing the plates as anodes along with suitable metallic cathodes in an alkaline solution, after which the reduced metal is oxidised, either by heating or by electrolysis.—H. B.

Zinc Sulphide; Chemical Production of —— and Electro-Chemical Formation of Barium Hydroxide by the Simultaneous Regeneration of the Soluble Salt of Zinc. J. B. and A. Candau. Fr. Pat. 338,322, Dec. 21, 1903. VII., page 606.

Lead Peroxide; Electrolytic Method of Producing Deposits of —— on Positive Plates of Large Area for Electric Accumulators. J. Diamant. Fr. Pat. 338,418, Dec. 26, 1903.

See Eng. Pat. 6954 of 1903; this J., 1904, 376.—T. F. B.

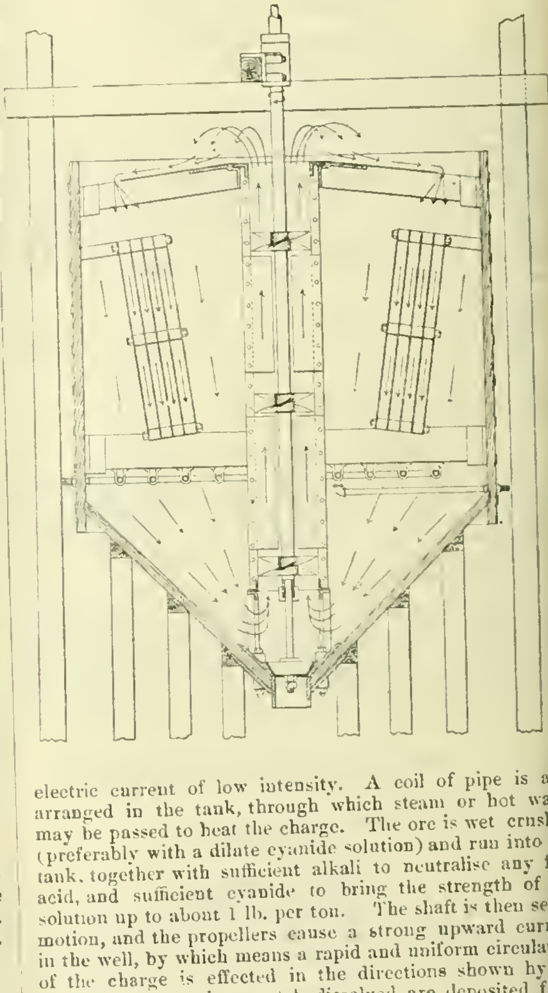
Hydroxides and Oxides; Electrolytic Process for Producing Metallic ——. F. F. Hunt. Fr. Pat. 338,156, Dec. 29, 1903.

See U.S. Pat. 748,609 of 1904; this J., 1904, 119.—T. F. B.

(*B.*)—ELECTRO-METALLURGY.

Hendryx Cyanide Process; The ——. C. M. Fassett. Eng. and Mining J., 1904, **77**, 723—724.

The apparatus (see figure) in which the extraction and deposition of the gold and silver are carried on in one operation, consists of a cylindrical tank having a conical bottom. A circular well or tube extends through the centre of the tank nearly from top to bottom, and is supported by braces from the side of the tank. At the top the well is connected to a circular apron, which is inclined slightly downwards towards the side of the tank. A hollow shaft, provided with a driving pulley at the top and carrying the screw propellers, passes through the centre of the well. The stem of the discharge valve at the bottom of the tank extends through the hollow shaft, and is operated by a hand-wheel located above the driving pulley. Outside the well, and between the apron and the bottom of the tank, anode and cathode plates are arranged, being supported from the side of the tank and connected to a source of electric current of low intensity. A coil of pipe is als arranged in the tank, through which steam or hot wate may be passed to heat the charge. The ore is wet crushe (preferably with a dilute cyanide solution) and run into th tank, together with sufficient alkali to neutralise any fre acid, and sufficient cyanide to bring the strength of th solution up to about 1 lb. per ton. The shaft is then set i motion, and the propellers cause a strong upward curre in the well, by which means a rapid and uniform circulatio of the charge is effected in the directions shown by t arrows. The precious metals dissolved are deposited fro the solution on the cathodes. It is claimed that the extra tion of gold and silver can be made in much less time a at a much smaller cost than by the usual methods, a that the process is perfectly adapted to the treatment tailings and slimes.—A. S.



Gold; Solubility of —— in certain Oxidising Agen V. Lenher. J. Amer. Chem. Soc., 1904, **26**, 550—55

Gold is readily attacked in many reactions in which oxyg is formed, particularly on the application of heat. Thus goes into solution when heated with sulphuric acid (phosphoric acid) and nitric acid, telluric acid, the hig oxides of lead, manganese, and chromium, or nickelic oxi Gaseous oxygen and acid are without action. An oxygen will attack gold in presence of strong sulphu acid. Operating with a current of 0·3—0·4 ampère resistance of 5 volts, an anode of sheet gold, and a platin crucible as cathode, it was found that when the acid hot, the gold was readily dissolved and then deposited the cathode. Using phosphoric acid or dilute sulph acid, no solution took place, an incrustation of gold o being left on the anode. This is also the case when solutions of neutral salts, *e.g.*, nitrates and sulphates of potassium and sodium, are electrolysed. With caustic alkalis a little gold passes into the solution, perhaps owing to the formation of an aurate.—E. H. T.

English Patents.

Enamelling Metallic Articles [*Electro-plating*]. W. Kenyon and S. Hobson. Eng. Pat. 14,219, June 27, 1903. VIII., page 607.

Iron Sand, Iron Oxides, and other Suitable Substances; Method and Apparatus [*Electric Furnace*] *for the Reduction of* ——. D. R. S. Galbraith and W. Steuart, Auckland, N.Z. Eng. Pat. 25,032, Nov. 17, 1903. Under Internat. Conv., Nov. 18, 1902.

See Fr. Pat. 336,726 of 1903; this J., 1904, 378.—T. F. B.

Iron Sand, Iron Oxides, and other Suitable Substances; Method and Apparatus for the Reduction of ——. D. R. S. Galbraith and W. Steuart, Auckland. Eng. Pat. 25,033, Nov. 17, 1903. Under Internat. Conv., Nov. 18, 1902.

See Fr. Pat. 336,727 of 1903; this J., 1904, 378.—T. F. B.

United States Patents.

Electrolytic Apparatus. H. S. Blackmore. Mount Vernon, N.Y. U.S. Pat. 759,798, May 10, 1904.

The layer of liquid-metal forming the cathode in the electrolytic cell communicates with a feeding chamber containing the metal, the height of the column in the chamber being balanced by the weight of the cathode and superposed electrolyte in the electrolytic cell. The height of the column in the chamber controls, by means of a float, the supply of metal from a reservoir, and a saturator maintains the electrolyte at uniform density. An outlet, near the surface of the cathode, carries the alloy from the electrolytic cell to a reservoir, in which the metal is covered by an independent body of electrolyte communicating with the electrolyte in the electrolytic cell, and then to an oxidising vessel, thus preventing any possibility of short-circuiting between the cathode and the alloy in the oxidising vessel. The alloy passes by a tortuous passage through the oxidising vessel, the latter being provided with an outlet for the alloying metal, the outlet having a float-valve controlled by the height of the oxidising liquid. The height of the latter is maintained uniform by an inlet and outlet, for the oxidising liquid and oxidised product, adjacent to but above the outlet and inlet for the alloying metal and alloy respectively.—B. N.

Electrolytic Apparatus. H. S. Blackmore. Mount Vernon, N.Y. U.S. Pat. 759,799, May 10, 1904.

Light-metal compounds are electrolysed in a containing vessel divided into two compartments by a tube-like partition, provided at its open lower end with a diaphragm of loose granular material. In the inner compartment is the anode and electrolyte, and in the other is a molten or liquid-metal cathode, supporting and in contact with the diaphragm, but the upper surface of the cathode is above its surface of contact with the diaphragm. Means are provided for removing the light metal from the alloy or amalgam as it rises to the upper surfaces of the cathode, the depleted portion of the cathode returning into contact with the diaphragm. An oxidising agent is injected beneath the surface of the alloy, and a layer of granular material, electronegative in relation to the oxidisable metal, and in contact with the alloy, serves to distribute the reagent, an oxidising electrolyte being maintained in contact with the granular material and the alloy. In extracting an alkali metal from the liquid alloy, sodium hydroxide is injected; the resulting product is removed, treated with water, and again returned into contact with the alloy.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Olives; Preservation of —— *before Expression.* H. Mastbaum. Chem. Rev. Fett- u. Harz-Ind., 1904, **11**, 39—42, 64—69, 89—91.

The total proportion of oil in olives dried in the air diminishes, at first slowly, and then more rapidly, so that after five months it is only about two-thirds of the original quantity. The acidity of the oil shows a steady increase. The diminution of oil is considered as possibly due to a species of "intercellular respiration" but "chemical reaction may also play a part." Olives kept in running water are well preserved, but the quality of the oil is inferior, the acidity increasing by about 1 per cent. for each month. The result of keeping the olives in brine or in a vessel from which air is excluded is shown by the following experimental results:—

Method of Keeping.	Water.	Oil.	Oil in dry Substance.	Acidity of Oil.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
In brine	60·34	16·81	42·38	4·03
Air excluded, no salt used	53·51	19·61	42·19	5·81
Air excluded, salt used	53·09	20·12	42·90	5·21

The odour and flavour of the oil obtained from olives preserved by the two latter processes were superior to those of oil from olives kept in brine.—C. A. M.

Melon-Seed Oil. G. Fendler. Z. Unters. Nahr. u. Genussm., 1903, 1025.

The kernels of Togo melon seeds contain 5·8 per cent. of water and 43·8 per cent. of a yellow, almost tasteless oil which has the following characters:—M. pt., 5·5° C.; congealing pt., 5° C.; m. pt. of fatty acids, 39° C.; congealing pt. of fatty acids, 36° C.; acid value, 4·81; saponification value, 193·3; iodine value, 101·5. It appears to be suitable for dietetic use.—J. O. B.

Acrocomia Vinifera [*Nicaraguan Coyol Palm*]; *Fatty Oil of Seeds of* ——. G. Fendler. Z. Unters. Nahr. u. Genussm., 1903, 1025.

The kernels of the seeds yield 6·55 per cent. of water and 48·66 per cent. of a yellow pleasant-tasting oil. At about 15° C. the oil separates in feathery crystals and ultimately becomes solid. It has the following characters:—Sp. gr. at 25° C., 0·9136; m. pt., 25° C.; congealing pt., 17° C.; acid value, 1·69; saponification value, 246·2; iodine value, 25·2; Reichert-Meissl value, 5·0. The portion which first crystallises out has the m. pt. 34° C., when recrystallised from alcohol. The liberated fatty acids melt at about 54° C. and probably contain myristic acid.

—J. O. B.

Aleurites Moluccana; Fatty Oil from the Seeds of ——. G. Fendler. Z. Unters. Nahr. u. Genussm., 1903, 1025.

The kernels of the seeds of *Aleurites moluccana* from the Cameroons, contain 3·65 per cent. of water and 64·4 per cent. of fat; the residue free from fat contains 60·62 per cent. of albuminoids. The oil obtained by extraction with ether is strong-smelling, acrid, and yellow; it is sparingly soluble in alcohol. It dries quickly in a thin layer, and should be useful as a drying oil for varnishes. It has the following characters:—Sp. gr. at 15° C., 0·9254; congealing pt., – 15° C.; m. pt. of fatty acids, 18° C.; congealing pt. of fatty acids, 15·5° C.; acid value, 0·97; saponification value, 194·8; iodine value, 114·2; Reichert-Meissl value, 1·2.—J. O. B.

Rhus Glabra; Fixed Oil of the Seeds of ——. G. B. Frankforter and A. W. Martin. Amer. J. Pharm., **76**, 151. Pharm. J., 1904, **72**, 681.

The seeds free from husks yielded on extraction with ether, 9·1 per cent. of a light-yellow oil of pleasant taste and peculiar odour. Sp. gr., 0·9203 at 20° C, and 0·9312 at 0° C.; *n* = 1·48228 at 15° C. and 1·48821 at 0° C.; saponification value, " 190—200 "; and iodine value, 85·96 —87·86. The oil contains about 0·696 per cent. of an unsaponifiable alcohol, probably a cholesterol. The husks of the seeds after being freed from tannin and calcium acid malate by treatment with water, yielded, on extraction with ether, 8·5 per cent. of a black semi-solid oil, of sp. gr. 0·933 at 35° C. and 0·9412 at 20° C.; iodine value, 87·2; and saponification value, 179·7. From this oil, by treatment with acetone, 80 per cent. of a yellow oil was separated, a black semi-solid oily residue being left.

—A. S.

Fats; Enzymic Action of Plant Seeds on ——. S. Fokin. Chem. Rev. Fett- u. Harz-Ind., 1904, **11**, 48—49, 69—71.

Of the seeds of 60 plants belonging to 30 families examined, more than half effected the hydrolysis of 10 to 16 per cent. of fat, but this hydrolysis was not produced by the same seeds when old and was therefore not attributed by the author to the presence of an enzyme. When seeds contain an enzyme there is a quantitative relationship between the yield of fatty acids and the amount of seed employed. Thus in the case of castor seeds the yield of fatty acids liberated increases with the proportion of seed used, but in the case, *e.g*, of fresh *Cynoglossum* seeds, the amount of fatty acids liberated from an oil remained the same (30 per cent.), whether the seeds were used in the proportion of 24 or 100 per cent. Of all the plants examined only two answered this requirement of an enzyme, *viz.*, celandine (*chelidonium majus*) and *linaria*. Compared with the seeds of the castor oil plant and celandine, the seeds of *linaria vulgaris* contain but little enzyme, 20 to 30 parts only having the same lipolytic action as 4 to 5 parts of castor seeds. A yield of 90 per cent. of fatty acids was obtained from sunflower oil by the action of 46·7 per cent. of crushed linaria seeds with dilute acetic acid. The author suggests that lipolytic activity may be invariably accompanied by the presence of an alkaloid.

Characteristics of Vegetable Oils Examined.—The following results were obtained :—

Oil from Seeds of	Yield of Oil.	Sp. Gr. at 20° C.	Iodine Value.	Saponification Value.	Fatty Acids.			
					Solidification Point.	Sp. Gr. at 20° C.	Iodine Value.	Acid Value.
	Per Cent.				° C.			
Xantium "strumarium" (in husks)	14·2	..	142·0	..	9—10	..	..	193·8
" " "	..	0·912	132·2	185·4	..	..	..	..
Xantium strumarium (decorticated)	28·0	..	..	..	..	..	147·9	..
Tilia parvifolia (decorticated)	26·6	0·925	125·9	184·8	9—18 [m. pt. 17—26].	..	136·3	197·0
Delphinium elatum	36·6	0·921	..	..	..	0·8915	108·2	191·8
Evonymus verrucosus	43·64	0·959	..	..	22—23	0·912	110·6	198·5
Galeopsis ladanum	40·4	0·927	..	..	..	..	147·0	..
Leonurus cardiaca	23·0	0·923	..	..	..	..	133·7	..

All six oils contained linolic acid, whilst linolenic acid was detected in the oil of *Galeopsis ladanum*. The author concludes that the presence of a lipolytic enzyme is not the characteristic property of any particular families of plants. (See also this J., 1904, 259.)—C. A .M.

Castor Seeds; Hydrolysing Power of ——. M. Nicloux. Comptes rend., 1904, **138**, 1175—1177.

The author finds that the substance possessed of lipolytic properties contained in castor seeds is the "cytoplasma" (Comptes rend., 1904, **138**, 1112), to the exclusion of all other parts of the seed. Whether the cytoplasma is endowed with specific properties, or whether it secretes a soluble ferment, is a matter for further investigation.—A. S.

Ethyl Butyrate; Hydrolysis of —— by Lipase. J. H. Castle, M. E. Johnston, and E. Elvove. XXIV., page 628.

English Patent.

Fat and other Substances; Apparatus for Extracting —— by Means of Vapours or Volatile Solvents. O. Schneider, Nürnberg. Eng. Pat. 8897, April 20, 1903.

This apparatus, specially intended for the continuous extraction of bones, &c., comprises an extractor and a connected distillation vessel. The cylindrical extractor consists of an outer shell and an inner perforated compartment for the material. It has a perforated false bottom beneath the inner chamber, whilst a compartment below the false bottom (with which it communicates by means of a protected opening) contains a heating arrangement. The vaporised solvent enters the extractor through a pipe from the top of the distillation vessel, and passes through the material, and the condensed liquid runs back into the distillation vessel through another pipe below the false bottom.—C. A. M.

French Patents.

Press; New Form of —— [for Olive and Seed Oils]. Lèbre Frères. Fr. Pat. 338,066. Dec. 24, 1903.

The apparatus consists of a circular bed with channels and exit tube for the escape of the oil and an upper arm fixed, *e.g.*, to a wall. A central screw rod is fixed in the lower bed, whilst the corresponding upper part of the screw rod is fixed, pointing downwards, in the upper horizontal arm, a small space being left between the points of the two. The plates of the press are perforated in the centre to allow of their being passed over the lower screw rod, and have ledges round their circumference to retain the expressed material, whilst the top plate and a collar are carried by the upper screw rod, and can be brought down by means of a lever.

—C. A. M.

Fat; Apparatus for Extracting —— by Means of Carbon Tetrachloride. P. Bernard. Fr. Pat. 338,354, Dec. 24 1903.

The dried crushed material is fed into a cylindrical steam-jacketed extractor where it meets an ascending column o carbon tetrachloride. The solvent charged with fat passe into adjoining vessels where it is evaporated, condensed and stored in a tank until again put into circulation. Th extracted oil is passed through a filter below the evaporatio vessel.—C. A. M.

Oils; Apparatus for Washing —— by Decantation. V. Coq. Fr. Pat. 338,356, Dec. 22, 1903.

The mixture of oil and aqueous impurities obtained, e.g in the expression of olives, is introduced into a vess surrounded by a concentric chamber containing water. Th oil falls from a tap in the bottom, and meets a fine spra of water from the outer chamber, and both fall into vessel below, where they are separated by decantation. Th outlet for the separated oil is controlled by a float of suc density that it floats in a mixture of oil and water, bu sinks in pure oil.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

United States Patents.

Pigment, and Method of Producing it from Ferrous Liquors. A. S. Ramage, Cleveland. U.S. Pat. 758,687, May 3, 1904.

Air is blown through concentrated ferrous sulphate liquor, and the solution is neutralised, basic ferric sulphate being precipitated; the solution is now diluted, and air is again injected, and the solution neutralised, precipitating basic ferric hydroxide. These precipitates, when mixed together, dried, and calcined, form a golden-yellow pigment.—T. F. B.

Lead-Bearing Ores; Process of Treating ——. C. H. Rider. U.S. Pat. 759,192, May 3, 1904. X., page 610.

(*B.*)—RESINS, VARNISHES.

English Patent.

Varnish Substitute; Manufacture of an Improved —— from Rosin Oil. R. Blume, Magdeburg. Eng. Pat. 14,987, July 6, 1903.

See Fr. Pat. 333,602 of 1903; this J., 1903, 1358.—T. F. B.

(*C.*)—INDIA-RUBBER, &c.

French Patent.

India Rubber; Regeneration of ——. M. Pontio. Fr. Pat. 338,018, Oct. 16, 1903.

The rubber is digested with a suitable solvent, the insoluble constituents are separated by filtration or in a centrifugal machine, and the solution is evaporated under reduced pressure. The residue is treated with acetone, boiled, the acetone decanted, and alcoholic soda added. After boiling and decanting, the rubber is treated a second time with boiling alcohol, decanted again and boiled with water, finally, it is treated with superheated steam to remove the last traces of alcohol and water.—J. K. B.

XIV.—TANNING; LEATHER, GLUE, SIZE.

United States Patent.

Chrome Tanning Bath. C. A. O. Rosell, New York. U.S. Pat. 759,831, May 10, 1904.

The tanning liquor contains an inorganic reducing sulphur salt of chromium and consists essentially of chromium thiosulphate and chromium sulphite, or of chrome alum, a thiosulphate and a sulphite.—R. L. J.

French Patents.

Tanning Materials; Apparatus for the Cold Extraction of ——. A. Lautard. Fr. Pat. 338,360, Dec. 23, 1903.

A series of extractors, made of heavy glass, are connected with a powerful exhaust pump. Large movable lids are placed on rubber seatings, and close automatically under he external pressure. The liquors are sucked from one vessel to the next, and ammonia vapour is introduced as a lecolorising agent. Mechanical details are given.
—R. L. J.

Cork-Leather; Manufacture of ——. L. Couher. Fr. Pat. 338,205, Nov. 17, 1903.

A suitable textile fabric is coated, on one or both sides, vith gelatin mixed with more or less glycerin according to he degree of suppleness required, and containing formaldeyde (1—5 per cent.) or chromic acid (1—3 per cent.). ork-dust is sprinkled on the sticky surface or surfaces and he whole compressed till solid between heated metal plates. urther coats of cement and cork may be superimposed to ive required thickness. Alternatively, a solid block of ork-dust with glycerin-gelatin cement is prepared and liced into sheets.—R. L. J.

Leather, Artificial; Manufacture of ——. G. Gautier. Addition, dated Dec. 19, 1903, to Fr. Pat. 310,726 of May 11, 1901. See this J., 1902, 1405.

Animal fibres (raw leather, parchment, &c.) or vegetable fibres are combined with "Volta" leather (prepared by the process described in the main patent) by warming the surfaces to be united and treating them with a special animal glue, then submitting the block to pressure.
—J. K. B.

XV.—MANURES, Etc.

Phosphate, Wolter. P. Wagner. Bied. Centr., 1904, **33**, 301—302; from Illust. landw. Zeit., 1903, 959.

Wolter phosphate is prepared by fusing a mixture of crushed phosphorite (100 parts), sodium bisulphate (70 parts), calcium carbonate (20 parts), sand (22 parts), and coal (6—7 parts). The melt is granulated by being poured into cold water, and the dried substance is then finely ground. As regards the solubility of the phosphate, it was found that when 2·5 grms. of the substance are agitated with 1 litre of 0·5 per cent. citric acid solution for 10 minutes, 97 per cent. of the phosphoric acid is dissolved. Under the same conditions only 80 per cent. of the phosphoric acid of basic slag dissolved in the citric acid solution. The author considers that the phosphoric acid of Wolter phosphate is hardly slower in its action than the water-soluble phosphoric acid in superphosphate; and the results of vegetation experiments showed that the effect of two samples of the phosphate was 72 and 94 respectively, as compared with superphosphate = 100. The new phosphate is stored without difficulty and is not hygroscopic.
—N. H. J. M.

Phosphoric Acid of Tricalcium Phosphate; Action of Sterile Organic Substances and those occurring in Fermentations on the Solubility of ——. A. Stalström. Centr.-Bl. Bakter u. Parasitenk., **11**, 724—732; Chem. Centr., 1904, **1**, 1323.

The results obtained by the author confirm the view that organic substances are capable of exerting a solvent action on minerals, and that this power depends upon biological activity. The kind of fermentation set up depends upon the nature of the organic substances: with peat, peat litter, dung, or "bouillon," an ammonia and carbon dioxide fermentation is caused; with milk, sour milk, and milk-sugar a lactic fermentation; and with peat together with milk-sugar a butyric fermentation. In the case of the ammonia and carbon dioxide fermentation, the solvent action on tricalcium phosphate is very small, but it is quite distinct in the case of the lactic and butyric fermentations. Sterile organic substances have no solvent action on tricalcium phosphate.—A. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar Experiment Station Laboratory, Louisiana; Results of Investigations at the ——. C. A. Browne, jun. The Louisiana Planter and Sugar Manufacturer, Jan. 14, 1904, 47—51.

Among the non-sugar constituents of the cane are the insoluble carbohydrates which make up the fibre of the cane and constitute a complex including cellulose, lignin, and hemicellulose. To the latter group belong the so-called gums of the cane. The cane gums are mixed pentosans which make up about one-fourth of the weight of the dried fibre and contain both *xylan* and *araban*. By inversion with acids about four parts of xylose were obtained to one of arabinose. *Galactan* is only found in small quantities. The percentage of gums in the cane-juice is usually not more than 0·2 per cent. Foreign canes often show more, as also do the juice from old canes or those which have remained a long time in the "windrows." The hemicelluloses of sound cane while comparatively insoluble in cold water are appreciably dissolved if heat be applied. Of the enzymes or natural ferments of the cane the presence of invertase in the green parts of the stalk has an important bearing on the "windrowing" of the cane, since the rapid deterioration of the cane when "windrowed" with the tops on is accounted for by the invertase there present. The very rapid coloration which takes place when the green top of the cane is cut through near the apex and exposed to the air is caused by *oxidase*. This coloration is also produced, but less rapidly, in the ripe portions of the stalk. The discoloration which occurs when cane is injured by the borer may result from the oxidising action of this ferment, since Dodson has shown that sterilised canes do not develop this colour. The darkening of cane-juice after milling is produced in the same way, but is soon arrested by sulphuring. The destruction of the enzymes by heat before milling is hardly practicable in actual work. The presence of both oxidase and reductase in the cane finds a parallel in the pepsin and anti-pepsin in the stomach. The author is inclined to believe that the oxidising ferments have the function of protecting the plant, when injured, from infection by moulds, bacteria, &c., through the formation of germicidal products, the deleterious effects of these upon the plant itself being prevented by the action of the reducing enzymes. Analysis of the juice from the green tops of the cane shows that there is nearly twice as much sucrose late in the evening as in the early morning, assimulation being suspended during the night, whereas the process of inversion by the invertase still goes on. Towards the bottom of the stalk the sucrose is re-formed. At very early stages of growth the juice shows a minus reading due to the preponderance of invert sugar; somewhat later the juice becomes inactive, although about 1 per cent. of sucrose is present. Then the rotation becomes positive until, as the cane matures, the polariscopic reading and true percentage of sucrose coincide, when the polarising power of dextrose and levulose neutralise one another. If circumstances are favourable for complete ripening, which is not usual in Louisiana, the levulose will almost completely disappear, when the polariscopic reading will slightly exceed the content of sucrose, owing to the predominating rotatory power of the dextrose. Probably no fermentation product gives the sugar-maker so much trouble as the gum dextran. A small amount of this substance renders cane-juice exceedingly viscid, so that successful clarification and boiling become almost impossible. The high polarising power of the gum, three times that of sucrose, also introduces an error into the analytical work unless the dextran is first precipitated with alcohol before polarising.—L. J. de W.

Diffusion Juice; Cold Liming of ——. Aulard. Bull. Assoc. Chim. Sucr. et Dist., 1904, **21**, 1057—1062.

Prangey and de Grobert state that the proportion of lime being reduced to the minimum necessary to secure good filtration, the purification of the juice is better in proportion as the time of contact is shortened, provided that the temperature is sufficiently raised. This is in direct contradiction to the method favoured by the author, who claims that he obtains juice of a higher purity and a minimum of molasses by liming cold and maintaining the contact for at least an hour. Sellier is of opinion that limed juice should not be heated beyond 80° C. to avoid risk of redissolving part of the precipitated albumin.—L. J. de W.

Water; Rate of Diffusion of —— through a Semi-permeable Membrane [Molecular Weight of Dextrin]. J. Šebor. XXIV., page 628.

French Patents.

Sugar; Extraction of —— from Plants. G. Tauer. Fr. Pat. 338,039, July 31, 1903.

Beetroots and sugar cane are protected from the action of the air, during the process of their reduction by chopping, rasping or crushing, by submerging the working level of the reducing machinery below the surface of a circulating mass of crude juice, heated to a temperature between 45° and 97° C. (preferably 85° C.). The reduced matter, as it falls into the heating juice, is conveyed to an immersed screen, whence it is elevated and transported to the diffusers or presses.—J. F. B.

Massecuites [Sugar]; Process and Apparatus for Boiling ——, with Circulation. H. Roy. Fr. Pat. 337,227, Dec. 1, 1903.

A vacuum pan of the usual shape is provided with a circulating system in such a manner that syrup can be withdrawn from near the surface of the boiling mass by means of a pipe adjustable to a suitable height; the syrup is then mixed with fresh feed-syrup and passed, by means of a centrifugal pump, through a re-heater and back into the vacuum pan at the bottom, where it is mixed with the coarse granulated mass by means of a stirring apparatus. In this way the pan can be fed with syrups at a higher degree of concentration than usual, since the re-heater prevents the formation of fine grain.—J. F. B.

Sugar and Saccharine Products; Denaturing ——. C. Dutordoir. Fr. Pat. 338,294, Dec. 9, 1903.

The denaturing of sugar for fiscal purposes is effected by the addition to 100 parts of sugar of sodium chloride, 4—8 parts, powdered oil cake [*e.g.* linseed] 2 parts and yellow ochre 0·25 part. The product, whilst still suitable for cattle food, cannot be purified for human consumption.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Amylase; Action of Heat and Acidity on ——. P. Petit. Comptes rend., 1904, **138**, 1231—1233.

An infusion of malt in water made faintly alkaline by sodium carbonate gives a filtrate, the diastatic activity of which may be increased by the addition of minute quantities of lactic acid. If the acid be added gradually a turbidity appears when the acidity reaches a certain point and increases with increase of acid but re-dissolves when a certain excess of acid has been added. If this precipitate be collected, washed with acidulated water and dried *in vacuo* it turns brown and dissolves, but only partially, in dilute alkali or acid. The solutions of this substance liquefy and saccharify starch paste. If the substance be dissolved in N/50 sodium carbonate solution in presence of phenolphthalein the alkaline reaction disappears and additions of more soda have to be made repeatedly as the substance dissolves. It would appear that the alkali displaces the amylase fro an insoluble combination with lactic acid. If an infusio of malt faintly acid, be neutralised exactly with sodiu carbonate and if increasing quantities of lactic acid b added to portions of it and these be heated for 10 minute at the temperature of the boiling water-bath, a decreas of the acidity takes place, due to the heating, whic increases the higher the proportion of acid initially adde The change in acidity takes place according to a consta law expressed by the equation $y = 0{\cdot}4 - 0{\cdot}337x$, whe x = the initial acidity, and y = the change in acidity. progressive formation of a turbidity and finally a coagulatio take place parallel with this decrease in acidity. The coag ations produced in aqueous infusions of malt on heating a due to the excess of acidity of the infusions, and if t acidity be reduced by successive additions of sodium ca bonate no coagulation or turbidity is produced on heating. —J. F. B.

Starch; Coagulation of ——. A. Fernbach and J. Wol J. Fed. Inst. Brewing, 1904, **10**, 216—237.

The authors communicate certain observations in additi to those previously recorded (this J., 1903, 1302; and 19 124), relative to the enzyme *amylo-coagulase*. The pe liarities of all these reactions may be traced to the f that two antagonistic enzymes, coagulase and diastase, t part simultaneously, and if the diastase be allowed predominate no coagulation may occur. Conditions wh favour the diastase are elevated temperatures and dil starch solutions, but if these be allowed for, it may stated that the first signs of coagulation appear earlier greater the quantity of malt extract employed. Coag tion is easier the lower the temperature at which the st has been rendered soluble and the shorter the dura of the process of heating under pressure. If the coag tion has proceeded rapidly, it first appears as a turbi which subsequently forms clots like those of curdled

If coagulation has been very slow a powdery white precipitate is deposited. With a 2 per cent. solution of starch, coagulation may take place at 8° C., but not at 22° C., but with a 4 per cent. solution coagulations are readily produced at 15°—25° C., the lower temperatures are, however, always more favourable. Like diastase, the amylo-coagulase is very sensitive to the influence of traces of free acids and alkalis, but it is less sensitive than diastase to caustic soda, and the addition of 80 mgrms. per litre of that alkali to the solutions acts as a restrainer of the diastase and consequently assists the coagulation. By this means, for instance, the proportion of starch coaguluted, was raised from 14·4 per cent. without caustic soda to 24·1 per cent. with caustic soda, at 15° C. Owing to diastatic activity, it frequently happens that increased proportions of malt infusion cause a decrease in the quantity of starch coagulated. The coagulated substance dissolves readily in boiling water and separates again partially on cooling. A portion of the coagulated matter consists of amylo-cellulose and resists hydrolysis by malt extract at 67° C. Although the activity of the coagulase in solution is destroyed by heating at 63° C. for 5 minutes, it resists the action of heat in the dry state and is normally present in kilned and cured malts.—J. F. B.

Potatoes; Bad Attenuations shown by Certain Sorts of ——. G. Heinzelmann. Z. Spiritusind., 1904, **27**, 193—194.

The author describes the procedure adopted for the analysis and examination of a batch of Silesian potatoes which had the reputation of giving poor attenuations in the distillery, the gravity of the fermented mashes being sometimes as high as 5° Balling. Fermentation experiments showed that the potatoes were perfectly normal and yielded as much alcohol as could be expected from the quantity of starch present. A very valuable means for checking cases of suspected bad attenuations is afforded by the re-fermentation of the residual extract of the fermented mashes. —200 c.c. of filtered fermented mash are half neutralised and evaporated on the water-bath to a syrupy consistency; the residue is diluted again to 200 c.c. and sown with 4 grms. of pure yeast at 28° C. After 24 hours the alcohol produced is determined by distillation, and the results are calculated per 100 c.c. of mash. If the mash showed a deficiency of diastase the same determination should also be carried out, with the addition of 100 c.c. of water and 100 c.c. of malt extract (100 grms. of green malt to a litre of water) to the syrupy extract, and the results should be corrected for the quantity of alcohol yielded by the malt extract. (See also this J., 1904, 263.) In good distillery practice the residual extract should not yield more than 0·2—0·3 per cent. by volume of alcohol calculated on the mash. Further experiments showed that the proportion of unfermentable extract is increased by steaming the potatoes at higher pressures. The mashes produced, on the one hand, by steaming for 1 hour at 2 atmospheres, and on the other at 4 atmospheres, showed final gravities of 0·2° and and 0·9 Balling respectively. The poor attenuation, in the latter case, was, however, only apparent, since the yield of alcohol was the same in both cases. When high final gravities are obtained, the fermented mashes should be analysed in the manner described above, and if no fault is indicated in the efficiency of the yeast, the potatoes should be steamed at lower pressures.—J. F. B.

Malt; The Ready-formed Sugars of ——. A. R. Ling and T. Rendle. J. Fed. Inst. Brewing, 1904, **10**, 238—263.

In a previous paper Ling (this J., 1898, 478) pointed out that the extraction of the ready formed sugars of malt by cold water involves an incipient saccharification of the starch by the diastase and the appearance of maltose and other conversion products in the extract. The soluble carbohydrates of malt include cane sugar, invert sugar, maltose (doubtful), pentoses and gummy substances. They are formed chiefly during flooring, but considerable metabolism goes on during withering and in the earlier stages of kilning. This metabolism consists in the production of reducing sugars from the starch, and the conversion of these reducing sugars into cane sugar; it is attended by an energetic growth of the aerospire whilst the rootlet dies away. The authors propose to extract the soluble carbohydrates of malt by means of a dilute solution of caustic potash, soda or ammonia, sufficiently powerful to inhibit all diastatic action :—25 grms. of ground malt are digested for three hours at the ordinary temperature with 250 c.c. of a solution containing 15 c.c. of N/20 caustic potash solution in excess of the amount which is necessary to neutralise the acidity of the malt. The extract is filtered through a dry filter, filtration being assisted by the addition of purified kieselguhr or fuller's earth. The total soluble matter, which includes the soluble albuminoids as well as the carbohydrates, is determined in a portion of the filtrate either directly by drying or indirectly from the specific gravity (divisor, 3·86). The total reducing sugars are determined volumetrically in 25 c.c. of the filtrate diluted to 100 c.c. In absence of any precise information as to their nature, although some of them are certainly unfermentable, the whole of the reducing sugars are expressed in terms of invert sugar. For the determination of the cane sugar 25 c.c. of the original filtrate are mixed with 10 c.c. of N/2 hydrochloric acid, the solution is slowly raised to boiling and maintained in ebullition for one minute, the mixture is cooled, neutralised by 10 c.c. of N/2 caustic soda solution, and diluted to 100 c.c. The cupric-reducing power is then determined and the proportion of cane sugar is calculated. All results are expressed in terms of the dry malt. The authors give tables showing the results of a full examination of 42 samples of malt, together with all available information regarding the method of their preparation. The majority of the samples had not been "forced," *i.e.*, they had been germinated on the cool system with limited amounts of sprinkling liquor. Depletion of the endorsperm adjacent to the acrospire was taken as the indication of "forcing." Although in a general manner the proportion of soluble carbohydrates and the sum of the ready-formed sugars tend to increase under "forcing" conditions, no definite limits can be fixed for any of these constituents by which "forcing" can be diagnosed. The proportions in which they exist in malt are the resultants of a large number of factors, some of which, *e.g.*, respiration, whether aërobic or anaërobic, tend to reduce the amount of soluble carbohydrates. In very pronounced cases of "forcing," the sum of the proportions of cane sugar and reducing sugar may amount to over 12 per cent., but in more moderate cases, such as are usually met with, the proportion of these sugars may be no higher, and sometimes even less, than in malts which have not been forced. Pneumatic malts appear to contain somewhat smaller amounts of soluble carbohydrates, other than cane sugar and invert sugar, than floor malts. The amount of soluble carbohydrates of malt probably varies according to the kind of barley and its condition.—J. F. B.

Mashing Heats. H. W. Harman. Brewers' J., 1904, **40**, 351—352.

The control of the behaviour of different worts towards yeast, which is obtained by varying the mashing heats, depends upon the quantity and the type of the maltodextrins produced by the conversion of the starch. At 158° F. the liquefaction of the starch by the diastase is most rapid and complete; a temperature of 130° F. is most favourable for the production of free maltose, and below 145° F. no considerable percentage of maltodextrins is produced. From 145° F. to 150° F. low-type maltodextrins are formed in small but increasing quantities, whilst above 150° F. the production of maltodextrins is considerable in amount, but no great change of type results until a temperature of 156°—158° F. is reached, when the higher and more stable maltodextrins are formed. A mixture of malt and flaked maize saccharifies far more rapidly if mashed at 148° F., and raised in 15 minutes to a temperature of 158° F., than if mashed at 150° F. all through. The diastase does better work, even though partially crippled, at 158° F., at which temperature the starch is readily convertible, than a more energetic diastase at a lower temperature, less favourable to the liquefaction of the starch.
—J. F. B.

Fermentation Gas; Wittemann's Collecting and Carbonating System for ——. J. Steinemann. Hantke's Letters on Brewing, 1904, **3**, 223—229.

The collecting and carbonating plants form two independent systems. No changes in the mashing and fermentation processes are involved. One brew out of every six or seven is fermented under a pressure of 3—5 lb. in two closed storage tuns. The wort is run into the closed tuns the first morning after pitching, and fermentation is allowed to continue for 6—8 hours with the valves open in order to expel the air. The tuns are then closed, and when the pressure has reached 4 lb. the compressor pump is started. In about 24 hours sufficient gas will have been collected for the carbonation of 2,000 barrels of beer. The pitching temperature is 8·8° to 9·4° C., and this rises to 12·5° C. during the fermentation under pressure. After sufficient gas has been collected, the fermenting wort is preferably returned to the open tuns. The gas is compressed by the pump to a pressure of 250 lb. In the purifiers the compressed gas is saturated with water, both entering from above, the gas is passed on to the storage cylinders, and the separated water is used for cooling the compressor. The circulating water removes objectionable volatile acids, whilst "through the cooling the hop ether is retained in the carbonic acid." The stored carbon dioxide cools down to the temperature of the cellar in about 24 hours, and a further cooling is obtained in its expansion at the time of carbonating. The aroma of the gas depends on the quality of the beer, and the best, strongly-hopped brews are selected for providing the gas. In the carbonator the beer, entering at 0·6°—0° C., is cooled by the gas to −0·6° C. For bottled beers carbonation is effected at 8—9 lb. pressure, for draught beers at 10—12 lb. The beer should be carbonated direct from the chip-cask, and should not be more than three weeks old. Young beers so treated are more aromatic than "kräusened" beers. Beers stored for 2—3 months are not suitable for carbonation; they should be treated with 2—6 per cent. of "Kräusen."—J. F. B.

Alcoholic Fermentation; Production of Sulphuretted Hydrogen in ——. M. E. Pozzi-Escot. Bull. Assoc. Chim. Sucr. et Dist., 1904, **21**, 1071—1073.

Hydrogenases or reductases are present in yeast in abundance, and when sulphur, a sulphate, or sulphite is added to a liquid undergoing alcoholic fermentation, sulphuretted hydrogen is formed. This direct fixation of hydrogen is not limited to sulphur, but extends to all the metalloids of this family, and even to phosphorus and arsenic. While sucrase will diffuse through parchment during the whole course of the fermentation, the reducing diastase only appears towards the end when about one-tenth of the sugar is left.—L. J. de W.

Potable Spirits used by the Native Population of India; Analyses of ——. H. H. Mann. Analyst, 1901, **29** 149—152.

The results are given of the examination of numerous samples of these spirits, which the author divides into four classes:—Those derived from *mahua* (the flowers of *Bassia latifolia*); those obtained from rice; those from the refuse of sugar manufacture; and those representing imported foreign low-grade spirit. All the samples were very dilute, only two exceeding 25 degrees under proof. Large quantities of volatile and fixed acids were present, and the percentage of fusel oil was extremely high in nearly all cases. Furfural was present in all the spirits, except one. The imported spirits were highly sweetened. The fusel oil was estimated by Röse's method, and as this process has recently been severely criticised (this J., 1902, 815), the author hopes shortly to repeat the determinations, and also to investigate the physiological action of the quantity of both furfural and aldehydes in the spirits (this J., 1992, 96—102).—W. P. S.

Ferment Actions. L. Liebermann. XXIV., page 628.

Beer Filtration; Pulp Boards for ——. XIX., page 620.

Tartaric Acid [in Wine and Crude Argol]; New Method for the Determination of ——. H. Ley. XXIII., page 626.

Ammonium Fluoride and Rubber Hose. E. Bidtel. XVIII. C., page 629.

English Patents.

Grain; Process and Apparatus for Drying, Desiccating, and Roasting Germinated and Non-Germinated ——. O. Imray, London. From Brau. Gross-Crostitz, Leipzig. Eng. Pat. 6975, March 22, 1904.

In order to obviate the troubles arising from the condensation of moisture on the upper walls of the drying chamber, as in the apparatus described in Eng. Pat. 26,473 of 1901, the apparatus is so arranged that two-thirds of the moisture is removed by heated currents of air introduced at the top of the chamber, and withdrawn, together with the moisture, at the bottom. The drying may then be completed by currents of air ascending through the chamber. The moisture in the saturated air is condensed in a mixing chamber below the apparatus. The condensation of moisture on the outside of the drying chamber is prevented by surrounding the latter with heating or cooling pipes. Heating or cooling pipes are also arranged in the air-supply channel instead of inside the chamber as before. —J. F. B.

Malt; Apparatus for Making —— and Treating other similar Materials. H. J. Sulzen, Sacramento. Eng. Pat. 1797, Jan. 23, 1904.

The apparatus for turning and aerating malt on the germinating floor is mounted on a carriage propelled by a motor, and provided with steering gear. At the bottom of the carriage in front are situated a number of ploughs, which turn and lift the grain, delivering it to a series of spiral conveyors, which raise it to the summit of the carriage. In its upward course the grain in the elevators is subjected to a blast of air from a fan situated below the perforated walls of the conveyors. At the summit, the malt may be treated with a spray of water if desired. It then falls on to a series of alternate shelves and shakers, from which it is discharged through an adjustable door at the back of the carriage.—J. F. B.

Wort [Raw Grain] for Brewing or Distilling; Preparation of ——. F. B. Aspinall, Blackheath. Eng. Pat. 9106, April 22, 1903.

Raw grain is disposed in layers or columns, freely accessible to water, but protected from heat other than that conveyed by the water. The receptacles containing the layers of grain, so arranged that there is room for the expansion of the latter, are placed in a digestor, in which the grain is boiled with water under pressure until the water is saturated with "liquefied starch." The boiling is repeated with changes of water until the whole of the starch is extracted; the bulk of the albuminoid matter remains in the grain. —J. F. B.

French Patents.

Liquids under Pressure; Bottling ——. Filter u. Brautech Masch. Fab. vorm. L. A. Enzinger. Fr. Pat. 338,18 1903. I., page 600.

"*Alcovinometer*" [*Alcoholometer*]; *Capillary* ——. Soc L. Legrand and Lafaverge. Fr. Pat. 338,291, Dec. 1903. XXIII., page 623.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Phosphorus Compound in Wheat Bran; Nature of i Principal ——. A. J. Patten and E. B. Hart. Am Chem. J., 1904, **31**, 564—572.

The authors find that nearly the whole of the solul phosphorus in wheat bran exists in the form of a ma nesium-calcium-potassium salt of a phospho-organic acid. The free acid is probably identical with Posternak's anhydro-oxymethylene-diphosphoric acid, $(OH)_2PO.O.CH_2.O.CH_2.O.PO(OH)_2$. The alkali salts of this acid are readily soluble in water, the calcium and copper salts are slightly soluble, and the barium and strontium salts are but sparingly so. The acid or its salts have already been isolated from the seeds of red fir, peas, beans, pumpkin, red and yellow lupin, and also from the potato and other tubers and bulbs.—A. S.

Palm of Madagascar; Alimentary Pith from a ——. R. Gallerand. Comptes rend., 1904, 138, 1120—1121.

The pith is obtained from the *Satranabe* palm, *Medemia nobilis*, which grows abundantly in Ambongo. After being dried, ground, and sifted, it is used as a food by the natives. The specimen of the meal examined contained 13·3 per cent. of water. The dry material contained:—Starch, 66·833; cellulose, 12·939; albuminoids, 10·538; fat, 1·037; and mineral matter, 8·2 per cent. The meal is thus richer in albuminoid matter than potatoes, manioc, sweet potatoes, and yams, which contain 6·23, 3·30, 3·85, and 7·24 per cent. respectively of nitrogenous substances. —A. S.

Caseïn; Hydrolysis of ——. Z. H. Skraup. Ber., 1904, 37, 1596—1597.

From the products of the hydrolysis of caseïn the author has isolated *diaminoglutaric acid* and *diaminoadipic acid*. He has also separated several hydroxyamino acids, including mono- and diamino derivatives of di- and tribasic acids. Amongst these are described:—*Hydroxyaminosuccinic acid*, m. pt. 320 C.; an acid, $C_8H_{16}N_2O_6$, m. pt. 243° C., which is named provisionally *dihydroxydiaminosuberic acid*: an acid, $C_9H_{16}N_2O_7$, occurring in characteristic rystals, melting at 192° C., and yielding a sparingly soluble opper salt and a well-crystallised hydrochloride; this acid eceives the name of *caseanic acid*; it is apparently a nonohydroxy tribasic acid; finally an acid, $C_{12}H_{16}N_2O_5$, ermed *caseïc acid*, which is dibasic and yields a copper alt which is very sparingly soluble in cold water and eadily turns violet. Caseïc acid occurs in two modiications, one melting at 226° C., feebly dextro-rotatory and rystallising in fairly well formed prisms, the other melting t 246° C., optically inactive and crystallising in very ndistinct prisms; both forms apparently yield the same opper salt and hydrochloride.—J. F. B.

Butter; Distinction of Natural from Artificial ——. A. Quartaroli. XXIII., page 625.

ard; Detection of Cocoanut Oil in ——. F. Morrschöck. XXIII., page 625.

Melon-Seed Oil. G. Fendler. XII., page 613.

English Patent.

eat Extract; Manufacture of a ——. A. R. da S. Braga, Sao Paulo. Eng. Pat. 7895, April 5, 1904.

quantity of meat and some finely-divided fruit of the paw family (*carica papaya*) are mixed with a little water ightly acidulated with hydrochloric acid, and digested at temperature of 50° to 70° C., until disintegrated, when the ixture is boiled. After cooling, straining, and removing lid fat, the liquid is evaporated and mixed with a suitable antity of glycerin to form either a liquid or pasty meat tract.—W. P. S.

United States Patent.

Flour; Process of Treating —— [Electrically]. N. Alsop, Owensboro. U.S. Pat. 759,651, May 10, 1904.

E Eng. Pat. 14,006 of 1903; this J., 1903, 1062. —T. F. B.

French Patent.

Foodstuffs; Process for the Partial or Complete Suppression of the Products of Decomposition of ——, formed by Micro-Organisms. H. Frings, jun. Fr. Pat. 338,333, Dec. 19, 1903.

This invention is based on the facts that, while saccharomycetes can flourish in presence of a certain quantity of hydrogen peroxide, *mycelium* and the schizomycetes cannot develop under the same conditions; and also that, with a sufficient quantity of hydrogen peroxide, the growth of the saccharomycetes is also stopped. Hydrogen peroxide is, then, added to fruit, wines, beer, meat, &c., in very small quantities (*e.g.*, 0·03 per cent. for wines) to partially or completely prevent the development of micro-organisms. Instead of hydrogen peroxide, compounds which produce it, such as metallic peroxides or percarbonates, may be used.—T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

Sewage; The Organic Colloids of ——. W. Biltz and O. Kröhnke. Ber., 1904, 37, 1745—1754.

Samples of town sewage were submitted to dialysis in parchment tubes immersed in distilled water, and the oxidisable matter was determined at intervals in the undiffused residue by means of permanganate. The speed of diffusion of the putrescible matters was generally slow, and slackened down towards the end of the period of observation until the permanganate value of the residue remained practically constant. The inorganic salts, *e.g.*, chlorides, diffused with extreme rapidity. The results showed that one-half to one-third of the total oxidisable matter of the sewage exists in the form of practically undiffusible colloids. Electrical tests of the convective migration of the oxidisable matters of the sewage showed that these tended to concentrate at the anode, and belong therefore to the class of negatively charged colloids (see this J., 1904, 459). Precipitation tests with the partially diffused sewage showed that the colloids were almost completely precipitated by colloidal solutions of ferric hydroxide and zirconium hydroxide in absence of electrolytes. The precipitations followed the law of optimum proportions enunciated *loc. cit.* In the chemical precipitation of sewage by ferric salts, the influence of the positive colloidal hydroxide is assisted by that of the electrolyte. The primary action in the biological purification of sewage is a mechanical one, due to the production of "adsorption compounds" between the colloids of the sewage and the gelatinous slimy layer of bacterial growths. Similar precipitations are produced by fungoid growths in solutions of inorganic colloids; they also appear to play a part in the sedimentation which takes place in the septic tank and in the "auto-purification" of rivers.—J. F. B.

Cellulose; Decomposition of —— by Aerobic Micro-Organisms. C. van Iterson, jun. Centr.-Bl. Bakter. u. Parasitenk., 11, 689—698. Chem. Centr., 1904, 1, 1338.

Cellulose can be brought into solution by the action of denitrifying non-sporulating bacteria, with restricted access of air. The presence of considerable quantities of soluble organic matter, prevents the nitrification process, but cellulose is without influence, if the aeration be good. The conjoint action of nitrification and denitrification processes must play an important part in the destruction of cellulose in the self-purification of waters and soils and the biological purification of effluents. Cellulose is also decomposed by aerobic, non-sporulating bacteria, of which a brown pigment-bacterium (*Bac. ferrugineus*) is the most important. This bacterium is particularly active in symbiosis with a yellow micrococcus, which by itself is inactive. In nutritive solutions in which the cellulose is decomposed by the aerobic bacteria of mud or garden soil, spirilla-cultures are always formed abundantly. The property of attacking cellulose is a general one among the fungi, and is due to an enzyme, which the author names *cellulase*. One of the causes of the formation of humus colouring matters is the production of pigments from cellulose by the action of bacteria and fungi. The nature of the anaerobic decomposition of cellulose may be of two kinds: In absence of potassium nitrate, carbon dioxide and hydrogen or methane, together with acetic and butyric acids, are formed; whilst in presence of potassium nitrate, the cellulose is decomposed by denitrifying bacteria, with formation of nitrogen, carbon dioxide, and water.—A. S.

English Patents.

Town Refuse such as is at present sent to Destructors; Separation or Treatment of ——. G. E. H. Rawlins and G. W. Douglas, both of Waterloo. Eng. Pat. 14,897, July 4, 1903.

The refuse is passed into a solution of such specific gravity that most of the carbonaceous matter will float therein, whilst most of the mineral matter will sink. The carbonaceous matter is removed by an elevator which dips just below the surface of the solution, and the mineral matter by a second elevator reaching to the bottom of the tank. After leaving the elevator, the carbonaceous matter is washed and dried. The salts used for making the solution are cheap ones, such as sodium chloride, calcium chloride, sodium sulphate, and the like.—W. P. S.

Sewage and like Waters; Process and Apparatus for Disinfecting ——. G. Porion, Arques. Eng. Pat. 7383, March 28, 1904.

The sewage or water is aerated or oxidised by means of rapidly revolving paddle-wheels placed across the channel through which the sewage flows. The paddles dip just below the surface and project a thin film of the sewage or water into the air. A weir maintains a constant level in the channel. The paddle-wheels may be mounted on a raft, together with suitable driving machinery, for use in rivers and reservoirs.—W. P. S.

Settling or Filtering Tanks [*Water Softening*] *and the like.* F. J. Farrell, London. Eng. Pat. 10,682, May 11, 1903.

The invention relates to a settling or filtering tank having a series of plates or trays arranged to slope downwards from each side of the tank towards a clear space in the centre. These trays form, between their ends and the end plates of the tank, oppositely arranged wedge-shaped recesses. The water to be treated enters the recess having its apex at the top, and its flow is diverted through or over the trays by means of centrally arranged baffle plates. The precipitate or sludge falls through the still water in the central space to a gutter at the bottom of the tank, where it is periodically drawn off. The clear water passes over a sill at the top of the tank, and, if desirable, may be filtered as it leaves.—W. P. S.

(*C.*)—DISINFECTANTS.

Ammonium Fluoride and Rubber Hose. E. Bidtel. Hantke's Letters on Brewing, 1904, **3**, 238—239.

Acid ammonium fluoride is the best disinfectant for rubber hose. The behaviour of the nearly chemically pure salt differs considerably from that of the technical salt. Pure vulcanised Para rubber is employed for lining the vessels in which the solutions of the salt are concentrated. This rubber resists the action of the hot concentrated solutions of acid ammonium fluoride for 3—4 years. With solutions of the technical salt, however, the rubber loses its elasticity, becomes brittle, and cracks, and the entire surface turns dark in colour. This is due to the fact that the technical fluoride, prepared in lead vessels, contains 2—3 per cent. of lead, which desulphurises the rubber. Other inferior qualities of rubber are always more or less attacked by the acid fluoride. For brewery purposes, therefore, pure rubber hose and pure acid ammonium fluoride should always be used. (See this J., 1904, 265.)—J. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

Pulp Boards for Beer Filtration. Wochenbl. f. Papierfab., 1904, **35**, 1546.

The pulp employed in filters for beer and wine is a long-fibred, "free"-beaten cotton half-stuff. When filtration was first introduced in the brewing industry, sheets of filter pulp were employed, which were used until they became clogged, and were then discarded. Later, on account of the expense, the pulp was supplied in blocks 40 cm. square and 3—5 cm. thick; these blocks were pulped up in water and distributed on the sieves of the filter to any desired thickness. After use the pulp was washed, sterilised, and dried. Owing to improper treatment in manufacture and irrational drying in thick blocks, the pulp frequently presented difficulties in the disintegration previous to use. There has lately, therefore, been a tendency to replace the thick blocks by sheets of thin cardboard, weighing 200—400 grms. per square metre, ready for use, which are prepared on the Fourdrinier paper machine at a far less cost than the blocks. The whole art of preparing a filtering pulp which disintegrates readily and uniformly in water, lies in maintaining the fibres in the same condition as they exist in the rags, with a minimum of chemical and mechanical treatment. For this reason the raw material should consist of knitted white cottons [cellular shirtings] which require very little beating. Strong bleaching should, above all, be avoided, since this tends to the production of a "wet" half-stuff, which resists the desired disintegration in water.

—J. F. B.

Cellulose; Decomposition of —— *by Aerobic Micro-organisms.* C. van Iterson, jun. XVIII. B., page 619.

United States Patent.

Viscose; Manufacture of Filaments or Films from ——. C. N. Waite, Lansdowne, Assignor to General Artificial Silk Co., Delaware. U.S. Pat. 759,332, May 10, 1904.

"Residual constituents such as sulphur and caustic soda" are removed from viscose threads by steaming, under tension, in an atmosphere containing sulphur dioxide.

—T. F. B.

Casein; Treatment of ——. L. A. Dreyfus, New Brighton. U.S. Pat. 759,808, May 10, 1904.

The "insoluble properties of casein" are improved by heating it in the presence of acid (*e.g.*, sulphuric acid), with or without the addition of a mineral base, for a period of 24 hours, more or less.—R. L. J.

French Patents.

Paper [*from Sawdust*]; *Process and Machine for Manufacture of* ——. C. Pfeifer. Fr. Pat. 338,330, Dec. 19, 1903.

Wood sawdust is screened and thoroughly steeped in water; the material is then pumped into a refiner, in which it is subjected to a milling process. From the refiner it passes through a cylindrical-strainer and thence to a special cylindrical mill. This mill has a conical form and the grinding being and outer cylinder are constructed of stone, the object edges to beat the fibres to a mucilaginous consistency. After the pulp has passed through the conical portion of the mill, it is further ground by a portion of the cylindrical roller set with emery stones, before being finally ejected.—J. F. B.

Papier-Maché Articles; Process of Making ——. C Gaertner. Addition, dated Dec. 23, 1903, to Fr. Pat 337,480, Nov. 19, 1903.

See Eng. Pat. 27,339 of 1903; this J., 1904, 453.—T. F. B

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Ceriсsulphuric Acid; Salts of —— *with the Rare Eart Elements.* B. Brauner. Z. anorg. Chem., 1904, **39** 261—295.

When concentrated sulphuric acid and water react o ceric oxide and the products are crystallised, a yellow a a red salt result. The former is normal ceric sulphat $Ce(SO_4)_2.4H_2O$, and its crystal-constants have be measured by the author. The red salt is the hydrog cerous salt of the complex tetrabasic cericsulphuric ac

$Ce^{iv}(SO_4)_4Ce'''H.12H_2O$. This salt can be produced synthetically by adding solution of cerous sulphate to excess of ceric sulphate solution containing sufficient free sulphuric acid to form the complex acid. If the solution contain no more sulphuric acid than is just sufficient to prevent hydrolysis of the ceric sulphate, a bright orange salt, possibly normal cerous cericsulphate, $Ce_4'''[Ce^{iv}(SO_4)_4]_3.44H_2O$, is formed, usually, however, in admixture with other products. The cerous cerium in the red salt can be replaced by other rare earth elements, such as lanthanum and the didymiums. These other salts can also be formed synthetically from cerisulphuric acid and the sulphates of lanthanum, praseodymium, or neodymium; they are isomorphous with the cerous salt.—J. T. D.

Chloroform; Electrolytic Preparation of —— from Acetone.
J. E. Teeple. J. Amer. Chem. Soc., 1904, **26**, 536—543.

The conditions necessary for the successful preparation of chloroform by the electrolysis of a chloride in presence of acetone are: a temperature below 25° C., absence of alkali, a high current density at the cathode and a low one at the anode. A solution containing 120 grms. of sodium chloride in 700 c.c. of water, and 25 c.c. of acetone, was electrolysed The anode consisted of platinum foil of 75 sq. cm. area, a platinum wire forming the cathode. To obtain information as to the course of the reaction, portions of the liquid were pipetted off at different intervals and analysed for total alkali and free hypochlorite. The current efficiency (*i.e.*, he ratio of the amount of chloroform formed to that calculated from the current passed through) was 80—90 per cent. uring the first few minutes, but fell very rapidly as the lkalinity of the liquid increased. If, during the electroysis, acid be added to neutralise the alkali, then the fficiency is 80 per cent. for the first 8 ampère-hours. The lkalinity may be observed by the addition of trinitrobenzene o the bath, this being colourless in an acid, and red in an lkaline, solution. A good yield of chloroform is obtained y the action of chlorine upon calcium hydroxide solution ontaining acetone. This suggests that the electrolysis of a alcium chloride solution in presence of acetone would be e best method of making chloroform, provided that the igh resistance of the deposits on the anode could be vercome.—E. H. T.

Anethol; Contribution to our Knowledge of ——.
P. Hoering. Ber., 1904, **37**, 1542—1560.

N experimental and theoretical study of anethol; more pecially of the bromine compounds.—A. S.

ohimbine: Composition of ——, and its Relation to Yohimboaïc Acid. L. Spiegel. Ber., 1904, **37**, 1759—1766.

HE author has repeated the purification and analysis of himbine, and has established beyond a doubt that the rmula of the hydrated base is $C_{22}H_{30}N_2O_4$, and that this es 1 mol. of water under certain conditions, yielding *hydroyohimbine*, $C_{22}H_{25}N_2O_3$, m. pt. 234° C., which exists such in the salts of yohimbine. Examination of the mmercial hydrochloride showed that this is indeed a single bstance. The nitrate crystallises readily from water, and lts at 276° C. *Yohimboaïc acid*, which is identical with *yohimbine*, $C_{20}H_{26}N_2O_4$ (this J., 1903, 228), is a monosic acid. This acid, when esterified with methyl alcohol presence of hydrogen chloride, yields yohimbine hydrooride. Yohimbine is not, however, simply the methylic er of yohimboaïc acid. Esterifications of this acid with thyl, ethyl, and propyl alcohols showed that two alkyl oups are taken up, and that 1 mol. of water is split off all three cases.—J. F. B.

squiterpenes; Action of Paraformaldehyde on ——.
P. Genvresse. Comptes rend., 1904, **138**, 1228—1229.

E sesquiterpenes, like the terpenes, form molecular mpounds with formaldehyde, having an alcoholic function. imolecular proportions of paraformaldehyde and sesquipene are heated in a Pfungst tube for 10 hours at 180 00° C. The excess of the reagents is removed by illation with steam, and the alcoholic residue is exted and rectified. The products give, on analysis, results corresponding to the formula $C_{16}H_{26}O$. Compounds are described obtained in this manner from *caryophyllene*, *clovene*, and *cadinene*; they are all odourless and lævorotatory. The acetic ester of the product obtained from caryophyllene is also described.—J. F. B.

Terpenes and Essential Oils. **66** *and* **67**. O. Wallach.
Annalen, 1904, **332**, 305—351.

The 66th communication relates to the addition products of unsaturated compounds with nitrogen trioxide and nitrosyl chloride. It is divided under the following headings:—(1) Compounds of the anethol series, (2) compounds of the isosafrol series, and (3) compounds of the methylisoeugenol series. The 67th communication is entitled "A new case of optical isomerism," and treats of optically isomeric derivatives of cyclomethylhexanone.—A. S.

Patchouli Oil: A New Adulterant. W. H. Simmons.
Chem. and Druggist, 1904, **64**, 815.

The author points out that, in addition to cedarwood and cubeb oils, the usual adulterants of patchouli oil, apparently an ester or an oil containing an ester is also now employed for adulteration. Two samples of patchouli oil recently examined gave the following figures:—Sp. gr. at 15° C./15° C., 0·9948 and 0·9937; optical rotation, $\alpha_D = -38° 30'$ and $-49° 30'$; refractive index at 20° C., 1·5175 and 1·5110; saponification value, 58 and 18·5; solubility in 90 per cent. alcohol, 1 in 0·75 and 1 in 0·5.
—A. S.

Monodora Myristica Seeds; Essential Oil of ——.
H. Thoms. Ber. Pharm., **14**, 24; Pharm. J., 1904, **72**, 617.

The seeds of *Monodora myristica*, Duval, a native of Western Africa, yield, when subjected to steam distillation, 7 per cent. of an essential oil of very pleasant odour, and having a yellow colour with greenish fluorescence. The oil is lævo-rotatory, $\alpha_D = -64° 16'$. It contains *l*-limonene and a terpene alcohol, $C_{10}H_{16}O$, probably identical with myristicol; but no myristicin or other phenolic esters such as are present in nutmeg or mace oil (see this J., 1903, 1255).—A. S.

Essential Oil of Ilex Paraguayensis [Paraguay Tea Oil].
H. Haensel's Report, April 1904, 21.

The yield from the dried compressed maté leaf was 0·975 per cent. The oil is solid at the ordinary temperature, of a dark green colour, and possesses the characteristic odour and flavour of maté. It melts at about 26·5° C., and has the following characters:—Sp. gr. at 15° C., 0·8875; opt. rot., α_D^{20} + 3·73°; acid value, 61; saponification value, 91. The oil is acid in reaction, readily soluble in 96 per cent. alcohol, but only sparingly so in 80 per cent. alcohol.
—J. O. B.

Pinene; Action of Nitrosyl Chloride on ——.
W. A. Tilden. Proc. Chem. Soc., 1904, **20**, 122.

Pinene nitrosochloride having been shown by von Baeyer to have the double formula $(C_{10}H_{16}.NOCl)_2$, it occurred to the author that the unsatisfactory yield of this compound by the usual processes might be improved by using a mixture of equal quantities of *d*- and *l*-pinenes, which is optically inactive. Whereas previously the yield of nitrosochloride from ordinary *d*-pinene was about 32 per cent. of the pinene, and the product from the more highly rotatory pinene obtained from French turpentine was still less, the employment of a mixture prepared so as to be optically inactive gives 55 per cent. The melting point of pure pinene nitrosochloride is not 103°, as originally given, but 115° C. (*circa*). For the regeneration of pinene from the nitrosochloride, methylaniline is recommended in preference to aniline, as there is no violent action, and the yield of pinene is greater.

Mercuric Chloride; Delicate Reaction for —— [in Calomel and other Mercurous Preparations]. A. Moulin. XXIII., page 623.

Methyl Alcohol in Formaldehyde; Determination of ——.
R. Gnehm and F. Kaufler. XXIII., page 626.

Formaldehyde and Trioxymethylene; Determination of ——. C. Kleber. XXIII., page 626.

Tartaric Acid; New Method for the Determination of ——. H. Ley. XXIII., page 626.

Lead; [Determination of ——] in Citric and Tartaric Acids. C. T. Bennett. XXIII., page 624.

Quinine; Detection of —— by J. J. André's [Thalleioquin] Reaction. E. Léger. XXIII., page 625.

Quinine; Determination of —— in Mixtures with other Cinchona Alkaloids. E. Léger. XXIII., page 626.

Morphine in Opium; Determination of ——. P. Schidrowitz. XXIII., page 626.

Nux Vomica, Ignatius Beans, Ipecacuanha, and Cinchona Bark; [Alkaloidal] Assay of ——. E. Léger. XXIII., page 626.

Distillation of Immiscible Liquids. E. Charabot and J. Kocherolles. XXIV., page 628.

Camphor Group; Metallo-organic Syntheses in the ——. G. Oddo. XXIV., page 629.

French Patent.

C.C-Dialkylbarbituric Acids; Process for the Production of ——. C. E. Merck. Fr. Pat. 338,183, Oct. 16, 1903.

C.C-Dialkylbarbituric acids are obtained by heating the corresponding dialkylmalonyl chlorides with urea, hydrochloric acid being evolved, thus:— $R_2C(COCl)_2 + CO(NH_2)_2 = 2HCl + R_2C:(CO.NH)_2:CO$. Dimethylbarbituric acid is prepared by heating 5 parts of dimethylmalonyl chloride with 2·66 parts of urea for 10 hours on the water-bath, and then for 2 hours, at 130° C., on the oil-bath. (See also Eng. Pats. 1945, 1944, 1664, and 2054 of 1903; this J., 1903, 818, 880, and 923).—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Sodium Thiosulphate; Oxidation of ——. E. Sedlaczek. VII., page 605.

Calico Printing; Photographic Preparation of Rollers for ——. J. Wolkoff. V., page 604.

English Patents.

Photographs on Linen or other Fabrics or Substances; Production of ——. O. Fulton, Chiswick, and W. M. Gillard, Twickenham. Eng. Pat. 11,219, May 16, 1903.

A closely woven fabric is stiffened by means of a dilute solution of celluloid, dried, and coated on both surfaces with a sensitive emulsion (silver, platinum, bichromate, &c.). The object of this treatment is to produce a "duplex" photograph, *i.e.*, a photograph on each surface of the fabric, whereby "the effect of density is produced by transmitted light, and the effect of brilliancy by light reflected from the photograph produced."—T. F. B.

Photographic Printing Paper or the like; Process for Preparing ——. I. Hoffsümmer, Düren. Eng. Pat. 3855, Feb. 16, 1904.

Instead of preparing paper (for receiving emulsions) by treatment with "zapone," (a solution of cellulose in amyl alcohol, &c.) as described in Eng. Pat. 25,390 of 1903 (this J., 1904, 337), cellulose acetates may be employed in a similar manner.—T. F. B.

French Patent.

Photographs in Colours; Process for Obtaining ——. Dr. Riebensahm and Posseldt, Ges. m. beschr. H. Fr. Pat. 338,170, Dec. 29, 1903.

A finely-divided pigment is thoroughly incorporated with a silver halide emulsion, and the mixture spread on paper in the usual manner. After exposure under a reversed negative, the paper is developed in the usual manner, washed, and immersed for 10 or 15 minutes in a 5 per cent. solution of potassium bichromate. By this treatment, a quantity of the gelatin, corresponding to the reduced silver of the image, is rendered insoluble. The paper having been washed and the excess of bichromate neutralised with alkali, the film is transferred to a support, developed by means of hot water, and fixed with "hypo (sodium thiosulphate)." By this means permanent photographs in any desired colour may be obtained.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

Nitrocellulose; Study of ——. II. C. Haeussermann. Ber., 1904, **37**, 1624—1625. (See this J., 1904, 36.)

The aqueous distillate obtained when nitrocellulose is boiled with caustic alkali was treated with dilute sulphuric acid and distilled. The portion coming over first was treated with potassium carbonate, and the oil which separated was distilled *in vacuo* at a temperature not rising above 40° C. In this way a colourless mobile liquid was obtained, which yielded iodoform with alkali and iodine dissolved in potassium iodide solution, but did not reduce ammoniacal silver nitrate solution. The residue consisted of a red resinous substance insoluble in water. The distillate appears to consist of the oxime-like compound of an aldehyde or ketone; it contains 5·4 per cent. of nitrogen, 56 per cent. of carbon, and 10 per cent. of hydrogen. A distillate capable of yielding iodoform is obtained from both fibrous and amorphous nitrocellulose, and also from other nitrated carbohydrates, *e.g.*, nitro-inulin, nitrostarch, nitrolactose and nitroglucose (this J., 1898, 271), and the nitro-amyloid obtained by Lunge and Weintraub by allowing nitric acid to drop into a solution of cellulose in sulphuric acid (Z. angew. Chem., 1899, 448; this J., 1899, 705).—A. S.

Explosions Produced by Ferrosilicon. A. Dupré and M. B. Lloyd. Iron and Steel Inst., May 5, 1904.

In December last 48 drums of ferrosilicon were landed at Liverpool, and, after being left on the quay until January 12, were removed to Bootle. While the drums were being placed in a warehouse, one violently exploded, as also did another shortly afterwards. The ferrosilicon was then transferred to wooden barrels, in the ends of which holes were bored to prevent accumulation of inflammable gas. Notwithstanding these precautions, however, a third explosion occurred in one of the barrels on January 21. The ferrosilicon contained: silicon, 59·40; iron, 36·85; manganese, 0·08; aluminium, 2·73; calcium, 0·14; magnesium, 0·17; carbon, 0·218; sulphur, traces; and phosphorus, 0·056 per cent. The authors found that 4 kilos. of the powdered ferrosilicon, when moistened with water, gave off an inflammable gas consisting mainly of phosphoretted hydrogen, in sufficient quantity to render explosive 64 litres of air. The explosions were therefore probabl caused by water having got into the interior of the drums the gas evolved forming with the air in the drums a explosive mixture which could be fired by the heat produce by the friction of the hard lumps against each other whe the drums were moved about, or possibly by the spontaneous ignition of some phosphoretted hydrogen contained in "pocket" in the material and liberated suddenly by th breaking of a lump. It is suggested that in future th drums be filled up with paraffin oil of high flashing poin or that the material be submerged in water until all actio has ceased. The drums should be water-tight and not liabl to become insecure under the ordinary conditions transport.—A. S.

English Patent.

Explosives. J. Führer, Vienna. Eng. Pat. 3301, Feb. 10, 1904.

On account of the large number of calories developed oxidation, it is proposed to use silicon in certain explosive The following composition is given: Ammonium nitra (73 per cent.), charcoal (2·5 per cent.), dinitrotolue (14·5 per cent.), and silicon (10 per cent.).—G. W. McD

United States Patent.

Pyrotechnical Compositions; Process for Making ——. M. Magnard, Salaise. U.S. Pat. 759,387, May 10, 1904.

Five kilos. of gum-arabic are mixed with 5 kilos. of magnesium carbonate, 5 litres of water are added, and the mixture is heated to 50° C.; 1 kilo. of white phosphorus is then added, and the mixture allowed to cool to 25° C. under continuous agitation, when 2·5 kilos. of red ochre and 3 kilos. of potassium chlorate are put in. The product resulting is then powdered.—L. F. G.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Pyrometers suitable for Metallurgical Work. Report by R. A. Hadfield, J. E. Stead, and B. H. Brough. Iron and Steel Inst., May 1904.

A description, with illustrations, of a number of pyrometers is given. In the *Baird and Tatlock pyrometer* the electromotive force developed by the difference in temperature of two similar thermo-electric junctions opposed to one another, is measured. *Bristol's recording air pyrometer* consists of a porcelain bulb connected by a capillary tube to a recording pressure-gauge. It allows of the measurement of temperatures of high ranges and gives continuous records on a moving chart. In the *Callendar and Griffiths' thermometers* the increase in resistance of a platinum wire with rise of temperature is observed. The principle on which the *Le Chatelier pyrometer* is based, is the conversion of heat into an electric current and the determination of the electromotive force of the current produced. By the *Mesuré and Nouel optical pyrometer* the temperature of incandescent bodies is measured by observation of the luminous tint of the light emitted by them. The *Roberts-Austen pyrometer* is of the recording electrical type. The *Rosenhain-Chalmers optical pyrometer* measures the temperature of a hot body by comparing the intensity of the light emitted by the body with that of the light given out by a comparison body at a known temperature. The *Siemens electric pyrometer* is a platinum resistance thermometer. In the *Siemens water-pyrometer*, the degree of heat imparted to a known volume of water by a metal cylinder which has been exposed to the temperature to be measured, is determined. The *Uehling pneumatic pyrometer* is based upon the laws governing the flow of air through small apertures; it is combined with an autographic recorder. By the *Wanner optical pyrometer* the temperature is measured by determining the quantity of light radiated from he hot body. A comparison is made, by polarisation, of he rays of the temperature to be measured with the rays of a known temperature emitted by an electric lamp. The *Wiborgh thermophones* consist of small cylinders which explode with a sharp crack at the end of an interval of ime corresponding to the temperature of the furnace. A list of English patents relating to pyrometry and a bibliography of the subject are also given.—A. S.

English Patents.

Lids or Covers for Crucibles. J. H. R. Appleyard, Huddersfield, and W. Cranfield, Halifax. Eng. Pat. 14,242, June 27, 1903.

Covers for porcelain or other crucibles are constructed with he interior surface of the lid convex or inclining downards, from the outer upper-edge to the centre. By this ethod of construction anything that splashes up, on to the d gravitates to the centre, and falls back into the crucible, stead of running down to the edge and being lost.
—W. H. C.

Cupels; Manufacture of ——. The Morgan Crucible Co., Ltd., and J. C. Fox, Battersea. Eng. Pat. 1695, Jan. 22, 1904.

He base or underside of the cupel is hollowed out, so that e litharge may penetrate the mass, flowing laterally, and not reach the floor of the oven on which the cupel rests, as it is liable to do with a cupel having the usual flat base.
—E. S.

French Patent.

Alcovinometer [Alcoholometer]; Capillary ——. Soc. L. Legrand et Lafaverge. Fr. Pat. 338,291, Dec. 3, 1903.

For the determination of alcohol in wines advantage is taken of the height to which the wine ascends in a capillary tube starting from a constant level. The wine is placed in a receiver up to a constant level determined by a needle-point. The containing vessel and capillary tube are made in one piece, which is levelled on an adjustable stand; when the vessel has been filled with wine, the latter is forced up the capillary tube by pressure on a piece of rubber tubing, the height at which the column stands is then read off and corrected for temperature.—J. F. B.

INORGANIC—QUALITATIVE.

Mercuric Chloride; Delicate Reaction for —— [*in Calomel and other Mercurous Preparations*]. A. Moulen. L'Union Pharm., 1904, **45**, 147—148.

A reagent is prepared by dissolving 2 grms. of diphenylcarbazide in 100 c.c. of 90 per cent. alcohol, and 10 c.c. of 50 per cent. acetic acid. When solution is complete, the volume is made up to 200 c.c. A few drops of this reagent are added to the aqueous solution to be tested, followed by a few c.c. of 10 per cent. sodium acetate solution. In the presence of mercuric chloride a characteristic blue colour is produced. The presence of 1 part in 1,000,000 can be readily detected by this reaction. It is specially applicable for the detection of mercuric salt in calomel, in wash waters from other mercurial preparations, and in mercurous iodide.
—J. O. B.

INORGANIC—QUANTITATIVE.

Gelatinous Precipitates; Filtration and Ignition of ——. M. Dittrich. Ber., 1904, **37**, 1840—1842.

The filtration of gelatinous precipitates, and especially of those which, like aluminium and ferric hydroxides, become slimy on heating, can be considerably accelerated by adding to the precipitate, before filtration, filter-paper shaken up with water so as to form a pulp. One filter-paper of 7—11 cm. diameter, according to the quantity of precipitate, is usually sufficient. The filtration and washing can then be carried out very quickly. In the ignition, care must be taken that the whole of the filter-paper is completely burnt, this generally requiring repeated careful and cautious shaking, so as to change the position of the mass. The ignited precipitate then consists, not of hard lumps, but of an extremely fine powder. Ferric hydroxide precipitates, treated in this way, may be placed in the crucible in the wet state and ignited without any fear of reduction taking place. When it is required to dissolve a precipitate and re-precipitate it, the filter-paper and precipitate are placed in the original beaker, in which they are boiled with moderately concentrated acid until the precipitate is dissolved and the filter paper converted into a coarse pulp; the precipitant is then added and the liquid filtered. In the separation of ferric hydroxide and alumina by fusion with caustic soda, the fine division of the precipitate by the filter pulp makes it extremely ready of attack by the soda. The grinding of ignited precipitates in an agate mortar, in order to treat them with various reagents, is also obviated.
—T. H. P.

Bleaching Powder; New Method for the Technical Analysis of ——. U. Roberto and F. Roncali. L'Ind. Chimica, **6**, 93—95; Chem. Centr., 1904, **1**, 1294.

The method is based upon the fact that when chlorine water is added to an aqueous solution of hydrazine sulphate, nitrogen is evolved, in accordance with the equation—

$$N_2H_4.H_2SO_4 + 2Cl_2 = N_2 + 4HCl + H_2SO.$$

100 c.c. of water, 2—3 grms. of hydrazine sulphate and 30 c.c. of dilute sulphuric acid are introduced into a

300—400 c.c. flask, and the latter is closed with a double-bored cork carrying a funnel-tube and a gas-outlet tube. 10 grms. of the bleaching powder are well mixed with water and the whole made up to 1 litre. The hydrazine sulphate solution is heated to boiling, and after the air is expelled from the flask, 100 c.c. of the bleaching powder solution (= 1 grm. of the sample) are introduced through the funnel-tube, followed by 30—40 c.c. of water, the solution in the flask being kept boiling. The nitrogen is collected in the usual way, and from the volume corrected to 0° C. and 760 mm. pressure, the percentage of available chlorine is calculated.—A. S.

Iron and Zirconium; Separation of —— by Means of Nitroso-β-naphthol. G. von Knorre. Z. angew. Chem., 1904, **17**, 641—647, 676—678.

Iron and zirconium in chloride solutions containing oxalic acid can be quantitatively separated by means of nitroso-β-naphthol, if the solution be strongly acidified with hydrochloric acid, and then heated to boiling before precipitating the iron. The method was carried out as follows. 50 c.c. of ferric chloride solution (= 0·1131 grm. of ferric oxide) and 100 c.c. of zirconium chloride solution (= 0·309 grm. of zirconium dioxide) were mixed together, and 20 c.c. of N/1 oxalic acid solution added, followed by 5 c.c. of hydrochloric acid of sp. gr. 1·12; the solution was then treated with 10 c.c. of 90 per cent. acetic acid, heated to boiling, and the iron precipitated by a hot solution of 1·5 grms. of nitroso-β-naphthol in 10 c.c. of acetic acid. The precipitate was filtered off cold, washed, dried, ignited, and weighed as ferric oxide. In the filtrate the zirconium can be precipitated by ammonia, either directly, or preferably after destroying the organic matter by boiling with potassium chlorate and hydrochloric acid. In most cases, however, it would be better to precipitate in a fresh portion of the original solution the iron and zirconium together by ammonia and determine the zirconium by difference. In the case of sulphate solutions, the precipitation of zirconium is not completely prevented by oxalic acid, but the separation can be readily effected in presence of tartaric acid. The solution containing iron and zirconium is treated with tartaric acid, a slight excess of ammonia is added to dissolve the precipitate produced, the clear liquid diluted to about 200 c.c., slightly acidified with hydrochloric acid, 10—20 c.c. of acetic acid added, the solution heated to boiling and the iron precipitated, whilst stirring, with a hot solution of nitroso-β-naphthol in acetic acid. The procedure is then the same as described above. (See also this J., 1889, 819; 1892, 713; 1893, 711; and 1897, 67.)—A. S.

Ferrous Salts; Conversion of ——, into Ferric Salts for Volumetric Determinations or for Separation of Iron with Manganese. L. L. de Koninck. Bull. Soc. Chim. Belg., 1904, **18**, 90—92.

A solution of pure ferrous chloride, completely oxidised by means of bromine, is decomposed on heating, a basic salt being precipitated. After boiling the solution, with or without the addition of hydrochloric acid, the presence of a ferrous salt can be detected on addition of potassium ferricyanide. Thus ferric bromide, in solution, is dissociated by boiling, even in presence of hydrochloric acid or a chloride; the author concludes that the use of bromine as an oxidising agent for ferrous salts should be avoided when an excess of bromine is undesirable in the solution.

—T. F. B.

Cupric Salts; Precipitation of —— by Potassium Hydroxide. L. L. de Koninck. Bull. Soc. Chim. Belg., 1904, **18**, 89—90.

The presence of a large excess of alkali nitrate does not, as is stated in several works on analytical chemistry, prevent the complete precipitation of cupric salts by potassium hydroxide; the solvent action attributed to the nitrate is probably due to the use of a large excess of alkali in the precipitation or to the presence of organic matter in the reagents used.—T. F. B.

Cyanogen; Volumetric Determination of ——. J. McDowall. Chem. News, 1904, **89**, 229.

The author recommends, for the rapid determination of cyanides, *e.g.* in the valuation of potassium cyanide for gold extraction, titration with a standardised solution of copper sulphate to which excess of ammonia has been added. The presence of chlorides has no influence on the results.—A. S.

Silver [in Silver Alloys]; Proposed Modification of Volhard's Method of Determining ——. C. Hoitsema. Z. angew. Chem., 1904, **17**, 647—650.

Rose (this J., 1904, 470) has proposed to alter Volhard's method by adding directly sufficient standardised thiocyanate solution to precipitate nearly the whole of the silver, then filtering, adding the iron indicator and finishing the titration with the clear filtrate. The author finds that whilst the sensitiveness of the final reaction is considerably increased by the alteration, the accuracy is, in certain cases impaired. For example, in six tests with 1000, 1001, 1002, 1003, 1004, and 1005 mgrms. respectively of pure silver, after adding to the solution 100 c.c. of standard thiocyanate solution (1 c.c. = 10 mgrms. of silver), and filtering, the amounts of dilute thiocyanate solution required to produce a yellow colour in the filtrate were 0, 1, 3, 7, 14, and 20 drops, instead of there being a regular increase of 20 drops (= 1 mgrm. of silver) in each case. In other tests, also variable results were obtained, and these are shown by the author to be due to the "adsorption" by the silver thiocyanate precipitate of soluble silver salts and also of the soluble thiocyanate. The author concludes that Rose's proposed modification may give rise to false results and should therefore not be used.—A. S.

Tin. Assay of ——, and Solubility of Cassiterite. J. H. Collins. Inst. Min. Metall., May 19, 1904.

For practical purposes on the mine, the author recommends vanning; for scientific determinations the old Ecole des Mines method of reducing by fusion with potassium cyanide and weighing as metallic tin, due precautions being taken when lead, bismuth, arsenic, antimony, &c., are present. In the assay of "black tin" by the direct fusion method, he deprecates a previous cleansing by boiling with acid, cassiterite not being altogether insoluble under such treatment. The results of a number of experiments on the solubility of different forms of native oxide of tin in dilute sulphuric and hydrochloric acids in presence of metallic zinc are then recorded, and the author concludes that it is only the "wood-tin" varieties which are in any important degre soluble—some varieties being almost completely solubl under the conditions named.—J. H. C.

Copper; Quantitative Electrolytic Precipitation of —— T. W. Richards and H. Bisbee. J. Amer. Chem. Soc 1904, **26**, 530—536.

Among the conditions upon which the rapid deposition o the copper depends are the area of the cathode and the concentration of the solution. The best conditions are thu obtained by employing a thin film of the liquid between tw large surfaces, such as the annular space between two concentric platinum crucibles or dishes, separated by a suitabl device made of thin glass rod. As the electrolysis proceed the current density can be automatically diminished b employing a single storage cell without resistance. copper solution was used for the experiments, and it w found that the time of deposition was approximately i versely proportional to the concentration.—E. H. T.

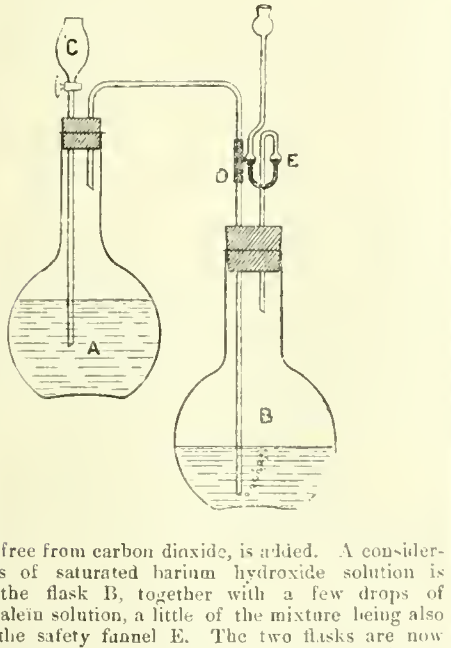
Lead; [Determination of ——] in Citric and Tartar Acids. C. T. Bennett. Chem. and Druggist, 1904, **6** 815.

According to A. H. Bennett, the results obtained in t colorimetric determination of lead by means of sodiu sulphide are slightly higher when distilled water is used f the preparation of the standard colours than when pu solutions of ammonium citrate or tartrate are employed, originally proposed by Warington. The author finds t

although a slight difference is discernible when the proportion of lead is greater than about 20 parts per million, the discrepancy is practically negligible with smaller amounts. If, therefore, when the amount of lead is greater than 20 parts per million, the solution be diluted before being tested, the great drawback to Warington's method, viz., the impossibility of obtaining commercially samples of citric and tartaric acids quite free from lead, may be overcome.
—A. S.

Carbon Dioxide; Rapid Method for the Volumetric Determination of ——. T. Macara. Analyst, 1904, **29**, 152—153.

The process is based on the fact that barium carbonate behaves like an alkali towards Methyl Orange. A known quantity of the substance (equivalent to not more than 2·5 grms. of calcium carbonate) is placed in the flask A, and water, free from carbon dioxide, is added. A considerable excess of saturated barium hydroxide solution is placed in the flask B, together with a few drops of phenolphthalein solution, a little of the mixture being also placed in the safety funnel E. The two flasks are now onnected, hydrochloric acid is added by the funnel C, and he contents of A gradually raised to boiling, the flask B eing vigorously shaken meanwhile. When all carbon lioxide has passed over, the flasks are disconnected, dilute ydrochloric acid is added to the contents of B through a unnel attached at D until all free barium hydroxide has een neutralised, 2 or 3 c.c. of barium hydroxide are added o make the solution again alkaline, and the flask is well haken. The contents of E and B are now mixed, eutralised exactly with N/10 hydrochoric acid, and the arium carbonate titrated with N/10 hydrochloric acid after dding Methyl Orange as indicator. Should sulphides, lphites, chlorine, bromine, or nitrites be present in the ıbstance, the usual precautions must be taken by adding opper sulphate or chromate to the evolution flask. With e latter, sulphuric acid must be used instead of hydroloric acid.—W. P. S.



ulphur; Forms in which —— occurs in Coal; their Calorific Values and Effects on the Accuracy of the Heating Powers, calculated by Dulong's formula. E. E. Somermeier. II., page 601.

ORGANIC—QUALITATIVE.

utter; Distinction of Natural from Artificial ——. A. Quartaroli. Staz. sperim. agrar. ital., **37**, 18—23. Chem. Centr., 1904, **1**, 1373—1374.

RELLI and Carcano (Staz. sperim. agrar. ital., **25**, 77) oposed to detect adulteration of butter by determining s molecular weight from the lowering of its freezing-point in benzene solution according to Raoult's method, but were unable to detect additions of less than 25 per cent. of margarine. The author obtains better results by the following method depending on the same principle. 30 grms. of the sample are melted at 60° C. in a dry porcelain dish, and filtered through a dry filter, 5—6 c.c. of the filtrate are made up to nearly 50 c.c. with acetic acid, the mixture is allowed to stand for 24 hours in a hermetically-closed flask, then filtered rapidly, and the cryoscopic determination made immediately in a Beckmann's apparatus. The results given in the following table show that whilst the lowering of the freezing point scarcely varies in direct proportion to the amount of margarine present, yet the presence of 10 per cent. of the latter can be detected.

—	Lowering of Freezing Point.
	°
Butter, No. 1 (fresh)	0·56—0·57
„ No. 2 „	0·54—0·55
„ No. 1 } After 24 days {	0·53
„ No. 2 }	0·52
Margarine, No. 1	0·29
„ No. 2	0·17
Butter, No. 2 + Margarine No. 1 (90 : 10)	0·30
„ „ „ No. 2 (50 : 50)	0·35
„ No. 1 + „ No. 1 (80 : 20)	0·34
„ „ „ „ (60 : 40)	0·33
„ „ „ „ (40 : 60)	0·32
„ „ „ „ (20 : 80)	0·30
„ „ „ „ (90 : 10)	0·40
„ „ „ „ (95 : 5)	0·40

—A. S.

Lard; Detection of Cocoanut Oil in ——. F. Morrschöck. Z. Unters. Nahr.- u. Genussm., 1904, **7**, 586—587.

The results of the experiments given show that pure lard is only slightly soluble in 95 per cent. alcohol. This soluble portion has a considerably higher iodine value (70) than the original lard; it has a + refraction, but the saponification value does not appreciably alter. The presence of a small quantity of cocoanut oil in the lard distinctly alters the composition of the fraction soluble in alcohol. The saponification value is increased, compared with that of the original mixture, the iodine value is lower, and the refraction is negative. The alcohol-soluble portion of a mixture containing 10 per cent. of cocoanut oil had an iodine value of 46·56, against 54·65 for the original mixture; a saponification value of 221·6 against 204·2, and a refraction of − 3·4 compared with − 1·9.
—W. P. S.

Quinine, Detection of ——, by J. J. André's [Thalleioquin] Reaction. E. Léger. J. Pharm. Chim., 1904, **19**, 281—284, 434—435.

It is shown that the green colour-reaction obtained with salts of quinine in the presence of ammonia and free bromine or chlorine depends entirely upon the amount of the latter present. It is, therefore, necessary to employ a definite quantity of bromine solution to obtain a positive reaction. By adding 1 drop only of saturated bromine water to 10 c.c. of the quinine solution, agitating, then adding 1 drop of ammonia, without shaking, a green zone is formed at the line of contact, with a dilution of 1 : 20,000 of quinine. The Swiss and Italian Pharmacopœias adopt this test to indicate the amount of quinine in the "total alkaloids" of the official cinchona bark. The 0·5 grm. which the 10 grms. of bark should yield, is directed to be dissolved in 100 c.c. of water by the aid of a little acetic acid. If the bark meets the official requirement of containing 1 per cent. of quinine, this will give a 1 : 1000 solution. The bromine reagent is directed to consist of 1 c.c. of freshly prepared saturated bromine water and 99 c.c. of distilled water. To 10 c.c. of this reagent, 1 c.c. of the alkaloidal solution is added, then 5 or 6 drops of ammonia. A green colour should be produced. If instead of employing the bromine reagent of the strength indicated, one of half the strength be employed, a green colour may be obtained with 0·5 c.c. of the alkaloidal solution almost as intense as with the official quantity. The colour reaction depends, therefore, not on the amount of quinine present, but on the dilution of the bromine reagent. Other tests confirmed the view that the reaction is useless for quantitative purposes.—J. O. B.

ORGANIC—QUANTITATIVE.

Quinine; Determination of ——, in Mixtures with other Cinchona Alkaloids. E. Léger. J. Pharm. Chim., 1904, **19**, 427—434.

It is found that, although quinine may be precipitated from a solution of cinchona alkaloids as basic tartrate by means of solution of Rochelle salt, and the precipitate does not carry down the other bases, the same is not the case with cinchonidine, precipitated as tartrate under similar conditions. This precipitate is found to be largely contaminated with the other alkaloids. Consequently the method of Oudemans alone, based on the polarimetric reading of the solution of the tartrates is inapplicable to the case of the determination of quinine in "total alkaloids," although it gives very accurate results with quinine and cinchonidine only. The method of Carles also, in which the crystallised quinine sulphate is weighed as such, gives good results with barks rich in quinine and poor in cinchonidine; but is unsatisfactory with those in which the cinchonidine is in preponderance. The author proposes to combine the two methods. In the first place, the basic sulphates of quinine and conchinidine are obtained in a crystalline form, employing a saturated solution of quinine sulphate, instead of water, as the solvent of the sulphates of the other alkaloids; these sulphates of quinine and cinchonidine are then converted into tartrates in a cold saturated solution of quinine and cinchonidine tartrates. The rotation of the mixed tartrates is then determined as in Oudemans method. The details of the process are as follows. The total alkaloids in the form of basic sulphates are treated in a conical flask with a boiling mixture of 5 c.c. of water and 75 c.c. of aqueous solution of quinine sulphate saturated in the cold. The mixture is then heated over the naked flame to complete solution, and set aside for 24 hours to crystalise. In this manner the sulphates of quinine and cinchonidine are separated, whilst the sulphates of the other bases remain in the mother liquor of saturated quinine sulphate. The crystalline sulphates are collected on a tared filter comprising a funnel, a perforated porcelain disc, and a round flannel filter pad, drained by a vacuum, washed with saturated solution of quinine sulphate and finally with 2 c.c. of distilled water. After draining, the crystalline cake of sulphates is first dried in the air, then at 30° C. The funnel, the disc, and the flannel pad are dried and weighed as well as the crystals. The crystalline mass is then powdered, 0·7 grm. weighed off into a conical flask, treated with 40 c.c. of saturated solution of tartrates of quinine and cinchonidine previously heated to boiling, and the mixture heated until solution is complete. To the hot solution 2 c.c. of solution of sodium-potassium tartrate, containing 0·35 grm. per c.c., are added. After 24 hours, the crystalline precipitate of double tartrates is collected on two counterpoised filters, and washed, first with saturated solution of quinine and cinchonidine tartrates, then with 5 c.c. of water. The filters are then drained and pressed between bibulous paper, the contents withdrawn, the filters and tartrates dried separately in the air until constant, then weighed. The index of rotation is then determined as in Oudeman's method according to his formulæ—

$$215{\cdot}8 \times x + 131{\cdot}3\,(100 - x) = 100 \times \alpha m$$

in which αm = the observed rotation of the mixed tartrates. Hence—

$$x = \frac{100\,\alpha m - 13130}{215{\cdot}8 - 131{\cdot}3}$$

in which 215·8 is the rotatory index of quinine tartrate, and 131·3 that of cinchonidine tartrate. The quantity of quinine tartrate TQ in the mixed tartrates TM will be therefore—

$$TQ = \frac{TM\,(100\,\alpha m - 13130)}{100\,(215{\cdot}8 - 131{\cdot}3)}$$

and the corresponding amount of quinine Q will be—

$$Q = \frac{324 \times TM\,(100\,\alpha m - 13130)}{408 \times 100\,(215{\cdot}8 - 131{\cdot}3)}$$

324 being the mol. wt. of quinine and 408 that of quinine tartrate. With mixtures of quinine, cinchonidine and cinchonine sulphates the method has afforded very accurate results.—J. O. B.

Methyl Alcohol; Determination of ——, in Formaldehyde. R. Gnehm and F. Kaufler. Z. angew. Chem., 1904, **17**, 673—676.

Ninety grms. of the sodium salt of sulphanilic acid are dissolved in 35 c.c. of boiling water, and rapidly cooled, with agitation. To the magma, 20 c.c. of the formaldehyde are added and occasionally shaken during 3—4 hours; the aldehyde is thus fixed. Next 30—35 c.c. are distilled over, made up to 50 c.c., and weighed in a pycnometer, thus obtaining the specific gravity of the methyl alcohol; this specific gravity must be known to four places of decimals, and the temperature must therefore be carefully adjusted or allowed for. Traces of a body, not formaldehyde, which reduces ammoniacal silver nitrate, are always found in the distillate. The maximum error observed in applying this method was 0·5—0·6 grm. in 100 c.c.—W. A. C.

Formaldehyde and Trioxymethylene; Determination of ——. C. Kleber. Pharm. Rev., **22**, 94. Pharm. J., 1904, **72**, 682.

A concentrated solution of sodium bisulphite is treated with sodium hydroxide solution till all odour of free sulphurous acid has disappeared, and is then diluted until 30 c.c of it exactly neutralise 50 c.c. of N/1 sodium hydroxide solution. Formaldehyde and trioxymethylene act towards this solution as alkalis. 5 c.c. of the formaldehyde solution, or 2 grms. of trioxymethylene with a few c.c. of water, are titrated, in presence of phenolphthalein, with the bisulphite solution, until the red colour is destroyed, and does not reappear on warming.—A. S.

Tartaric Acid; New Method for Determination of ——. H. Ley. Pharm. Zeit., 1904, **49**, 149.

The method is based on the complete insolubility of zinc tartrate in alcohol and in acetic acid, so that by their employment the precipitation of hydrated carbonate or other basic compounds of zinc is avoided.

Tartaric Acid.—A few decigrms. of the acid are dissolved in water or alcohol; the solution is gently warmed, then treated with alcoholic solution of zinc acetate in excess; after standing for some time in the warm, from 100 to 150 c.c. of alcohol, and 5 c.c. of 50 per cent. acetic acid are added and the mixture is kept for about 10 minutes on the water-bath. After cooling, the precipitate is collected, washed with alcohol, dried, calcined, redissolved in a little nitric acid, again calcined, and weighed as zinc oxide.

Potassium Acid Tartrate.—With pure cream of tartar the process is conducted as above, the first solution, however being obtained by heating with the smallest possible quantit of water, which is then precipitated with aqueous zinc acetat solution. In crude argol the whole of the tartaric aci must first be converted into potassium tartrate, by digestin with potassium carbonate, a few drops of phenolphthalei being used as indicator to avoid excess of alkali. Th solution thus obtained is made up to a known volume, an after standing, an aliquot part is taken for the determinatio which is then conducted as described above. The metho may be applied to the determination of tartaric acid i wines, but the tannin present must be first eliminated b treatment with animal charcoal.—J. O. B.

Morphine in Opium; Determination of ——. I Schidrowitz. Analyst, 1904, **29**, 144—148.

The following method is described, being based to certain extent on the process given in the Pharmacopœ Germanica IV. Six grms. of powdered opium are mix into a cream with 6 c.c. of water, and then transferred to 100 c.c. Erlenmeyer flask, which has previously be counterpoised. The weight of opium and water is th made up to 54 grms. After shaking the contents of t flask for 1 hour, the whole is poured on a filter. Exac

42 grms. of the filtrate are shaken for half a minute with 2 grms. of a solution of sodium salicylate containing 50 grms. per 100 c.c. and again filtered. 36 grms. of filtrate are collected, 15 c.c. of ether are added, and then 5·2 c.c. of ammonia solution prepared by mixing 17 grms. of ammonia (sp. gr., 0·960) with 83 grms. of water. The whole is vigorously shaken for 10 minutes and allowed to stand for 24 hours, when the ether is poured on a filter, 15 c.c. of fresh ether are added to the flask, cautiously shaken, and again poured on the filter together with the aqueous portion. The greater part of the crystals remain in the flask and are washed with 3 quantities of 5 c.c. of water saturated with ether. Of each 5 c.c., 3 c.c. are used to rinse the flask, and 2 c.c. run directly on the filter. The filter and its contents are then pressed between blotting-paper, and the greater part of the crystals returned to the flask. The filter and flask are dried at 55° C., when the crystals remaining on the filter are readily transferred to the flask The crystals are now dissolved in 25 c.c. of N/10 sulphuric acid, and the excess of acid titrated back with N/10 alkali, using Methyl Orange as indicator. The amount of morphine in the sample is then calculated from the equation—

$x \times 0{\cdot}7575 + \frac{1}{13}(x \times 0{\cdot}7575) =$ per cent. of morphine where $x =$ the number of c.c. of N/10 acid used.

Test analyses are given which show that the method is accurate.—W. P. S.

Nux Vomica, Ignatius Beans, Ipecacuanha, and Cinchona Bark; [*Alkoloidal*] *Assay of* ——. E. Léger. J. Pharm. Chim., 1904, **19**, 479–484.

Nux Vomica: First Method.—An amount of the powdered drug, equivalent to 12 grms. of the dry substance, is agitated for 5 minutes, with a mixture of 20 c.c. of chloroform and 100 c.c. of ether, sp. gr., 0·721. 5 c.c. of a mixture of equal volumes of solution of ammonia and distilled water are then added, and the mixture is well agitated occasionally for 3 hours; 80 c.c. of the liquid are filtered off (corresponding to 8 grms. of the original powder), and shaken out successively with 25, 15, and 10 c.c. of a solution of 2 c.c. of hydrochloric acid in 48 c.c. of water. The acid extracts are mixed, the alkaloids liberated with a slight excess of dilute ammonia, and shaken out twice with 50 c.c. of the above ether-chloroform mixture; the bulked alkaloidal solutions are washed with 2 c.c. of water, and the solvent is then distilled off in a small tared flask, the residue dried at 100° C. and weighed. The amount of alkaloids thus found should be about 2·5 per cent.

Second Method.—A modified Prollius's extraction menstruum, consisting of solution of ammonia 4 c.c., absolute alcohol 16 c.c., ether sp. gr. 0·721, 130 c.c., may be employed instead of the ether-chloroform mixture. In this case, 180 c.c. are taken for the 12 grms. of powder operated n. After macerating for 12 hours, 150 c.c. are filtered off, nd distilled in two portions from a small flask. The esidue is dried, first on the water-bath, then at 100° C., n the drying oven; then dissolved in 12 c.c. of a mixture f hydrochloric acid 1 c.c. and water 14 c.c. by heating he rubber-corked flask on the water bath and well agitating fter the fatty matter has melted. When the solution is cold, his adheres to the sides of the flask. The acid liquid is ltered through a small paper, 10 c.c. of the filtrate are endered alkaline with ammonia, and the alkaloids shaken ut with three successive 20 c.c. of chloroform. The bulked hloroform extracts are washed with 2 c.c. of water, then istilled; the residue dried at 100° C. and weighed. The eight × 12 gives the percentage of alkaloids.

Ignatius Beans.—The equivalent of 12 grms. of the dry aterial is weighed off, and treated as described under x vomica by the first method. Ignatius beans are somemes richer in alkaloids than nux vomica, G. Sandor *ahresbericht der Pharm.*, **1896**, 135), having found 1 to 3·22 per cent.

Ipecacuanha: First Method.—Similar to the first method r nux vomica, but adding 2 c.c. of solution of ammonia d 8 c.c. of water to the ether-chloroform extraction fluid; aceration is conducted for one hour only, after which the wdered drug is aggregated by the addition of 10 c.c. of ter; 100 c.c. of liquid, equivalent to 10 grms. of drug, are filtered off. The amount of total alkaloids should not fall below 2 per cent.

Second Method.—Similar in all respects to the second method for *nux vomica*.

Cinchona Bark.—The method is based on Portes' modification of the Prollius method. A weight of powdered bark equivalent to 6 grms. of dry material is macerated for 1 hour with 6 c.c. of solution of ammonia, and 24 c.c. of 90 per cent. alcohol; 120 c.c. of ether (sp. gr., 0·721) are then added and maceration continued for 6 hours with occasional agitation. 120 c.c. of filtrate are collected (equivalent to 4·8 grms. of the dry drug), distilled to dryness in several small portions, and the perfectly dry residue dissolved in 12 c.c. of a mixture of hydrochloric acid, 1 c.c. in water 14 c.c. The acid alkaloidal solution is passed through a small filter, and 10 c.c. of the filtrate are rendered alkaline with 2 c.c. of solution of ammonia, and 2 c.c. of water, and the liberated alkaloids shaken out with three successive 20 c.c. of chloroform. The bulked chloroformic extracts are washed with 2 c.c. of water filtered, then distilled from a small tared flask, and dried to constant weight at 100° C. and weighed. The weight × 25 = the percentage of total alkaloids.
—J. O. B.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Radioactivity and Matter. C. Winkler. Ber., 1904, **37**, 1655—1662.

The author discusses the question whether the so-called radio-active elements are elements, or whether radio-activity is not a purely physical process, somewhat similar to the magnetism of magnetite. He considers that the question will be satisfactorily answered only when larger quantities of the radio-active substances have been isolated and subjected to a more thorough chemical examination.—A. S.

Emanium. An Emanating Substance. F. Giesel. Ber., 1904, **37**, 1696—1699.

The emanation obtained from pitchblende (this J., 1903, 322) has been further investigated. The anhydrous chloride or bromide phosphoresces, the spectrum being discontinuous, and containing 3 lines lying between red and bluish-green. The glass in which the substance is preserved is coloured violet, whilst paper is turned brown and disintegrates. The activity of the solid reaches a maximum about 1 month after its separation from solution, and the emission of β-rays diminishes the longer the solid has been kept in solution, and the more dilute the solution. These properties point to the presence of a new element, which is named "Emanium" and which appears to belong to the rare earths. The scintillations produced on a Sidot's fluorescent screen are much brighter and larger than those produced by radium. A spinthariscope containing emanium is therefore more effective than one containing radium or polonium.—L. F. G.

Silicon; Apparent Volatilisation of —— *in Hydrogen.* A. Dufour. Comptes rend., 1904, **138**, 1169—1170.

In vacuum tubes containing arsine, the metallic arsenic deposited by the discharge is displaced, when the discharge is taking place, by a simple process of distillation, and deposits on the coolest part of the tubes; by artificial cooling it can be made to deposit at any desired part of the tube. With silicon hydride, however, this is not the case; the silicon deposits always in the Faraday's dark space. The author considers that the silicon is not volatilised, but converted by the free hydrogen into silicon hydride, which is decomposed at that particular part of the tube.—J. T. D.

Aluminium, Mercuric Chloride, and Benzene; Reaction between ——. W. Gulewitsch. Ber., 1904, **37**, 1560—1564.

If a mixture of 10 grms. (1 mol.) of aluminium turnings, and 151 grms. ($1\frac{1}{2}$ mols.) of mercuric chloride, be covered with 15 grms. of benzene, the mass becomes heated, and the benzene boils. The reaction is allowed to continue under a reflux condenser and another 43 grms. of benzene (2 mols. in all) are added. The mixture evolves hydrochloric acid, and is vigorously shaken towards the end of the reaction. A reddish-brown layer of liquid is produced, which, on filtering from metallic mercury, deposits transparent, yellow, six-sided plates on standing over sulphuric acid. The crystals are hygroscopic, and their composition is $C_6H_6.AlCl_3.HgCl$.—L. F. G.

Distillation of Immiscible Liquids. E. Charabot and J. Rocherolles. Bull. Soc. Chim., 1904, **31**, 533—544.

IN general the proportion in which an immiscible liquid distils with water is expressed by

$$\frac{P}{P^1} = \frac{M.F}{M^1.F^1}$$

where P is the weight of condensed liquid, M its molecular weight, and F its vapour-tension at the common boiling point, P^1, M^1, and F^1 being the corresponding functions of water. The authors' experiments show that P/P^1, if less than unity, increases as the boiling point is raised by pressure, whilst if greater than unity it diminishes under the same circumstances. When steam is passed into a less volatile immiscible liquid, the relation $\frac{P}{P^1} = \frac{M.\phi}{M^1.h}$ holds good, where ϕ is the vapour-tension of the liquid corresponding to the observed temperature of the mixed vapours, and h is the pressure. Hence, in steam distillation (as, for instance, of essential oils), the proportion of oil in the distillate can be raised, (1) by heating the still from outside and thus increasing ϕ; (2) by applying a vacuum and thus diminishing h.—W. A. C.

Water; Rate of Diffusion of ——, through a Semi-permeable Membrane. [*Molecular Weight of Dextrin*]. J. Sebor, Z. Elektrochem., 1904, **10**, 347—353.

THE rate of diffusion of water into a sugar-solution contained in a copper ferrocyanide cell is found to be, disregarding a moderate experimental error, directly proportional to the osmotic pressure; the experiment consumes much less time than Pfeffer's familiar measurement of the ultimate pressure. Applying this method, the molecular weight of dextrin is found to correspond to $(C_6H_{10}O_5)6{\cdot}3$. Further, the molecular weight of freshly-dissolved glucose remains the same whilst its rotation is simultaneously decreasing towards constancy; hence the bi-rotation of glucose cannot be due to the existence and breaking down of complex molecules.
—W. A. C.

Alkoli Fusion of Sulphonic Acids; Introduction of —— into Technology. H. Wichelhaus. Chem. Ind., 1904, **27**, 234.

H. BRUNCK has stated that Graebe and Liebermann in their process for the manufacture of alizarin, were the first to introduce into technology the sulphonating process, and the alkali fusion of sulphonic acids. The author points out, however, that he, in conjunction with L. Darmstädter, patented on Jan. 12, 1869, the preparation of α-naphthalene-sulphonic acid and of α-naphthol from the same, by fusion with alkali; and that a German firm intimated their willingness to carry out the process on the manufacturing scale on Mar. 22, 1869. Graebe and Liebermann's second patent for the manufacture of alizarin, in which the use of anthraquinone-sulphonic acids and the fusion of the same with alkali are claimed, was taken out on June 25, 1869.
—A. S.

Ethyl Butyrate; Hydrolysis of ——, by Lipase. J. H. Castle, M. E. Johnston, and E. Elvove. Amer. Chem. J., 1904, **31**, 521—550.

A CLEAR solution of the lipase was prepared by macerating 1 grm. of fresh hog liver with powdered glass or coarse white sand and 75 c.c. of water. The mixture was heated to 35° C., 5 c.c. of $N/_{10}$ butyric acid added gradually, and the whole made up to 100 c.c. with water. The heavy precipitate produced, was filtered off on a folded filter, a perfectly clear filtrate being obtained, usually of a faint yellowish colour. 5 c.c. of the clear solution when allowed to act upon 0·26 c.c. of ethyl butyrate at 40° C., will hydrolyse from 5 to 6·25 per cent. (or about 0·0145 grm.) of the ester. The solution loses only 7 per cent. of its lipolytic activity in five months, the very small amount of acid present exercising a preservative action on the enzyme. If the clear solution be filtered through a Pasteur-Chamberland filter, the filtrate possesses no enzymic activity. Experiments with clear solutions of the lipase which had been previously neutralised with standardised caustic soda solution, showed that small amounts of free acid (hydrochloric and butyric) greatly inhibit the action of the enzyme, whilst larger amounts completely destroy the ferment. Between 0° and 40° C., the rate of hydrolysis was increased by rise of temperature, being, on the average, 1·69 times greater for a rise of 10° C. Lipase appears to be a true catalytic agent, in that it suffers no permanent alteration while effecting the hydrolysis of the ethyl butyrate. The degree of hydrolysis effected by lipase is, within certain limits, independent of the concentration of the ethyl butyrate. From a comparison of the hydrolysing action of lipase, hydrochloric acid, and sodium hydroxide, the authors conclude that lipase as a hydrolysing agent more nearly resembles sodium hydroxide than it does hydrochloric acid.—A. S.

Ferment Actions. L. Liebermann. Ber., 1904, **37**, 1519—1524.

THE effect of hydrogen or nitrogen gas on a colloidal platinum solution is, in general, to diminish the amount of active oxygen it contains, but in some cases, and more especially immediately after nitrogen has been passed through such a solution, the latter exhibits a considerably increased activity for the catalysis of hydrogen peroxide. This the author considers to be due to an alteration brought about in the molecular structure of the colloidal platinum, possibly by increasing the smallest particles o platinum and so the surface of the latter. Colloidal platinum solutions containing 6—8 mgrms. of metal per 100 c.c., or boiling for half an hour or longer, become greatly diminishe in activity, which, however, they gradually recover whe cold; if such a boiled solution be allowed to cool i contact with air or oxygen, its catalytic activity is appreciably greater than if the cooling take place in nitrogen o hydrogen. These and similar results lead to the conclusio that oxygen plays an important part in the catalysis hydrogen peroxide by colloidal platinum, and the autho assumes that the latter possesses the power of rendering th molecular oxygen of the air active, and that this activ oxygen initiates the catalysis, which then proceeds witho requiring any source of oxygen other than the hydroge peroxide itself.

In studying the action of animal and vegetable enzym in catalysing hydrogen peroxide, the author has made u of an apparatus by means of which the pressure of t oxygen evolved, is measured by a mercury manomete These catalases, or the solutions containing them, nev contain active oxygen, nor have they the power of renderi active, oxygen led into them. In most cases, howev they are capable of taking up active oxygen (ozone) although, as a rule, for only a short time—and of retaini it in such a manner that it can be detected in the soluti At ordinary temperatures, air, oxygen, hydrogen, a nitrogen are practically without action on the cataly power of these enzymes, but when these are heated, t presence of oxygen or air lowers the temperature at whi they are destroyed. The action of these enzymes diff from platinum-catalysis in this, that here a direct action the enzyme on hydrogen peroxide undoubtedly takes pla as no active oxygen is required to initiate the reaction. may hence be assumed that an intermediate oxide peroxide of the enzyme is formed which reacts rea with hydrogen peroxide and carries on the catalysis. F tissue yields an extraordinarily active catalase, w causes brisk effervescence when added to a 3 per c solution of hydrogen peroxide.—T. H. P.

Reductases of Yeast; Conversion of Nitrobenzene Aniline by Philothion and ——. M. E. Pozzi- Bull. Assoc. Chim. Sucr. et Dist., 1904, **21**, 10 1075.

THE author, in reply to the criticism of Abelons and Gé maintains that the hydrogenising and reducing fermen yeast are capable of converting nitrobenzene into an

Beer or wine yeast pressed, but not dried, is distributed in a mixture of alcohol and water of about 40° C., and left for 30—40 hours, with occasional agitation; it is then filtered. The clear amber-coloured filtrate, with a few drops of nitrobenzene, is introduced into a flask and shaken from time to time for 24 hours, when the odour has almost disappeared. The liquid does not give the reaction of aniline until the alcohol has been distilled off in a hydrochloric acid solution and the residue treated with an excess of baryta and distilled with steam. The action is increased in the presence of sulphur.—L. J. de W.

Chromous Tartrate; Crystalline ——. G. Baugé.
Comptes rend., 1904, **138**, 1217—1220.

Moist chromous acetate is treated with a cold, boiled solution of tartaric acid (1 : 3) in an atmosphere of carbon dioxide. The acetate rapidly dissolves, giving a blue liquid. The flask is immersed in a bath of boiling brine, and a blue powder is deposited, whilst aqueous acetic acid distils off The blue deposit is filtered off, whilst still maintaining the atmosphere of carbon dioxide, washed with boiled water and dehydrated with alcohol, and finally with ether. The salt has a pale blue colour and crystallises in the form of microscopic prismatic crystals. It has a density of 2·33 at 15° C., and is insoluble in water. Analysis indicated the formula $C_4H_4CrO_6$. Chromous tartrate is very readily oxidised, and reduces ammoniacal silver nitrate. In contact with a concentrated solution of an alkali carbonate, in absence of air, it is converted into a double carbonate of chromium protoxide. In dilute solutions, containing a large proportion of carbonate relatively to tartrate, the saline oxide of chromium ($Cr_3O_4.4H_2O$; see this J., 1899, 305) is produced quantitatively on boiling.—J. F. B.

ERRATUM.

This J., 1899, 305, abstract of Baugé's article on "A New Hydrate of Chromous Oxide," *for* "$CrCr_3O_4$" throughout the abstract *read* "Cr_3O_4."

Camphor Group; Metallo-organic Syntheses in the ——.
G. Oddo. Ber., 1904, **37**, 1569—1572.

For the preparation of dicamphor and dicamphoquinone from bromocamphor, magnesium powder gives better results than sodium, which was previously proposed:—184·8 grms. of bromocamphor, 19·2 grms. of magnesium powder and 800 c.c. of dry toluene are mixed in a large flask under a reflux condenser and heated in an oil-bath. When the reaction begins it is very violent for the first 10 minutes, and the flask must be cooled. After the reaction has subsided, the contents of the flask are boiled for 24 hours; the mixture is then treated with ice and acidified with dilute sulphuric acid. The volatile constituents are removed by distillation with steam for four hours, and the residue is recrystallised from dilute alcohol (yield 37·2 per cent.). The dicamphoquinone is extracted from this product by means of a mixture of light petroleum spirit and benzene, and the dicamphor is eparated from the residue by treatment with dilute acetic acid.—J. F. B.

Ethane; Action of Ozone on ——. W. A. Bone and J. Drugman. Proc. Chem. Soc., 1904, **20**, 127.

The authors have obtained ethyl alcohol by the interaction of ethane and ozone at 100° C. Two experiments have been carried out as follows: ethane and ozonised air (the latter ontaining about 2½ per cent. of ozone) were separately led nto the top of a vertical, wide glass tube, about 18 inches ong, packed with glass beads and heated by a steam jacket. The proportions of the gases were so regulated that the ethane was always present in large excess, under which conditions the zone entirely disappeared as the mixture slowly descended he tube. The gases were then drawn through a series of ooled glass worms containing water for the absorption of soluble intermediate products. Each experiment extended ver 3 or 4 days, during which about 5 litres of ethane and 13 o 15 litres of the ozonised air passed through the apparatus. Subsequent examination of the liquid from the coolers showed that it contained ethyl alcohol, acetaldehyde, and traces of formaldehyde. At temperatures where ethane begins to react with oxygen with appreciable velocity, the alcohol is oxidised so many times faster than the ethane that it is practically impossible actually to detect its formation.

Prizes.

Butter; Detection of Adulterating Matters in ——.
Bd. of Tr. J., May 26.

The "Bulletin Commercial" (Brussels) of 14th May states that the Berlin Association of Butter Merchants is offering the following prizes:—

(1) 150*l.* for the best method of detecting the presence of palm fats in butter.

(2) 50*l.* for the best method of detecting the presence of lard in butter.

(3) 50*l.* for the best method of detecting the presence of palm fats in lard.

The methods must be of a nature which will allow them to be carried out in the course of one day in laboratories established for the purpose, and must be able to detect the presence of 15 per cent. of adulterating matter. The fee for each analysis must not exceed 6*s.*

New Books.

Elements of Water Bacteriology with Special Reference to Sanitary Water Analysis. By Samuel Cate Prescott and C. E. Amory Winslow, Lecturers in the Massachusetts Institute of Technology. John Wiley and Sons, New York, U.S. America. 1904. Price 5*s.* 6*d.* net. Chapman and Hall, Ltd., London.

Small 8vo volume containing 118 pages of subject-matter, an appendix of 9 pages, a list of references (bibliography) of 14 pages, and indexes of authors and subject-matter (20 pages). The following subjects are treated of:—I. Bacteria in Natural Waters. II. Quantitative Bacteriological Examination of Waters. III. Interpretation of preceding. IV. Determination of the Number of Organisms developed. V. Isolation of Specific Pathogens from Water. VI. Isolating the Colon Bacillus. VII. and VIII. Significance of and Presumptive Tests for *B. Coli* in Water. IX. Other Intestinal Bacteria. X. Significance and Applicability of the Bacteriological Examination.

Gas Works, their Construction and Arrangement, and the Manufacture and Distribution of Coal Gas. Originally written by Samuel Hughes, C.E. Ninth Edition, revised, with Notices of Recent Improvements, by Henry O'Connor, Assoc. M. Inst. C.E. Crosby Lockwood and Son, 7, Stationers' Hall Court, Ludgate Hill. 1904. Price 6*s.*

Small 8vo volume, containing frontispiece, preface, and 410 pages of subject-matter, with 75 illustrations.

The leading subjects treated of are as follows:—I. Historic Sketch. II. Chemistry of Gas-Lighting. III. Composition of Coal Gas. IV. Coal used in Gas Making. V. Carbonisation. VI. General Construction. VII. Retorts and Retort Settings. VIII. The Hydraulic Main and Valves. IX. The Exhauster. X. Purification of Gas. XI. Gas Holders. XII. Station Meter. XIII. The Photometer. XIV. The Governor, Regulator, Pressure Gauge, and Pressure Register. XV. Residual Products. XVI. Distribution. XVII. Consumers' Meter. XVIII. Burners and Glasses. XIX. Applications of Gas for Heating, Cooking, &c. XX. Explosions. XXI. Light Production. XXII. Controlling Influences, affecting Quality and Volume. XXIII. Public Lighting. XXIV. General Remarks (Naphthalene Removal; Mond Gas; Coke Ovens; and Acetylene Gas). XXV. The Sliding Scale.

Trade Report.

I.—GENERAL.

NATAL; IMPORT TRADE OF ——. GERMAN AND UNITED STATES COMPETITION WITH THE UNITED KINGDOM.

Bd. of Trade J., May 19, 1904.

The Board of Trade have received from Port Natal the following statement, showing the value of certain imports into Natal, by sea, in 1903, from Germany and the United States of America, comprising goods which might have been supplied by British manufacturers:—

Goods.	Germany.	United States of America.
	£	£
Ale and beer	17,400	1,400
Apothecary-ware	9,100	3,700
Candles	600	5,000
Cement	32,300	..
Cottons—piece, printed and dyed	12,000	1,000
Earthenware	12,500	1,100
Glass—bottles	4,000	300
„ window	2,700	..
Glassware	11,000	1,500
Malt	14,000	..
Medicines	1,400	10,300
Milk—condensed	3,600	8,800
Oilman's stores	800	9,400
Oils—other than paraffin and linseed, &c.	1,300	29,000
Painter's colours	500	5,000
Paper—		
Printing	6,600	4,000
Wrapping and brown	2,800	..
Perfumery	2,100	1,200
Soap	1,300	2,100
Spirits (not including perfumed)	3,500	2,700

SWITZERLAND; TRADE OF —— IN 1902.

Foreign Office Annual Series, No. 3150.

Switzerland imported "chemicals" to the value of 1,497,600*l.* in 1903, as compared with 1,434,400*l.* in 1902; "glass, pottery, and porcelain" amounted to 455,600*l.* in 1903 and 412,800*l.* in 1902.

JAVA; TRADE OF —— IN 1903.

Foreign Office Annual Series, No. 3163.

The following table shows the exports of some articles from Java and Madura during the year 1901-3:—

Articles.		1901.	1902.	1903.
Copra	Tons	27,220	43,781	15,155
Cinchona bark—				
Private	Lb.	13,076,016	13,682,335	14,087,143
Government	„	825,570	1,026,266	879,736
Gum dammar	Cwts.	26,272	35,451	37,400
Gutta-percha	Lb.	179,112	52,360	22,848
Hides	Pieces	550,404	529,499	500,664
Indigo	Lb.	1,411,310	1,128,664	1,297,274
India rubber	„	39,168	34,408	60,928
Quinine suphate	Oz.	1,032,800	794,400	766,800
Sugar (all kinds)	Tons	676,795	808,457	869,295
Tin—				
Private	„	4,296	4,105	3,436
Government	„	14,697	10,339	15,381

Cinchona Bark.—Although the total exports are somewhat larger than those of 1902, the average unit price obtained at 10 auctions held in Amsterdam was slightly better, *viz.*, 7·06 against 6·90 c. (5 c. = 1*d.*), while at the 12 London auctions an average price of 1⅜*d.*, or the same as in 1902, was realised.

Copra.—From the official returns, it appears that the greater part was shipped to Port Said for Marseilles or Amsterdam, the bulk probably going to the former port.

Indigo.—The increase in the indigo production may be ascribed partly to the larger acreage which, on account of the more favourable prices paid for the article during the previous year, was brought under cultivation, and partly to the propitious weather experienced while the crop was in the ground. Good prices were paid at the Samarang auctions for the first eight months of the year, but latterly results were less satisfactory. The bulk of the production during the year found its way to Japan, and this outlet appears to have taken the place of the Amsterdam market, which hitherto absorbed the greater part of the Java product.

Prospects for the coming season are not so bright, as buyers for Japan have withdrawn from the market, and planters have been forced to commence consigning their indigo to the Amsterdam market, which is over-stocked, apparently with the cheaper artificial indigo.

The prices obtained were much more satisfactory than in the preceding year, the lowest point reached being the equivalent of 7*s.* 3*d.* per cwt., as against 6*s.* 2*d.* per cwt. in 1902.

Notwithstanding the low values of the last two years, only five mills in Java have been compelled to close.

Petroleum.—The imports of petroleum during 1903 were slightly in excess of those of 1902. Of American oil only some 675,000 cases were brought in, against 813,898 and 1,344,085 cases in 1902 and 1901 respectively. This was no doubt due to the large stocks in hand at the close of 1902. No reliable statistics are available for Russian and other brands, but the number of cases imported probably showed an increase over the previous year.

The quantity of oil produced locally during the past three years was as follows:—

—	1901.	1902.	1903.
	Cases	Cases.	Cases.
Java, Wonokromo	478,290	293,947	407,853
Java, Blora	1,201,466	1,265,583	1,169,823

Sugar.—The production of sugar exceeded that of any previous year, the total reaching nearly 35,000 tons in excess of the year 1902. The results obtained, however, in the various divisions of the island were very dissimilar. In East Java, where the long dry monsoon was regarded as likely to prove unfavourable to the production, heavy rains fell early in the year, entirely altering the aspect of affairs, and the quantity produced was 500,507 tons, as against 463,364 tons in 1902 and 436,032 tons in 1901. The increase in production amounted to about 8 per cent., although the area planted for 1903 was about 1 per cent. less than in 1902.

In Mid Java heavy rains fell at frequent intervals during the milling season, and although the crop was the largest so far produced, being 228,604 tons as compared with 222,546 tons in 1902 and 182,833 tons in 1901, the percentage of sugar in the cane was very disappointing.

In West Java, where the weather was also unfavourable, the crop obtained from practically the same area as in the previous year amounted only to 153,907 tons, while in 1902 and 1901 the figures were 162,111 and 147,477 tons respectively.

ALKALI, &C. WORKS BILL [No. 202].

Ordered by the House of Commons to be Printed, May 17th, 1904.

A Bill to consolidate and amend the Alkali, &c. Works Regulation Acts, 1881 and 1892. Presented by Mr. Walter Long. (See also this J., 1903, 1022, *seq.*)

[N.B.—*Amendments of substance in the existing law are underlined.*]

PART I.

Alkali Works and Alkali Waste.

1.—(1) Every alkali work shall be carried on in such manner as to secure the condensation, to the satisfaction of the chief inspector, of the muriatic acid gas evolved in such work, to the extent of ninety-five per centum, and to such an extent that in each cubic foot of air, smoke, or chimney gases, escaping from the works into the atmosphere, there is not contained more than one-fifth part of a grain o muriatic acid.

(2) The owner of any alkali work which is carried on in contravention of this section shall be liable to a fine not exceeding, in the case of the first offence, fifty pounds, and in the case of every subsequent offence one hundred pounds.

2.—(1) In addition to the condensation of muriatic acid gas as aforesaid, the owner of every alkali work shall use the best practicable means for preventing the escape of noxious or offensive gases by the exit flue of any apparatus used in any process carried on in the work, and for preventing the discharge of such gases into the atmosphere, whether directly or by a chimney or other outlet, and for rendering such gases where discharged harmless and inoffensive, subject to the qualification that, on the basis of the amount of acid gas per cubic foot, no objection shall be taken under this section by an inspector to any muriatic acid gas in the air, smoke, or gases discharged into the atmosphere by a chimney or other outlet where the amount of such acid gas in each cubic foot of air, smoke, or gases so discharged does not exceed the amount limited by the last preceding section.

(2) If the owner of any alkali work fails, in the opinion of the court having cognisance of the matter, to use such means, he shall be liable to a fine not exceeding, in the case of the first offence, twenty pounds, and in the case of every subsequent offence, fifty pounds, with a further sum not exceeding five pounds for every day during which any such subsequent offence has continued.

3.—(1) Every work of whatever description in which ny liquid containing acid or any other substance capable of liberating sulphuretted hydrogen from alkali waste or rainage therefrom is produced or used shall be carried on n such manner that the liquid shall not come in contact vith alkali waste, or with drainage therefrom, so as to cause nuisance.

(2) The owner of any work which is carried on in conravention of this section shall be liable to a fine not xceeding, in the case of the first offence, fifty pounds, and n the case of every subsequent offence, one hundred ounds, with a further sum not exceeding five pounds for very day during which any such subsequent offence has ontinued.

(3) On the request of the owner of any such work as is entioned in this section the sanitary authority of the istrict in which such work is situate shall, at the expense f such owner, provide and maintain a drain or channel r carrying off such liquid as aforesaid produced in such ork into the sea or into any river or watercourse into hich the liquid can be carried without contravention of e Rivers Pollution Prevention Act, 1876, as amended any subsequent enactment; and the sanitary authority all for the purpose of providing any such drain or channel ve the like powers as they have for providing sewers, hether within or without their district, under the Public ealth Act.

(4) Compensation shall be made to any person for y damage sustained by him by reason of the exercise by sanitary authority of the powers conferred by this section, d such compensation shall be deemed part of the penses to be paid by the owner making the request to e sanitary authority under this section.

4.—(1) Alkali waste shall not be deposited or discharged thout the best practicable means being used for effectually eventing any nuisance arising therefrom.

(2) Any person who causes or knowingly permits any ali waste to be deposited or discharged in contravention this section, shall be liable to a fine not exceeding, in case of the first offence, twenty pounds, and in the case every subsequent offence, fifty pounds, with a further n not exceeding five pounds for every day during which such subsequent offence has continued.

5. Where alkali waste has been deposited or discharged, er before or after the commencement of this Act, and plaint is made to the chief inspector that a nuisance is asioned thereby, the chief inspector, if satisfied of the existence of the nuisance, and that it is within the power of the owner or occupier of the land to abate it, shall serve a notice on such owner or occupier requiring him to abate the nuisance; and if such owner or occupier fails to use the best practicable and reasonably available means for the abatement thereof, he shall be liable to a fine not exceeding twenty pounds, and if he does not proceed to use such means within such time as may be limited by the court inflicting such fine he shall be liable to a further penalty not exceeding five pounds for every day after the expiration of the time so limited during which such failure continues.

PART II.

Sulphuric Acid, Muriatic Acid, and other specified Works.

6.—(1) Every sulphuric acid work as defined in Paragraph (1) of the First Schedule to this Act shall be carried on in such manner as to secure the condensation, to the satisfaction of the chief inspector of the acid gases of sulphur or of sulphur and nitrogen, which are evolved in the process of the manufacture of sulphuric acid in that work, to such an extent that the total acidity of those gases in each cubic foot of residual gases after completion of the process, and before admixture with air, smoke, or other gases does not exceed what is equivalent to four grains of sulphuric anhydride.

(2) Every muriatic acid work as defined in paragraph (8) of the First Schedule to this Act shall be carried on in such manner as to secure the condensation to the satisfaction of the chief inspector of the muriatic acid gas evolved in such work, to such extent that in each cubic foot of air, smoke or chimney gases escaping from the work into the atmosphere there is not contained more than one-fifth part of a grain of muriatic acid.

(3) The owner of any sulphuric acid work or of any muriatic acid work which is carried on in contravention of this section shall be liable to a fine not exceeding, in the case of the first offence, fifty pounds, and in the case of every subsequent offence, one hundred pounds.

7.—(1) The owner of any work specified in the First Schedule to this Act (herein-after referred to as a scheduled work) shall use the best practicable means for preventing the escape of noxious or offensive gases by the exit flue of any apparatus used in any process carried on in the work, and for preventing the discharge of such gases into the atmosphere, whether directly or by a chimney or other outlet, and for rendering such gases where discharged harmless and inoffensive, subject to the qualification, that on the basis of the amount of acid gas per cubic foot no objection shall be taken under this section by an inspector—

- (*a*) To any muriatic acid gas in the air, smoke, or gase discharged into the atmosphere by a chimney or other outlet, where the amount of such acid gas in each cubic foot of air, smoke, or gases so discharged does not exceed the amount limited by the last preceding section:
- (*b*) To any acid gases in the air, smoke, or gases discharged into the atmosphere by a chimney or other outlet receiving the residual gases from any process for the concentration or distillation of sulphuric acid where the total acidity of such acid gases (including those from the combustion of coal) in each cubic foot of air, smoke, or gases so discharged, does not exceed what is equivalent to one grain and a half of sulphuric anhydride.

(2) If the owner of any such work fails, in the opinion of the court having cognizance of the matter, to use such means, he shall be liable to a fine not exceeding, in the case of the first offence, twenty pounds, and in the case of every subsequent offence, fifty pounds, with a further sum not exceeding five pounds for every day during which any such subsequent offence has continued.

8.—(1) An inspector may inquire whether, in any works in which aluminous deposits are treated for the purpose of making cement, herein-after called cement works, means can be adopted at a reasonable expense for preventing the discharge from the furnaces or chimneys of such works into the atmosphere of any noxious or offensive gas evolved in such works, or for rendering such gas where discharged harmless or inoffensive.

(2) Where it appears to the Local Government Board that such means can be adopted at a reasonable expense, the Board may by order require the owners of such works to adopt the best practicable means for the purpose, and may by the order limit the amount or proportion, in the case of cement works, of any noxious or offensive gas which is to be permitted to escape from such works into the chimney or into the atmosphere, and may also by the order extend to such works such provisions of this Act relating to scheduled works as they think fit.

(3) An order made under this section shall be provisional only, and shall not be of any validity until confirmed by Parliament, but when so confirmed shall have full effect, with such modifications as may be made therein by Parliament; and the expression "this Act" when used in this Act shall be deemed to include an order so confirmed, so far as is consistent with the tenor of that order.

(4) The Board shall take such steps as they may think fit for giving notice to persons interested of the provisions of any order made by them under this section before any Bill for confirming the same is introduced into Parliament.

(5) An order made under this section may impose fines for a breach of its provisions of like amount as any fines imposed by this Act for offences against this Act.

(6) An order made under this section may be repealed, altered, or amended by any subsequent order made under this section, and confirmed by Parliament.

PART III.

(i) *Registration of Works.*

9.—(1) An alkali work, a scheduled work, or a cement work, shall not be carried on unless it is certified to be registered.

(2) The work shall be registered in a register containing the prescribed particulars, and the register shall be conducted and the certificates issued in the prescribed manner.

(3) A certificate of registration, if issued at a time when a previous certificate is in force, shall be in force for one year after the time when that certificate ceases to be in force, and if issued at a time when no previous certificate is in force shall be in force until the following first day of April.

(4) An application for a certificate of registration of a work may, in the case of the first registration of that work, be made at any time, and an application for any subsequent certificate in respect of that work shall be made in the month of January or February.

(5) A certificate of registration shall be issued on application being made in the prescribed manner by the owner of the work, if the conditions of registration are complied with, and one of the conditions, in the case of the first registration of an alkali or scheduled work, or the registration of such a work if the work has been closed for a period of twelve months previously, shall be that the work is at the time of registration furnished with such appliances as appear to the chief inspector or, on appeal, to the Local Government Board to be necessary in order to enable the work to be carried on in accordance with such of the requirements of this Act as apply to the work:

Provided that the Local Government Board may dispense with the last-mentioned condition in the case of works erected before the commencement of this Act which were not before the commencement of this Act required to be registered.

(6) *There shall be charged upon every such certificate a stamp duty of five pounds in the case of an alkali work, and of three pounds in the case of any other work, and the Commissioners of Inland Revenue shall issue stamped forms of certificate for the purpose.*

(7) Written notice of any change which occurs in the ownership of a work or in the other particulars stated in the register shall, within one month after such change, be sent by the owner to the Local Government Board, and the register and the certificate shall be altered accordingly in the prescribed manner without charge and without the issue of a new certificate. If such notice is not sent as so required the work shall not be deemed to be certified to be registered.

(8) The owner of a work which is carried on in contravention of this section shall be liable to a fine not exceeding five pounds for every day during which it is so carried on.

(ii) *Inspection.*

10.—(1) The Local Government Board may, with the approval of the Treasury as to numbers and salaries or remuneration, appoint such inspectors (under whatever title they may fix) as the Board think necessary for the execution of this Act, and may assign them their duties and award them their salaries or remuneration, and shall constitute a chief inspector, and may regulate the cases and manner in which the inspectors are to execute and perform the powers and duties of inspectors under this Act, and may remove such inspectors.

(2) Notice of the appointment of every such inspector shall be published in the London Gazette, and a copy of the Gazette shall be evidence of the appointment.

(3) *The salaries or remuneration of the inspectors, and such expenses of the execution of this Act as the Treasury may sanction, shall be paid out of moneys provided by Parliament.*

(4) A person holding the office of chief inspector or inspector shall not be employed in any other work except with the sanction of the Local Government Board.

11. A person who—

(*a*) acts or practises as a land agent; or

(*b*) is engaged or interested directly or indirectly in any work to which this Act applies, or in any patent for any process or apparatus carried on or used in any such work, or in any process or apparatus connected with the condensation of acid gases, or with the treatment of alkali waste, or with preventing the discharge into the atmosphere or rendering harmless or inoffensive any noxious or offensive gas, or otherwise with any of the matters dealt with by this Act; or

(*c*) is employed in or about or in connexion with any work to which this Act applies, or in any other chemical work for gain,

shall be disqualified to act as an inspector under this Act.

12.—(1) For the purpose of the execution of this Act, an inspector may at all reasonable times by day and night, without giving previous notice, but so as not to interrupt the process of the manufacture,

(*a*) enter and inspect any work to which, in the opinio of the Local Government Board, any of the pro visions of this Act applies; and

(*b*) examine any process causing the evolution of an noxious or offensive gas, and any apparatus fo condensing any such gas, or otherwise preventin the discharge thereof into the atmosphere, or fo rendering any such gas harmless or inoffensiv when discharged; and

(*c*) ascertain the quantity of gas discharged into th atmosphere, condensed or otherwise dealt with and

(*d*) enter and inspect any place where alkali waste treated or deposited, or where any liquid co taining acid or any other substance capable liberating sulphuretted hydrogen from alkali was or drainage therefrom is likely to come in contact with alkali waste or drainage therefro and

(*e*) apply any such tests and make any such experimen and generally make all such inquiries, as seem him to be necessary or proper for the executi of his duties under this Act.

(2) The owner of any such work shall, on the demand of the chief inspector, furnish him within a reasonable time with a sketch plan, to be kept secret, of those parts of such work in which any process causing the evolution of any noxious or offensive gas or any process for the condensation of such gas or preventing the discharge thereof into the atmosphere, or for rendering any such gas harmless or inoffensive when discharged, is carried on.

(3) The owner of every such work and his agents shall render to every inspector all necessary facilities for an entry, inspection, examination, and testing in pursuance of this Act.

(4) Every owner of a work in which such facilities are not afforded to an inspector as are required by this Act, or in which an inspector is obstructed in the execution of his duty under this Act, and every person wilfully obstructing an inspector in the execution of his duty under this Act, shall be liable on conviction under the Summary Jurisdiction Acts to a fine not exceeding ten pounds.

13. The chief inspector shall, on or before the first day of March in every year make a report in writing to the Local Government Board of the proceedings of himself and of the other inspectors under this Act, and a copy of such report shall be laid before both Houses of Parliament.

14.—(1) If any sanitary authority apply to the central authority for an additional inspector under this Act, and undertake to pay a proportion of his salary or remuneration, not being less than one half, the Local Government Board may (if they see fit), with the sanction of the Treasury, appoint an additional inspector under this Act, to reside within a convenient distance of the works he is required to inspect; and such inspector shall have the same powers and be subject to the same power of removal and the same regulations and liabilities as other inspectors under this Act.

(2) The proportion of salary or remuneration aforesaid shall be paid at the prescribed times into the Exchequer, and shall be a debt due from the sanitary authority to the Crown.

(iii) *Special Rules.*

15.—(1) The owner of an alkali work or of a scheduled work may, with the sanction of the central authority, make special rules for the guidance of his workmen who are employed in or in connexion with any process causing the evolution of any noxious or offensive gas, or in or in connexion with the condensation or other treatment of that gas, and may annex fines to any violation of such rules, so that the fine for any offence do not exceed two pounds.

(2) A printed copy of the special rules in force under this section in any work shall be given by the owner of that work to every person working or employed in or about that work who is affected thereby.

(3) Any fine incurred under this Act in respect of an offence against a special rule may be recovered in accordance with the Summary Jurisdiction Acts.

(iv) *Procedure.*

16. In calculating the proportion of acid to a cubic foot of air, smoke, or gases, for the purpose of this Act, such air, smoke, or gases shall be calculated at the temperature of sixty degrees of Fahrenheit's thermometer, and at a barometric pressure of thirty inches.

17. The following regulations shall have effect with respect to the recovery of fines for offences under this Act other than fines recoverable summarily:—

(1) Every such fine shall be recovered by action in the county court having jurisdiction in the district in which the offence is alleged to have been committed:

(2) The action shall be brought, with the sanction of the central authority, by the chief inspector, or by such other inspector as the Local Government Board may in any particular case direct, within three months after the commission of the offence, and for the purposes of such action the fine shall be deemed to be a debt due to such inspector:

(3) The plaintiff in any action for a fine under this Act shall be presumed to be an inspector authorised under this Act to bring the action, until the contrary is proved by the defendant:

(4) The court may, on the application of either party, appoint a person to take down in writing the evidence of the witnesses, and may award to that person such remuneration as the court thinks just; and the amount so awarded shall be deemed to be costs in the action:

(5) If either party in any action under this Act feels aggrieved by the decision or direction of the court in point of law, or on the merits or in respect of the admission or rejection of any evidence, he may appeal from that decision to the High Court.

(6) Subject to the provisions of this section, all the enactments, rules, and orders relating to proceedings in actions in county courts, and to enforcing judgments in county courts, and appeals from decisions of judges of county courts, shall apply as if the action related to a matter within the ordinary jurisdiction of the court.

18.—(1) In any proceeding under this Act in relation to a fine for an offence other than an offence against a special rule—

(*a*) It shall be sufficient to allege that any work is a work to which this Act applies, without more; and

(*b*) It shall be sufficient to state the name of the registered or ostensible owner of the work, or the title of the firm by which the employer of persons in such work is usually known.

(2) A person shall not be subject to a fine under this Act for more than one offence in respect of the same work or place in respect of any one day.

(3) Not less than twenty-one days before the hearing of any proceeding against an owner to recover a fine under this Act for failing to secure the condensation of any gas to the satisfaction of the chief inspector, or for failing to use the best practicable means as required by this Act, an inspector shall serve on the owner proceeded against a notice in writing stating, as the case requires, either the facts on which such chief inspector founds his opinion, or the means which such owner has failed to use, and the means which, in the chief inspector's opinion, would suffice, and shall produce a copy of such notice before the court having cognisance of the matter.

(4) A person shall not be liable under this Act to an increased fine in respect of a second offence, or in respect of a third or any subsequent offence, unless a fine has been recovered within the preceding twelve months against such person for the first offence, or for the second or other offence, as the case may be.

19. All fines recovered under this Act, other than those recovered summarily, shall be paid into the Exchequer.

20. The owner of a work in which an offence under this Act other than an offence against a special rule has been proved to have been committed shall in every case be deemed to have committed the offence, and shall be liable to pay the fine, unless he proves to the satisfaction of the court before which any proceeding is instituted to recover such fine, that he has used due diligence to comply with and to enforce the execution of this Act, and that the offence in question was committed, without his knowledge, consent, or connivance, by some agent, servant, or workman, whom he shall charge by name as the actual offender; in which case such agent, servant, or workman shall be liable to pay the fine, and proceedings may be taken against him for the recovery thereof and of the costs of all proceedings which may be taken either against himself or against the owner under this Act:

Provided that it shall be lawful for the inspector to proceed against a person whom he believes to be the actual offender, without first proceeding against the owner, in any case where the inspector is satisfied that the owner has used all due diligence to comply with and to enforce the provisions of this Act, and that the offence has been committed by that person without the knowledge, consent, or connivance of the owner.

21. Any notice, summons, or other document required or authorised for the purposes of this Act to be delivered to or served on or sent to the owner of any work, may be served by post or by delivering the same to the owner, or at his residence or works; and the document shall be deemed to be properly addressed if addressed to the registered address of an owner, or, when required to be served on or sent to the owner of any works, if addressed to the owner of the works at the works, with the addition of the proper postal address, but without naming the person who is the owner.

22.—(1) Where complaint is made to the central authority by any sanitary authority, on information given by any of their officers, or any ten inhabitants of their district, that any work (either within or without the district) to which this Act applies is carried on, or that any alkali waste is deposited or discharged (either within or without the district) in contravention of this Act, and that a nuisance is occasioned thereby to any of the inhabitants of their district, the central authority shall make such inquiry into the matters complained of, and after the inquiry may direct such proceedings to be taken by an inspector as they think just.

(2) The sanitary authority complaining shall, if so required by the central authority, pay the expense of any such inquiry.

23.—(1) Where a nuisance arising from the discharge of any noxious or offensive gas or gases is wholly or partially caused by the acts or defaults of the owners of several works to which any of the provisions of this Act applies, any person injured by such nuisance may proceed against any one or more of such owners, and may recover damages from each owner made a defendant, in proportion to the extent of the contribution of that defendant to the nuisance, notwithstanding that the act or default of that defendant would not separately have caused a nuisance.

(2) This section shall not authorise the recovery of damages from any defendant who can produce a certificate from the chief inspector that in the works of that defendant the requirements of this Act have been complied with and were complied with when the nuisance arose.

(v) *Miscellaneous.*

24. Any expenses incurred by a sanitary authority under this Act shall be defrayed as general expenses incurred by the authority in the execution of the Public Health Act.

25. In determining any matter which under this Act is to be determined by the chief inspector, the chief inspector may found his opinion on facts disclosed by his own examination, or by an examination by any other inspector.

26.—(1) For a period of three years after the commencement of this Act paragraph (*b*) of section seven of this Act shall apply where the process for the concentration of sulphuric acid is that known as the over-heat pan process, as if in that paragraph two grains of sulphuric anhydride were substituted for one grain and a half of sulphuric anhydride.

(2) For the purposes of this section "the over-heat pan process" means the process in which the concentration of sulphuric acid is effected by the passage of the heated gases resulting from the combustion of fuel over the surface of the acid.

27.—(1) In this Act, unless the context otherwise requires,—

The expression "alkali work" means every work for—

(*a*) the manufacture of sulphate of soda or sulphate of potash, or

(*b*) the treatment of copper ores by common salt or other chlorides whereby any sulphate is formed,

in which muriatic acid is evolved:

The expression "noxious or offensive gas" includes the following gases and fumes:—Muriatic acid; sulphuric acid; sulphurous acid, except that arising solely from the combustion of coal; nitric acid and acid-forming oxides of nitrogen; sulphuretted hydrogen; chlorine, and its acid compounds; fluorine compounds; cyanogen compounds; bisulphide of carbon; chloride of sulphur; fumes from cement works; fumes containing copper, lead, antimony, arsenic, zinc, or their compounds; fumes from tar works:

The expression "owner" includes any lessee, occupier, or any other person carrying on any work to which this Act applies:

The expression "best practicable means," where used with respect to the prevention of the escape of noxious and offensive gases, has reference not only to the provision and the efficient maintenance of appliances adequate for preventing such escape, but also to the manner in which such appliances are used and to the proper supervision, by the owner, of any operation in which such gases are evolved:

The expression "prescribed" means prescribed by the Local Government Board:

The expression "Local Government Board" means the Local Government Board established by the Local Government Board Act, 1871:

The expression "central authority" means as regards England the Local Government Board, as regards Ireland the Local Government Board for Ireland, and as regards Scotland the Secreta ry for Scotland:

The expression "sanitary authority" means any local authority entrusted with the execution of the Public Health Act:

The expression "the Public Health Act" means, as regards England, the Public Health Act, 1875, or in the case of London the Public Health (London) Act, 1891; and as regards Scotland, the Public Health (Scotland) Act, 1897; and as regards Ireland, the Public Health (Ireland) Act, 1878, and includes any enactment amending those Acts.

(2) Nothing in this Act shall be construed as exempting any work from any of the provisions of this Act applicable to the work as being a work of a certain class or description by reason only that the work is subject to other provisions of this Act as being a work of some other class or description.

28. In the application of this Act to Scotland—

(*a*) references to the Secretary of Scotland shall be substituted for references to the Local Government Board, and references to the Edinburgh Gazette shall be substituted for references to the London Gazette;

(*b*) the court of the sheriff or sheriff substitute of the county in which the offence is committed shall be the county court, and may award costs to either party, and may sentence the offender to imprisonment for any period not exceeding six months, unless the fine and costs be previously paid; and any decision or sentence of such sheriff or sheriff substitute shall be subject to review and appeal according to law.

29. Nothing in this Act shall legalise any act or default that would, but for this Act, be deemed to be a nuisance, or otherwise be contrary to law, or deprive any person of any remedy by action, indictment, or otherwise, to which he would have been entitled if this Act had not passed.

30. The Acts specified in the Second Schedule to this Act are hereby repealed to the extent mentioned in the third column of that Schedule:

Provided that—

(*a*) Nothing in this Act shall affect any certificate special rule, or notice issued, made, or serve before the commencement of this Act in pursuance of any enactment so repealed, but every such certificate, special rule, and notice shal continue in force as if issued, made, or served i pursuance of this Act; and

(*b*) Nothing in this Act shall affect the tenure of offic of any inspector appointed under any enactmen so repealed, but every such inspector shall hol office as if appointed under this Act; and (*c*) Nothing in this Act shall affect any liability of a sanitary authority incurred under any enactment so repealed to pay any proportion of the salary or remuneration of an additional inspector.

31.—(1) This Act may be cited as the Alkali, &c. Works Regulation Act, 1904.

(2) It shall come into operation *on the first day of January nineteen hundred and five.*

SCHEDULES.

First Schedule.

List of Works.

(1) Sulphuric acid works, that is to say, works in which the manufacture of sulphuric acid is carried on by the lead chamber process, namely, the process by which sulphurous acid is converted into sulphuric acid by the agency of oxides of nitrogen and by the use of a lead chamber.

(2) Sulphuric acid (Class II.) works, that is to say, works in which the manufacture of sulphuric acid is carried on by any process other than the lead chamber process, and works for the concentration or distillation of sulphuric acid.

(3) Chemical manure works, that is to say, works in which the manufacture of chemical manure is carried on and works in which any mineral phosphate is subjected to treatment involving chemical change through the application or use of any acid.

(4) Gas liquor works, that is to say, works (not being sulphate of ammonia works or muriate of ammonia works) n which sulphuretted hydrogen or any other noxious or offensive gas is evolved by the use of ammoniacal liquor in any manufacturing process, and works in which any such iquor is desulphurised by the application of heat in any process connected with the purification of gas.

(5) Nitric acid works, that is to say, works in which the manufacture of nitric acid is carried on, and works in which itric acid is recovered from oxides of nitrogen.

(6) Sulphate of ammonia works and muriate of ammonia works, that is to say, works in which the manufacture of lphate of ammonia or of muriate of ammonia is carried on.

(7) Chlorine works, that is to say, works in which hlorine is made or used in any manufacturing process.

(8) Muriatic acid works, that is to say—

(*a*) Muriatic acid works, or works (not being alkali works as defined in this Act) where muriatic acid gas is evolved either during the preparation of liquid muriatic acid or for use in any manufacturing process;

(*b*) Tin-plate flux works, that is to say, works in which any residue or flux from tin-plate works is calcined for the utilisation of such residue or flux, and in which muriatic acid gas is evolved; and

(*c*) Salt works, that is to say, works (not being works in which salt is produced by refining rock salt otherwise than by the dissolution of rock salt at the place of deposit) in which the extraction of salt from brine is carried on, and in which muriatic acid gas is evolved.

(9) Sulphide works, that is to say, works in which sul-uretted hydrogen is evolved by the decomposition of tallic sulphides, or in which sulphuretted hydrogen is d in the production of such sulphides.

(10) Alkali waste works, that is to say, works in which ali waste, or the drainage therefrom, is subjected to any emical process for the recovery of sulphur or for the lisation of any constituent of such waste or drainage.

(11) Venetian-red works, that is to say, works for the manufacture of Venetian-red, crocus, or polishing powder, by heating sulphate or some other salt of iron.

(12) Lead-deposit works, that is to say, works in which the sulphate of lead deposit from sulphuric acid chambers is dried or smelted.

(13) Arsenic works, that is to say, works for the preparation of arsenious acid, or where nitric acid or a nitrate is used in the manufacture of arsenic acid or an arseniate.

(14) Nitrate and chloride of iron works, that is to say, works in which nitric acid or a nitrate is used in the manufacture of nitrate or chloride of iron.

(15) Bisulphide of carbon works, that is to say, works for the manufacture of bisulphide of carbon.

(16) Sulphocyanide works, that is to say, works in which the manufacture of any sulphocyanide is carried on by the reaction of bisulphide of carbon upon ammonia or any of its compounds.

(17) Picric acid works, that is to say, works in which nitric acid or a nitrate is used in the manufacture of picric acid.

(18) Paraffin oil works, that is to say, works in which crude shale oil is refined.

(19) Bisulphite works, that is to say, works in which sulphurous acid is used in the manufacture of acid sulphites of the alkalis or alkaline earths.

(20) Tar works, that is to say, works where gas tar or coal tar is distilled or is heated in any manufacturing process.

(21) Zinc works, that is to say, works in which, by the application of heat, zinc is extracted from the ore, or from any residue containing that metal.

Second Schedule.

Repeals.

Session and Chapter.	Short Title.	Extent of Repeal.
44 & 45 Vict. c. 37.	The Alkali, &c. Works Regulation Act, 1881.	The whole Act.
47 & 48 Vict. c. clvii.	The Local Government Board's Provisional Order Confirmation (Salt Works) Act, 1884.	The whole Act.
55 & 56 Vict. c. 30.	The Alkali, &c. Works Regulation Act, 1892.	The whole Act.

X.—*METALLURGY.*

Radium Minerals in Quebec.

Halifax Mercantile Maritime Merchant and Commercial Review. U.S. Cons. Rep., No. 1948, *May* 9, 1903.

Minerals containing radium have been discovered in the Province of Quebec. The ore from which radium and oxide of uranium have been extracted was taken from a white-mica mine about 18 miles from Murray Bay, in Charlevoix County. White-mica deposits exist at several points in Quebec and Eastern Ontario, and these will be developed in future by an electric company, which hitherto has imported its mica supplies from India.

XIII. C.—*INDIA-RUBBER, Etc.*

Rubber in Ceylon.

F. J. Holloway. India-Rubber J., 1904, **27**, 471—472.

It has been found that the Para rubber tree will yield rubber in paying quantities when grown on different soils, on hill sides up to 2,700 ft. in elevation. The only soil on which the tree yielded no rubber was a blue sandy soil with sandstones below the surface. It does not yield well, however, on very stiff soil. The best temperature for cultivation lies between 74° and 94° F., with a rainfall of from 80 to 150 ins. The best yields of rubber per acre of soil cultivated were obtained by planting about 15 ft. by 15 ft. apart, giving about 200 trees per acre.—A. S.

XVI.—SUGAR, STARCH, Etc.

Starch; Cassava —— in Jamaica.

Bd. of Trade J., May 26.

In its issue of 26th March, the Jamaica *Daily Telegraph* refers to the efforts that are being made in that island to establish an export business in cassava starch, and more particularly to the trial shipment that had been made by a firm, who had started a factory for the manufacture of this starch at Longville, Clarendon. This firm has just received a report from Manchester on the result of the tests to which the cassava starch made at their factory has been subjected. The results of the trial have been very satisfactory, and they have been asked to send at the earliest opportunity 50 tons, for which a price of 10*l.* per ton in Bristol is offered.

It is stated that the manufacturer has succeeded in making a starch to suit the finishers of high-class goods in Manchester, who at present use, for their finer processes, wheat starch which costs, on an average, 27*l.* per ton.

The cultivation at Longville consists of about 50 acres, which will be ready for starch-making this season. The capacity of the plant is about 150 tons per annum.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 11,430. May. Apparatus for mixing substances together in regular proportions. May 18.
„ 11,454. Stansfield. Condensing machines. May 18.
„ 11,533. Henderson. Determination and control of the temperature of furnaces, &c. May 19.
„ 11,680. Wollaston. Apparatus for controlling the flow of liquids. May 21.
„ 11,752. McKenna (Holst and Fleischer). *See under* XVII.
„ 11,797. Murray. Gas or air compressors. May 24.
„ 11,839. Cautley. Hydro-extractors. May 24.
„ 11,854. Matkol. Filters. [U.S. Appl., July 3, 1903.]* May 24.
„ 11,945. Crosfield and Markel. Apparatus for precipitating and separating solids from water and other liquids. May 25.
„ 11,979. Sellenscheidt. Filters. May 26.
„ 12,145. Lennox. Evaporator for evaporating the liquid in brewers' wash, sewage, waste or spent dyes, and the like, and concentrating the solids in the same. May 28.
„ 12,161. Dall. Centrifugal separators. [Appl. in Denmark, May 28, 1903.]* May 28.
[C.S.] 12,297 (1903). Rawson. High pressure filter. June 1.
„ 15,148 (1903). Cebulla. Gas kilns. May 26.
„ 16,760 (1903). Lebedinsky. Filters. June 1.
„ 16,936 (1903). Macfarlane. Centrifugal machines. May 26.
„ 27,287 (1903). Wetter (Boellinghaus). Filtering apparatus. May 26.

II.—FUEL, GAS, AND LIGHT.

[A.] 11,268. Schweich. Gas producers.* May 16.
„ 11,685. Brooks. Manufacture of peat fuel. May 21.
„ 11,719. Hills and Schill. Construction and working of producer gas generators. May 21.
„ 11,917. Warburton. Process for obtaining producer gas and electrical energy from peat. May 25.
„ 11,948. Guilbaud. Apparatus for generating gas.* May 26.
„ 11,984. Darby. Cleaning blast furnace and other gases. May 26.
[C.S.] 15,645 (1903). Kent. Process for making gas. June 1.
„ 16,853 (1903). Welsbach. *See under* X.
„ 26,776 (1903). Abel (Siemens und Halske Act.-Ges.). Manufacture of incandescence bodies for electric glow lamps. June 1.
„ 1676 (1904). Blondel. Manufacturing electrodes for arc lamps. June 1.
„ 3901 (1904). Thompson (Hoberecht). Means for economising fuel and preventing smoke. May 26.
„ 7979 (1904). Boutillier. Gas producers for poor gas free from tarry matters. May 26.
„ 9376 (1904). Bildt. Apparatus for the continuous feeding and distributing of material in gas producer furnaces and the like. June 1.
„ 9483 (1904). Mackenzie (Cie. des Charbons et Briquettes de Blanzy and de l'Ouest). Ovens for the manufacture of smokeless briquettes. June 1.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 12,122. Weyl. Distillation of coal tar. [Ger. Appl., May 27, 1903.]* May 27.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 11,317. Schmitt. Method and apparatus for recovering sulphur colouring matters from dye liquids and washing liquids. May 17.
„ 11,863. Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of green sulphur dyes. May 24.
[C.S.] 12,120 (1903). Johnson (Kalle and Co.). Manufacture of disazo colouring matters. June 1.
„ 15,515 (1903). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of yellow sulphurised colouring matters. May 26.
„ 16,995 (1903). Johnson (Badische Anilin und Soda Fabr.). Manufacture of new azo dyestuffs and of products to be used in the said manufacture. June 1.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 11,317. Schmitt. *See under* IV.
„ 11,397. Hannau. *See under* XIII. B.
„ 11,450. Johnson (Badische Anilin und Soda Fabrik). Production of blue to blue-black shades on wool. May 18.
„ 11,736. Bernhardt. Potash leaching apparatus for raw wool. May 21.
„ 12,145. Lennox. *See under* I.
[C.S.] 15,358 (1903). Grime. Dyeing of cotton cloth. May 26.

[C.S.] 18,599 (1903). Chischin. Method of fixing or protecting designs impressed on fabrics. June 1.

,, 28,508 (1903). Boult (Horton). *See under* XII.

,, 9510 (1904). Gaisman. Elastic fabrics. June 1.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 11,237. Blackman. Formation of an acid or electrolyte from water. May 16.

,, 11,256. Wood Smith. Purification of natural salts such as alkaline carbonates, chlorides, sulphates, and nitrates. May 16.

,, 11,891. Brindley. Manufacture of ferric sulphate from scrap iron or steel. May 25.

[C.S.] 13,419 (1903). Thompson (Wischin). Manufacture of sulphuric anhydride. June 1.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 11,243. Jones. Glazing and enamelling kilns. May 16.

[C.S.] 9033 (1904). Rowart and Francq. Apparatus for the manufacture of sheet glass. May 26.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 11,218. Wulf. Manufacture of floor covering. May 16.

,, 11,258. Stöffler. Fireproof quartz bricks or blocks. [Ger. Appl., May 16, 1903.]* May 16.

,, 11,398. Hargreaves. *See under* XIII. B.

,, 11,441. Bates and McTierard. Paving materials. May 18.

,, 11,523. Stöffler. Manufacture of lime and sand bricks or blocks. [Ger. Appl., Oct. 31, 1903.]* May 19.

,, 11,565. Draenert. Manufacture of bricks, building blocks, &c., and apparatus therefor May 19.

,, 11,765. Liversedge. Pavements. May 21.

,, 11,803. Marlow. Manufacture of tiles, bricks, &c. May 24.

,, 11,830. Kauffmann and Medberg. Manufacture of artificial stone for paving, decorative, and other purposes. May 24.

,, 11,997. Hadlington. Brick and like kilns. May 26.

[C.S.] 16,301 (1903). Lambert. Building blocks or slabs. May 26.

,, 21,947 (1903) Hocke. Manufacture of Portland cement. May 26.

X.—METALLURGY.

[A.] 11,386. Johnson. Improvements whereby scrap or refuse metal can be used up in manufactures. May 18.

,, 11,437. Clark (Goldschmid). Process of and apparatus for refining ores. May 18.

,, 11,527. Sulman and Picard. Treatment of complex sulphide ores. May 19.

,, 11,579. Ackland. Apparatus for and method of calcining ore or other material. May 20.

,, 11,733. Martin. Casting pig iron and other metals. May 21.

,, 11,743. Martin. Filtering apparatus for the extraction of liquid from finely crushed minerals, &c. May 21.

,, 12,020. Jenkins. Magnetic ore separators. May 26.

,, 12,098. Engels. Process for treating steel and armour plates. [Ger. Appl., March 24, 1904.]* May 27.

,, 12,117. Abelspies. Ore concentrating apparatus. May 27.

[C.S.] 14,295 (1903). Edison Ore-Milling Syndicate, Ltd. (Edison). Electro-magnetic separators. May 26.

,, 15,849 (1903). Tomellini. Method for soldering aluminium. May 26.

,, 16,853 (1903). Welsbach. Manufacture of metallic alloys having pyrophoric action, and their application to the purposes of ignition and illumination. June 1.

,, 26,775 (1903). Abel (Siemens und Halske Act.-Ges.). Manufacture of incandescence bodies for electric glow lamps. June 1.

,, 8994 (1904). Wedge. Process of preparing iron pyrites for desulphurisation. May 26.

,, 9445 (1904). Orbison. Melting furnaces. June 1.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 11,237. Blackman. *See under* VII.

,, 11,470. Atkins. Poles or electrodes of electrolytic apparatus, &c. May 18.

,, 11,917. Warburton. *See under* II.

,, 11,920. Bruno. Manufacture of electrodes for electric accumulators.* May 25.

,, 12,061. Cie. Franc. de l'Ozone. *See under* XVIII. B.

[C.S.] 9531 (1903). Round and Round. Electro-depositing metals. June 1.

,, 11,145 (1903). Calandri. Accumulator electrodes. May 26.

,, 12,312 (1903). Carolan (Gen. Electric Co.). Manufacture of materials suitable for electric insulating purposes. June 1.

,, 28,780 (1903). Eimer. Electric furnaces or ovens. May 26.

,, 3912 (1904). Soc. Anon. l'Ind Verrière et ses Dérivés. Apparatus for regulating the intensity and heating effect of electric currents. May 26.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 11,436. Fischer. Manufacture of resin soap. May 18.

,, 11,553. Wilson. Refining of linseed oil. May 19.

,, 11,638. Bamberg. Hydrolysis. May 20.

,, 11,966. Jones (Tailfer). Treating or maturing linseed oil. May 26.

[C.S.] 28,508 (1903). Boult (Horton). Manufacture of dyeing soap. May 26.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(*B.*)—RESINS, VARNISHES.

[A.] 11,397. Hannan. Method of rendering linoleums, floor-cloths, &c., non-combustible. May 18.

,, 11,398. Hargreaves. Manufacture of varnishes and paints for waterproofing and like purposes, also for indurating building materials. May 18.

XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

[A.] 11,249. Amidon. Apparatus for treating hides, skins, and sides of leather. [U.S. Appl., Jan. 28, 1904.]* May 18.

,, 11,581. Lippert and Schlosser. Quick tanning process for chrome leather. May 20.

,, 11,885. Southworth. Process for treating raw hide. May 25.

XV.—MANURES, ETC.

[A.] 11,421. Crone, Taylor, Williams, and Lewis. Manufacture of fertilisers. May 18.

[C.S.] 8949 (1904). Bell. Fertiliser and insecticide. May 26.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 11,752. McKenna (Holst and Fleischer). Malting and drying drums. May 21.

„ 12,069. Boord. Production of absolute alcohol. May 27.

„ 12,145. Lennox. *See under* I.

[C.S.] 6742 (1904). Kuhn. Process and apparatus for the manufacture of effervescent wines. May 26.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A*.)—Foods.

[A.] 11,899. Richardson. Bleaching wheat and other cereals. May 25.

„ 12,113. Schröder. Sterilisation of food and other substances. May 27.

[C.S.] 7896 (1904). Braga. Process for the manufacture of meat preparations. *May 26.

(*B*.)—Sanitation; Water Purification.

[A.] 11,900. Bordigoni. The bacterial or septic tank treatment of sewage. May 25.

„ 11,945. Crosfield and Markel. *See under* I.

„ 12,061. Cie. Franc. de l'Ozone. Apparatus for the sterilisation of water by means of an electric current. [Fr. Appl., Nov. 20, 1903.]* May 27.

„ 12,145. Lennox. *See under* I.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 11,259. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new derivatives of barbituric acid. May 16.

„ 11,349. Morgan. Manufacture of certain organic compounds of thorium. May 17.

„ 11,747. Imray (Meister, Lucius und Brüning). Manufacture of new perfumes and of intermediate products therefor. May 21.

„ 11,991. Boissiere and Faucheux. Manufacture of cream of tartar, tartaric and citric acids and secondary products. May 26.

„ 12,091. Newton (F. Bayer & Co.). Manufacture of pyrimidine derivatives. May 27.

[C.S.] 15,782 (1903). Imray (Meister, Lucius und Brüning). Manufacture of a new therapeutical compound. May 26.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 11,192. Croft. Method of preparing photographic printing paper in the gum bichromate process. May 16.

„ 12,125. Southey. Photographic materials. May 28.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 11,427. Luck. Manufacture of explosives. May 18.

„ 11,428. Luck. Manufacture of explosives. May 18.

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N.B.—The names in *italics* are those of members of Committee who retire from their respective offices at the end of the current se

Notices.

ANNUAL GENERAL MEETING, NEW YORK, 1904.

The Annual General Meeting will be held in New York City on Thursday, Sept. 8th, and following days. Members who propose to attend the meeting are requested to inform the General Secretary, as soon as possible, by what steamer they will travel. The principal boats will be met on arrival at New York by a representative of the Reception Committee, who will escort the guests to the Hotel Seville, Madison Avenue and 29th Street, which will be the Society's Headquarters in New York. A similar system will be observed at all the other cities visited by the special train. A revised programme appeared in the March 31st issue.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Mr. Wm. H. Nichols has been nominated to the office of President under Rule 8; Dr. Edw. Divers, Prof. W. R. Eaton Hodgkinson, Mr. Max Muspratt, and Mr. T. J. Parker have been nominated Vice-Presidents under Rule 8; and Sir Wm. Ramsay has been nominated a Vice-President under Rule 11.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the ordinary members of the Council. Forms for this purpose can be obtained, on application, from the General Secretary, or from the Hon. Local Secretaries of the Canadian, New York, and Sydney Sections.

Extract from Rule 18:—"No such nomination shall be valid unless it be signed by at least ten members of the Society who are not in arrear with their subscriptions, nor unless it be received by the General Secretary, at the Society's Office, at least one month before the date of the Annual General Meeting at which the election to which it refers takes place. Nor shall any such nomination be valid if the person nominated be ineligible for election under Rules 12 or 15. No member shall sign more than one nomination form."

HONOUR LIST, JUNE 24TH, 1904.

His Majesty has been pleased to confer a Baronetcy of the United Kingdom on Mr. W. J. Goulding, Dublin; and the honour of Knighthood on Prof. Jas. Dewar, F.R.S., and Dr. Thos. Stevenson.

DUTY-FREE ALCOHOL.

The Council of the Society of Arts has awarded to Mr. Thomas Tyrer the Society's Silver Medal for his paper on "The Need of Duty-free Spirit for Industrial Purposes," and the presentation of the Medal will take place at the opening meeting of the Society's session in November next.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye laws the Society has the right of priority of publication for three months of all such papers. nfringement of this Bye-law renders papers liable to be ejected by the Publication Committee, or ordered to be bstracted for the Journal, in which case no reprints can e furnished to the author.

List of Members Elected

23rd JUNE 1904.

ack, J. Wyclif, 20, Mardale Crescent, Edinburgh, Analytical Chemist.

oyce, Framroze H., City of Bombay Manufacturing Co., Ltd., 39, Hornby Road, Bombay, India, Technical Chemist.

Carter, A., Cuba Street, Petone, Wellington, New Zealand, Works Manager.

Hayman, Jack V. J., Semper Aurea, Burwell, Cambridge, Chemist.

Hermsdorf, Dr. Walter, Salzstrasse 69, Chemnitz, Saxony, Chemist.

Hildebrand, Charles C., 113, Metoxan Avenue, Ridgeway, Pa., U.S.A., Chemist.

Johnson, Cedric, Field House, Winnington, Northwich, Chemical Engineer.

Kane, Richard W. H., 88, Kimmersitch Street, Burton-on-Trent, Mechanical Engineer.

Kniffen, Frederick, Indian Head, Md., U.S.A., Chemist.

Kunz, Dr. George F., c/o Tiffany and Co., 11–15, Union Square, New York City, U.S.A., Gem Expert.

Lorimer, John H., 280, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Textile Machinist and Merceriser.

Meads, Charles J., Bel Air, Dartmouth, Inland Revenue Officer.

O'Brien, Claude H., c/o Fiji Sugar Co., Suva, Fiji, Chemist.

Schwitter, Martin, Tin City, Cape Prince of Wales, Alaska, U.S.A., Chemist and Assayer.

Southall, A. W., Lower Priory, Birmingham, Manufacturing Chemist.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

Adgate, Matthew, l/o Syracuse; retain Journals.

Allen, Richard F., l/o Baltimore Avenue; 1241, South 47th Street, Philadelphia, Pa., U.S.A.

Bowes, Harry, l/o Higher Crumpsall; 40, Radford Street, Blackley, Manchester.

Buchanan, D. G., l/o Glasgow; c/o Gibbs & Co., Iquique, Chile.

Campbell, Ashley, l/o Sydney; c/o Colonial Sugar Refining Co., Yarraville Refinery, Melbourne, Vic., Australia.

Cargill, Jno. T.; Journals to c/o Burmah Oil Co., Rangoon, Burmah.

Carhart, Dr. C., l/o Keyport; c/o Mr. Berk Talley, Rama, Nicaragua.

Carlsson, Hugo, l/o Cape Breton; 42, Smålandsgatan, Stockholm, Sweden.

Christie, Jno., l/o Pitsea; c/o The New Explosives Co., Ltd., Stowmarket, Suffolk.

Crane, Jasper E., l/o Boston; c/o The Arlington Co., Arlington, N.J., U.S.A.

Cunningham, Edw., l/o Kilby Street; c/o S. Cabot, 141, Milk Street, Boston, Mass., U.S.A.

De Blois, W. H., l/o Camden; c/o General Chemical Co., Syracuse, N.Y., U.S.A.

Ellis, A. W., l/o Brixton Hill; Public Analyst's Laboratory, Town Hall, Southwark, S.E.

Ermen, F.; Journals to c/o Walter Ermen, 14, Park Road, Eccles, Manchester.

Garrigues, W. E., l/o Broadway; 66, Beaver Street, New York City, U.S.A.

Hübner, Julius, l/o Crumpsall; Ash Villa, Cheadle Hulme, Cheshire.

Ingalls, Walter R., l/o Lynn; 52, Broadway, New York City, U.S.A.

Jacoby, A. H.; Journals to c/o American Dyewood Co., 156, William Street, New York City, U.S.A.

Knapp, R. E., l/o Ann Arbor; 1219, 8th Street, Evansville, Ind., U.S.A.

Levy, A. G.; Journals to 45, Warrington Crescent, Maida Vale, W.

STATEMENT OF REVENUE AND EXPENDITURE FOR THE YEAR 1903.

(Made up to the 20th May 1904.)

REVENUE.

	£	s.	d.	£	s.	d.
Annual Subscriptions for 1903:—						
2 subscriptions received in 1901	2	10	0			
318 subscriptions received in 1902	397	10	0			
3,318 subscriptions received in 1903	4,147	10	0			
50 subscriptions received in 1904	62	10	0			
(Sundry balances and excess payments)	5	14	1			
				4,615	14	1
3,688						
Entrance Fees (386 at 1*l.* 1*s.*)	405	6	0			
Life Composition Fees (1 at 20*l.*)	20	0	0			
"Collective Index" Subscriptions	..			5	10	0
Amount received "On Deposit" from the "Saville Shaw" Testimonial Fund	14	0	0			
Investments:—						
Interest on Metropolitan 3 per cent. Consolidated Stock	127	11	6			
Interest on Gas Light and Coke Company's 3 per cent. Consolidated Stock	16	19	0			
Interest on Great Eastern Railway 4 per cent. Irredeemable Guaranteed Stock	24	12	8			
Interest on Great Northern Railway 3 per cent. Debenture Stock	22	12	0			
Interest on Great Western Railway 5 per cent. Guaranteed Preference Stock	28	5	0			
Interest on Midland Railway 2½ per cent. Perpetual Preference Stock	39	18	6			
Interest on North British Railway 3 per cent. Consolidated Lien Stock	30	13	8			
Interest on New South Wales 3 per cent. 1935 Stock	13	15	3			
Interest on New Zealand 3 per cent. 1945 Stock	28	7	6			
Interest on Nottingham Joint Stock Station 3 per cent. Debenture Stock	5	13	0			
Interest on South Eastern Railway 4½ per cent. Preference Stock	28	10	4			
Interest on Southwark and Vauxhall Water Company 3 per cent. Debenture Stock	28	7	6			
Interest on Deposit Account at Bank	29	17	5			
				425	3	4
Journal:—						
Sales				537	4	10
				£5,583	12	3

EXPENDITURE.

	£	s.	d.	£	s.	d.	£	s.	d.
Journal Expenses:—									
Publishing				1,039	5	0			
Editorial:—									
Editor's Salary	600	0	0						
Editor's Expenses	62	3	11						
Abstractors	609	18	11						
Indexing Journal	149	17	0						
Sub-Editor's salary	150	0	0						
Foreign Journals	10	6	6						
Sundry Journals	7	2	7						
				1,589	8	11			
Insurance of Stock				7	2	6			
French Patents and Specifications				68	18	0			
Translations				12	12	0			
							2,717	6	5
Sectional Expenses				533	5	10			
Annual Meeting Expenses				188	4	5			
							721	10	3
Secretary's Salary				300	0	0			
Assistant				110	0	0			
							410	0	0
Printing Sundries				46	9	6			
Stationery				59	11	3			
Library (Binding Books)				16	3	3			
Clerical Assistance				13	4	0			
Honorarium to Treasurer's Assistant				52	10	0			
							187	18	0
Office Expenses (including Rent of additional rooms, and consequent alterations, &c.)				..			274	16	9
Auditors' Fee				10	11	6			
Sundries				15	19	5			
Bank Charges				3	11	0			
							30	1	11
Treasurer's Petty Cash, Postage and writing up Subscriptions				17	4	2			
Secretary's Petty Cash and Postage				68	19	1			
							86	3	3
National Physical Laboratory (Second Donation)				..			100	0	0
Decennial Index (1895—1904) and Insurance of Manuscript				..			212	1	0
Investment:—									
Midland Railway 2½ per cent. Guaranteed Preference Stock, 960*l.*				798	3	0			
Balance of Revenue over Expenditure							843	14	8
							£5,583	12	3

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Royle, Chas. L., l/o India; retain Journals.

Schweickert, Karl; all communications to 6, Oliver Street, Rahway, N.J., U.S.A.

Steel, John S.; Journals to Adelaide Chemical Works, Thebarton. Adelaide, S. Australia.

Van Zwaluwenberg, J. G., l/o Argentine; 210, Observatory Street, Ann Arbor, Mich., U.S.A.

Wallace, Robt. A., l/o Merton; 58, Abinger Road, Bedford Park, W.

Whowell, Fred., l/o Tottington; Wood End, Bromley Cross, Bolton.

MEMBER OMITTED FROM LIST.

1896. Tonkin, John, 2603, East Broad Street, Richmond, Va., U.S.A., Manufacturing Chemist.

Liverpool Section.

ERRATA.

STUDIES ON THE CLAUS REACTION, PART II.

BY R. FORBES CARPENTER AND S. E. LINDER, B.Sc.

(This J., June 15, 1904, 577—590.)

Page 587, col. 2, 8th line from bottom and following lines should read as follows:—

Total = 37·51 × 1,330, or 49,888 calories.

$$\text{Heat produced by oxidation of the sulphuretted hydrogen to water vapour}\ \ldots \begin{cases} = 57{,}400 \times \dfrac{26{\cdot}94}{34} \\ \text{or } 45{,}480 \text{ calories.} \end{cases}$$

$$49{,}888 + 45{,}480 = \underline{95{,}368} \quad ,,$$

$$\text{Less heat required to decompose the sulphuretted hydrogen}\ \ldots \begin{cases} = 4{,}740 \times \dfrac{26{\cdot}94}{34} \\ \text{or } 3{,}756 \text{ calories.} \end{cases}$$

$$\text{Ditto sulphurous acid} = 71{,}970 \times \frac{25{\cdot}33}{64} \text{ or } 28{,}490 \quad ,,$$

$$3{,}756 + 28{,}490 = \underline{32{,}246} \quad ,,$$

$$\text{Net heat evolved} = 95{,}368 - 32{,}246, \text{ or } \underline{63{,}122} \quad ,,$$

Page 589, col. 1, 2nd line from bottom, for −0·344 read −344.

THE TREASURER—IN ACCOUNT WITH THE SOCIETY OF CHEMICAL INDUSTRY FOR THE YEAR 1903.

Dr.

		£ s. d.	£ s. d.
To Cash on Deposit (1st January 1903)		250 0 0	
Balance at Bank (1st January 1903)		587 5 1	
Cash in Secretary's hands (1st January 1903)		17 17 5	
			855 2 6
Annual Subscriptions:—			
5 for the year 1901		6 5 0	
64 for the year 1902		80 0 0	
3,318 for the year 1903		4,147 10 0	
121 for the year 1904		151 5 0	
2 for the year 1905		2 10 0	
4 for the years 1906, 1907, and 1908 (less 10*s.*)		4 10 0	
(Sundry balances of subscriptions and excess payments)		5 14 1	
3,514			4,397 14 1
Entrance Fees (386 at 1*l.* 1*s.*)		..	405 6 0
Life Composition Fees (1 at 20*l.*)		..	20 0 0
"Collective Index" Subscriptions		..	3 0 0
"Saville Shaw" Testimonial Fund—Amount received on Deposit		..	14 0 0
Interest from Investments:—	£ s. d.		
Gas Light and Coke Company's 3 per cent. Consolidated Stock	(600 0 0)	16 19 0	
Great Eastern Railway 4 per cent. Irredeemable Guaranteed Stock	(654 0 0)	24 12 8	
Great Northern Railway 3 per cent. Debenture Stock	(800 0 0)	22 12 0	
Great Western Railway 5 per cent. Guaranteed Preference Stock	(600 0 0)	28 5 0	
Metropolitan 3 per cent. Consolidated Stock	(4,476 9 2)	127 11 6	
Midland Railway 2½ per cent. Perpetual Preference Stock	(736 0 0) (960 0 0)	39 18 6	
North British Railway 3 per cent. Consolidated Lien Stock	(1,084 13 4)	30 13 8	
New South Wales 3 per cent. 1935 Stock	(485 4 8)	13 15 3	
New Zealand 3 per cent. 1945 Stock	(1,000 0 0)	28 7 6	
Nottingham Joint Stock Station 3 per cent. Stock	(200 0 0)	5 13 0	
South Eastern Railway 4½ per cent. Preference Stock	(673 0 0)	28 10 4	
Southwark and Vauxhall Water Company's 3 per cent. Debenture Stock	(1,000 0 0)	28 7 6	
	(13,269 7 2)		
Interest on Deposit Account at Bank		29 17 5	
			425 3 4
Journal:—			
Sales		..	195 0 6
			£ 6,315 6 5

Cr.

	£ s. d.	£ s. d.	£ s. d.
By Journal Expenses:—			
Publishing		1,210 14 8	
Insurance of Stock		7 2 6	
Editorial:—			
Editor's Salary	600 0 0		
Editor's Expenses	60 19 10		
Abstractors	615 16 9		
Sub-Editor's Salary	150 0 0		
Indexing Journal	184 14 0		
Foreign Journals	10 6 6		
Sundry Journals	6 9 11		
		1,628 7 0	
French Patents and Specifications	55 12 0		
Translations	12 12 0		
		68 4 0	
			2,914 8 2
Sectional Expenses:—			
Canadian Section		41 7 6	
Canadian Journals		17 0 0	
Liverpool Section		38 16 0	
London Section		93 15 11	
Manchester Section		42 10 0	
Newcastle-on-Tyne Section		20 13 10	
New York (U.S.A.) Section		196 10 0	
Nottingham Section		22 4 5	
Scottish Section		40 7 11	
Yorkshire Section		20 0 3	
			533 5 10
Annual Meeting Expenses (1903)		188 4 5	
Annual Meeting (On account. New York, 1904)		154 19 2	
			343 3 7
Secretary's Salary (see also Sub-Editor)		300 0 0	
Assistant		115 5 0	
			415 5 0
Printing Sundries		..	46 1 2
Stationery		..	53 2 9
Library (Binding Books)		..	16 3 3
Clerical Assistance		..	13 4 0
Honorarium to Honorary Treasurer's Assistant (1902)		..	52 10 0
Office Expenses, &c.:—			
Rent, &c.		156 7 8	
Gas and Electric Light		7 19 6	
Cleaning, Attendance, &c.		16 14 4	
Furniture, Repairs, &c.		23 2 9	
Alterations to Offices, &c.		58 11 6	
Fire Insurance		0 8 0	
Sundry Requisites		11 13 0	
			274 16 9
Auditors' Fee		..	10 11 6
National Physical Laboratory (Second Donation)		..	100 0 0
Investment:—			
960*l.* Midland Railway 2½ per cent. Guaranteed Preference Stock		..	798 3 0
Decennial Index (1895—1904), paid on account		207 0 0	
Decennial Index—Insurance of Manuscript		5 1 0	
			212 1 0
Sundries		..	15 19 5
Bank Charges		..	3 11 0
Treasurer's Petty Cash and Postage		..	17 4 2
Secretary's Petty Cash and Postage		..	68 19 1
Balance at Bank (31st December 1903)		407 8 2	
Cash in Secretary's hands (31 Dec. 1903)		19 8 7	
			426 16 9
			£ 6,315 6 5

We have compared the above Statement with the Vouchers, Counterfoils of the Receipts issued, and other records, and are of opinion it correctly exhibits the Cash transactions of the Society for the year 1903. The amounts of the Metropolitan 3 per cent. Consolidated, 3 per cent. New Zealand, and 3 per cent. New South Wales Stocks have been confirmed by the Chief Accountant to the Bank of England. Certificates for the remaining investments have been inspected, and the Bank Balances have been certified to us by the Bankers.

23, St. Swithin's Lane, London, E.C.,
21st April 1904.

(Signed) MIALL, WILKINS, RANDALL, & Co.,
Chartered Accountants.

London Section.

Meeting held at Burlington House, on Monday, June 6th, 1904.

MR. WALTER F. REID IN THE CHAIR.

THE LOSS OF NITRE IN THE CHAMBER PROCESS.

BY J. K. H. INGLIS.

The question of the loss of nitre in the chamber process has long been the subject of discussion and investigation; but no very satisfactory solution of the question has as yet been obtained. The difficulty in the investigation is threefold. Not only does the total amount of nitrous gases lost amount to only a fraction of a per cent. of the flue gases, but endless complications arise (*cf.* Carpenter and Linder, this J., Dec. 1902) when the flue gases are treated with aqueous absorbents so that an interpretation of the analysis is very difficult. The third difficulty is that no means have been devised for detecting small quantities of nitrous oxide, which many authorities believe is formed in the chambers and causes the "chemical loss" as opposed to the "mechanical loss," due to incomplete absorption in the Gay Lussac tower.

Sir W. Ramsay, in his researches on the "Gases of the Atmosphere," found that fractional distillation of liquefied gases at low temperatures gave in many cases a satisfactory separation; and he, therefore, kindly suggested to me that I should attempt analysis of the flue gases by that method. This paper gives a preliminary account of some of the results that have been obtained; but the experiments have not yet been brought to a conclusion.

The flue gases may consist of nitrogen, oxygen, nitric oxide, nitrogen peroxide, nitrous oxide, sulphur dioxide, carbon dioxide, and possibly sulphuric acid vapour. The gases, nitrous oxide, carbon dioxide, and sulphur dioxide, were first of all prepared and it was found that they could be almost completely separated from a large volume of air by passing the mixture through a spiral cooled with liquid air to a temperature of about − 185° C. At that temperature these gases and nitrogen peroxide are non-volatile solids, and therefore by exhausting the spiral with a Töpler pump all the nitrogen and oxygen could be removed. At this temperature nitric oxide is also a solid, but it has a slight vapour pressure, so that its separation from nitrogen by this means is not quite complete. But if the vapour pressure of nitric oxide at that temperature is known, the amount lost can be calculated, since its partial pressure in the escaping gas is equal to its vapour pressure. Exact measurements of this vapour pressure have not as yet been made, so that to this extent the research is incomplete. When the nitrogen oxides, carbon dioxide, and sulphur dioxide, sulphuric acid, &c., have been obtained free from nitrogen and oxygen, the further separation is not difficult. It was found that by repeated fractionation at suitable temperatures the substances could be divided into the fractions:—(1) Nitrogen and nitric oxide; (2) Nitrous oxide and carbon dioxide; (3) Sulphur dioxide; (4) Nitrogen peroxide and sulphuric acid. Fractions 1, 2, 3, were measured and then analysed in the ordinary way. The fourth fraction, which remained in the spiral, was washed out with distilled water and titrated with baryta, using phenolphthalein as indicator. The precipitate of barium sulphate was boiled with dilute nitric acid, filtered off and weighed; and then, knowing the total barium hydroxide used and the barium sulphate formed, the amount of nitrogen peroxide could be calculated.

When this method of analysis had been worked out, Dr. Messel very kindly gave me permission to carry out a series of analyses at Messrs. Chapman and Messel's works in Silvertown. I am glad to take this opportunity of thanking him for the facilities and for the advice which he was always ready to give me.

A calculation of the total loss of nitre (3 per cent. of the sulphur burnt) showed that if the total loss occurred as nitric oxide the amount in the flue gases would amount to 0·1 per cent. Hence it was evident that at least 10 or 20 litres of the flue gases must be used for each analysis. As it was obviously impossible to carry samples of 10—20 litres away from the works, the first part of the fractionation was carried out while the sample was being taken. A large aspirator drew the flue gases at the rate of 5 litres per hour through a spiral which was immersed in liquid air. At each end of the spiral there was a stop-cock, and a side tube led from the spiral through a third stop-cock to a large bulb holding about 130 c.c. Before taking a sample, this bulb was evacuated and the stop-cock turned off: the gases were then led through the spiral, and when sufficient quantity of gas had been taken, the spiral was evacuated by means of a small mercury pump. The first two stop-cocks were then closed and, the third one being opened, the condensed gases were allowed to evaporate into the vacuum. For subsequent analysis, by cooling the spiral again with liquid air the whole of the gas was condensed into the spiral, and the fractionation could then be proceeded with. In the earlier experiments the gases from the flue were led through a wash-bottle containing C.O.V. before passing through the spiral; but in the later experiments this washing was omitted as the small quantity of nitrous gases absorbed by the C.O.V. could not be accurately determined.

The total volume of the flue gases analysed amounted to 284 litres, and the results obtained were fairly constant. In every case a small quantity of nitrous oxide was obtained, amounting to about 0·002 per cent. This quantity is so extremely small that it shows that the "chemical loss" of nitre is negligible in so far as nitrous oxide is concerned. The percentage of sulphur dioxide found was quite appreciable when the gases were washed with C.O.V. (0·02 per cent.), but when the gases were taken directly into the spiral no sulphur dioxide was found. The analyses showed that about 0·02 per cent. of the flue gases was separated as nitric oxide; but it must be remembered that a certain amount of nitric oxide is always lost, owing to its vapour pressure at − 185°. This loss may easily amount to 0·02 per cent., but no exact figure can as yet be given. The total amount of nitric oxide is, therefore, about 0·04 per cent. The carbon dioxide found was about 0·05 per cent., this being the amount usually present in the atmosphere. The sulphuric acid found was always constant in parallel experiments, but seemed subject to fluctuations. It seemed to be about 0·008 grm. per 10 litres. The estimation of the nitrogen peroxide was in some ways the most difficult of all. As this gas acts on mercury it was necessary to estimate it by titration, and since it is then determined by difference, the result is not very exact. In addition, traces of nitrogen peroxide usually came over with the sulphur dioxide and got lost through combining with the mercury. The amount of nitrogen peroxide found was about 0·03 per cent. of the flue gases. Adding to this the probable amount of nitric oxide (0·04 per cent.), we find as the total nitre in the flue gases 0·07 per cent.; whereas the total loss of nitre would be accounted for by 0·1 per cent. Hence, we find that 70 per cent. of the nitre lost is lost partly as nitric oxide, partly as peroxide. The loss of nitre in the process is therefore mainly determined by the efficiency of the Gay-Lussac tower, and is thus mechanical and not chemical loss.

This is the chief result so far obtained in this research, but I hope at a later date to give a further account of my work on this subject.

I have great pleasure in expressing my gratitude to Sir W. Ramsay both for suggesting this research and for the advice and help he has so often given me. I should also like to thank Mr. E. C. Thompson for the help he so willingly rendered me at the works in Silvertown.

Discussion.

Dr. **Messel** considered that Mr. Inglis's interesting experiments had finally proved that the loss of nitric acid in the chamber process was purely mechanical and not chemical, unless its reduction to nitrogen was assumed, for which, however, there was no warranty.

Dr. **Divers** said that he had intended to try to show the great improbability of any production in the lead chambers of either the unknown dihydroxylamine-sulphonic acid, as suggested by Raschig, or even of the well-established hydroxylaminedisulphonic acid, or, again, of peroxylaminesulphonic acid (nitrosodisulphonic acid), as quite recently suggested by Trautz, to account for the loss of nitre. But such a demonstration had now become unnecessary, for Mr. Inglis's experiments had clearly settled, as Dr. Messel had just said, that the loss was after all mechanical and not chemical. They disproved the formation of any nitrous oxide, and, by showing the escape of so much of the lost nitre under the form of nitric oxide and peroxide, indirectly proved also the non-formation of nitrogen. From these experiments, therefore, it was to be concluded that hydroxylamine derivatives were not produced in a normally working lead chamber.

Mr. **Hogben** said that Mr. Inglis had not attempted to deal with the loss in the other departments of the process, the mechanical loss from the running of the acids in the different towers, and the other sources of loss there might be. He had had the privilege of working with the first Lunge tower erected in this country, and by taking special precautions he had been able to reduce the loss down to nearly one-third of the loss here stated to occur. Any one accustomed to work according to Dr. Lunge would say that it would be almost impossible to bring the consumption of nitre down below 4 parts on the 100 of sulphur; but by working on different lines he diminished that loss down to below 1·3 parts on the 100 of sulphur. He did not think that had been attained elsewhere in this country, and it was a practical proof of the conclusion Mr. Inglis had arrived at, that the loss was entirely mechanical.

Mr. Guttmann congratulated Mr. Inglis on the results obtained by examining these gases. Last week he had listened to a paper by Dr. Raschig, who had taken up again his old theory of the chamber process, and he was very gratified to hear the references made to the work of Prof. Divers and Mr. Haga. Dr. Raschig, in the presence of Prof. Lunge and others, had demonstrated the correctness of his theory by analyses on the large scale. But apart from that he could confirm what Mr. Inglis had found, *viz.*, that the loss in the Gay-Lussac tower was mechanical. He showed, in a paper read in Manchester some time ago, that it was the practice abroad, and occasionally in this country, to erect central or "catch" Gay-Lussac towers, which took up the loss out of three or four ordinary towers; but even then it was found that, owing to differences in temperature and pressure, there was a mechanical loss which could never be avoided in the manufacture of sulphuric acid.

The Chairman said they must all congratulate the author on such an interesting industrial application of a new scientific fact. It evidently was of the utmost importance to one of our greatest chemical industries that the source of loss had been identified. No doubt when the paper was published, ways might be suggested of getting out of the difficulty; for, although the loss did not appear great in itself, yet when dealing with hundreds of thousands of tons it meant a great deal to the chemical manufacturer.

Mr. Inglis, in reply, said with regard to the estimation of the loss of nitric oxide that seemed rather doubtful to many members present, but aided by the other two towers it amounted to at least 50 per cent. If nitric oxide were condensed at the temperature of liquid air with a mercury pump, a figure would be obtained which undoubtedly pointed to some loss, and the conclusion he drew at present was that something over 50 or 60 per cent. of the loss was due to nitric oxide or peroxide, which, it was not possible to say, because the nitric peroxide might be formed again by taking up the oxygen from the sulphur dioxide or trioxide. He tried to guard against any reaction in the bulb, but it seemed as if some action did take place, and that chamber crystals did form in the bulb.

ACETONE: ITS MANUFACTURE AND PURIFICATION.

BY ARTHUR MARSHALL.

Acetone, as is well known, is manufactured by the dry distillation of acetate of lime, which is one of the principal by-products obtained in the carbonisation of wood. The consumption of acetone is considerable as it is used largely in the manufacture of smokeless powders, of celluloid articles, and for the preparation of many chemicals. In this country especially there is a large demand for acetone for the manufacture of cordite. The other products that are formed together with acetic acid in the distillation of wood—charcoal, tar, creosote, wood spirit, and, in the case of resinous woods, turpentine—are all valuable and find a ready market. It is therefore evident that charcoal burning when carried out in a rational scientific manner is a remunerative ndustry, especially where there is a large supply of cheap wood, or where there is an active demand for the charcoal, which is, after all, the principal product, and the one which bears transport least well.

In the conversion of acetate of lime into acetone there are but few by-products. The material remaining in the retorts onsists of impure calcium carbonate mixed with some tar, nd is of no value. From the purification of the crude istillate some tar is obtained which may be used as fuel, nd from the fractional distillation there results a certain roportion of high boiling fractions consisting largely of thyl methyl ketone, and other higher homologues of cetone. For these there is not a very active demand, but here can be little doubt that suitable outlets will be found for them when attention has been sufficiently drawn to them. Ethyl methyl ketone is obtained directly in a state of considerable purity, mixed with about 12 per cent. of water, and only very small quantities of other impurities. There appears to be no good reason why this should not be used for denaturing alcohol for some technical purposes, as the boiling points of ethyl methyl ketone and alcohol, 79·7° and 79·3° respectively, are very close together, and they form a mixture having a constant boiling point at about 74° C.

As usually carried out the production of crude acetone from acetate of lime consists in heating charges of 300 to 600 lbs. of grey acetate of lime in retorts heated by direct fire, the last portion of distillate being driven over with the aid of steam. The distillate separates into two layers, the lower of which contains the greater part of the acetone together with water, whilst the upper layer consists largely of tarry matter. The upper layer is separated from the lower and is washed several times with water, the washings being mixed with the lower layer. The mixture thus obtained, consisting principally of acetone and water, is now neutralised with caustic soda and submitted to fractional distillation. The plant employed for this purpose is of the same type as is now used almost universally for the fractionation of organic liquids. The vapour is made to ascend a high copper tower provided with a number of plateaux, each of which is covered with liquid that is running down the tower. From the top of the tower the vapour is conducted into a tubular condenser, where a portion of it is condensed and returned to the top of the tower. The remainder is led down to another condenser where it is entirely condensed. This primary distillate is not of such a quality as to satisfy the requirements of the manufacturers of smokeless powders, for although there is no difficulty in obtaining the acetone free from water, and containing only a trace of higher ketones, there are other impurities, the last traces of which are very difficult to remove. The acetone is therefore again mixed with several times its bulk of water, with or without the addition of other substances, and is again submitted to fractional distillation. The distillate is tested from time to time by the "permanganate test," and when the colour remains for the specified time, the acetone is turned into a separate receptacle. This test has been somewhat fully discussed by Conroy (this J., 1900, 206), and it will suffice here merely to state that it consists in mixing 100 c.c. of the acetone with 1 c.c. of 0·1 per cent. of potassium permanganate solution, and observing the time required at a temperature of 15° C. for the characteristic colour of the permanganate to disappear. The present requirements of the War Department are that the acetone shall endure the test for 30 minutes. Two other clauses of the most recent official specification for acetone lay down that—

"The liquid is to be genuine acetone, and must contain no other ingredients except small quantities of substances which are normal by-products of the manufacture of acetone. It must be colourless and absolutely transparent, and when mixed with distilled water in any proportions it must show no turbidity. It must leave no residue when evaporated upon a boiling water-bath.

"The specific gravity must not be greater than 0·800 at 15·5 C. with water at the same temperature."

These clauses, combined with that which relates to the permanganate test, ensure that only the middle fractions from the distillation are supplied, and that the acetone is not contaminated with foreign matter, and contains no more than traces of any substances except ethyl methyl ketone, and only a small quantity of that. But, although all the acetone supplied to the Royal Gunpowder Factory for years past has on delivery complied with this specification in all respects, it was found that after keeping it for a year or two much of it had deteriorated very seriously, the permanganate test falling in many cases to only a few minutes, and the acetone assuming a dark yellowish brown tint. The material therefore had to be redistilled before being used. This was a serious matter as it is considered expedient to keep a large reserve stock of acetone in hand. The Superintendent of the Royal Gunpowder Factory therefore gave me instructions to inquire into this matter, to ascertain if possible why it was that some consignments of acetone rapidly deteriorated, whereas others remained unaffected after many years, and to devise means to prevent this deterioration.

Up to that time acetone had been tested for acid substances by titration with standard caustic alkali using phenolphthalein as an indicator, but no attempt had been made to detect or estimate weak bases. Upon testing various samples of commercial acetone with such indicators as methyl orange or nitrophenol it was found that many of them contained perceptible amounts of basic bodies, whilst most of the others were neutral to these indicators, a very few of the samples being slightly acid. Moreover, the interesting observation was made that the drums of acetone which had deteriorated all contained comparatively large amounts of basic substances or else were acid, whereas the drums that had kept well were almost or quite neutral. From these facts the conclusion was drawn that the presence of these basic bodies was directly connected with the deterioration of the acetone. This was confirmed by a number of laboratory tests and then comparative experiments were carried out on the manufacturing scale.

Several tons of acetone were made as described above from each of three different consignments of acetate of lime, and rectified in the presence of caustic soda. Each of the acetones thus obtained was then divided into three portions: one of these was not treated any further, the second was re-rectified over caustic soda and the third was re-rectified in the presence of a small excess of sulphuric acid, which combined with the basic bodies and enabled a distillate to be obtained which was perfectly neutral to para-nitrophenol. Some crude acetone was also purified by distilling with sulphuric acid and redistilling one-half with caustic soda and the other half with sulphuric acid. The permanganate test of the eleven portions thus obtained were taken a month after distillation and again at intervals. In the table below are given tho original results and those obtained on May 9th, 1904, when the acetones were seven months old.

——		Alkalinity, c.c. N/10 per 100 c.c.	Permanganate Test. Minutes.		Fall.
			One Month.	Seven Months.	
					Per Cent.
Acetones redistilled once with caustic soda	I.	0·12	34	33	3
	II.	0·55	90	54	40
	III.	0·57	95	58	39
The same redistilled again with caustic soda	I.	0·12	over 300	225	about 30
	II.	0·22	37	30	22
	III.	0·42	180	65	36
Ditto redistilled with sulphuric acid	I.	0	over 300	over 300	..
	II.	0	over 300	over 300	..
	III.	0	over 300	225	about 30
Crude acetone distilled with sulphuric acid and redistilled with caustic soda		0·0	80	48	40
Crude acetone distilled with sulphuric acid and redistilled with sulphuric acid		0	180	260	rise 44

All these acetones when freshly prepared stood the permanganate test for at least 100 minutes.

It will be seen that not only have the acetones that were distilled with acid maintained their very high original purity, but that they were even at first attacked by permanganate very much more slowly than the samples that had been distilled with alkali only. This is no doubt due in part to chemical actions taking place with comparative rapidity in the freshly distilled basic acetones between the alkaline bodies and other substances, producing compounds which cause the reduction of the permanganate. The basic acetones have not deteriorated so much as many that have been obtained from other manufacturers, although some of them are now giving decidedly lower figures by the permanganate test. The important fact, is, however, clearly brought out by rectifying in the presence of sulphuric acid instead of caustic soda, acetone is obtained at no additional cost, which possesses a considerably higher degree of purity as shown by the permanganate test and which does not deteriorate on keeping. The full reasons for this and the exact nature of the chemical changes involved are matters which are still being investigated.

It is not very easy to ascertain exactly what are the basic bodies that occur in commercial acetone, as they are present even in the worst samples only to the extent of about 0·01 per cent. Up to the present I have made a thorough examination only of the alkaline substances obtainable from the early fractions. In the sample that I collected they consisted of monomethylamine mixed with about 25 per cent. of ammonia. But that there are other amines as well as methylamine present is shown by the examination of various fractions obtained on distillation. The early portions show strong alkalinity due principally to the bodies already mentioned. The middle fractions are less strongly alkaline, but towards the end of the distillation the alkalinity again rises indicating the presence of bases having boiling points above that of acetone, or forming mixtures with it which boil at a higher temperature than acetone itself.

All these bodies, as well as any acid substances, it is desired to exclude from acetone supplied. A clause has, therefore, been inserted in the specification which reads:

> "The acetone is not to contain more than 0·002 per cent. of carbon dioxide and is otherwise to be quite neutral."

The acid and basic substances may of course be detected and estimated by any method the analyst finds suitable. At the Royal Gunpowder Factory the basic bodies and strong acids are usually estimated by diluting the acetone with an equal volume of boiled distilled water, adding two to four drops of a saturated solution of para-nitrophenol in water, and titrating with standard acid or alkali solution. Weak acids may be detected and estimated by mixing with water as before, boiling for five or ten minutes, adding phenolphthalein and titrating with standard caustic alkali. Carbon dioxide is readily determined by adding water and phenolphthalein and titrating at once without boiling.

By far the greater portion of the acetone used in this country is imported from abroad; yet there seems to be no good reason for this. It may be objected that there is no cheap timber available as in America or Austria. But this objection will not hold, for a large portion of our acetone is manufactured at Hamburg and other places in Germany from acetate of lime imported from America, and if this can be done at a profit in Germany, why not in England? The destructive distillation of wood might also be carried on to a far greater extent than is done at present, for although wood is more expensive here than in many other parts of the world, on the other hand the price obtainable for charcoal is also high here, and very large quantities are required for metallurgical and various other technical purposes. Every year timber is imported into the United Kingdom to the value of about 25,000,000*l.* From this there must be immense quantities of waste wood and after it has been used for structural or other purposes a large proportion of the timber might still be very economically employed for the manufacture of charcoal wood naphtha, and acetone.

Discussion.

Mr. Guttmann said that Mr. Marshall's paper showe that Waltham Abbey was moving very much with the times and also letting the public know what they were doing. The improvement shown by the author depended on th change of treatment of the crude acetone by sulphuric aci instead of caustic soda. He had not told them whether th acetone manufactured at Waltham Abbey in former time had deteriorated so rapidly as the foreign acetone to whic he alluded. He (Mr. Guttmann) had reason to think th the Waltham Abbey acetone did not deteriorate in th rapid way. The reason was obvious, for in Germany t neutralisation of the crude acetone was generally done wi lime, which economically might be preferable, but wou probably form more unstable compounds than would occ from treatment with caustic soda. He did not think t figures given in the paper were very bad, so far as t manufacture at Waltham Abbey was concerned, because if after a month it only varied to the extent of 3 per cent. in one case and 14 per cent. in another—still leaving 35 minutes—it was not so bad, and if Mr. Marshall treated them with lime he would probably find they were much worse. The question whether the crude acetone should be treated with sulphuric acid would no doubt engage the attention of all manufacturers concerned, and would be solved in a way which would confirm Mr. Marshall's results. The only objection to it could be that the acetone might become acid. A good deal of discussion was at one time carried on as to whether acetone when kept a year or two would become acid, and so have to be rejected. He saw no reason why slight traces of acidity should not be left, just the same as slight traces of alkalinity were left now. Mr. Marshall put the question why acetone should not be made cheaply in this country, and why it should be imported, and adduced, not exactly reasons, but arguments, in favour of the manufacture here. Probably he would modify his views if he were to consult the merchants who imported acetone, and the manufacturers abroad. He gave an example of a place in Germany which he said had no woods to speak of, which nevertheless produced acetone from American acetate of lime. He was not conversant with the status of the factory referred to, but he was under the impression that it was not making much profit, and that there were some difficulties about making the cost of production balance the selling price. At any rate the present price of acetone, as delivered to Waltham Abbey, was such that it would not pay anybody to produce it either here or abroad if it were made from American acetate of lime. The Americans, being prudent people, kept the price of acetone low, and that of acetate of lime high, thus preventing people making it at a profit. With regard to the factories in Germany and Austria that did produce acetone, and sent a good deal over here, that was quite intelligible when it was remembered that there were large factories for the distillation of wood which could dispose of every item they manufactured, and who manufactured probably all the prime materials they required. Last year he inspected one of the largest factories in Hungary which supplied large quantities of acetone to this country, and when he saw the way in which they undertook the manufacture of products of all kinds, and the enormous character of the works, he could quite understand that there was a profit to be made on acetone; but if he were asked whether it would be worth while to erect acetone works for the sole purpose of supplying the demand for British explosives, he would certainly say no.

Dr. Lewkowitsch said it was not to be wondered at that basic substances were produced. He pointed to the the fact brought out by the author's experiments that, after the bases had been removed, the acetone so obtained again yielded basic substances on treatment with caustic soda. This did not occur in the case of tar, shale, and lignite oils. Would the inference be correct that the basic substances, or some of them at least, were formed from some nitrogenous substance by the action of caustic alkalis?

Mr. Watson Smith, as a former wood distiller, asked Mr. Marshall first if it were not possible to produce acetone by the treatment of commercial wood spirit itself, which contained a considerable amount, by means of the bisulphite reaction and the after-treatment of the precipitate which it produced with caustic soda. He had reason to believe that owards the end of the wood-distilling process the acetone ncreased in the wood spirit, so that the latter fractions contained considerably more than the earlier stages. In the distillation of wood two fractions were obtained, an acid aqueous one and a tarry one. The acid aqueous fraction ontained the spirit, together with acetone and other bodies uch as acetic acid. This aqueous mixture had to be treated with lime to produce acetate of lime, from which by the sual process acetone was obtained. Now acetone was ot only produced by the dry distillation of calcium cetate, but might be produced to a lesser extent by passing cetic acid through hot tubes. No doubt some of it as thus formed in the wood retorts, especially as they got hotter, towards the end of the process. He thought it xceedingly probable, moreover, that a larger proportion of acetone would be found in the spirit produced towards the end than earlier in the process. The acetic acid would be, he thought, more largely decomposed as the retorts got hotter, and thus produce more of this acetone. There was another matter of considerable interest which he discovered in 1870, and which was recorded in a paper contained in the J. Chem. Soc. (1871, 1101—1108), and this contributed to make this speculation of his more probable. He found that in the distillation of wood the acetic acid increased to a maximum which was reached near the end of the process, when of course the retorts were hottest, after which some diminution took place. This being so, the acetone might hence be expected *pro rata* to be also at a maximum at that later stage. Had Mr. Marshall tested the distillate at various stages, and had he found such variations in the proportion of acetone?

Mr. B. Biggs said that it was generally believed that acetone had been a commercial product only within the last 10 or 15 years, but it was made in South Wales 50 years ago in considerable quantities. At that time methylated spirit was introduced, and Government required contracts for a large quantity of wood spirit. One of his friends had found that a spirit could be prepared from acetate of lime, and he made a considerable quantity, which was supplied and accepted as wood spirit. If he remembered rightly, brown acetate of lime was then worth about 4*l*. 10*s*. per ton, and the contract he made with Government for the spirit was at 8*s*. 6*d*. per gallon of about 8 lb. 1 cwt. of the lime produced $3\frac{1}{2}$ or 4 galls. of acetone of about 60—62 over proof, which was the standard required, so that raw material costing 4*s*. 6*d*. gave a product which fetched some 32*s*., or about 1*s*. a lb., or 112*s*. a cwt. The introduction of methylated spirit brought down the price of other spirit solvents, and the manufacture of acetone was then abandoned. Within the last 10 years acetone, brought up to the standard shown by Mr. Marshall, had been utilised in the production of smokeless explosives, and was now a manufacture of importance, although he was obliged to admit that the bulk of the supply came from abroad, a late contract for 200 tons having been all taken by foreign producers.

Dr. P. Schidrowitz said he had frequently found that in rectifying organic liquids, more especially of a spirituous nature, it was more satisfactory to use a strong organic acid, such as tartaric acid, than a mineral acid. Of course sulphuric acid was much cheaper than tartaric acid, but the quantity required for the final rectification would be very small, and it might be worth trying. Some 10 years ago he strongly advised a firm of manufacturers in the North of England to make acetone, because at that time he knew there was a very fair profit to be made.

The Chairman said this was a very interesting paper to those who used acetone, and it threw light on many things which one had noticed without being able to explain why they happened. Thus, acetone kept in glass bottles deteriorated in the test; and acetone which was apparently quite pure at first, after a time would fail to pass the test. He was inclined to think it was almost a case like one Mr. Watson Smith had pointed out some time ago, of the bottle itself taking the part of a reagent, and that the alkalinity of the glass acted on the acetone, and probably caused it to deteriorate. After this communication they would have to look on the acidity of acetone with a little less suspicion, especially if it were of an organic nature. He thought the suggestion Mr. Marshall had thrown out was a very good one, that waste wood and other sustances capable of producing acetone should be used for that purpose. There was one source of acetone which might very well be used which was, to a great extent, wood originally, namely, the enormous quantity of waste paper and cardboard. In London there was more than 100 tons a week of waste paper and cardboard, and the greater part of it was burnt to get rid of it. It seemed that this might become a source of profit to those who would take it up. There was any amount of material to be had, and a good demand for the product, and to utilise it would certainly be rendering the public a service, and getting rid of an article which was at present a nuisance. There was another opening for the production of acetone which was a very hopeful one, and that was its synthetical production. The cellulose molecule could be treated in a number of different ways; the decomposition of the molecule could be conducted under such conditions as to destroy it, and only obtain a small quantity of acetone, or in such a way as to obtain a large percentage of that particular article which was most valuable. In that direction there was considerable hope. Acetone was a liquid which could be used on a much larger scale if it could be obtained at a cheaper price. With regard to ethyl methyl ketone, there were better uses for this than for denaturing alcohol, and it could be used for purposes for which alcohol could not—such as a solvent in the celluloid and similar industries—with great advantage. If a large quantity of it could be produced, a market could easily be found for it. With regard to denaturing alcohol, he was inclined to think it was not sufficiently unpleasant, because something was required which would combine easily with the alcohol and which was extremely repulsive to the taste. He had also noticed that the test for acetone went down very rapidly if it came in contact with lead; it did not keep well in lead-lined vessels. Perhaps that had some connection with the research of Mr. Marshall. There might be some alkalinity produced.

Mr. **Marshall**, in reply, said Mr. Guttmann had suggested that foreign acetone was worse than that made at Waltham Abbey with regard to alkalinity, owing to the use of lime, and this seemed a possible explanation. He thought that as a matter of fact the price of acetone was lower in Germany than in England. If the German manufacturer could make and sell it at the lower price, he could not understand why manufacturers could not make it at a profit in England, where the price is higher. Dr. Lewkowitsch had referred to the formation of basic bodies, but there was only one experiment bearing upon the point, and it was not advisable to draw too many conclusions from it, the more so as the quantity of alkaline substance in the sample in question was extremely minute. Mr. Watson Smith pointed out that acetone might be obtained by the treatment of commercial wood spirit with bisulphite. There was certainly no chemical reason why this should not be done, but as it was not carried out anywhere, so far as he was aware, it was to be concluded that the manufacturers found a better opening in other directions for wood spirit containing acetone. Dr. Schidrowitz suggested the use of tartaric acid or other organic acid instead of sulphuric; he had the same idea himself, but had not yet been able to apply it. Mr. Reid had made a number of valuable suggestions, and he did not think that he could add anything to them. Acetone was not kept in lead vessels, so that the trouble referred to on that score had not arisen. He did not want it to be inferred that acidity was not harmful. Practically all the acetone made was distilled over caustic soda or lime, and consequently did not contain any acid, but if it did he had little doubt that it would deteriorate just as rapidly as if it contained alkaline bodies, if not more so. In one or two cases where acetone in drums had been found to be slightly acid it invariably deteriorated rapidly.

Mr. **Guttmann** asked if the acetone would be acid if it were distilled over sulphuric acid.

Mr. **Marshall** said it was not found to be so. If the distillation were carelessly carried out it might be possible for some acetic acid to distil over, but he did not see how sulphuric acid could pass over, as the vapour tension of sulphuric acid was very small compared with that of acetone.

A NEW METHOD FOR THE ANALYSIS OF TANNIN AND TANNING MATERIALS AND THE IDENTIFICATION OF ADMIXTURES IN TANNING EXTRACTS AND LIQUORS.

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Contribution from the London Leather Industries
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In the analysis of tanning materials by the standard method prescribed by the International Association of Leather Trades Chemists certain figures are obtained which are supposed to nearly represent the results which would accrue in the ordinary course of extraction of materials and use of liquors in tanning. The figures obtained by this method give the amount of tanning matters absorbed by the hide-powder and the amount of other soluble matters which are not absorbed by the hide-powder; these are returned as being non-tannins. The process which is now about to be described will show conclusively some of the many errors caused by the hide-powder, and the extent of such, and will also show the reason why the analytical results as obtained by the hide-powder process are not borne out in practical manufacture.

It has been shown by Procter (this J., 1903, 482, and Collegium, 1903, 114) and others, and is a well-known fact that by the hide-powder process the hide-powder absorbs acids other than tannic acid, and even retains inert matters, such as dextrin and other non-tanning substances which are present in many tan-yard liquors. It has also been shown by Boegh and Paessler (this J., 1899, 927) that the hide-powder method is extremely inaccurate for the analysis of liquors surcharged with natural acids The difficulties of getting concordant results with gambier, myrobalans, and sumach are too well known to require further consideration; and although we acknowledge that the hide-powder process of tanning analysis is in many ways a great advance over the old Loewenthal process, yet the difficulties of obtaining results accurate within half a per cent. have only been surmounted by the most stringent regulations as to exactitude in every manipulative detail.

From time to time the I.A.L.T.C. have modified the process of hide-powder analysis, based on research work carried out in the various leather trades' laboratories of Europe, but one of the main difficulties, which has ever been and probably ever will be as far as the hide-powder process is concerned, is the obtaining of a standard hide-powder free from soluble matter, with an absorptive power sufficient to absorb all matters capable of uniting with hide substances. The authors have made many samples of hide-powder, under varying conditions, with and without the use of aldehydes and chrome salts, but have absolutely failed to produce a hide-powder of unvarying quality and certain standard. They have found that very little variation in the coarseness of the powder, the part of the hide from which the powder is made, the time of the preliminary liming, and the alkalinity or acidity cause the results obtained to vary 1 to 2 per cent; a hide-powder prepared from cow hide is different from a similar powder made under identical conditions from an ox or bull hide; and, again, a powder prepared from the butt varies from one prepared from the belly even of the same beast. It is a matter for congratulation that the differences obtained under present conditions by two chemists analysing the same material are not more divergent than they are.

In the first instance, it is necessary to define the general principals of tanning. Commencing on the limed skin o hide stage, the same having received the required amount of preparatory treatment, generally the process of tannin may be described as—

(1) Reduction or neutralisation of the alkalinity, wit more or less removal of the bases and salts produced.

(2) Fixation or tannage, with the necessary direc combination of the collogen or skin fibres with the acid o acids, or compounds of them.

(3) Loading or filling, which is purely a deposition o and between the fibres of difficultly soluble substance phlobaphenes, bloom and gums, which gives specifi physical characteristics to the skin or hide as leather.

Our method of analysis directly affects the substance which are present in the extracts or liquids whic accomplish the first two parts of this process of tanning and it is well known that materials, extracts, and liquo which give like results by the present method of hid powder analysis do not produce like results in practic The method about to be described shows why this is th case. Tanning materials contain generally, but n always, in addition to the true tannin and non-ac constituents, a variable amount of acid, acids, or acid sal and it is these latter which, although, strictly speakin non-tannins, are necessary and indispensable tanni adjuncts; in fact, strange though the statement may be, pure true tannin, which we term anhydrous digallic acid, does not make leather without the aid of an adjunct, and pure tannic acid does not precipitate collin without the addition of a tanning adjunct, *i.e.*, it requires the addition of a small quantity of organic acid. The ratio of pure tannin to tanning adjuncts can be determined; and the proportions or ratios vary in undoubtedly pure and authentic samples of materials and extracts, or liquors of them prepared under precisely identical conditions.

In the first place, we must consider substances in their behaviour and relations in the pure state, and afterwards draw the inferences resulting from the varying differences, relying always upon corroborative evidence of subsequent analysis, &c. The basis of tanning in almost every instance is the combination of the so-called gallotannic acid, or rather, anhydrous digallic acid, or a compound of it, with collogen, and we base our calculations upon results obtained from the combination of these two substances in their purest known form, taking the substance collin as representative of collogen, which substance it actually is, but deprived almost entirely of its calcium basis.

Having proved that the majority of tanning materials depend upon the anhydrous digallic acid content for their activity as tannin agents, it was considered expedient to devise some convenient, quick and accurate method whereby it could be estimated, and after a considerable amount of investigation and numberless experiments, it has been found that the method about to be described is quickly used, and that a number of other important onclusions can be drawn from the results obtained.

The all-important reaction upon which the method of analysis depends is the formation by anhydrous digallic cid with calcium hydroxide of a basic, insoluble compound. his we have found to proceed fairly rapidly, almost to ompletion within the hour, to be quite completed within our hours, the extra three hours making a difference of —$1\frac{1}{2}$ per cent. only. The method is as follows:—

Take 300 c.c. of an N/5 calcium hydroxide solution and dd to it 200 c.c. of the clear liquor to be examined. This quor should be of the same strength as laid down by ie I.A.L.T.C. for the hide-powder process. Shake several mes in a stoppered cylinder, allow to stand for the quired time, shaking at intervals, filter off 100 c.c., and rate the amount of N/5 calcium hydroxide remaining in e filtrate in the presence of phenolphthalein. This nount multiplied by five and deducted from 300 c.c. mount originally present) gives the quantity of N/5 lcium hydroxide solution which has been absorbed by the 0 c.c. of the original liquor. This figure may be termed e total absorption figure or total absorption value, and y be expressed either in per cent., or in terms of c.c.'s N/5 calcium hydroxide per 100 c.c. absorbed.

We have found in the case of absolutely pure anhydrous gallic acid, prepared and purified by the most careful l accurate methods by means of ether separation, that rm. will exactly absorb 125 c.c. of N/5 calcium hydroxide, ich amount exactly corresponds with the theoretical ount according to the following equation:—

$$C_{14}H_{10}O_9 + 4Ca(OH)_2 = C_{14}H_{10}O_9Ca_4(OH)_8$$
$$322 + 40 \text{ litres } N/5\ Ca(OH)_2.$$

1 molecule of anhydrous digallic acid forming with four molecules of calcium hydroxide an insoluble basic salt. This, however, only takes place if the lime water is in sufficient excess: if a large excess is not used, other salts are formed of various constitution which prevent correct estimation. Barium hydroxide may be substituted for calcium hydroxide, but we prefer the calcium. Sodium or potassium hydroxide cannot be used, as they do not form insoluble precipitates.

When tannin is impure, as in the case of all tanning materials, and contains acids or colouring matters, free or combined with it, it is necessary to make a second determination to ascertain their nature, weight, and acidity, and for this means we take another 200 c.c. of the original liquor and detannise it. This was the most difficult problem to overcome, as the precipitation by means of any of the metallic salts, such as lead nitrate, barium acetate, alumina, &c., or of a solution of gelatin and salt, removed both the tannic and gallic acids, and after numberless experiments we decided to use a neutral solution of collin which was originally devised by one of us for a specific purpose in connection with pharmaceutical preparations. A solution of collin is prepared as follows:—

Take 60 grms. of a good commercial gelatin, soak in about 500 c.c. of distilled water, and warm until dissolved; to this add 120 c.c. normal caustic soda solution, and heat on a water-bath for 20 minutes at 90° C. Filter through linen; the calcium and other salts are thus removed. When cold, fill a 500 c.c. flask exactly to the mark, and titrate 100 c.c. of the remainder with N/1 hydrochloric acid, which will give the amount of normal acetic acid necessary to exactly neutralise the 500 c.c. This amount of acetic acid is added, and the collin is neutral to phenolphthalein; 1 c.c. of pure chloroform is added as a preservative, and the whole made up to exactly a litre, making approximately a 5 per cent. solution of neutral collin. This material *plus* dilute organic acid, is found to be a more delicate precipitant for tannic acid than any we have found. It is possible to detect by means of acidified collin 1 part in 10,000.

To detannise our solution for analysis 200 c.c. of the original liquor is taken, to this is added 100 c.c. of the collin solution in the presence of an added quantity of 100 c.c. N/5 acetic acid, or in cases where old acid tanyard liquors are under analysis, which usually contain only traces of tannin, 50 c.c. of collin and 50 c.c of acetic acid suffice. The tannin is by this means completely precipitated. The precipitate, which is amorphous leather, is filtered off, 200 c.c. of the clear, bright filtrate from the collin precipitate is now placed in a stoppered cylinder, and 200 c.c. of N/5 calcium hydroxide added; this is well shaken and allowed to stand for an hour, and the absorption figure, after filtration, is taken out. This gives, after deducting the amount of added acetic acid, the absorption *minus* the tannin. From these figures, therefore, we obtain the following results:—Total absorption, A c.c.; Acid absorption, B c.c.; True tannin by difference, A − B c.c. per litre.

The following table shows a few results on some tanning materials in common use in this country, and also shows how the total absorption value corresponds with the figures returned by the hide-powder method as tanning matters absorbed by hide, thus showing that the hide-powder absorbs many organic acids other than tannic acid.

—	Percentage of Tanning Matters by Hide-Powder.	Percentage by Parker and Payne's Total Absorption.	Total Absorption, c.c. $Ca(OH)_2$ for 100 c.c. Liquor.	Acid Absorption, c.c. $Ca(OH)_2$ for 100 c.c. Liquor.	True Tannin by Difference.
			c.c. $Ca(OH)_2$	c.c. $Ca(OH)_2$	c.c. $Ca(OH)_2$
nia	28·3	29·3	71·25	28·2	43·05
C tnut extract	29·7	29·71	52·0	21·6	30·4
S ach	28·0	28·0	*100·0	33·6	66·4
O vood extract	27·4	27·1	*100·0	47·15	52·85
M. osa park	23·3	23·35	*100·0	34·2	64·8
M balans	32·6	32·7	85·5	37·6	47·9
U tanyard liquors	1·5	1·2	148·0	135·2	12·8
S ” ”	1·5	1·2	149·2	132·8	16·4
” ”	0·28	0·2	29·7	29·7	..
tan	6·0	6·8	..	..	..

n the case of samples Nos. 3, 4, and 5, columns 4, 5, and 6 are the results stated to show the relative differences of acid to tannin, and no r comparison with columns of percentages obtained.

We have found that the collin precipitate, which we refer to above as being amorphous leather, is easily removed from the linen or from the filter paper upon which it is. If this is well washed with distilled water, completely removed to a tared porcelain dish, dried at 100° C., and then carefully weighed, a portion of the same may also be submitted to Kjeldahl analysis for the determination of nitrogen; we obtain from these figures the weight-giving or leather-forming capacity of the tanning material under examination. This method will, we have no doubt, be of great value to chemists engaged in the leather trade, as by its aid one can state exactly how many pounds of leather a given extract of tanning material is capable of forming.

The following is one example taken from a number, and reveals a very interesting and important fact, *viz.*, that collin, besides precipitating true tannin, also enters into physical combination with the colouring matter of the material. Whether this be only colouring matter, or whether it be colouring matter in chemical combination with other substances, we are not prepared to state, but in the case of the following sample of chestnut extract we have been able to prove the case both by the Kjeldahl and by the exact weight. If we take the weight of the collin precipitate we know from analysis the percentage of true tannin contained in the solution. With that as our basis, and subtracting that quantity from the total weight, we get the amount of collin combined. In this case the collin is got by difference. If we further submit this precipitate to Kjeldahl analysis we get the amount of nitrogen, and from the amount of nitrogen the amount of collin in the sample, and in this case the tannin by difference, but the two figures do not agree. Now, pure anhydrous digallic acid combines with collin in the proportion of 12 to 13 approximately. Having that as our basis the following example will be clear, and if our theory is correct, it is possible by this means to estimate the amount of colour weight* in any material.

Analysis of a Chestnut Extract.

By hide-powder	29·70.
By lime precipitation	29·71.
" "	17·37 per cent. true tannin.
True tannin ratio	58·46 tannin true.
Acid ratio	41·54 acid.
By weight of precipitate found	56·38 collin.
" " "	*a43·62 tannin true (from true tannin calculation).
By Kjeldahl	*b46·80 collin.
"	53·2 tannin.

Now 12 true tannin combines with 13 pure collin (approximately); therefore *a*43·62 true tannin would combine with 47·25 collin, but by weight 56·38 were found; therefore, by difference, $56{\cdot}38 - 47{\cdot}25 = 9{\cdot}13$, colour weight.

Again, if 12 true tannin combines with 13 collin (approximately), how much tannin would *b*46·8 pure collin combine with 43·2? But the weight found was 53·2. By difference, $53{\cdot}2 - 43{\cdot}2 = 10{\cdot}0$, colour weight.

In the present method of analysis by the hide-powder process the volatile acids are largely driven off by drying the residues in the air-bath, and are only partly estimated in the analysis, but by the method above described they can be accurately determined. For this purpose the total absorption value of a liquor is taken out, and a further sample slowly evaporated to dryness on the water-bath, re-dissolved in water, and a second absorption taken out; the difference gives the amount of volatile acids contained in the sample. We have determined the following absorption factors on the purest materials obtainable:—Pure gallotannic acid (anhydrous digallic acid), 1 grm. absorbs 125 c.c. N/5 calcium hydroxide. Acid gallic, 1 grm. absorbs 177·75 c.c. N/5 calcium hydroxide. Acid ellagic, 1 grm. absorbs 125·92 c.c. N/5 calcium hydroxide. The usefulness of the method may be further applied in the detection of materials in admixtures. These may in part be obtained from the ratio of the true tans to the acid, from whic fairly accurate quantitative results are easy to calculate But the qualitative detection of admixtures is extremel easy, owing to the colour reaction given, on the one han when the tannin solution is added to the lime solution, bu still more marked when the detannised solution is adde to the lime water, the colours for each of the commercia tanning materials being very characteristic, ranging fro mangrove, which is a deep red, mimosa, which is lavender colour, to chestnut, which is a mahogany shade myrobalans, a brown yellow, and finally sumach, which if pure, is of a canary yellow colour, rapidly changing t a brilliant green, but if the sumach be adulterated wit any quantity of either pistacia or tamarix, the colour produced is a deep brown, with no trace of green colour o standing.

The authors intend this paper to be in part only preliminary note, and intend to follow the same up, as sou as time will permit, with a complete comparative list o figures showing the working of the method as compare with the hide-powder figures, and also establishing th leather-forming qualities of all the commercial materia used in the leather industry of this country.

Discussion.

Mr. R. L. **Jenks** said by the kindness of the authors h had examined this method and had had an opportunity o seeing it carried out. He was not quite sure whether D Parker had made clear the relation of this titration metho to those methods already existing. Anyone familiar wit the charming but illusory permanganate method, and th more trustworthy but tedious hide-powder one, would b curious to know what was the relation. Several hundre assays had shown that the first figure, *i.e.*, the "tot absorption" was practically the same as the ordinary hid powder result, and as this could be obtained a few minut it was a very useful check on what was at present th official method, which took a number of hours. Ther were a great many points to be found in the paper. Th interest lay not merely in determining the percentage tannic acid in a few minutes, but in the amount of lig thrown on a number of extremely difficult and compl questions. It was the only method at present which ev promised to throw light on the different tannic acids a to give a ready means of diagnosing them.

Dr. **Lewkowitsch** asked whether the precipitation tannic acid and "colline" also took place in a solution a mineral acid, or only in the presence of an organic ac He quite agreed with Dr. Parker as to the correctness proceeding in the same manner as is done in oil analys *viz.*, to determine numerical values first, obtain constan and then try to explain them.

Mr. **Duff Miller** thought it would be a very gr thing for those interested in tanning if they could get more simple method than they had at present of det mining the valuable properties of tanning materials, a he believed Dr. Parker was on the right road to sup this great want. His experience of the tanning trade been considerable, and he looked upon this as a m valuable research.

Dr. **Dvorkovitz** said about 15 years ago he working on the same lines, but for quite a differ purpose, namely, to ascertain the fermentation of tea the amount of tannin it contained. After experiment with all the existing methods, he found a reliable proc which consisted in depositing the tannin by means of bar hydroxide, and then titrating by potassium permanga the products of fermentation left in the solution. found that to use tannin as a standard was very reliable, as it had to be purified every time before it c be used; in preference, he used oxalic acid as a stand By careful comparison with pure tannin he found grms. of oxalic acid to be equal to 31·3 grms. of tannin. With regard to the colouring matters, he m say that he had at first the greatest difficulty in mating them. Most of the various kinds of tea analysed gave a tannin figure practically the same, alth he knew from the leaves he received, some being y

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* We use the term "colour weight" in a broad sense, as the exact nature of this material is still under investigation, and we hope to obtain a term which will more correctly express our meaning.

and others old, that the tannin matters must be different; only after he separated the tannins by means of barium hydroxide was he able to get the exact percentage. By further titration of the solution he estimated the percentage of colouring matter, which represented the "product of fermentation." He thought Dr. Parker would find this method very useful, namely, after depositing the tannin matter by means of barium hydroxide to titrate the colouring matters left in solution by means of potassium permanganate.

The CHAIRMAN said everybody seemed to want a good method for estimating tannin, and there did not seem to be one. The mere fact that it took an annual conference,—and already a great number had been held,—to regulate the hide-powder process, showed that it could not be an altogether satisfactory one. He was not an expert himself, but he was told that the hide-powder had to be of a special nature, and even the sex of the animal had to be specified, so that the analysts were rather in the hands of the manufacturer of the hide-powder. They wanted some reagent like lime, which could be procured everywhere. One great advantage of the method appeared to be the differentiation of the various substances which went to make up the weight of leather, which seemed very important, but on the other hand he was not quite disposed to agree that the experiments with collin were conclusive. He thought collin was not quite the same as hide powder, and that a more definite connection between he collin and hide substance should be shown before the act could be accepted that collin was similar to the hide ubstance. Although it might give a precipitate with tannin t did not follow that the reaction would be the same as with ide.

Dr. PARKER, in reply, said Mr. Jenks had pointed out an mportant factor which was noticed before when he communicated this method privately to several of his colleagues. he view had been taken that they were going to upset the ade because they were accustomed to figures based on the ide powder, and if others were substituted they would not e understood. If they wanted those figures they had the tal absorption value, and that figure in all extracts of aterials, not spoiled in the manufacture or heated to too gh a temperature, agreed within one-tenth per cent. of a operly carried out hide-powder analysis. It was only in tracts which had been fermented or chemically treated with bisulphite or some decolorising matter which altered them completely that any difficulty would arise.

Collin was made by heating a solution of hide powder or gelatin with caustic soda, and afterwards neutralising with acetic acid. The sodium acetate present would check any antagonistic action of the mineral acids. He was glad to have heard the remarks of Mr. Duff Miller, one of the pioneers in the extract manufacture, first in Canada, then in this country, and in Slavonia. He knew he had suffered severely from the faults of chemists or of hide powder. Chemists always blamed the hide powder, but Mr. Miller sometimes said it was the chemist. He was glad to hear he was pleased with the advances they were trying to make. He had tried barium hydroxide and found it acted very satisfactorily, but lime was cheaper and was easily obtained. With regard to the colour, the colour they estimated was colour combined, not uncombined. The uncombined value could no doubt be estimated in the way suggested by Dr. Dvorkovitch. The combined colour, which was combined with materials which did not form a compound with collin, could not be estimated by that method. The Chairman had touched upon one or two difficulties with regard to the use of hide powder. It was quite true that hide powder made from a cow-hide was not so satisfactory as that made from an ox-hide, and from a bull-hide it was worse still. Then there was another fact, that hide powder made from a portion of hide from the back or butt would be quite different from that made from the animal's belly, and gave different results. Thus the tannin chemist had been in the hands of the manufacturers of hide powder very largely. They had carefully analysed the collin and found the nitrogen factor was 17·8, exactly the same as in hide powder. Collin could be made either from gelatin or from hide powder. They claimed that collin acted in the same manner as collogen. It was in fact hide substance, or hide powder, from which the lime base had been removed. It was absolutely pure gelatin. From a commercial view they were quite satisfied with the similarity. By the old method they were satisfied when they got results to agree within 1 per cent., and they were specially pleased now they found that a difference of titration of 1 c.c. would make less than one-tenth per cent. difference in the analysis, and as they worked now with 300 c.c., where they formerly used 50, the error was not multiplied as it used to be by the complexity of the hide-powder method.

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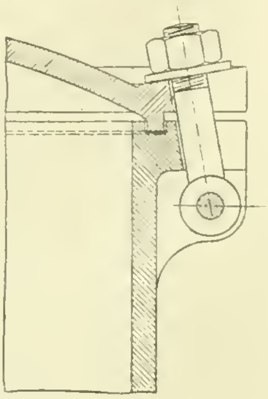
I.—PLANT, APPARATUS AND MACHINERY.

Screw Fastening; Safety —— for the Lids of Vessels [Stills, Autoclaves, &c.]. Landshoff and Meyer. Z. angew. Chem., 1904, **17**, 717.

The nature of the invention is clear from the accompanying figure:—



The flange of the cover, thicker at its outer than at its inner limit, forms everywhere an inclined plane rising outwards, and prevents the fastening-screws, when the nuts are tightened, from slipping off, as they are liable to do when the flange-surface is horizontal.—J. T. D.

English Patents.

Centrifugal Machines. J. W. Macfarlane, Glasgow. Eng. Pat. 15,015, July 7, 1903.

In machines of the "Weston" type, with bottom-discharge valve, described in Laidlaw's Eng. Pat. 16,794 of 1888, a catch is formed on the upper inner edge of the outer stationary casing, to engage with the bottom of the discharge valve when the katter is lifted and tilted, so as to allow the basket to be emptied.—W. H. C.

Separating or Grading Ground or Pulverised Materials; Improved Apparatus for ——. H. Branget, Pont de Pauy. Eng. Pat. 16,815, July 31, 1903.

The material to be separated is fed into a fixed tube, slightly inclined in the direction of its length, and is stirred up and moved forward therein by a shaft carrying stirring-blades and a spiral conveyor. A fan drives a current of air in the contrary direction, which removes the dust.—W. H. C.

Regenerator Furnaces; Construction of ——. J. West, Southport. Eng. Pat. 6718, March 19, 1904.

The division wall between the waste gas flue and the secondary air passages is constructed with special fireclay blocks instead of solid brickwork. The blocks are formed with substantial edges, but with thin centre parts, in order to offer less resistance to the transmission of heat.
—W. H. C.

Filtering Liquids; Improved System of and Apparatus for ——. P. M. Justice, London. From The Telluride Reduction Co., New York. Eng. Pat. 7210, "May 25, 1904" [Specification dated March 25, 1904].

A closed perforated box covered with filtering material is immersed in the liquid to be filtered. The liquid is drawn through into the box by suction, and is removed. The box is then transferred to a tank containing water, which is drawn through, to wash the residue. Finally, the box is removed to another tank, and water forced outward through the filtering material, to cleanse it.—W. H. C.

United States Patents.

Centrifugal Apparatus [Separator]. E. Séger, Stockholm. U.S. Pat. 760,261, May 17, 1904.

See Eng. Pat. 468 of 1904; this J., 1904, 363.—T. F. B.

Filter. P. Danckwardt, Deadwood. U.S. Pat. 760,429, May 24, 1904.

A series of vertical shells enclosing filtering chambers are arranged in steps, the bottom of one filter being connected by a pipe with the top of the next lower down. Suction pipes enter the filtering chambers, and "solvent-pipes" the outer shells, at the bottom.—W. H. C.

Evaporating or Distilling; Apparatus for ——. J. S. Forbes, Philadelphia. U.S. Pat. 760,440, May 24, 1904.

A vacuum evaporating chamber is connected with a condenser by means of an exhausting and compressing pump. Means for heating the evaporator and for drawing off the concentrated liquid are provided. Heat interchangers are arranged so that the heat, both from the evaporated and the condensed liquid, is transferred to the liquid to be evaporated.—W. H. C.

Roasting Furnace. L. T. Wright, Keswick. U.S. Pat. 760,510, May 24, 1904.

The furnace has a vertical central hollow shaft with hollow arms carried over a series of superposed floors, the shaft enclosing a pipe having conduits connected to it, discharging into the hollow arms. A feed-pipe leads upward to, and is connected with, the bottom of the enclosed pipe, and the shaft has a discharge pipe at its top.—E. S.

Muffle Kiln; Continuous ——. T. S. Nickerson, Newburyport. U.S. Pat. 760,551, May 24, 1904.

A series of muffle chambers are arranged in line, having a track running through the series, on which trucks containing the material to be heated travel. The chambers are heated by separate furnaces, and doors are placed at the ends and between the chambers. Means for operating the doors and for moving forward the trucks are provided. The material is warmed up in the first chamber and is then passed on to the second chamber, where it is heated to any desired temperature. When the material has been sufficiently heated, the truck is passed on to the las chamber, where it is allowed to cool. By this means it i claimed that there is no lowering of temperature in th middle chambers.—W. H. C.

Furnaces; Method of avoiding Loss of Heat in ——. A. Kurzweruhart, Zuckmantel, Austria. U.S. Pat 760,633, May 24, 1904.

See Eng. Pat. 1890 of 1904; this J., 1904, 434.—T. F. B.

Dryer. L. Gathmann, Washington. U.S. Pat. 761,011, May 24, 1904.

The drying chamber has a coil connected with a heatin or cooling device. A liquid is forced through the coil s that the temperature of the chamber can be varied. Mean are provided for isolating the drying-chamber from th "heater-condenser."—W. H. C.

Dryer. L. Gathmann, Washington. U.S. Pat. 761,042, May 24, 1904.

The drying chamber is arranged so that air, heated cooled as required, can be forced through it by a fan in upward or downward direction. Means are provided f regulating and for heating and cooling the air.—W. H. C.

French Patents.

Heat evolved from Reactions; Process and Apparatus f Utilising the —— for Heating all kinds of Liqu A. Lang. Addition, dated Dec. 18, 1903, to Fr. P 331,997, May 12, 1903.

See Eng. Pat. 11,632 of 1903; this J., 1904, 527.—T. F.

Concentrating and Evaporating Apparatus for Liqu Soc. Anon. des Forges et Chantiers de la Mediterran Fr. Pat. 338,603, Dec. 31, 1903.

Inside an evaporating chamber are arranged a right- a a left-handed spiral steam-heating coil, provided with inl for live steam and outlets for waste steam. The chamber is braced across to make it rigid, and the parts of the spirals are made interchangeable. Suitable doors are provided to make every part of the apparatus accessible for rapid cleaning and dismounting.—L. F. G.

II.—FUEL, GAS, AND LIGHT.

English Patents.

Coke; Treatment of ——. E. S. Beaven, Warminster. Eng. Pat. 13,047, June 10, 1903.

The coke is immersed in a solution of lime in water, containing about 2—5 lb. of lime in 10 galls., until saturated, the object being to fix the arsenic in the ash of the fuel on burning.—L. F. G.

Separating Coke and other Electric Conductors from Cinders and other Substances; Improved Electrical Apparatus for ——. H. Lelarge, Liège. Eng. Pat. 5799, March 9, 1904.

A revolving drum, with receptacles for cinders, coke, &c. on its surface, is fed with the material to be separated. If the body in any particular receptacle is a conductor, it makes a contact with one end of a wire connected, through battery and electro magnet, to the body of the drum. The electro-magnet brings a chute into position, directing he coke, &c. into a special receiver. If the body is not a onductor, it falls on to another shute and is directed into nother receiver.—W. H. C.

Tan and like Fuel; Furnaces for Burning ——. D. M. Myers, New York. Eng. Pat. 5045, March 1, 1904. Under Internat. Conv., March 2, 1903.

Long narrow feed chute, enlarged at its upper end so as o form a hopper, supplies the tan bark to inclined grate evices, the uniform movement of the tan being effected y a rotating shaft provided with teeth. Auxiliary deflectng teeth, controlled by a lever, regulate the rate of admison of the tan to the rotating stoker. The grate device onsists of horizontal bars provided with feet, resting one n the other, so as to form horizontal air inlets and an clined front down which the fuel slides. Before reaching e grate bars, the fuel passes over a "dead" plate, where is dried. The grate bars are arranged on opposite sides of e furnace, so that the horizontal draughts produced, meet the centre, causing intense heat, whilst reverberating fficient heat to heat the dead plate. The furnace is itably connected to a boiler, and the ashes are removed rough a shaking grate.—L. F. G.

ases; Purification of ——. J. Y. Johnson. From Bad. Anilin u. Soda Fabr. Eng. Pat. 11,549, May 20, 1903. VII., page 659.

s and Air; Apparatus for Producing Mixtures of —— [*for Illuminating Purposes*]. H. H. Lake, London. From Selas Ges. m. b. H., Berlin. Eng. Pat. 11,827, May 23, 1903.

e Fr. Pat. 333,033 of 1903; this J., 1903, 1287.—T. F. B.

s Producers for Poor Gas Free from Tarry Matters. Boutillier, Paris. Eng. Pat. 7979, April 6, 1904. Under Internat. Conv., April 7, 1903.

vertical retort, closed by a cap at its upper end, passes trally down through the main body of fuel in the proer, and its lower end opens into chambers situated eath the fire-bars. "Poor caking (bituminous) coal" is into the retort at its upper end; the tarry vapours which il off pass out at its lower end, and are thence carried the usual currents of steam and air up through the ndescent fuel in the producer. The coke thus produced he retort collects in the chamber below the firebars, nce it is taken as required to replenish the fuel bed in roducer.—H. B.

United States Patents.

Coke-Oven. J. B. Beam, Bigrun, Assignor to the Beam Coke Oven Steam Boiler Power Co., Punxsutawney. U.S. Pat. 760,372, May 17, 1904.

The claim is for a combination of a series of ovens connected to a main flue running below the bottom level of the ovens, but close enough to impart heat to them, the ovens being connected to the main flue by passages provided with valves, the passages entering the ovens above the coke-level close to the filling orifice. The main flue is divided into sections by means of valves, and furnaces are connected with the main flue by passages fitted with valves passing underneath and between two ovens, heating these. —L. F. G.

Gas Furnace; Regenerative ——. F. Siemens, Dresden. U.S. Pat. 760,263, May 17, 1904.

See Eng. Pat. 25,057 of 1902; this J., 1903, 1197.—T. F. B.

Gas Generator. W. F. Mattes, Scranton. U.S. Pat. 760,638, May 24, 1904.

The fuel is fed from a hopper into a series of vertical tubes, and falls into a combustion chamber containing a water-sealed ash-pit at the bottom. The tubes are surrounded by other tubes in which the hot gases from the combustion chamber circulate, and means are provided for regulating the supply of fuel and of air for combustion. —L. F. G.

Gas Purifier. P. Winand, Charkow. U.S. Pat. 760,674, May 24, 1904.

See Fr. Pat. 319,668 of 1902; this J., 1902, 1523.—T. F. B.

Electrically Smelting Materials; Process of —— [*Calcium Carbide, &c.*]. A. H. Cowles. U.S. Pat. 760,057, May 17, 1904. XI. A., page 666.

Calcium Carbide; Process of Making ——. A. H. Cowles. U.S. Pat. 760,312, May 17, 1904. XI. A., page 666.

Incandescent Mantle, and Art of Manufacturing same. W. K. L. Dickson, London. U.S. Pat. 760,317, May 17, 1904.

See Eng. Pat. 4707 of 1901; this J., 1902, 461.—T. F. B.

French Patents.

Briquettes of Coal and Peat; New ——. G. Adrot. Fr. Pat. 338,674, April 8, 1903.

See U.S. Pat. 729,711 of 1903; this J., 1903, 790.—T. F. B.

Moulding and Briquetting; Process and Apparatus for Preparing Pulverulent Substances for ——. The Zwoyer Fuel Co. Fr. Pat. 339,419, Jan. 9, 1904.

See Eng. Pat. 541 of 1904; this J., 1904, 316.—T. F. B.

Furnaces; Regenerative Gas ——. F. Siemens. Fr. Pat. 339,323, Jan. 2, 1904.

See Eng. Pat. 5866 of 1903; this J., 1904, 317.—T. F. B.

Gas Retort; Horizontal or Vertical ——. H. Gielis. Fr. Pat. 338,684, Nov. 5, 1903.

The retort, viewed in cross-section, is roughly rectangular, consisting of four walls, each of which is curved inwards slightly, the curvature serving to strengthen the retort against the outward pressure of the charge and of the gases. When used horizontally the retort is provided externally with transverse rectangular ribs, and when a number of such retorts are superposed in the furnace, the ribs form the supporting pillars for the whole, the bottom edge of each rib resting on the top edge of the one below. —H. B.

Water-Gas, &c.; Process and Apparatus for Production of ——. P. Schmidt and Desgraz. Fr. Pat. 338,626, Nov. 26, 1903.

In this apparatus the gas and tarry vapours which distil from the fresh fuel are drawn off by means of a steam injector and forced into the incandescent part of the fuel, for the purpose of producing non-condensable gases. The producer is provided with a series of apertures at various levels, communicating with the draw-off pipe, at the foot of which is situated the injector, directed into the incandescent zone. To prevent condensation within this pipe, a portion of the hot gas from the incandescent zone is led into it, or it may be provided with a jacket through which the hot gases are led. The main off-take for the gases is situated just above the incandescent zone. Air enters the producer through an inclined grate, the perforations in the lower part of which are larger than those in the upper part.—H. B.

Gas Generator worked by Aspiration. A. E. Kiderlen. Fr. Pat. 338,522, Dec. 30, 1903.

See Eng. Pat. 23,751 of 1903 ; this J., 1904, 54.—T. F. B.

Gas ; Process of Making Poor ——. W. A. Köneman. Fr. Pat. 338,587, Dec. 31, 1903.

See U.S. Pat. 749,302 of 1904 ; this J., 1904, 247.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Coal-Tar Bases. F. B. Ahrens and R. Gorkow. Ber., 1904, **37**, 2062—2066.

α-β-Dimethylpyridine has been isolated from the fraction of tar bases boiling at 160°—165° C., by treating in hydrochloric acid solution with mercuric chloride and distilling with potash. It boils at 159°—160° C., and has an odour of lutidine. On oxidising the base with potassium permanganate α-β-pyridinedicarboxylic (isocinchomeronic) acid is produced. α-β-Dimethylpiperidine is obtained by reducing the foregoing base in boiling alcoholic solution with sodium. It boils at 138°—140° C., and has an odour of piperidine.

β-β-Dimethylpyridine has been isolated from the fraction of bases boiling at 165°—170° C. by fractional precipitation with mercuric chloride and crystallisation at different temperatures. It boils at 171° C. Oxidation with potassium permanganate converts it into β-β-pyridinedicarboxylic acid. This base is identical with the lutidine obtained by Dürkopf and Göttsch from dimethylpyridinecarboxylic acid (this J., 1890, 820).—D. B.

Aniline Homologues; Direct Hydrogenation of ——. P. Sabatier and J. B. Senderens. Comptes rend., 1904, **138**, 1257—1259.

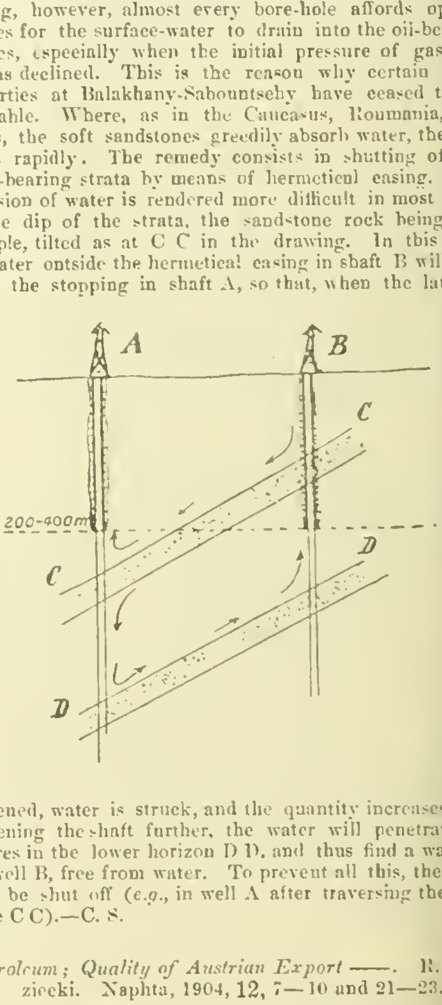
Mono- and dialkylanilines are reduced by hydrogen in presence of finely divided nickel, at 160°—180° C., to the corresponding hexahydro compounds. A secondary reaction takes place to a very small extent, viz., the formation of cyclohexane and alkylamine. Methylaniline is reduced with some difficulty; the resulting cyclohexylmethylamine possesses a powerful odour resembling that of methylamine, and boils at about 145° C. Ethylaniline similarly gives cyclohexylethylamine, of b. pt. 164° C., density 0°/0° = 0·868. Cyclohexyldimethylamine and cyclohexyldiethylamine have boiling points 165° and 193° C., and densities each of 0°/0°, 0·876 and 0·872 respectively. All these compounds are colourless powerful bases, alkaline to litmus, and form easily soluble salts. Aniline substituted in the benzene ring, by an alkyl group, is reduced in a manner similar to aniline (this J., 1904, 341) ; thus, in the case of the toluidines, hexahydrotoluidine, dimethyldicyclohexylamine and methylcyclohexytolylamine are formed. The reduction of the toluidines and xylidines, however, proceeds very slowly, and only to a limited extent.—T. F. B.

Aniline-Toluidine Oil from Russian Naphtha. W. N. Ogloblin. Z. Farben- u. Textil-Chem., 1904, **3**, 179—183 and 199—202.

The author has investigated two aniline-toluidine oils obtained from Russian naphtha by Nikiforoff's process (Eng. Pat. 10,957 of 1886 ; this J., 1887, 540). Oil No. I., of which 60 per cent. distilled below 182° C., consisted of about 60 per cent. of aniline and 32 per cent. of *o*-toluidine. Oil No. II. contained aniline and the three toluidines, the chief constituent being *o*-toluidine.—A. B. S.

Petroleum ; Wasteful Methods of Winning ——. K. Angerman. Naphta, 1904, **12**, 3—6.

Oil deposits are usually separated from surface water-bearing strata by impervious, plastic, sedimentary rocks, and if care were taken to maintain this separation in drilling oil wells a flow of oil quite free from water could be secured for many years. Under the usual conditions of drilling, however, almost every bore-hole affords opportunities for the surface-water to drain into the oil-bearing fissures, especially when the initial pressure of gas and oil has declined. This is the reason why certain large properties at Balakhany-Sabountschy have ceased to be profitable. Where, as in the Caucasus, Roumania, and Texas, the soft sandstones greedily absorb water, the evil grows rapidly. The remedy consists in shutting off the water-bearing strata by means of hermetical casing. The exclusion of water is rendered more difficult in most cases by the dip of the strata, the sandstone rock being, for example, tilted as at C C in the drawing. In this case the water outside the hermetical casing in shaft B will flow under the stopping in shaft A, so that, when the latter is deepened, water is struck, and the quantity increases. O deepening the shaft further, the water will penetrate th fissures in the lower horizon D D, and thus find a way int the well B, free from water. To prevent all this, the wate must be shut off (*e.g.*, in well A after traversing the sandstone C C).—C. S.



Petroleum ; Quality of Austrian Export ——. R. Zaloziecki. Naphta, 1904, **12**, 7—10 and 21—23.

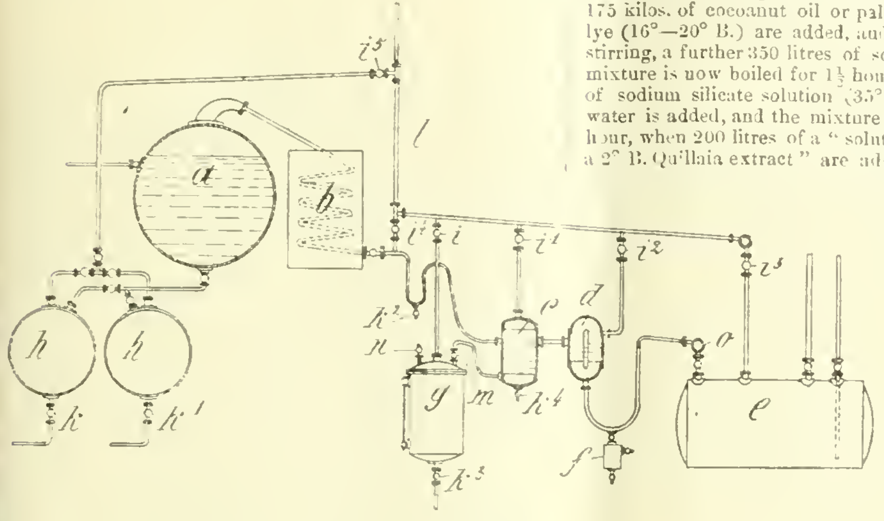
The proposal made to mix light, medium, and heav Galician oils, in order to compete with American oil, impracticable owing to the low capillarity of the heavi fractions. This has been shown by photometric tests w a 10''' Cosmos burner, an American oil, with 30·7 per cen of fractions boiling above 300° C., giving a light of 11 standard candles, whilst a Roumanian oil, with 17·4 p cent. of heavy fractions, gave a light of only 6·76 candl An examination of the fractions of Urycz crude oil sho that, to furnish a mixed oil of sp. gr. 0·800 and flashi point 21° C. (Abel), the yield would have to be reduced about 25 per cent. The essential point for increasing t consumption is the provision of a suitable lamp, the gre success of American oil being attributable to this factor. —C. S

Viscosity of Pitch-like Substances. F. T. Trouton an E. S. Andrews. XXIII., page 680.

English Patents.

Distillation of Fats, Oils, Tars, and the like; Continuous Vacuum ——. G. Bokelberg and J. Sachse, Hanover. Eng. Pat. 7204, March 25, 1904.

The still a is connected with a condenser b, and with a tar or residue outlet tube, which passes to the residue tanks h h; these are connected with a vacuum pump, and are



provided with cocks so that they can be used alternately; the gaseous products coming from the condenser are drawn up the pipe l as produced, and the distillate passes to the receiver c, which is connected with the pump; the temperature and vacuum are so regulated that the distillation products condense without the water. The receiver c is connected on the one hand with a reservoir g, in which any condensed water collects, and on the other hand with a vessel d, which enables a portion of the distillate to be inspected: both these vessels are connected with the vacuum pump. A second reservoir similar to g is provided so that these can be used alternately without stopping the distillation. The vessel d is connected with a cock f, by which a sample of the distillate can be removed as required; the distillate finally passes to the storage tanks e (of which there are two), which are also connected with the pump; the cocks shown at i, i^1, &c., serve to regulate the vacuum in the various parts of the apparatus; drain cocks k, k^1, k^2, &c., are also provided.—T. F. B.

Ammonium Sulphate from Ammonia Gases; Saturator for the Recovery of ——. K. Zimpell. Eng. Pat. 6891, March 22, 1904. VII., page 660.

Lubricating Substances for use in the Manufacture of Bricks, Tiles, Pottery, and the like. W. H. Sandwith and H. T. Rayner. Eng. Pat. 16,125, July 21, 1903. IX., page 662.

United States Patents.

Retort [for Producing Oil from Shale]. S. L. Hague, Salt Lake City. U.S. Pat. 759,988, May 17, 1904.

A horizontal retort is heated at one end by a furnace, with which are connected flues which warm the rest of the retort; it is also furnished with a revolving screw conveyor (which draws the shale from the cooler end towards the hotter end of the retort) and with a steam jet at the hotter end of the retort to drive the oil vapours towards the cooler end, where they are removed.—T. F. B.

Bituminous Pavements; Process of Preparing Compositions for, and of Heating and Laying ——. J. H. Amies, Assignor to Amies Asphalt Co. U.S. Pat. 760,051, May 17, 1904. IX., page 662.

French Patents.

Petroleum and its Homologues; Process for "Saponifying" ——. F. J. Lothammer and C. Trocquenet. Fr. Pat. 338,636, Oct. 19, 1903. Under Internat. Conv., Oct. 16, 1903.

300 litres of petroleum are added gradually to 1 litre of "Quillaia saponaria," 6° B., the mixture being stirred after each addition until it begins to thicken. The mixture is distilled, and the product of the distillation warmed with 175 kilos. of cocoanut oil or palm oil. 350 kilos. of soda lye (16°—20° B.) are added, and then, gradually, and with stirring, a further 350 litres of soda lye (20°—25° B.); the mixture is now boiled for $1\frac{1}{2}$ hours, a solution of 110 kilos. of sodium silicate solution (35° B.) in 25 litres of boiling water is added, and the mixture is again boiled for half an hour, when 200 litres of a "solution of sodium carbonate in a 2° B. Quillaia extract" are added, the boiling being continued until a sample of the product solidifies rapidly on cooling. 12 litres of ammonia solution (65° B.) are then added, and the soap is stirred until the requisite consistency is attained.—T. F. B.

Petroleum and its Homologues; Process for Saponifying ——. F. J. Lothammer and C. Trocquenet. First Addition, dated Oct. 29, 1903, to Fr. Pat. 338,636, Oct. 19, 1903 (see preceding abstract).

The petroleum, solidified as described above, is spread on plates of incombustible, badly-conducting material, provided with perforations or channels, and inclined to the horizontal. The mass is ignited and the oil which separates is collected and treated as described.—T. F. B.

Vaseline Soluble in, or easily Miscible with Water; Process for Making ——. Ges. z. Verwerthung der Boleg'schen Wasserlöslichen Mineralole und Kohlenwasserstoffe G. m. b. H. Fr. Pat. 338,640, Oct. 26, 1903.

Mineral oils soluble in water (*viz.*, crude mineral oils which have been oxidised, in presence of alkali, by means of compressed air or ozone, and subsequently heated under pressure) are added, in the proportion of about 10 or 15 per cent., to vaseline, melted at as low a temperature as possible (40°—50° C.); the mixture is allowed to cool, with continual agitation. In place of the mineral oils, crude rosin oils which have been subjected to a similar treatment may be employed. The resulting greases are easily miscible with water. (Compare Fr. Pat. 332,324 of 1903; this J., 1903, 1289.)—T. F. B.

Hydrocarbons Soluble in Water [Disinfectants, &c.], i.e., capable of Easily Forming Stable Emulsions; Process of Making Derivatives of ——. Ges. z. Verwerthung der Boleg'schen Wasserlöslichen Mineralöle und Kohlenwasserstoffe G. m. b. H. Fr. Pat. 338,738, Oct. 26, 1903.

"Derivatives of hydrocarbons" soluble in water are produced by heating the compound to be rendered soluble (*e.g.*, nitrobenzene, phenols, &c.) with soluble mineral oils (see preceding patent) under pressure, and in presence of alkali. For instance, 20 parts of nitrobenzene are treated with compressed air, at 50° C., in presence of alkali for 15—20 minutes, 70—80 parts of soluble mineral oil or rosin oil are added, and the mixture is heated to about 70° C. These "derivatives" are intended for use in the manufacture of soaps and disinfectants.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

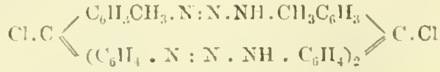
Diazobenzene and Phenol; Limit of Coupling of ——. L. Vignon. Comptes rend., 1904, **138**, 1278—[illegible].

The author obtains p-hydroxyazobenzene in satisfactory yields by the action of diazobenzene chloride on a solution

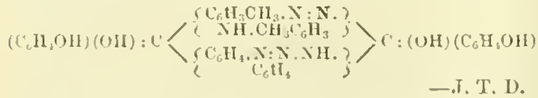
of phenol in excess of caustic alkali. On treating this substance with diazobenzene chloride in alkaline solutions phenolbisdiazobenzene, $C_6H_3(OH)(N:N.C_6H_5)_2[1.2.4]$, is formed. The same substance is more satisfactorily prepared by the action of 2 mols. of diazobenzene chloride on phenol in alkaline solution. It is very soluble in alkaline solutions. It is also formed by the action of diazobenzene chloride on *p*-hydroxybenzoic acid, and is identical with the substance obtained by Griess by acting on diazobenzene chloride with potassium carbonate. The author attempted in vain to prepare phenoltridiazobenzene.
—E. F.

Diazo-amino-fuchsine and Diazo-amino-rosaniline. L. Pelet and W. Redard. Bull. Soc. Chim., 1904, **31**, 644—646.

Graebe and Caro, and later E. and O. Fischer, showed that by the action of nitrous acid on Fuchsine it was converted into Rosolic Acid, and that an unstable chloride of diazofuchsine was formed as an intermediate product. The authors find that by careful addition of a solution of Fuchsine of known strength to an acidified solution of potassium nitrite, there is formed diazo-amino-fuchsine chloride—



The speed of reaction increases with the strength (degree of ionisation) of the acid employed, and for the same acid, with its concentration. Sodium carbonate produces in the solution of diazo-amino-fuchsine a brown flocculent precipitate, unstable, having the composition of di-diazo-amino-rosaniline—

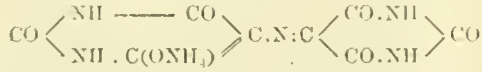


—J. T. D.

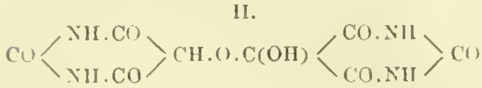
Purpuric Acid and Murexide; Constitution of ——. M. Slimmer and J. Stieglitz. Amer. Chem. J., 1904, **31**, 661—679.

From the results of a study of the derivatives of purpuric acid, the authors conclude that the constitution of murexide (the ammonium salt of purpuric acid) and of alloxantin may be best expressed by the formulæ I. and II. respectively—

I.



II.

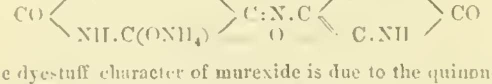


Purpuric acid in the free state probably exists in the pseudo form—

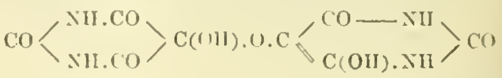
—A. S.

Murexide; Constitution of —— and of some Uric Acid Derivatives related to it. O. Piloty and K. Finckh. Annalen, 1904, **333**, 22—71.

From the results of their investigation, the authors conclude that murexide is the ammonium salt of diureide-oxazone—



The dyestuff character of murexide is due to the quinonoid character of the alloxan nucleus it contains, and its stability to the oxazone ring. No derivatives of murexide substituted at the nitrogen atom connecting the two ureide rings could be obtained, and this fact is in accordance with the formula given. The existence of two isomeric sodium salts of murexide is due to the unsymmetrical structure of the two ureide rings. For alloxantin the most probable formula is—



—A. S.

Indigo Plant; Fermentation of the ——. C. Bergtheil. Chem. Soc. Proc., 1904, **20**, 139.

The fermentation of the indigo plant has been ascribed to a bacterium and also to enzymes, but has hitherto never been satisfactorily investigated. The author shows that, although there are many bacteria capable of producing the fermentation, it is in the main due to a specific enzyme occurring in the plant cells. A very active solution of this enzyme has been obtained, and the course of the fermentation produced by adding this to an extract of the indigo plant made in boiling water, has been studied. It is found that the fermentation proceeds in a similar manner to that observed by Adrian Brown for invertase (Chem. Soc. Trans., 1902, **81**, 373) and by Horace Brown and Glendinning for diastase (Chem. Soc. Trans., 1902, **81**, 388), namely, that equal quantities of substance are transformed in equal intervals of time in the early stages, but not in the later ones. The point at which the course of the change can no longer be represented by a straight line is when 17 to 20 per cent. of the total action has taken place. The curve representing the reaction ceases to be linear at about the same point when the time factor is kept constant, but the quantity of acting enzyme varied. The optimum temperature for the action is almost exactly 50° C., and the temperature at whicht he enzyme is destroyed is 71° C. The rate of action is decreased by the presence of both acids and alkalis. Sodium acetate up to 1 per cent. does not affect the rate of action. Various antiseptics all produced inhibition, formalin to the greatest, and boric acid to the least extent. Emulsin can produce the indigo fermentation, but has a very weak action. It is doubtful whether the indigo enzyme can decompose amygdalin. Myrosin cannot ferment an extract of the indigo plant, and the indigo enzyme cannot ferment sinigrin. No evidence of the existence of an oxydase in the indigo plant was obtained.

Polyhydric Phenols and their Derivatives; Action of Molybdates on —— [Distinguishing between m- and p-Phenylenediamine]. C. Frabot. XXIII., page 685.

"Flocculation" Phenomena [Aniline Dyestuffs, &c.]. M. Neisser and U. Friedemann. XXIV., page 688.

English Patents.

Colouring Matter Lakes [from Azo Dyestuffs]; Manufacture of ——. J. Y. Johnson. From Badische Anilin u. Soda Fabrik. Eng. Pat. 15,193, July 13, 1903. XIII. A., page 670.

Sulphurised Colouring Matters [Sulphide Dyestuffs]; Manufacture of Yellow ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 15,515, July 13, 1903.

See U.S. Pat. 738,027 of 1903; this J., 1903, 1082.—T. F. B.

United States Patents.

Indigo; Chlorinated ——, and Process of Making same. P. E. Oberreit, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on-Rhine. U.S. Pat. 761,007, May 24, 1904.

Cyanmethylanthranilic acid is chlorinated and treated with caustic alkali, chlorinated phenylglycocoll-o-carboxylic acid being formed; this is then treated with acetic anhydride, and the resulting acetylchloro-indoxyl is oxidised by air in alkaline solution to a chlorinated indigo. Tetrachloro-indigo obtained thus from dichloro-indoxyl, is claimed, and also the "indigo colouring matter from acetylated monochlorindoxyl," which dyes cotton blue shades.—T. F. B.

Azo Dyestuff; Red ——. H. Witter, Elberfeld, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 761,123, May 31, 1904.

See Fr. Pat. 337,942 of 1903; this J., 1904, 543.—T. F. B.

French Patents.

Indoxylic Acid and Indoxyl; Production of —— [*Indigo*]. Badische Anilin und Soda Fabrik. Fr. Pat. 338,458, March 26, 1903.

See U.S. Pat. 731,385 of 1903; this J., 1903, 861.—T. F. B.

Monazo Dyestuff Susceptible to Chroming on the Fibre; Production of a ——. Badische Anilin und Soda Fabrik. Fr. Pat. 338,494, March 27, 1903.

See U.S. Pat. 737,445 of 1903; this J., 1903, 1125.—T. F. B.

Anthracene Series; Production of Dyestuffs of the —— [*Anthracene Dyestuffs*]. Badische Anilin und Soda Fabrik. Fr. Pat. 338,529, March 30, 1903.

See Eng. Pat. 7394 of 1903; this J., 1904, 319.—T. F. B.

Indigo; Purification of Synthetic ——. Badische Anilin und Soda Fabrik. Fr. Pat. 338,530, March 30, 1903.

See Eng. Pat. 7395 of 1903; this J., 1904, 249.—T. F. B.

Monazo Dyestuff from o-Amino-p-Sulphobenzoic Acid and Phenylmethylpyrazolone; Process for Making a Yellow ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 338,531, March 30, 1903.

See U.S. Pat. 731,670 of 1903; this J., 1903, 862.—T. F. B.

Anthraquinone Dyestuffs; Process of Making Green ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 338,566, March 31, 1903.

See Eng. Pat. 7353 of 1903; this J., 1904, 319.—T. F. B.

Anthraquinone-α-Sulphonic Acids; Process for Preparing —— [*Anthracene Dyestuffs*]. Soc. Anon. Prod. F. Bayer et Cie. Addition, dated Dec. 11, 1903, to Fr. Pat. 333,144, June 17, 1903.

See Eng. Pat. 13,808 of 1903; this J., 1904, 438.—T. F. B.

Mono-azo Dyestuffs; Process for Making Mordant ——. Act.-Ges. f. Anilinfabr. First Addition, dated Dec. 30, 1903, to Fr. Pat. 331,121, April 11, 1903.

Dyestuffs similar to those described in the principal patent (this J., 1903, 1126) are obtained from 1-hydroxy-2-diazo-4-mono-arylaminobenzene, or its sulphonic or carboxylic acids, or nitro or halogen derivatives. They may be prepared by coupling diazotised *p*-aryl-acetamino-*o*-aminophenol [1-hydroxy-2-diazo-4-arylacetaminobenzene] or its derivatives with an amine, phenol, &c., and subsequently eliminating the acetyl group, or by coupling 1-hydroxy-2-diazo-4-mono- or diarylamino benzene or its derivatives with phenols, &c.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

New Azo Bistre [*from Chrysoïdine*], *produced upon the Fibre; and Discharge for Same.* La. Soc. de la Manuf. E. Zundel. Bull. Soc. Ind. Mulhouse, 1904, **74**, 54.

A bistre, which, it is stated, is very fast and of great brightness of shade, is produced by padding cotton tissues in a solution containing 20 grms. of "Chrysoïdine" per litre, drying, and passing at full width through a bath containing 27 grms. of diazotised paranitraniline per litre. The tissues are afterwards washed, soaped for 10 minutes at a temperature of 50° C., dried, printed with a discharge-mixture containing formaldehyde-hydrosulphite, steamed for 2—4 minutes, soaped for 2 minutes at 50° C., washed, dried, and, finally, cleared with bleaching powder solution.
—E. B.

Hydrosulphites; Application of —— *in Tissue Printing.* J. Frossard, C. Sünder, and G. Thesmar (of La Soc. de la Manuf. E. Zundel). Bull. Soc. Ind. Mulhouse, 1904, **74**, 36—46.

A. Sodium Hydrosulphite in Solution.—The strength of the preparation employed by the authors was such that 8—9 c.c. of it decolorised 20 c.c. of a solution of ammoniacal copper, containing 25 grms. of copper per litre, or 4—4·5 c.c. of it decolorised an amount of indigotin-disulphonic acid corresponding with 0·5 grm. of indigotin.

(*a*) *Slop-padding with "Modern Violet."*—The dyestuff in the form of powder is mixed first with its own weight of the sodium hydrosulphite solution and then with water, acetic acid, glycerin, gum tragacanth paste, and chromium acetate. Other dyestuffs, *e.g.*, "Alizarin Blue," may also be added to the mixture for shading purposes. The tissues, padded with the mixture and dried, are, in the case of dark and medium shades, passed through the Mather-Platt ager, printed with chlorate ferricyanide discharge-mixtures, again passed through the ager to render the shades even), and are then steamed without pressure for an hour, and soaped in an open-soaping range. In the case of pale shades, the tissues are preferably steamed for an hour before, and for a few minutes after, printing the discharges upon them, as the action of the latter can be made much more rapid than is possible with darker shades.

(*b*) *Slop-padding with Indigo.*—The apparatus employed for this purpose consists of a small trough into which an alkaline solution of "Indigo White," prepared by means of sodium hydrosulphite, is continuously fed through a perforated tube fixed near the bottom of the trough. The tissue to be padded passes vertically downwards into the trough between two upright boards, to prevent it from coming into contact with the froth on the surface of the solution, and, on leaving the trough, passes over an expander, between two squeezing rollers and then over a series of rollers to oxidise the reduced indigo. The vat must be maintained at a constant level. The solution employed must not contain more "Indigo White" than corresponds with 10 grms. of indigotin per litre. Sixteen pieces, each 100 metres in length, can be padded per hour with this apparatus. The method is, however, successful only with mercerised tissues. With these, in the medium and pale shades of blue produced, the evenness and regularity of dyeing obtained are excellent and greater than are commonly found in the dyeings done in vats in the ordinary manner, but the fastness to soaping is inferior, as the deposition of dyestuff takes place too superficially.

(*c*) *Slop-padding with Mixtures of Basic Dyestuffs, Tannic Acid, and Sodium Hydrosulphite.*—In presence of acetic acid, the leuco-bases of basic dyestuffs are not precipitated by tannic acid. The padding liquor employed contains besides a basic dyestuff, *e.g.*, Methylene Blue, and sodium hydrosulphite (30 parts of the solution of the strength given above to 1 part of Methylene Blue), acetic acid, water, tannic acid, gum-senegal solution, and zinc acetate. The colour-lakes fixed on cotton tissues by means of such mixtures, are faster to soap and are more evenly distributed than those obtained by padding first with basic dyestuffs and tartar emetic and then, after drying, with tannic acid. They are, however, less fast to light than the latter.

B. Solid Zinc Hydrosulphite.—This was prepared in a crystalline state by acting, at a temperature not exceeding 42° C., with zinc and sulphuric acid, diluted with ice, upon sodium bisulphite diluted with ice. Two hours after the whole of the acid had been added, the crude zinc salt which had separated out, was collected, pressed, well ground, mixed with thick gum-senegal solution and made up to a standard strength. This was called paste A. It was employed for the following purposes:—

(*a*) *Discharging Dyed Silk Tissues.*—A mixture of paste A, sodium carbonate, zinc oxide made into a paste with glycerin, and gum-senegal thickening, was printed, the printed tissue being steamed for 4 minutes, washed, soured, washed, and dried.

(*b*) *Discharging Paranitraniline Red.*—To this end, the paste A was mixed with stannous hydroxide paste, sodium acetate, and common salt. The discharge was produced by steaming for 4½ minutes, souring, washing, drying, and clearing with bleaching powder.

(*c*) *Printing Indigo.*—A mixture is made of paste A, "Indigo pure" ground with glycerin, sodium carbonate, and gum-senegal solution. The tissues printed with this are steamed, and are then passed through a 5 per cent. solution of sodium carbonate. They are then squeezed and left piled up and exposed to the air for about an hour, to oxidise the Indigo White, afterwards being soured, washed, soaped, washed, and dried. This process is highly successful. Shades of any intensity can be produced with regularity and certainty. They are very smooth, full, and even, and the colours are rather faster to soaping than those produced on the fibre from Kalle's "Indigo salt." Moreover, the process is economical, and has the advantage of allowing colours which require for their development or fixation a steaming of short duration, *e.g.*, "Aniline Black," to be printed along with the "Indigo" colour mixtures.—E. B.

Hydrosulphurous Acid Derivatives [*Formaldehyde-Hydrosulphite Compounds*] *and their Application in Tissue Printing.* La Soc. de la Manuf. E. Zundel. Bull. Soc. Ind. Mulhouse, 1904, **74**, 48—53.

The grinding operation necessary to reduce zinc hydrosulphite to a sufficiently fine state to be suitable for use in tissue printing is a serious drawback to the use of this salt. No such objection attends the use of the double compounds of hydrosulphites and formaldehyde. Sodium hydrosulphite-formaldehyde is readily prepared by adding formaldehyde (40 per cent.) to solid sodium hydrosulphite. Solution takes place very rapidly and much heat is evolved. On fractionally crystallising, the compound is obtained, separating out last, in the form of small, colourless needles very soluble in water. The zinc compound may be similarly prepared. It is less soluble than the sodium compound. For the preparation of zinc hydrosulphite in quantity the following method was adopted:—Zinc powder, dilute sulphuric acid, and ice are added simultaneously to a well-stirred mixture of sodium bisulphite and ice, enough of the last-named being used to keep the temperature below 10° C. The stirring is continued for 10 minutes. Then the mixture is allowed to rest for 10 minutes, and the clear solution is withdrawn from the greyish black sediment of zinc, lead, metallic sulphides, sulphites, &c. After standing for about an hour, the zinc hydrosulphite begins to crystallise out. Its separation may be assisted by heating to 30°—40° C., or, better, by adding common salt. The product thus obtained is quite colourless. On admixture with formaldehyde and a little acid it dissolves with evolution of heat, and, on cooling, the formaldehyde compound partly separates out in small, colourless plates. The latter compound may also be prepared by boiling together for a few minutes a mixture of formaldehyde, sodium bisulphite, acetic acid, water, and zinc powder. This method, judging from the reducing power of the solution obtained, would appear to give a good yield, but it has the disadvantage of requiring the evaporation of a relatively large quantity of water in order to obtain the compound in a sufficiently concentrated state for use in tissue printing. This is the case also with the solution obtained by adding formaldehyde to the product of the reaction of zinc powder on sodium bisulphite solution. On adding sodium carbonate to an aqueous solution of the zinc compound, the sodium compound is formed with precipitation of zinc carbonate. The formaldehyde hydrosulphite compounds possess the remarkable property of not exhibiting their reducing action and of behaving as indifferent substances under ordinary conditions; thus, they do not reduce "Indigo Carmine" or ammoniacal copper solution. They are perfectly stable in the cold, and may be boiled in the presence of a small quantity of acid, with little decomposition. Under reduced pressure, their solutions may be concentrated without loss. The concentrated solutions, when thickened and printed, &c., discharge "Paranitraniline Red" exceedingly well. Hence it would seem that scission of the compounds into their components occurs during the operation of steaming, and that the hydrosulphite then liberated, exerts to the full its reducing power. The two, *i.e.*, the zinc and the sodium, compounds are not equally decomposable by steam, for, while the sodium compound completely discharges Paranitraniline Red after four minutes, 15 minutes' steaming is required with the zinc compound. The time may be shortened by adding to the printing mixture a sodium salt, *e.g.*, sodium chloride, which is capable of converting the zinc compound into the more easily decomposable sodium compound. The hydrosulphite-formaldehyde compounds can replace with advantage almost all the reducing-agent reserves and discharges employed in tissue printing. They give, for example, with suitable additions, an excellent white reserve under "Aniline Black" on silk. They resist "Nitroso Blue," and discharge most of the direct azo dyestuffs, even in very dark shades, both on silk and on cotton. The white produced upon tissues dyed with "Paranitraniline Red" is perfect and unalterable; and does not suffer when the red ground is converted into a brown by treatment with a copper salt. This "Paranitraniline Brown" may be first produced on the tissue, it may then be discharged in the same way as the "Red." "Naphthylamine Bordeaux" may also be discharged. Mixed with sodium acetate, the hydrosulphite-formaldehyde compounds furnish excellent discharge-reserves for tissues dyed "Paranitraniline Red" and overprinted with "Aniline or Diphenyl Black." Similarly, when printed upon tissues dyed "Paranitraniline Red" and padded with "Aniline Black," the mixture gives excellent whites upon a bronze ground. Moreover, coloured discharges may readily be produced with the aid of the new compounds; thus, for example, a "Prussian Blue" discharge of great brilliancy, may be obtained upon tissues dyed "Paranitraniline Red" by means of a mixture containing, besides one of the hydrosulphite-formaldehyde compounds, ferrous ferrocyanide and albumin.—E. B.

Hydrosulphite-Formaldehyde Compounds; Application of —— in Tissue Printing. Reports upon the preceding communications from La Soc. de la Manuf. E. Zundel and C. Kurz. H. Schmid. Bull. Soc. Ind. Mulhouse, 1904, **74**, 55—66.

Frossard (see abstract above) has observed that sodium hydrosulphite may be employed with advantage in effecting and maintaining the reduction of certain dyestuffs of the "Gallocyanine" group, such as "Modern Violet." The latter dyestuff comes into commerce in the form of a leuco-compound which has the property of readily becoming oxidised and, in consequence, insoluble. By the addition of hydrosulphite to it this action is prevented, and perfectly even and regular dyeings are obtained in slop-padding with it. A second application consists in reducing basic dyestuffs. The leuco compounds of these are not precipitated by tannic acid, the slop-padding bath containing them remaining clear even in the presence of a precipitant of tannic acid, such as zinc acetate, provided that sufficient acetic acid is added to keep the zinc tannate in solution. The method devised in the year 1902 (see above abstract) has since been modified. The padding bath, free from zinc salt, is now applied to oil-prepared tissues, which are steamed and then passed through a tartar emetic fixing bath. The application of zinc hydrosulphite and of sodium hydrosulphite-formaldehyde in effecting the fixing of "Indigo" in calico printing is of the highest technical importance. This method is likely to supersede all other methods of printing with "Indigo." As a discharging agent for "Naphthylamine Bordeaux" zinc hydrosulphite is superior to sodium hydrosulphite-formaldehyde. Unfortunately the printing mixtures containing zinc hydrosulphite suffer from the drawbacks attending the use in printing of insoluble matters of high density. They are unsuitable for printing mercerised and "raised" (flannelette, etc.) tissues. For these it is preferable to employ sodium hydrosulphite-formaldehyde. C. Kurz deposited (Dec. 1, 1902) a sealed note (this J., 1904, 58) concerning the preparation of a discharge-mixture, containing sodium hydrosulphite and formaldehyde, for "Paranitraniline Red" and "Diamine," &c., dyestuffs. The principle of the reaction had been previously indicated by Pellizza and Zuber (this J., 1900, 438). Kurz's mixture gives satisfactory results shortly after it has been made, but, as it contains too little formaldehyde, it soon decomposes and becomes unfit for printing.

The hydrosulphite-formaldehyde compounds described in the note deposited by La Soc. de la Manuf. E. Zundel are well defined, highly stable, crystallisable compounds in which the reducing power of the hydrosulphites is latent. They are more stable than the difficultly soluble zinc hydrosulphite and have the advantage of being soluble and therefore applicable to all kinds of tissues. The most important of them is sodium hydrosulphite-formaldehyde, $Na_2S_2O_4 + 2CH_2O$, which is manufactured under the name of "Hydrosulphite N F" (this J., 1904, 369). This compound discharges "Paranitraniline Red" perfectly, without the least injury to the fibre. A good white is also obtained with this compound upon the author's (H. Schmid's) puce, which is produced by padding tissues dyed "Paranitraniline Red" with "Aniline Black" and developing the "Black." The compound is printed before the "Black" is developed, and thus acts as a discharge-reserve. By printing along with it an ordinary white reserve for "Aniline Black," two-colour, red-and-white, effects are obtained on the puce ground. The puce from "Chrysoidine" and diazotised *p*-nitraniline (see abstract above) was discovered by Binder and Vernier in 1899. The impossibility of reserving it and, prior to the discovery of the hydrosulphite-formaldehyde discharge, of discharging it, has prevented it from hitherto coming into use.—E. B.

English Patents.

Wool; Apparatus for Treating [Degreasing] ——. N. Rousselle, Verviers. Eng. Pat. 10,234, May 5, 1903.

See addition of Dec. 2, 1902, to Fr. Pat. 300,492 of 1900; this J., 1903, 905.—T. F. B.

Mercerising, Scouring, Bleaching, Dyeing, &c. of Yarn in Hank form; Machine for ——. W. H. Crompton and W. Horrocks, Radcliffe, Lancaster. Eng. Pat. 10,255, May 6, 1903.

The yarn is hung on pairs of reels, one above the other, the lower of which revolves in a trough. The dye-liquor or mercerising solution to be applied is sprayed over the hanks from perforated pipes and caught in the lower trough, from which it is raised by suitable means so as to cause a continuous circulation of the liquid. The reels are easily removable for filling, &c.—A. B. S.

Drying, Bleaching, or other purposes; Apparatus for Treating Materials with Air or other Gases or Vapours for ——. H. Haas, Manchester. Eng. Pat. July 8, 1903.

The apparatus consists of chambers for holding the material to be treated and heating compartments containing steam coils or similar arrangements for heating the air. These chambers are arranged alternately, and the hot air from one heating chamber passes over the material to be dried, and then into another heating chamber, and so on. By a suitable arrangement of valves and pipes, the compartments can be heated in any order or only a part of them used.—A. B. S.

Dyeing of Cotton Cloth. W. Grime, Manchester. Eng. Pat. 15,358, July 11, 1903.

The warp or weft of a cotton material is mordanted with tannin before weaving; the tannin is fixed with antimony before or after weaving. The piece is then first dyed with basic dyestuffs, and finally, the unmordanted cotton in it is dyed with direct cotton dyestuffs.—A. B. S.

Waterproofing of Materials, such as Tissues, Fabrics, Paper, Leather, and Cords. S. Serkowski, Lodz, Poland. Eng. Pat. 8433, April 12, 1904.

The material is soaked in a solution of lanoline in benzene or other suitable solvent, and the solvent removed by drying.—A. B. S.

United States Patents.

Treating [Bleaching] Fabrics; Apparatus for ——. M. Muntadas y Rovira, Barcelona. U.S. Pat. 761,107, May 31, 1904.

See Fr. Pat. 327,931 of 1902, and addition thereto; this J., 1903, 948, and 1904, 251.—T. F. B.

Discharging Halogen Indigos; Process of ——. A. J. Stiegelmann and K. Reinking, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. U.S. Pat. 760,817, May 24, 1904.

Halogenated indigo dyestuffs are discharged by printing on the dyed material a mixture of an oxidising agent (*e.g.*, an alkali bichromate), a substance which acts as an oxygen carrier (*e.g.*, the double salt of antimony sulphate and fluoride), and a thickening agent, then drying, and treating the material with dilute acid.—T. F. B.

Oiling and Finishing Textile Materials; Process of ——. R. S., J., and F. R. Carmichael, Paris. U.S. Pat. 761,203, May 31, 1904.

See Eng. Pat. 5998 of 1902; this J., 1903, 211.—T. F. B.

French Patents.

Skins and other Materials; Degreasing of —— by Carbon Tetrachloride or other Volatile Solvent. C. Liliemaud. Fr. Pat. 338,495, March 28, 1903. XIV., page 671.

New Tissue; Manufacture of a ——. J. Clémencin. Fr. Pat. 338,731, April 14, 1903.

A material such as muslin is passed through a gum solution and hair or other animal or vegetable fibre shaken over it, through a sieve, whilst it is drying. The resulting material can be made to resemble plush or fur.—A. B. S.

Dyeing Machine. T. Robatel, J. Buffaud and Co. First addition, of Nov. 17, 1903, to Fr. Pat. 326,597 of Nov. 22, 1902. (See this J., 1903, 794.)

The lower roller for the yarn is fixed to a lever and the yarn is kept stretched by means of a counterpoise attached to the other end of the lever. The up and down movement of the whole frame supporting the yarn reels is also assisted by counterpoise weights.—A. B. S.

VII.—ACIDS, ALKALIS, AND SALTS.

Iodates; Formation of —— in Alkaline Solutions of Iodine. E. L. C. Foster. J. of Phys. Chem., **7**, 640—651. Chem. Centr., 1904, **1**, 1392.

The influence of the concentration of potassium hydroxide, iodine, and potassium iodide on the rate of formation of potassium iodate was investigated. With a large excess of alkali (colourless solutions) the velocity is approximately proportional to the concentration of hypoiodous and iodine ions and of iodic acid. With excess of iodide the relations are complicated; the velocity increases with the concentration of potassium hydroxide and iodine, but decreases on addition of potassium iodide. If potassium hydroxide be added continuously to the solution, so that the latter changes from brown to colourless, the rate of formation of iodate rises to a maximum and then again decreases.—A. S.

Sodium Picrate; Action of —— on Sodium Carbonate Solutions [Detection of Sodium Carbonate]. C. Reichard. XXIII., page 682.

Sodium Nitrite; Analysis of ——. G. Lunge. XXIII., page 683.

Nickel Salts; Action of Alkali Nitrites on ——. C. Reichard. XXIII., page 683.

English Patents.

Gases; Purification of [for Manufacture of Sulphuric Acid] ——. J. Y. Johnson, London. From Bad. Anilin und Soda Fab., of Ludwigshafen-on-Rhine. Eng. Pat. 11,549, May 20, 1903.

Sulphurous or other gases containing arsenic are passed at an elevated temperature, but below a red heat, into contact with granular or porous material, such as that described in Eng. Pat. 6,828 of 1901 (this J., 1902, 344); or with lumps of iron oxide, copper oxide, or chromic oxide or the like, separately, or mingled with porous material. Sulphurous gases, for use in the manufacture of sulphuric acid by the contact process, may, it is stated, be thus purified without formation of an appreciable quantity of sulphuric anhydride. But the process is claimed for the purification as well of burner and other gases generally.—E.S.

Potassium Chromate; Treatment of Chrome Iron Stone for the Production of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim - Elektron, Frankfurt-a-Main. Eng. Pat. 17,589, Aug. 13, 1903.

See Fr. Pat. 334,712 of 1903; this J., 1904, 116.—T. F. B.

Sulphate of Ammonia from Ammonia Gases; Saturator for the Recovery of ——. K. Zimpell, Stettin. Eng. Pat. 6891, March 22, 1904.

The apparatus comprises a large closed saturator, in an opening in the top of which is fixed a bottomless cylindrical vessel, whose lower rim reaches to just above the level of the acid in the first saturator. In this cylindrical vessel is placed the second saturator, which is of somewhat smaller diameter than the cylindrical vessel, and which is closed by a lid provided with a funnel for introducing acid and an outlet pipe for the waste gases. This second saturator is also provided with an acid-overflow, to keep the acid at a constant level, and also with a curved gas-inlet pipe, the bottom of which reaches below the acid level. The ammonia gases are introduced into the acid in the first saturator through a tube which passes through the second saturator; the gases pass thence up the cylindrical vessel, and into the second saturator; the object of this arrangement is to prevent the condensation of the steam in the second saturator.—T. F. B.

Iron Pyrites; Process of Preparing ——, *for Desulphurisation.* U. Wedge, Montgomery. Eng. Pat. 8994, April, 19, 1904.

See U.S. Pat. 757,531 of 1904; this J., 1904, 545.—T. F. B.

United States Patents.

Nickel Carbonyl; Manufacture of ——. J. Dewar, Cambridge. U.S. Pat. 760,852, May 24, 1904.

See Eng. Pat. 9300 of 1902; this J., 1903, 700.—T. F. B.

Cyanides: Apparatus for Manufacturing ——. J. A. Kendall, Streatham, Assignor to J. W. Swan, London. U S. Pat. 760,997, May 24, 1904.

See Eng. Pat. 8478 of 1903; this J., 1901, 370.—T. F. B.

French Patents.

Acidimeter; Universal ——. Soc. L. Legrand et Lafaverge. Fr. Pat. 338,634, Dec. 5, 1903. XXIII., page 682.

Nitrogen Compounds [*Cyanides*]: *Process for Making* ——. H. Mehner. Fr. Pat. 338,510, Dec. 30, 1903.

See U S. Pat. 754,474 of 1904; this J., 1904, 370.—T. F. B.

Cyanides; Process and Apparatus for Making ——. J. W. Swan and J. A. Kendall. Fr. Pat. 339,435, Jan. 8, 1904.

See Eng. Pat. 8478 of 1903; this J., 1904, 370.—T. F. B.

VIII.—GLASS, POTTERY, ENAMELS.

Porcelain; Molybdenum Yellow for ——. T. Hertwig. Sprechsaal, 1904, **37**, 791—792.

"Molybdenum and Tungsten Yellows" can be produced in a reducing fire on porcelain, provided certain bodies and glazes are used, together with metallic compounds that will cede oxygen to the pigmentary substances. Up to the present the only materials found suitable for this purpose are a felspar and quartz of the following composition:—felspar: silica, 72·98 per cent.; alumina, 15·32; ferric oxide, 0·52; lime, 0·28; potash, 6·85; soda, 3·59; loss on calcination, 0·43 per cent. Quartz: silica, 97·52 per cent; alumina, 1·40; ferric oxide, 0·36; lime, 0·12; magnesia, trace; alkalis, 0·68 per cent. The body from these ingredients had the composition: K_2O, 4·332 Al_2O_3, 20·906 SiO_2, with 0·08 per cent. of calcined sodium carbonate for casting. A moderate degree of fineness was found essential to prevent the glaze (fired at No. 12 Seger cone) from crazing. The glaze, 0·22, K_2O; 0·78, CaO; 0·70, Al_2O_3; 6·35, SiO_2; was compounded of: the above felspar, 290 parts, Wunsiedel calcspar 150, Zettlitz kaolin 220, and the above quartz, 140 parts. The pigment consisted of 10 grms. of crystallised ammonium molybdate and 100 c.c. of boiling water, the cooled solution being treated with 12 grms. of hydrochloric acid (15·5° B.), to dissolve the precipitate first formed. By the gradual addition of 1 grm. of granulated zinc, a deep indigo colour was obtained, the solution being immediately filtered, and the residue dissolved without washing. After firing the applied colour at 500° C., it was coated over with manganese nitrate (66·6 parts per 100 of water), dried and re-fired, then glazed and fired at No. 12 Seger cone. The yellow does not appear suitable for covering large surfaces. The omission of the manganese coating furnishes a delicate pale yellowish-green, while the manganese alone gives an ivory yellow. Reversing the order of applying the pigments also gives a yellow, but not so bright and sulphur-like. From the behaviour of the ware in the kiln it would seem as though the presence of air contributes to the development of the colour; but even if the action of manganese depends less on its oxidising properties than on pigmentary power, the use of molybdenum determines the production of the sulphur tint.—C. S.

English Patents.

Sheet Glass; Apparatus for the Manufacture of ——. E. Rowart, Anvelais, and L. Francq, Obourg. Eng. Pat. 9033, April 19, 1904. Under Internat. Conv., April 23, 1903.

Melted glass is poured into a hopper and is then caused by atmospheric pressure to pass through a narrow space formed between two rollers into a chamber exhausted of air and cooled by a refrigerating liquid circulating through compartments at the sides of the chamber, so that the glass in passing down between the rollers becomes solidified in the form of a thin sheet. The descent of the sheet of glass into the cooling chamber is controlled by means of a supporting bar carried by vertical rods supported by plungers, which work in hydraulic cylinders, by the discharge of water from which the plungers and consequently the supporting bar are allowed to descend at a regulated speed. Gripping tongs, supported by the hydraulic plungers, are also provided; these tongs descend into the hopper as the sheet is formed, seize the glass in the hopper to which the sheet is connected, and in rising again, lift the sheet out of the chamber, after which it is removed from the tongs and conveyed to the annealing chamber.—A. G. L.

Ceramic Articles; Manufacture of ——. J. Dausette, Paris. Eng. Pat. 13,046, June 10, 1903.

A piece of wire gauze cut to the size of the article to be manufactured is placed in a fusible paste consisting of kaolin, silica, boric acid, and alkali salts, ground so as to pass through a sieve having 3,600 meshes per sq. in. The plates or slabs obtained are allowed to dry at 40° C. in a vertical position, and are then heated for 4 or 5 minutes to about 900 C. in an enamelling furnace. A slightly less fusible paste ground so as to pass through a sieve having 14,400 meshes per sq. in., is then applied to one or both surfaces of the plate, which is then dried at 40 C. and heated for 5 minutes to 1,000° C. The surfaces are then coated with enamels consisting of various silicates with fusing points below 1,000° C. and possessing the same coefficient of expansion as the original paste, after which the plates are baked in the enamelling furnace for about 5 minutes and allowed to cool. Should any flaws appear, they are remedied by applying more enamel and repeating the operation. Suitable compositions are:—For the paste, kaolin, 120 parts; silica, 750; flint glass, 500; potassium nitrate, 75; soda glass, 300; boric acid, 600; and for the enamel, silica, 60 parts; minium, 80; boric acid, 15; potassium nitrate, 10.—A. G. L.

[*Pottery*] *Gas Kilns.* C. Celulla, Liberty City. Eng. Pat. 15,148, July 8, 1903.

Pottery kilns of the "Escherich" type are arranged so that the combustible gas can enter the kiln chamber

through apertures in the floor, through vertical pipes rising from the gas passage beneath the floor and having lateral perforations for distributing the gas, and through apertures provided over the whole area of the walls and leading from passages therein. By means of suitable valves the flow of gas to the various flues and outlets can be regulated.
—H. B.

Soda Glass and Pitch-like Substances; Viscosity of ——. F. T. Trouton and E. S. Andrews. XXIII., page 680.

FRENCH PATENT.

Glass; Method and Apparatus for Drawing ——. Window Glass Machine Co. Fr. Pat. 339,356, Jan. 5, 1904.

SEE Eng. Pat. 297 of 1904; this J., 1904, 371.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Normal [Standard] Lime. H. Seger and E. Cramer. Thonind.-Zeit., 1904, **28**, 587.

THE trials made on various kinds of limestone at the testing station Gross-Lichterfeld, in order to discover a normal lime suitable for testing the purity of trass, other puzzolane materials, cement-mortars, &c., have resulted in the selection of lime from the Christinenklippe (Harz) limestone quarries. The stone loses 43·89 per cent. on calcination, and furnishes a lime containing 97·79 per cent. of calcium oxide, 0·71 per cent. of silica and insoluble matter, 0·43 per cent. of ferric oxide, alumina, &c., 0.32 per cent. of magnesia, 0·12 per cent. of sulphur trioxide and 0·62 per cent. of alkalis and other residual substances. The lime is burned in ring kilns, and is carefully hand-picked before slaking. In this latter operation, the water is left to stand over the lime for some time, and only the upper three-fourths of the milk of lime is run off for settling in another tank. After storage for some months in a closed tank, the lime is packed in airtight tins, each of which bears an official leaden seal.—C. S.

Clay; Artificially Increasing the Cohesive Power of ——. H. Seger and E. Cramer. Thonind.-Zeit., 1904, **28**, 641—642.

SAMPLES of clay were stored for six months, in admixture with water either alone or in conjunction with 2 per cent. of starch, dextrin or tannic acid, the tensile strength and shrinkage being determined after three weeks and at the end of the experiment. Taking the tensile strength of fresh clay as unity, that of the stored wet clay at the end of three weeks was found to be 1·35 (kilos. per sq. cm.), and 1·39 after six months. No appreciable increase was found in the case of starch; and though dextrin gave an increase to 3·0 in three weeks, a decline to 2·63 was obtained in the final test, probably due to the putrefactive decomposition of the reagent. On the other hand, tannic acid gave higher results, the tensile strength being raised to 1·75 in three weeks and to 3·22 at the end of the experiment, thus confirming Acheson's results, though after a longer storage than he employed. The shrinkage was greater in all the treated samples than in the case of the stored wet clay (5·12 per cent. in six months), the figure for the one treated with tannic acid being 7·18 and rather less in the case of starch and dextrin. In this connection it is pointed out that Bischof in 1880 found the shrinkage of Westerwald clay was diminished from 10·2 per cent. to 6·9 per cent. by an admixture of 4 per cent. of gum arabic.
—C. S.

Clays; Relation between the Fusibility and Chemical Composition of ——. Ludwig. Thonind.-Zeit. 1904, **28**, 773—783.

THE law enunciated by Richter, on the action of various fluxes is now found to constitute a special application of a general natural law governing all dilute solutions. It must, however, be restricted to very dilute solutions, or mixtures containing relatively small quantities of flux, and does not apply when the flux attains considerable proportions as in the case of brick-earth and glazes. Unless the components are intimately mixed, the influence of the flux is not fully manifested, in laboratory tests, but will become more apparent under the prolonged heating usual in practice. The action of iron differs according to its condition of oxidation, one molecule of ferric oxide corresponding to two of ferrous oxide, and since the tendency is for the latter to form in the fusing process, the protoxide should be taken as the basis of calculation. The author rejects the assumption that double silicates are formed in the process of fusion, there being no endothermic silicates known, and the fusion products having a lower fusing point than the original constituents.—C. S.

Lime-Sand Brick and Ordinary Brick; Relative Drying Properties of ——. H. Seger and E. Cramer. Thonind.-Zeit. 1904, **28**, 788—789.

OBJECTIONS having been urged that lime-sand bricks take longer to become dry than ordinary bricks, the authors made comparative tests with the two kinds, by saturating a certain number of each with water, and taking the weights at intervals until constant. Curves plotted from the results show that the amount of water retained by the lime-sand bricks is considerably the smaller of the two during the early stage of drying. at the end of 30 days the amounts are equal in the lime-sand and ordinary brick, whilst towards the last the ordinary brick is slightly the better. Since the total amount of water absorbed by lime-sand brick is considerably smaller than that taken up by ordinary brick, it was considered advisable to make a second calculation, based on the percentage of water absorbed. In this case the original figures were 8·94 per cent. for lime-sand brick, and 13·07 per cent. for ordinary brick, and both parted with 5·3 per cent. in 15 days, the curves then running almost parallel until the percentage had fallen to from 3 to 4 per cent., and then drawing together until they coincided at the 75th day. The differences were attributed to the circumstance that the lime-brick examined was relatively close-grained, while the ordinary bricks were more porous.
—C. S.

(Portland Cement) Drying Chambers; Light Dust in ——. H. Seger and E. Cramer. Thonind.-Zeit., 1904, **28**, 531.

CLOUDS of fine dust deposited in the drying chamber of a Portland cement works where the waste furnace gases were utilised for drying, were found to consist of 43·65 per cent. of insoluble and 56·35 per cent. of soluble matters. The insoluble portion gave: loss on calcination, 10·9 per cent.: silica, 31·4; alumina, 14·7; ferric oxide, 4·9; lime, 36·8; and magnesia, 1·3 per cent. The proportion of silica is too high for the dust to have been formed from the cement. The soluble portion consisted of potassium sulphate, 61·1 per cent. and potassium carbonate, 38·9 per cent.—C. S.

Portland Cement and Blast-Furnace Slag. H. Passow. Thonind.-Zeit. 1904, **28**, 586—587.

FOR the production of "iron" Portland cement it is necessary to use vitreous slag, obtained by granulation: subsequent heating causes crystallisation. Mixed with cold water, these vitreous slags harden very slowly, but more quickly with hot water, and still more so with alkaline solutions. The useful proportion of the latter increases with the vitreous character of the slag, since the devitrified portions have an alkaline reaction. Microscopic examination shows that devitrification is accompanied by the separation of lime compounds. When ground vitreous slag is made up into tubular blocks and exposed in a current of carbon dioxide, no increase of temperature is recorded by an inserted thermometer, whereas in the case of calcined devitrified slag the temperature rises considerably. This behaviour shows that the latter slag contains active lime compounds, which form, with water, an alkaline solution capable of reacting on vitreous slag: a circumstance explaining the great hydraulic value of mixtures of two substances individually weak in this respect. The author ascribes greater influence to the preparation of the slag than to its composition, which may vary within considerable limits. By granulation in air, blast-furnace slag can be made to acquire hardening properties rendering it inde pendent of admixture with Portland cement. The product is termed by the author "Hansa" Portland cement, and can be modified by controlling the action of the air, a purely vitreous slag being obtained by energetic atmospheric action, whilst more gradual cooling results in crystallisation, which, however, does not extend to physical disintegration. If this latter product be ground to powder it will furnish cement said to exhibit the properties of good Portland. Since the vitreous portion of the slag reacts more slowly than the rest, it requires to be ground very fine. The addition of Portland cement to the mass is solely for the production of certain special effects, and plays a part analogous to that of gypsum in ordinary Portland cement making.—C. S.

Portland Cement; Washed ——. H. Seger and E. Cramer. Thonind.-Zeit., 1904, **28**, 625.

To ascertain the efficacy of washing the ground cement as a means of eliminating the soluble salts and free caustic lime, which produce efflorescence on cement tiles, 500 grms. of slow-setting Portland cement were mixed with 1,500 grms. of normal sand and stirred in 10 litres of water. The operation was twice repeated, the cement and sand settling down sufficiently in 10 minutes to enable the water to be poured off. The pasty residue was spread out on gypsum plates and dried with filter paper until it would ball in the hand without sticking. In the Böhme hammering tester the blocks withstood 110 blows. Other blocks, with 8·8 per cent. of moisture gave the following average results:—After seven days' hardening the tensile strength of those from unwashed cement was 16·04 kilos. per sq. cm. and the crushing strength 143·4 kilos., the corresponding figures for the washed cement being 8·95 and 78·0. After hardening for 90 days the results were (in the same order) 28·41 kilos., 234·7 kilos., 17·99 kilos., and 191·2 kilos. respectively, so that the method does not seem to afford any advantage.—C. S.

Concrete; Influence of Clay on the Tensile Strength of ——. H. Seger and E. Cramer. Thonind.-Zeit., 1904, **28**, 726—727.

The authors having found that no improvement is effected in sand by washing, made a series of tests in which pure sand was intentionally mixed with brick clay or kaolin. The bulk of the sand consisted of granules from 0·2 to 0·4 mm. in diameter. The tests were made with blocks, prepared in the Böhme apparatus and composed of 3 parts of sand to 1 of Portland cement (with $10\frac{1}{2}$ per cent. of water), 0·3 part of the sand being replaced by brick earth or kaolin in a certain number of the samples. In these latter cases, the clay was first stirred up with 11·4—11·5 per cent. of water, then mixed with the sand, and the whole incorporated with the cement, so as to produce the most unfavourable conditions. The blocks were stored for a month, part of them in the air, the rest under water. The tests gave the following results:—

——	Storage	
	In Air.	In Water.
	Kilos. per sq. cm.	Kilos. per sq. cm.
Cement-sand:—		
Tensile strength	20·91	17·85
Crushing „	175·3	142·9
Cement-sand-kaolin:—		
Tensile strength	27·84	21·12
Crushing „	163·4	140·5
Cement-sand-clay:—		
Tensile strength	26·21	16·43
Crushing „	157·8	125·4

Both clay and kaolin considerably increase the tensile strength, while the loss of crushing strength is small, especially in the case of the kaolin mixture when stored under water. The results are regarded as confirming those of Sherman (Engineering News, 1903, [21]).—C. S.

Portland Cement and Blast-Furnace Slag; Action of Acetic Acid on ——. F. Hart. XXIII., page 683.

English Patents.

Lubricating Substances for Use in the Manufacture of Bricks, Tiles, Pottery, and the like. W. H. Sandwith, Bracknell, and H. T. Rayner, Rettendon. Eng. Pat. 16,125. July 21, 1903.

Sodium stearate, oleate, or palmitate, and potassium oleate or stearate, are dissolved in water or other suitable menstruum, with or without the addition of suitable colouring matters. Petroleum, shale oil, or creosote oil is then added, and the whole mixed to form an emulsion. Suitable proportions of the ingredients are:—(1) 20 lb. of potassium oleate, 30 galls. of water, 10 to 20 galls. of shale or other oil; (2) 15 lb. of potassium oleate, 5 lb. of sodium oleate and stearate, 30 galls. of water, 10 to 20 galls. of shale or other oil. These mixtures should be diluted with two or three times their volume of water before use.—A. G. L.

Bricks; Coating ——, *and Apparatus therefor.* M. Perkiewicz, Ludwigsberg, Germany. Eng. Pat. 3760, Feb. 15, 1904.

To a liquid coating material composed of a mixture of gelatin and flour (see Eng. Pat. 12,095, this J., 1903, 1088), substances which prevent putrefaction are added, *e.g.*, carbolic acid (phenol), lysol (obtained by dissolving tar cresols in neutral soaps), sublimate (mercuric chloride), nitric acid, aluminium sulphate, tannic acid, or salts of chromium. To apply the coating, the bricks are laid upon an inclined conveyor and passed under a distributing box, from which the liquid drops on to the upper surfaces of the bricks through fine perforations or slits. The superfluous material runs along a trough into a well, from which it is pumped back to the distributing box, after passing through a sieve, if necessary.—A. G. L.

Portland Cement; Manufacture of ——. F. C. W. Timm, Hamburg. Eng. Pat. 11,324, May 18, 1903.

See Fr. Pat. 332,243 of 1903; this J., 1903, 1196.—T. F. B.

Portland Cement; Manufacture of ——. C. Hocke, Hamburg. Eng. Pat. 21,947, Oct. 12, 1903.

Low-grade fuel is utilised by mixing slack or powdered coal with the raw cement materials, pressing the mixture into bricks, and then burning it. The cement clinker produced is very porous, owing to the distillation of the fuel. —A. G. L.

White Cement; Manufacture of ——. H. Earle, Hull. Eng. Pat. 24,911, Nov. 16, 1903.

White chalk, kaolin, and felspar are mixed, either dry or wet, and burnt as a Portland cement; the resulting cement should contain 28 to 30 per cent. of silica, 61 to 63 of lime, 4 to 6 of alumina, and 2 to 3 of alkalis. Sodium or potassium carbonate may be used instead of felspar. Granite or gneiss may also be employed. All the materials used should be free from iron.—A. G. L.

United States Patents.

Bituminous Pavements; Process of Preparing Compositions for and of Heating and Laying ——. J. H. Amies, Germantown, Assignor to Amies Asphalt Co., Philadelphia. U.S. Pat. 760,051, May 17, 1904.

Granulated or powdered asphalt is mixed with cold, sharp, fine sand, which has been previously wetted with crude petroleum oil, and the composition is subjected to a suitable degree of heat to secure cementation and hardening. The heating may be effected by adding naphtha or gasolene to the petroleum oil, and afterwards sprinkling the composition with gasolene, the vapours given off being then ignited and the mass agitated in the flame, after which it is rolled with hot rollers.—A. G. L.

Sandstones [Artificial]; [Electrical] Process of Producing Refractory Calcareous ——. W. Schwarz, Zurich, Assignor to Schwarz System Brick Co., New York. U.S. Pat. 760,571, May 24, 1904.

Granulated quartz is heated nearly to its fusing point by means of a current of electricity. Lime is then added, and the plastic mass obtained moulded under pressure to the desired shape.—A. G. L.

Stone, Artificial; Apparatus for the Manufacture of ——. W. Schwarz, Zurich, Assignor to Schwarz System Brick Co., New York. U.S. Pat. 760,651, May 24, 1904.

See Eng. Pat. 18,163 of 1901; this J., 1902, 479.—T. F. B.

French Patents.

Bricks, Refractory, and other Ceramic Articles; Drying of —— before Burning. D. F. Henry, jun. Fr. Pat. 338,561, Dec. 31, 1903.

The drying kiln is divided by means of vertical partitions into a number of compartments connected by a zigzag passage. In each compartment a vertical endless conveyor s placed, which moves the materials to be dried, a current of air being forced through the compartments in a direction opposed to that in which the materials travel.—A. G. L.

Cement from Blast-Furnace Slag; Manufacture of ——. C. v. Forell. Fr. Pat. 339,316, Jan. 2, 1904.

The slag is granulated by pouring it into water, or ground nd pressed into bricks. In either form it is heated in an xidising flame to a temperature just below its fusing point, nd is then cooled as rapidly as possible and finally ground. ither just before, or at the commencement of, the cooling, he slag is treated with small quantities of water, which, ithout cooling the slag sensibly, exercise a considerable hemical action on it. The water used to granulate the ag may contain lime, alkali, &c.—A. G. L.

Blast-Furnace Slag; Process permitting the Transformation of —— into a Powder resembling Cement. W. Mathesius. Fr. Pat. 339,378, Jan. 6, 1904.

HE slag, which should be preferably in the granulated contion obtained by pouring it into water whilst still liquid, exposed to the action of steam under pressure until oroughly disintegrated. A dry powder resembling cement obtained, from which foreign bodies are removed by fting.—A. G. L.

ement; Process of Making White ——. E. Gogler and H. Seinfeld. Fr. Pat. 339,499, Jan. 11, 1904.

EE Eng. Pat. 388 of 1904; this J., 1904, 443.—T. F. B.

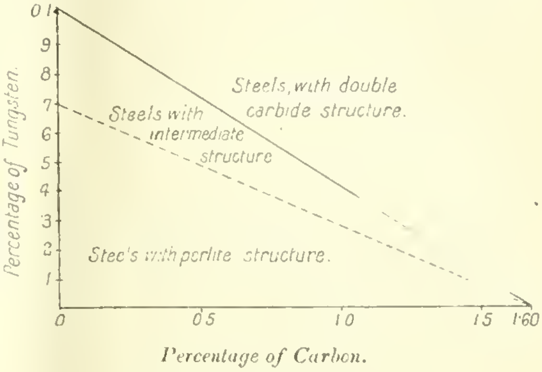
X.—METALLURGY.

Tungsten Steels. L. Guillet. Bull. Soc. d'Encourag., 1904, **106**, 263—283.

IE author examined two series of tungsten steels conining (1) from 0·110 to 0·276 per cent. of carbon, and) from 0·328 to 0·867 per cent. of carbon. The amount of ugsten present varied from 0·397 to 36·967 per cent. ie results show that tungsten steels may be divided oadly into two classes :—

ass.	Steels containing up to about 0·2 per cent. of Carbon.	Steels containing up to about 0·8 per cent. of Carbon.
.	From 0 to 7 per cent. of tungsten.	From 0 to 5 per cent. of tungsten.
I.	Above 7 per cent. of tungsten	Above 5 per cent. of tungsten.

The steels belonging to Class I. have a perlite structure l possess properties analogous to those of ordinary carbon els. Compared with carbon steels containing the same portion of carbon, they show higher breaking strength, stic limit, and hardness, but lower elongation, contraction, resistance to shock, as the percentage of tungsten reases. Quenching affects these steels in the same way carbon steels, but to a much greater degree. Annealing ens them distinctly. The steels belonging to Class II. e a double carbide (of iron and tungsten) structure; r properties vary with the percentage of carbon present. y are extremely brittle, and have a considerably lower aking strength and elastic limit than steels of Class I. containing the same amount of carbon. By quenching at 850° C., an extremely fine martensite structure is produced, but some of the double carbide is left undissolved, at least, when the percentage of tungsten is high. After quenching, the breaking strength, elastic limit, and hardness of the steels are much higher than before. By subjecting tungsten steels with a perlite structure to cementation, or steels with a double carbide structure to decarburisation, products having an intermediate structure can be obtained. By aid of the diagram (see figure) analogous to that previously given for nickel steels (this J., 1903, 999), the properties of a tungsten steel may be deduced from its composition.
—A. S.



Gold and Silver; Concentration of —— in "Iron Bottoms." M. N. Bolles. Trans. Amer. Inst. of Mining Engineers, Sept. 1904.

The absorption of gold in "iron bottoms" is generally satisfactory, and corresponds to, but is somewhat less than the absorption of silver in "copper bottoms." Silver is not well absorbed by "iron bottoms," the quantity obtained very seldom exceeding 5 per cent. of the total silver present. The precious metals tend to collect in the crust formed in liquation of the matte. Aluminium has no marked influence on the absorptive power of "iron bottoms," but the addition of potassium ferrocyanide gives a greater gold absorption. The addition of metallic iron to the mattes (corresponding to an increase in the reducing power and temperature of the furnace) raises their avidity, and the absorptive power for gold of a matte containing only iron and sulphur is largely dependent on the excess of iron present over the amount required for the formation of ferrous sulphate.
—T. F. B.

Slimes [Gold] Treatment; The Decantation Process of —— : Its Possibilities and Limitations. E. J. Laschinger. J. Chem., Metall. and Min. Soc., S. Africa, 1904, **4**, 348—364.

The author considers that the Rand treatment of low-grade slime gives very satisfactory results. It consists in washing the slimes into settling vats with a stream of water, allowing them to settle, and decanting off the water, about 45 per cent. of moisture being left in the slimes. The latter are then washed twice with cyanide solution; the first wash extracts about 92 per cent. of the gold which is precipitated by zinc, the resulting liquid being used for the second wash, which is not precipitated, but is used to make up the first wash, fresh cyanide being added to bring it up to strength. Thus, over 90 per cent. of the gold is recovered, even with slimes containing only 2 dwts. of soluble gold per ton, the working costs being less than 2s. per ton for a large plant, whilst the other expenses amount to less than 1s. per ton, taking interest at 4 per cent., and depreciation at 9 per cent. per annum. The best results are obtained when the ratio of cyanide solution to dry slime in each wash is as 3½ to 1. For slimes containing 2 dwts. of gold per ton, it is most economical to give only two washes; with 4 dwts., or more, of gold, however, three washes give better results, only the first being precipitated. When as much as 20 dwts. of gold are present, 98·3 per cent. can be recovered by giving three washes, and precipitating the first two, but this treatment should not be used unless the slimes contain at least 12 dwts. of gold. It is found that in all cases the best results are obtained when the slimes are allowed to settle thoroughly before each decantation, and when as much as possible of the gold is dissolved in the first extraction. It follows from the above that it should prove advantageous to grind finely the coarse and pyritic particles rich in gold and treat them together with the ordinary slimes. The author believes that by the Rand treatment a small profit may be made, after paying all expenses, on slimes even containing but 1 dwt. of gold.—A. G. L.

Zinc Oxide; Reduction Temperature of ——. W. McA. Johnson. Electrochem. Ind., 1904, **2**, 185—187. Paper read before Amer. Electrochem. Soc.

The determinations were made by enclosing the oxide mixed with charcoal or other reducing agent in a crucible constructed of Acheson graphite and provided with a screwed-on cover of the same material. An outlet tube through which the zinc vapour and gases could escape, as also a cavity drilled for the pyrometer, were provided in the crucible walls. The heating was effected in a gas reverberatory furnace, the temperature being regulated by varying the flow of gas. Pure zinc oxide was reduced by charcoal at 1,022° C., by soft coke at 1,029° C. The temperature of calcination of the ore or oxide influences the reduction. Zinc oxide, for example, calcined at 1,100° C., was only reduced by soft coke at 1,048°, and calcination at 1,300° brought the reduction temperature up to 1,061° C.
—R. S. H.

Blast-furnace Gases: Determination of Calorific Value of ——, *by the Mahler Bomb.* G. Arth. Bull Soc. Chim., 1904, **31**, 576—578.

The small weight of the quantity of gas which it is possible to burn in the Mahler bomb makes the experimental errors, and even the errors in the thermometer reading alone, of great relative magnitude, more than 5 per cent. of the quantity to be measured. Moreover, where there is not an unlimited quantity of the gas under test to draw upon, the filling of the bomb, the ascertaining of the quantity of gas employed, and the regulation of the oxygen so as not to overstep the limits of explosiveness, present very great difficulties. As these gases are mixtures of well known substances, the calorific values of which have been determined, and do not, like coals and similar fuels, contain complex compounds of unknown constitution, an accurate calculation of their calorific value is obtainable from the results of their analysis; and this calculated value is to be preferred to the direct result of combustion in the bomb.—J. T. D.

Cyanide Solutions; Determination of Constants in working. G. W. Williams. XXIII., page 683.

Oxygen in Working Cyanide Solutions; Industrial Method for the Determinatian of the ——. A. Prister. XXIII., page 684.

English Patents.

Steel; Manufacture of ——. J. W. Spencer, Newcastle-on-Tyne. Eng. Pat. 15,032, July 7, 1903.

Iron that has been decarburised so as to retain from 0·05 to 0·25 per cent. of carbon, is melted with silicon or a silicon alloy in proportion to yield a steel containing from 0·75 to 2 per cent. of silicon.—E. S.

Iron Sand or Concentrated Powdered Iron Ore; Hardening Lumps of ——, *Artificially Agglomerated, for Transport and for Reduction in Furnaces.* T. Rouse and H. Cohn, London. Eng. Pat. 15,188, July 9, 1903.

Iron sand, or concentrated iron ore or wastes, or mixtures of these, are moulded into briquettes with from 2 to 5 per cent. of lime, and the briquettes are hardened in a current of hot air and steam, in a chamber such as that described in Eng. Pat. 21,880, of 1902 (this J., 1903, 1090).—E. S.

Annealing Process. W. A. Nortcliffe, Brighouse. Eng. Pat. 16,533, July 28, 1903.

A layer of charcoal is interposed between the ordinary annealing pot and the tin or like cylinder containing the iron wire, for instance, to be annealed, the charcoal being also placed over the lid of the cylinder.—E. S.

Magnetic Material; Manufacture of ——. R. A. Hadfield, Sheffield. Eng. Pat. 2273, Jan. 29, 1904. Under Internat. Conv., June 12, 1903.

See U.S. Pat. 745,829 of 1903; this J., 1904, 23.—T. F. B.

Centrifugal Separators for Dry Materials [Minerals] of Different Densities. J. B. Loison, Paris. Eng. Pat 14,105, June 24, 1903.

A circular horizontal distributing plate, having a ring with radiating discharge grooves on the rim, and with a cover and feeding hopper, is directly connected to th vertical shaft of an electro-motor, situated below, in the hollow frame of the machine. It is claimed that th apparatus is very compact, can be started at full speed a once, is very easy to regulate and distributes the material (gold quartz for example) in concentric layers, accordi to their densities around the machine.—W. H. C.

Brazing of Metals [Cast Iron] and Fluxes for us therein. H. H. Lake, London. From J. C. Basset Cambridge, T. E. Parker, New Bedford, and H. J. Strout Brookline. Eng. Pat. 5671, March 8, 1904.

See U.S. Pats. 756,079 and 756,080 of 1904; this J., 1904 444.—T. F. B.

Aluminium; Method for Soldering ——. M. Tomelli Spezia. Eng. Pat. 15,849, July 17, 1903.

An oxyhydrogen flame obtained by burning previou dried hydrogen is used, a tin-aluminium solder bein applied to the joint, containing from 1 to 20 per cent. tin. The solder is distributed by means of a tool of copp platinum, or other metal which is a good conductor of hea
—E. S.

Aluminium; Flux for Soldering ——. C. Ellis, Bosto and O. J. Flanigan, Harrisburg. Eng. Pat. 26,29 Dec. 1, 1903. Under Internat. Conv., Dec. 31, 1902.

See U.S. Pat. 746,802 of 1903; this J., 1904, 66.—T. F.

Tin-Coating Machinery [Electrical]; Temperatur Regulating Apparatus for ——. A. M. Goodwin, Ea Toledo. Eng. Pat. 5009, Feb. 29, 1904.

The space in the tank, above the bath of molten metal divided by a transverse depressed bridge, extending a litt way below the level of the metal bath, into two com partments, in which separate bodies of oil rest upon t surface of the molten metal. The sheets of metal to b tioned enter the bath through the compartment containi the greater depth of oil. This compartment communicat by a valved horizontal pipe with a supplementary ta containing cold oil, in which a pump operated by mach nery is placed, whereby the cold oil can be forced throug an elevated tube on to the surface of the oil in the coat tank, whilst the heated oil flows into the supplementa tank through a horizontal connecting pipe. One end of vertical pyrometer bar is immersed in the oil, the oth end being connected to an indicator communicating w an electrical system including solenoid magnets, so th when a certain temperature is reached in the bath, the pump is actuated so as to supply cold oil to the san whilst another branch of the system is arranged to cont the fluid fuel burners whereby the bath is heated. Th the main circuit being established or broken by variatio in the temperature of the bath, the latter may be ma tained at a substantially steady temperature.—E. S.

United States Patents.

Blast Furnace. G. K. Hamfeldt, Munhall. U.S. Pat 759,991, May 17, 1904.

The claim is for "a blast furnace having an annu metal shell with its lower portion within the upper par the masonry stack, the shell being extended above the stack, and having its upper portion, where the dropping charge strikes it, of smaller diameter than the internal diameter of the top of the stack proper."—T. F. B.

Furnace for Melting Metals. J. Southern, Belleville. J. J. Connell, administrator of said J. Southern, deceased, assignor to W. H. Steinbrecher, New York. U.S. Pat. 760,195, May 24, 1904.

The thick wall in front of the hearth or melting chamber has a combination of combustion chambers leading through it, comprising passages adapted at their outer ends to receive burners, such passages being enlarged at their middle portions, through which they communicate with one another and with auxiliary passages which open into he melting chamber.—E. S.

luminium Sulphide and Aluminium Alloys; Manufacture of ——. Miyagoro Onda, Nagoya. U.S. Pat. 760,554, May 24, 1904.

Alumina or an aluminous ore is mixed with carbonaceous naterials and a metal sulphide, and the mixture is heated o a high temperature in a suitable furnace to obtain luminium sulphide and aluminium alloys.—E. S.

luminium; Flux for Soldering ——. C. Ellis, Boston, Assignor to N. L. Foster, Brooklyn. U.S. Pat. 760,783, May 24, 1904.

he flux consists of a salt of a heavy metal of which the eat of formation is less, and a saline body of which the heat f formation is greater, than that of the corresponding luminium salt, together with an organic body.—E. S.

Ore-Treating Furnace. C. C. Wilson, Denver.
U.S. Pat. 760,941, May 24, 1904.

horizontal ore-roasting cylinder is secured within a otating flue cylinder, and projects through a combustion hamber at one end and a smoke-stack at the other end, as to form a flue for fire-gases between them. For eding and rabbling the ore, a number of shelves project ngentially inwards from the inner periphery of the enosed cylinder, arranged to form a clear space at the axial atre, and on one side of each shelf a number of partition ades are fitted to stand at a transverse angular pitch to ich shelves and to the longitudinal cylinder axis, there ing a dam or apron at the end of each shelf. The rangement of the shelves is spiral, so that the ore verses the cylinder from the feeding to the discharge d. The closed feeding end of the inner cylinder moke-stack end) has a number of curved spouts to oop up ore delivered from a fixed hopper. An air steam pipe extends into and through the combustion amber a certain distance into the cylinder, and provision made for introducing hot air or superheated steam into e discharge end of the same. The flue cylinder has an larged diverging conical end to receive the products of mbustion from the combustion chamber, which is at one d of the furnace, opposite to the smoke-stack end. The claims include numerous details of the invention.
—E. S.

Ore-roasting Furnace. W. H. Smyth, Berkeley.
U.S. Pat. 761,049, May 24, 1904.

e furnace has superimposed chambers, the roof to the per and the hearth of the lower, being slotted longiinally and substantially centrally to the width of the nace. The slotted hearth is supported on arches and usverse beams, to which latter, apparatus is attached to intain the alignment of the slot, which is closed by ible overlapping plates, so arranged as to give way to passing arm and then automatically resume their sing position. The supports to the furnace are such as ermit free circulation of air beneath the hearth floor. netal skeleton or frame is suitably arranged to form the port and attachment for the rabble tracks and slot ependently of the brick structure. Rabbles are adapted ravel above the hearths, and devices for actuating the bles project downwards through the slot in the furnace roof, which is closed by laterally-swinging plates or gates, the ends of which swing transversely across the slot. Means are provided for transferring the devices which actuate the rabbles from one slot to another. In furnaces having more than two hearths, the superposed roasting chambers are provided alternately with a slotted roof and with a slotted hearth. An arm extending through each slot connects a carrier outside the furnace to the rabbling mechanism.—E. S.

Ore-roasting Furnace. W. H. Smyth, Berkeley.
U.S. Pat. 761,050, May 24, 1904.

The hearths are placed longitudinally adjacent on the same level, and each is divided longitudinally into two sections, slightly separated so as to form a slot. A metal framework bears members adapted to support the hearth sections. The slots are closed by flexible overlapping plates. The ore is stirred by travelling rabbles, which are worked by transferable devices projecting through the slots and supported on tracks. Compare the preceding abstract.—E. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

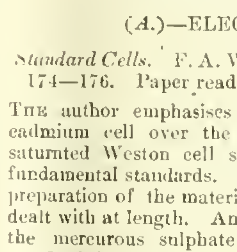
(*A.*)—ELECTRO-CHEMISTRY.

Standard Cells. F. A. Wolff. Electrochem. Ind., 1904, **2**, 174—176. Paper read before Amer. Electrochem. Soc.

The author emphasises the superiority of the Weston cadmium cell over the Clark cell, and urges that the saturated Weston cell should be adopted as one of the fundamental standards. The importance of the methods of preparation of the materials employed in standard cells is dealt with at length. An electrolytic method for preparing the mercurous sulphate is described. As a working standard the portable cell of the Weston Electrical Instrument Co. is stated to have given excellent results at the American National Bureau of Standards. In this cell a solution of cadmium sulphate is employed saturated at 4° C., and containing no excess of crystals.—R. S. H.

Standard Cells; Preparation of Materials for —— and their Construction. H. S. Carhart and G. A. Hulett. Electrochem. Ind., 1904, **2**, 176—177. Paper read before Amer. Electrochem. Soc.

Methods are described for preparing pure mercury, cadmium sulphate, cadmium amalgam, and mercurous sulphate. The purity of the latter substance is very important, since it greatly influences the E.M.F. of the cell; it is prepared by an electrolytic method similar to that independently developed by F. A. Wolff (see preceding abstract). Mercury is employed as anode in dilute (1 : 6) sulphuric acid, using a low-current density and stirring so as to keep the surface of the mercury exposed. In this way, and with 0·3 ampère, about 2·8 grms. of the salt can be prepared in an hour; the product is free from mercuric sulphate and, provided pure mercury and sulphuric acid are used, from other metallic salts. As to the construction of the cell, the modified H form shown in the figure is preferred. The necks of the two limbs are each contracted at *a*, so that the cell can be hermetically sealed after the materials have been introduced.
—R. S. H.



Weston Cell; The ——. H. T. Barnes and S. B. Lucas. J. Phys. Chem., 1904, **8**, 196—207. Chem. Centr., 1904, **1**, 1511.

The authors have made comparative tests with Weston cells of different construction. They find that cells containing solutions saturated at 0° C. have practically no temperature-coefficient; those with damp crystals and a 13 per cent. amalgam have the coefficient 0·0055 per cent. per degree; those with a 14·7 per cent. amalgam, 0·008 per cent. per degree centigrade. The ratio of the E.M.F. of the Clark cell at 15° C. and of the Weston cell at 20° C. is 1·40666; and as this value has been determined very accurately, it is immaterial whether the Clark cell or the Weston cell be used as a standard.—A. S.

Primary Cell; Experiments with a New ——. E. G. P. Bousfield. Electrochem. and Metall., 1904, **3**, 730—733.

A carbon pole is immersed in 31 per cent. nitric acid in a porous pot, the outer liquid being a 12—15 per cent. solution of caustic soda, with a zinc pole. Initial voltage, 2·6. Great "efficiency for laboratory purposes" is claimed.
W. A. C.

Copper and Aluminium Anodes; Behaviour of ——. F. Fischer. Z. physik. Chem., 1904, **48**, 177—219.

In dilute sulphuric acid a film of cupric sulphate gathers on copper anodes, whilst oxygen is evolved. When the current raises the temperature of the anode, cuprous sulphate is also formed, and the evolution of oxygen ceases. On still further heating, finely-powdered copper separates from the anode; in solutions of neutral sulphates, however, the powder separated, consists of cuprous hydroxide. The presence or absence of the film of sulphate, and consequently the resistance, depends on the comparative rates of formation and solution of the salt. Aluminium anodes, if kept cool, develop a film of considerable mechanical strength, having a thickness proportional to the voltage applied. In the absence of special cooling, the film is exceedingly thin, and is thrust away by hydrogen bubbles on reversing the current; hence the familiar action of aluminium in converting alternating into direct currents.—W. A. C.

Rotating Electrodes; Electrolytic Analysis with Application of ——. R. Amberg. XXIII., page 684.

English Patents.

Electric Furnaces or Ovens. A. Eimer, New York. Eng. Pat. 28,780, Dec. 31, 1903. Under Internat. Conv., May 22, 1903.

The electric oven described is one intended for use as a dentist's muffle or small laboratory crucible furnace. The plate which supports the articles to be heated, is formed in one piece with the door closing the furnace, so that the removal of both is operated at the same time. On the bottom of the oven is another movable plate, having depressions containing a resistance conductor, such as a platinum wire, the heating being effected by passing a current through this conductor. For purposes of observation the furnace is also provided with a transparent plug of fused quartz.—R. S. H.

Electric Sectional Furnaces. A. Eimer, New York. Eng. Pat. 28,782, Dec. 31, 1903. Under Internat. Conv., May 28, 1903.

The furnace is composed of a number of heating sections arranged end to end in trough-like conformation, and disposed in an approximately horizontal plane, each heating section comprising a separate base member and opposite side members of refractory material. Each member is provided with a resistance conductor embedded or disposed in suitable grooves in the material. The furnace is supported in a frame about its base, sides, and opposite ends by means of an intermediate packing of non-conducting material, and the top of each section is closed with a removable plate of refractory material, each plate being provided with an observation aperture having a transparent covering of mica, quartz, &c. Screws at the corners of the frame provide for the vertical adjustment of the furnace. Suitable ports at the ends serve for the introduction of the articles to be heated, the latter being centralised in the furnace by the upper concave surfaces of the refractory base members. Each terminal of the resistance conductors is bound by means of a binding screw to a slotted binding post, strips of metal being fastened in the slots, or connectors jointed pivotally may be used, for connecting the various heating sections in series or in multiple, or for throwing one or more sections out of the circuit.—B. N.

[*Electric Heating.*] *Apparatus for Regulating the Intensity and Heating Effect of Electric Currents.* Soc. Anon. l'Ind. Verrière et ses Dérivés, Brussels. Eng. Pat. 3912, Feb. 16, 1904. Under Internat. Conv., Feb. 18, 1903.

A layer of carbon or other solid resistance material, in the form of powder or small pieces, is interposed in the circuit of an electric current. By lengthening or shortening this resistance the regulation is effected. Apparatus is described for industrial and domestic heating, with fixed or movable electrodes, to pairs of which the current is directed by the [illegible] of suitable switches. (See Eng. Pat. 5921, March 10, 1904; this J., 1904, 550.)—R. S. H.

Electrodes for Electrolytic Purposes; Manufacture of ——. G. W. Johnson, London. From Chem. Fabr Griesheim-Elektron, Frankfurt. Eng. Pat. 17,587, Aug 13, 1903.

See Fr. Pat. 334,684 of 1903; this J., 1904, 119.—T. F. B

Bichromates and Alkali; [Electrolytic] Treatment o Alkali Chromates for the Production of —— there from. G. W. Johnson, London. From Chem. Fabr Griesheim-Elektron, Frankfurt. Eng. Pat. 17,588, Aug 13, 1903.

See Fr. Pat. 334,685 of 1903; this J., 1904, 119.—T. F. B

Tin-Coating Machinery; [Electrical] Temperatu Regulating Apparatus for ——. A. M. Goodwin Eng. Pat. 5009, Feb. 29, 1904. X., page 664.

Separating Coke and Other Electric Conductors fro Cinders and Other Substances: Improved Electrica Apparatus for ——. H. Lelarge. Eng. Pat. 579 March 9, 1904. II., page 653.

United States Patents.

Electrodes for Batteries; Process of Manufacturin ——. H. P. R. L. Pörscke and G. A. Wedekin Hamburg. U.S. Pat. 76,056, May 24, 1904.

See Fr. Pat. 337,276 of 1903; this J., 1904, 612.—T. F.

Peroxides [Magnesium and Zinc]; [Electrolytic] Proc of Manufacturing ——. F. Hinz, Berlin. U.S. Pa 759,887, May 17, 1904.

See Fr. Pat. 337,285 of 1903; this J., 1904, 549.—T. F.

Electrically Smelting Materials; Process of —— [*Ca cium Carbide, &c.*] A. H. Cowles, Cleveland. U. Pat. 760,057, May 17, 1904.

For smelting reducible materials which are normally po conducters of electricity, but whose conductivity increas with the temperature, a charge of the materials and reducing agent is supported in an electric furnace havi a conducting casing. An electric current, the density which increases along its path, is passed through the sol charge, which thus becomes heated to the temperatu required for its treatment. Those portions of the char adjacent to the inner face of the furnace-casing are cool to a sufficient extent to prevent any shunting of t current through the casing. (See also U.S. Pats. 750,093— and 750,170—1; this J., 1901, 192—3).—R. S. H.

Calcium Carbide; Process of Making ——. A. Cowles, Cleveland. U.S. Pat. 760,312, May 17, 1904.

A resistance conductor either of molten carbide or some independent material, is heated by the passage of electric current through it, to a temperature sufficient cause the surrounding carbide mixture to react, and bring the carbide into a molten condition suitable tapping. (See also U.S. Pats. 750,093—6 and 750,170— this J., 1904, 192—3, also preceding abstract.)—R. S. H

Sandstones [*Artificial*]; [*Electrical*] *Process of Producing Refractory Calcareous* ——. W. Schwarz, Assignor to Schwarz System Brick Co. U.S. Pat. 760,571, May 24, 1904. IX., page 662.

Purifying Water; [*Electrical*] *Method of* ——. V. M. George. U.S. Pat. 761,044, May 24, 1904, XVIII. B., page 676.

Nitro Compounds; [*Electrolytic*] *Reduction of* ——. M. Buchner. Assignor to C. F. Boehringer und Soehne, Mannheim-Waldhof. U.S. Pat. 761,284, May 31, 1904.

SEE Eng. Pat. 13,543 of 1900; this J., 1900, 893.—T. F. B.

French Patents.

Electric] *Furnace.* Le Roy W. Stevens and B. Timmerman. Fr. Pat. 339,532, Jan. 12, 1904.

EE U.S. Pats. 749,460 and 749,461 of 1904; this J., 1904, 92.—T. F. B.

Electric] *Furnace.* Le Roy W. Stevens and B. Timmerman. Fr. Pat. 339,533, Jan. 12, 1904.

EE U.S. Pat. 749,462 of 1904; this J., 1904, 192.—T. F. B.

(*B.*)—ELECTRO-METALLURGY.

lectrolytic Iron. C. F. Burgess and C. Hambuechen. Electrochem. Ind., 1904, **2**, 183—185. Paper read before Amer. Electrochem. Soc.

HE authors show how it is possible to obtain electrolytic on in large quantities and at reasonable cost. As ectrolyte a solution of ferrous sulphate with a certain rcentage of ammonium sulphate, was employed. The rrent density was 6 to 10 ampères per square foot of thode surface, and at the anode slightly less. The P.D. r each cell was a little under 1 volt, and the temperature the electrolyte 30 C. The anodes were of ordinary ades of wrought iron and steel, the starting sheets for e cathodes of sheet iron. The current efficiency was arly 100 per cent. The electrolytic iron absorbs large antities of hydrogen during deposition, which accounts : its extreme hardness.—R. S. H.

rro-Nickel from Pyrrhotite; Manufacture of ——. [*Electric Smelting*]. E. A. Sjöstedt. Electrochem. Ind., 1904, **2**, 188. Paper read before Amer. Electrochem. Soc.

E author has investigated the electric furnace treatment nickeliferous pyrrhotite of the Sudbury district. The rtially roasted ore, mixed with lime and coke, was uced, yielding a ferro-nickel pig, containing 3 per cent. nickel. About 200 h.p. produce a ton of ferro-nickel per hours. The total cost of production at Saulte Ste. rie (Canada), is estimated at about 5*l.* 5*s.* per ton.
—R. S. H.

ctrolytic Copper Refining; The Economic Balance in ——. L. Addicks. Electrochem. Ind., 1904, **2**, 180—81. Paper read before Amer. Electrochem. Soc.

economic balance is understood the interdependence of t conditions of working, and their bearing on the cost manufacture. The three chief factors are tank stance, age of electrodes, and current density; but all hese factors are of a somewhat complex nature. The k resistance is made up of metallic conductors, contacts, de slimes, counter E.M.F., electrolyte and a negative ntity due to imperfect efficiency. The author enters in ail into the relative importance of the several varying ditions, and shows how these conditions may differ in ortance from one refinery to another, according to local ditions. The only way to solve the problem of cheap luction is to consider the multiplicity of relations a pair time, and finally decide on those most favourable for particular works concerned. (Compare this J., 1903, 5.)—R. S. H.

Nickel; Passivity of ——. M. Le Blanc and M. G. Levi. Boltzmann Festschrift, 1904, 183—195. Chem. Centr., 1904, **1**, 1396—1397.

At the ordinary temperature and with a current of 0·5 ampére per sq. dcm., nickel goes quantitatively into solution in electrolytes containing haloid salts or cyanides, and in sulphuric acid, but in solutions of other salts, it is "passive"; in sodium acetate solution the behaviour of the nickel depends upon the treatment to which it has been previously subjected, but it exhibits a distinct tendency to become passive. Increase of temperature favours, as in the case of other metals, the change to the active condition. In potassium hydroxide solution, nickel is passive even at 80° C., and partially so, also in ammonium oxalate and sodium acetate solutions. Increase of current density renders the metal more passive; the concentration of the electrolyte is without influence. In sodium carbonate and potassium hydroxide solutions, the passivity of the nickel may be due to the production of an insoluble coating on the metal, but in the other solutions it appears to be a phenomenon depending on the reaction-velocity. The ions are formed too slowly, hence evolution of oxygen must take place. A small addition of sodium chloride to a solution in which the nickel becomes passive, suffices to bring the rate of formation of ions to the degree requisite for the quantitative solution of the metal; addition of sulphuric acid is less effective. The addition of sugar or acetone is without effect.—A. S.

Palladium; Electro-deposition of ——. R. Amberg. Z. Elektrochem., 1904, **10**, 386—387.

For the electrolytic precipitation of palladium, and for the determination of the atomic weight of this element, the author makes use of a solution of palladious-ammonium chloride ($PdCl_2.2NH_4Cl$) such as was used by S. Cowper-Coles (this J. 1899, 589). Under ordinary conditions the current density must be very low (0·013 ampère per 100 sq. cm.); but with a rapid rotation of 600—650 revolutions per minute, currents up to 0·3 ampére can be employed, and about 1 grm. of the metal deposited in 3 hours. It is advisable to work at 60°—65° C., and, above all, it is important not to exceed the critical P.D. of 1·25 volts, above which point peroxide appears on the anode, and the metal is no longer deposited in an adherent form.
—R. S. H.

Furnace; Electric ——. P. R. J. Willis, Kingston. From E. A. Sjostedt, Sault Ste. Marie. Eng. Pat. 14,963, July 6, 1903.

See U.S. Pat. 726,364 of 1903; this J., 1903, 637.—T. F. B.

English Patents.

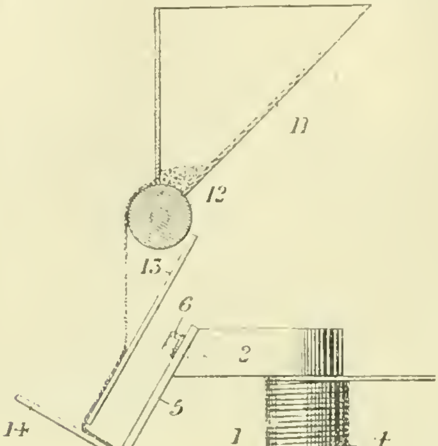
Furnaces; Electric. [*Induction Furnace.*] O. Frick, Stockholm. Eng. Pat. 4866, Feb. 27, 1904.

In order to avoid too great self-induction a transformer furnace is constructed with the annular crucible, which forms the secondary circuit, surrounding one leg of a magnetic iron core, the primary coil being wound around this leg, but above the melting crucible. In this manner the distance between the primary and secondary circuits is made very small; which can only be accomplished otherwise by making the inside wall of the annular crucible inconveniently thin.—R. S. H.

Electro-Magnetic Separators. The Edison Ore-Milling Syndicate, Ltd., London. From T. A. Edison, Llewellyn Park. Eng. Pat. 14,295, June 27, 1903.

In the drawing below, showing a portion of the magnetic separator in transverse section, the pole pieces 5 and 7 are of considerably greater length than the width of the magnet, corresponding in length to the inclined chute 13, on to which the ore falls from the hopper 11, and is deflected on to the inclined board 14, so as to descend to the pole pieces 5 near its edge, whence the non-magnetic portions pass by gravity to the front of the partition 10, whilst the magnetic portions are attracted to the opposite pole piece 7, and fall inside the partition.

The upper pole piece is of flat plate, and inclined in a direction transverse to its length, and its lower edge is on a vertical plane different from that of the edge of the lower pole piece. Both pole pieces are formed independently of, and are secured by screws to, the magnet body.



The pole pieces are "of such cross-sectional area in relation to their length and to the width of the air-gap between them, that with a given amount of electrical energy applied, a magnetic field of uniform strength throughout the length of the pole pieces is formed."—E. S.

Copper and Nickel from Mattes and Ores; Electrolytic Separation of ——. P. R. J. Willis, Kingston. From C. S. Shields, Sault Ste. Marie. Eng. Pat. 14,731, July 2, 1903.

See U.S. Pat. 725,998 of 1903; this J., 1903, 637.—T. F. B.

United States Patents.

Electrolytic Refining of Metals; Apparatus for ——. A. Schwartz, Assignor to General Metals Refining Co., New York. U.S. Pat. 760,023, May 17, 1904.

A cathode of large surface is employed, consisting of a number of parallel plates. The cathode plates are spaced apart and arranged at an angle to the face of the anode, so that there will be a free circulation of the solution.

—R. S. H.

[Precious] Metals; Recovering —— *from Ores or Sands.* W. J. and J. H. Jory, San Francisco. U.S. Pat. 760,539, May 24, 1904.

Ores containing precious metals are simultaneously powdered and treated "with reagents adapted to form by combination with less valuable constituents of the ores, solvents which will combine with the noble metals to form salts which, under electrolytic action, will be decomposed with the regeneration of the solvent." Thus, an alkaline sulphide solution, together with the "hydrate of the metal forming the base of the sulphide" may be used, the precious metals being recovered from the solution electrolytically. Ammonium sulphide solution is also claimed as a suitable solvent.—E. S.

French Patent.

Steel; Deoxidising ——. Aluminium Industrie Act.-G Fr. Pat. 338,702, Dec. 31, 1903

Molten steel, refined by the Bessemer, Thomas, or oth process, is freed from scoria, and is transferred, preferab to an electric furnace, where it is allowed to cool to ne its solidification point (in order that oxides may separate and is then covered with chalk, sand, or the like, or with slag, such as that formed in the manufacture of the ste The mass is then reheated for ordinary treatment. Inste of conducting the process in separate phases, as describ it may be carried out in a single furnace.—E. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Fats; Auto-Hydrolysis of Crude Animal ——. P. Pastr vich. Monatsh. f. Chem. 1904, **25**, 355—361.

Crude animal fats are hydrolysed spontaneously on kee ing, owing to the presence of decomposition products of t glutinous substance of the membranes; the products a free fatty acids and glycerin. The membranes were isolat from crude beef tallow, scraped free from fat, cleansed fro adhering particles by means of damp filter-paper, dried, ar powdered; the powder when digested in the dark at 35° with cotton-seed oil in presence of a little water caused steady increase in the acid value of the oil. Crude be tallow obtained from various organs of the body w reduced to a pulp and digested in the dark at 35° C., t increase in the free acidity being determined from ti to time. The tallow from the different organs differ considerably as regards the rate of hydrolysis. The tallo rich in oleïn were hydrolysed more rapidly than tho containing less oleïn. The addition of 12—18 per cent. water considerably increased the rate of hydrolysis. (S Dieterich, Chem. Rev. ü. Fett- und Harzind., 1899, **6**, 16 181, 201.) The addition of ammonia or caustic alkalis very small quantities favoured the hydrolysis, but larg quantities restricted it. The hydrolysis was also co siderably restricted by the addition of dilute mineral aci and of a 2 per cent. solution of chloral hydrate, whi the presence of mercuric chloride nearly prevented hyd lysis altogether. The odour of the decomposing mas was not unpleasant, but sour, somewhat resembling t of fresh cheese. The presence of ammonia or of fix alkalis caused in some cases a reddish-yellow colorati of the fat; in other cases the colour was unchang The products always contained small quantities of amn nium soaps, and in most cases formic acid was detect after acidification. The hydrolysis is probably due to an enzyme but to the decomposition of the al minoids by aërobic micro-organisms. It may be attribu to the saponifying influence of the ammonia derived fr the decomposing albuminoids; but since the saponifyi power of such minute quantities of ammonia under above conditions is very slight, it must be assumed that ammonium soaps produced are constantly dissociated, that the saponification is carried on under the catal influence either of the bacteria or of the albuminoid matt

—J. F. B

Therm-oleometer: Apparatus stated to permit of Detection of Adulteration of Olive Oil and ot Vegetable and Animal Oils. M. Tortelli. Boll. Ch Farm., **43**, 193—203. Chem. Centr., 1904, **1**, 142 1426.

The author's apparatus, by means of which the Maum test can always be carried out under the same conditi comprises a vacuum vessel and a thermometer provide the bottom with stirring blades. 20 c.c. of the oil introduced into the vacuum vessel, stirred well for abou minute with the thermometer, and the temperature no 5 c.c. of sulphuric acid are then cautiously added in course of about 30 seconds, with continuous stirring, the highest temperature attained in about two minute observed. The difference between the two readings g "degree of heat evolution" of the oil. Acid of gr. 1·8413 is used. From experiments under the ve conditions the author obtained the following results the "degree of heat evolution" of different oils:— ve oil, 44; cotton seed oil, 78; sesamé oil, 71·3; za oil, 61·2; rape oil, 60·8; arachis oil, 50·6; grape- l oil, 73·6; maize oil, 82; poppy-seed oil, 88·4; icline oil, 103·2; almond oil, 50·7; apricot kernel oil, 5; peach oil, 70·1; hazelnut oil, 48; peach-kernel oil, 7; mustard oil, 58·6; castor oil, 67·8; hemp-seed oil, niger-seed oil, 91·5; candle-nut oil, 96; "native nut" 104; linseed oil, 124·4; stillingia oil, 136·2. The hor is not able to confirm the statement of Thomson Ballantyne (this J., 1891, 234) that the formula

$$\frac{\text{rise of temperature with oil}}{\text{rise of temperature with water}} \times 100$$

ls to constant values; he finds that even with this nula the values obtained decrease as the strength of acid is reduced.—A. S.

ulmoogra Seeds; Constituents of ——. F. B. Power nd F. H. Gornall. Chem. Soc. Proc., 1904, **20**, 135.

seeds which afford the chaulmoogra oil of commerce derived from *Taraktogenos Kurzii* (King), a native of mah, and not, as has until quite recently been assumed, *Gynocardia odorata* (R.Br.). The oil has previously examined by Moss (Year-book of Pharmacy, 1879, –533), Petit (J. Pharm. Chim., 1892, **26**, 445), and recently by Schindelmeiser (Ber. deutsch. pharm. Ges., , **14**, 164), but their results differ in many respects those obtained by the present authors, which are as ws:—The seeds of *Taraktogenos Kurzii* (King) con- a hydrolytic enzyme, and also an unstable cyanogen ound, which reacts with the enzyme when the seeds crushed, giving rise to hydrogen cyanide. On expres- the seeds yielded 30·9 per cent. of a fatty oil, which the following constants:—m. pt., 22°—23° C.; sp. gr., 1 at 25° and 0·940 at 45° C.; $[\alpha]_D^{15°} = +52°$; acid value, ; saponification value, 213; iodine value, 103·2. On olysis, the fatty oil yielded glycerol, a very small int of phytosterol, $C_{26}H_{43}.OH$ (m. pt. 132° C.), and a ure of fatty acids (m. pt. 44°—45°; $[\alpha]_D = +52·6°$ in oform; acid value, 215; iodine value, 103·2), which sted chiefly of several homologous acids belonging to ries $C_nH_{2n-4}O_2$ containing a closed ring and one enic linking, no member of which has hitherto been ed from a fatty oil. The highest of these homologues nt, which was isolated in a pure condition, separates most of the usual organic solvents in glistening leaflets t. 68° C.; b. pt. 247°—248°/20 mm., $[\alpha]_D = +56°$), he formula $C_{18}H_{32}O_2$, and is designated *chaulmoogric* It combines with only two atomic proportions of ne or iodine. Palmitic acid also was identified, and is reason for assuming the presence of a near logue or homologues of chaulmoogric acid, but ging to the series having the general formula $_4O_2$ with two ethylenic linkings. Undecylic acid ydroxy acids were proved to be absent, and an indi- acid corresponding to hypogæic acid, could not be d. The "gynocardic acid" of all previous investiga- believed to be a mixture of several substances. The scake" yielded, besides formic and acetic acids and small amount of volatile esters having the character- lour of the seeds, an appreciable amount of a neutral *ubstance*, $C_{18}H_{32}O_2$ (b. pt. 214°—215°/18 mm.; sp. ·9066 at 16°/16° C., $[\alpha]_D = +42·4°$), which is ic with chaulmoogric acid.

moogric Acid; Constitution of ——. *Part I.* . Power and F. H. Gornall. Chem. Soc. Proc., 1904, 126—137.

he object of ultimately determining the constitution *ulmoogric acid*, $C_{18}H_{32}O_2$ (see preceding abstract), a r of its derivatives have been prepared and studied. *chaulmoograte*, $C_{17}H_{31}.CO_2CH_3$ (m. pt. 22°, b. pt. rr./20 mm., sp. gr. 0·9119 at 25°/25°, $[\alpha]_D^{15°} + 50$ roform), was prepared by the interaction of the nethyl alcohol, and hydrogen chloride. *Ethyl chaulmoograte*, $C_{17}H_{31}.CO_2C_2H_5$, a colourless oil (b. pt. 230 corr./20 mm., sp. gr. 0·9079 at 15°/16°, $[\alpha]_D^{20°} + 50·7°$), was prepared in like manner. *Chaulmoogramide*, $C_{17}H_{31}.CO.NH_2$ (m. pt. 106°, $[\alpha]_D^{27°} + 57·3°$ in chloroform), was obtained according to Aschan's method (*Ber.*, 1898, **31**, 2341). *Bromodihydrochaulmoogric acid*, $C_{17}H_{32}Br.CO_2H$ (m. pt. 36—38°; optically inactive), is formed when chaulmoogric acid is treated with hydrogen bromide in glacial acetic acid. Ethyl chaulmoograte absorbs two atomic proportions of bromine in the cold, forming *ethyl dibromodihydrochaulmoograte*, $C_{17}H_{31}Br_2.CO_2C_2H_5$, which is an oil. When chaulmoogric acid is treated with sodium in boiling amyl alcohol, the ethylenic linking is not resolved, but there were obtained, after fractional distillation of the product, *chaulmoogryl alcohol*, $C_{18}H_{33}.OH$ (m. pt. 36°, $[\alpha]_D + 58·4°$) and *chaulmoogryl chaulmoograte*, $C_{17}H_{31}.CO_2.C_{18}H_{33}$ (m. pt. 42°), together with unchanged chaulmoogric acid. The saturated acid, *dihydrochaulmoogric acid* $C_{17}H_{33}.CO_2H$ (m. pt. 71—72°, b. pt. 248°/20 mm.; optically inactive), is formed, however, on reducing bromodihydrochaulmoogric acid with zinc dust and alcohol, or chaulmoogric acid with hydriodic acid and phosphorus. By the latter process a hydrocarbon, *chaulmoogrene*, $C_{18}H_{34}$ (b. pt. 193—194°/20 mm.) is also formed. *Methyl dihydrochaulmoograte*, $C_{17}H_{33}.CO_2CH_3$ (m. pt. 26—27°, b. pt. 222—223°/20 mm.), was prepared from the corresponding acid. Chaulmoogric acid is not attacked by fused caustic alkalis even at 300° C. When chaulmoogric acid was oxidised with cold permanganate (1 atom of oxygen), *dihydroxydihydrochaulmoogric acid*, $C_{17}H_{31}(OH)_2.CO_2H$ (m. pt. 102°), was produced, but when the amount of permanganate was equivalent to 4—5 atomic proportions of oxygen, formic acid and *two dibasic acids* were obtained, the latter having the formulæ $C_{15}H_{28}(CO_2H)_2$ and $C_{15}H_{28}O(CO_2H)_2$ (m. pt. 128°). The *ethyl esters* of these acids were described. The molecular magnetic rotation of ethyl chaulmoograte very closely approximates to the calculated value for an unsaturated ester of the formula $C_{20}H_{36}O_2$, having a closed ring and one ethylenic linking, the latter being contained in an allyl group. This conclusion, based on the magnetic rotation, is in harmony with the results obtained by the oxidation of the acid.

Fatty Acids; Process for Characterising ——.
R. Locquin. XXIII., page 685.

Hydrolytic Properties of the Cytoplasma of Castor-Seeds are not due to a Soluble Ferment. M. Nicloux. XXIV., page 687.

Butter; Keeping Quality of ——. *I. Canned Butter.*
L. A. Rogers. XVIII. A., page 675.

ENGLISH PATENTS.

India-Rubber Substitutes [from Nitrated Oils]; Manufacture of ——. The Velvril Co., Ltd., and J. S. Howkins. Eng. Pat. 13,306, June 13, 1903. XIII. C., page 670.

Lubricating Substances for Use in the Manufacture of Bricks, Tiles, Pottery, and the like. W. H. Sandwith and H. T. Rayner. Eng. Pat. 16,125, July 21, 1903. IX., page 662.

Distillation of Fats, Oils, Tars, and the like; Continuous Vacuum ——. G. Bokelberg and J. Sachse. Eng. Pat. 7204, March 25, 1904. III., page 655.

UNITED STATES PATENT.

Soaps, Medicated; Process of Making ——. R. Reiss, Charlottenburg, and O. Schmatolla, Berlin. U.S. Pat. 760,018, May 17, 1904.

SEE Eng. Pat. 24,240 of 1903; this J., 1904, 195.—T. F. B.

FRENCH PATENTS.

Oils and Fats; Process for Decolorising ——. Soc. Anon. des Usines. J. E. de Bruyn. Fr. Pat. 338,677, Oct. 14, 1903. Under Internat. Conv., Oct. 28, 1902.

SEE Eng. Pat. 22,086 of 1903; this J., 1904, 69.—T. F. B.

Oils and Fats, more especially Cacao-Butter; Process for Purifying ——. Soc. Anon. des Usines. J. E. de Bruyn. Fr. Pat. 338,678, Oct. 14, 1903. Under Internat. Conv., Oct. 16, 1902.

See Eng. Pat. 22,085 of 1903; this J., 1904, 69.—T. F. B.

Fish Oil and Fish Guano; Process and Apparatus for the Manufacture of ——. H. J. A. Pompe van Meerdervoart. Fr. Pat. 338,472, Nov. 18, 1903.

The fish is boiled with water under a pressure gradually increasing from $3\frac{1}{2}$ atmos. in closed vessels provided with agitators. This is claimed to give a greatly increased yield of oil, and to leave a sterile residue of fish guano.—C. A. M.

Petroleum and its Homologues; Process for Saponifying ——. F. J. Lothammer and C. Trocquenet. Fr. Pat. 338,636, Oct. 19, 1903; and Addition to same, Oct. 29, 1903. III., page 655.

Soaps containing Phenol or Cresol which are Soluble in Water or form Emulsions; Process for Solidifying ——, *at the same time Increasing their Activity.* E. M. Raetz. Fr. Pat. 338,556, Dec. 31, 1903.

See Eng. Pat. 27,889 of 1903; this J., 1904, 500.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

English Patent.

Colouring Matter Lakes [*from Azo Dyestuffs*]; *Manufacture of* ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. Eng. Pat. 15,493, July 13, 1903.

Insoluble azo dyestuffs which have a soft, oily, or resinous consistency, or which are soft or liquid at about 100° C. (*e.g.*, those prepared from diazotised crude xylidine or toluidine and β-naphthol, &c.), are warmed and intimately mixed with a substratum of finely ground, dry barium sulphate, kaolin, alumina, &c., and the paste dried, or employed directly in the moist condition. Other substances which assist the "liquefaction" of the dyestuff may be added, such as phenols, glycerin, aniline, the alkali salts of higher fatty acids, &c. Other azo dyestuffs which are not alone adapted for use by this process (*e.g.*, "aniline-azo-betanaphthol") may be added to the dyestuffs first mentioned, and can then be used for lake-making by this process. In the place of the usual white substrata for these lakes, coloured compounds, such as minium or previously prepared lakes, may be used. As an example of the process, two parts of "aniline-azo-phenol" and three parts of sodium ricinoleate are melted by steam heat, and incorporated with 50 parts of ground barium sulphate and 10 parts of water; when dry, a yellow lake is said to result.
—T. F. B.

United States Patent.

Composition of Matter [*Varnish*]. C. Ellis, Assignor to G. M. Port, both of Boston. U.S. Pat. 760,185, May 17, 1904.

The composition of matter consists of a metallic palmitate, such as zinco-aluminium palmitate, dissolved in linseed-oil, to which Chinese wood-oil, gilsonite, and turpentine, or other similar substances, are added.—A. G. L.

French Patents.

Lithopone and Glauber's Salt; Process of Making ——. W. D. Gilman. Fr. Pat. 338,682, Oct. 27, 1903. Under Internat. Conv., Oct. 30, 1902.

See U.S. Pat. 732,732 of 1903; this J., 1903, 918.—T. F. B.

Pigments, and Process of Making same. W. J. Armbruste and J. Morton. Fr. Pat. 338,560, Dec. 31, 1903.

See U.S. Pat 751,414 of 1904; this J., 1904, 260.—T. F.

(*B.*)—RESINS, VARNISHES.

Varnishes; Studies on ——. A. Tixier. Monit. Scient 1904, **18**, 413—421.

A varnish consists of a solution of a substance, C, such a a gum, resin, &c., in a solvent, S. If to this solution ther be added a second liquid (an "insolvent"), I, which i miscible with S, but in which C is insoluble, a limit, *k*, will b reached beyond which any increase in the quantity of I wil cause precipitation of some portion of C. This limit, *k*, ma be represented by the formula $\frac{s}{s+i}$, where *s* is the weigh of the solvent S, and *i* that of the "insolvent" I. Th application of this law of "limit solvents" is of particula interest in the study of varnishes. Varnishes may b classified as "perfect" (consisting wholly of C + S), an "imperfect" (C + S + I), and each of these groups ma further be subdivided into "volatile" and "semi-fixed varnishes. In the "perfect" varnishes C is soluble in al proportions of S; such are those containing colophony o resinates dissolved in alcohol, oil of turpentine, &c. O the "imperfect" varnishes those made from copal ar the most important. In consequence of the insolubility o the gum-resins classed as copals in most of the liquid suitable for varnish manufacture, it has hitherto been th practice to form S by the partial depolymerisation of th copal at a high temperature. During this "preliminar fusion" a loss of weight, which may reach 20 per cent takes place. The author has, however, shown (compar Fr. Pat. 334,430, 1903; this J., 1904, 69) that terpineol i a solvent for unfused copals. The suitability of terpinec for playing the part of S in a copal varnish is, moreover increased by its high boiling point (218° C.). For if in varnish consisting of C, S, and I, S be more volatile than there is a tendency during the drying of the varnish fo the ratio $\frac{s}{s+i}$ to fall below the limit *k*, in which cas precipitation of C, and consequent turbidity of the film would occur. Solutions of copal in terpineol may therefor be mixed with alcohol, oil of turpentine, &c., in any propor tion below the solvent limit, and the resulting films retain portion of the terpineol, which confers on them gre flexibility and durability. As a general rule the gum-resi exhibit the character of acids or mixtures of acids, wit only traces of saponifiable esters. The optical rotatic ranges from − 83° 8′ to + 82° 24′.—M. J. S.

United States Patent.

Shellac; Substitute for ——. C. Ludwig, Schönber U.S. Pat. 760,541, May 24, 1904.

Fifty-six parts of "cheap resin," soluble in alcohol, a added to a boiling solution of 9 parts of potassiu hydroxide in 140 parts of water, 1 to 1·5 parts of ol acid are added, the mixture is diluted, and dilute sulphu acid added; the precipitate produced is suitable for use a substitute for shellac.—T. F. B.

(*C.*)—INDIA-RUBBER, &c.

English Patent.

India Rubber Substitutes; Manufacture of ——. T Velvril Co., Ltd., London, and J. S. Howkins, Thorn Heath. Eng. Pat. 13,306, June 13, 1903. (See a Eng. Pat. 21,995 of 1895.)

Nitrated castor or other oils are heated for, say, hours, to a temperature of 130° C., the resulting prod being a tough elastic body, which may be used a substitute for rubber.

The same effect may be produced by adding to nitrated oil, 2 per cent. of lead peroxide and heating 100° C. with constant stirring (compare this J., 1899, 9
—J. K. I

XIV.—TANNING; LEATHER, GLUE, SIZE.

Kangaroo Leather; Manufacture of ——. B. Kohnstein. Der Gerber, 1904, **30**, 97—99, 111—112, 145.

Kangaroo hides are tanned:—(1) with pure gambier, (2) as "dongola" or chrome for shoes, and (3) as "splits" for enamelling, the "flesh splits" with oak and the "grain splits" with chrome.

Preparatory Treatment.—One pack (500 kilos.) of dried skins are placed in an old "soak," handled the same day, transferred to fresh water (containing sodium sulphide, if necessary) the next day, stocked on the third, and then put in water containing salt to further soften them. Instead of the stocks a travelling millstone is often employed, as by its use alone the workmen can soften down the hard places n the hides. They are washed twice in fresh water and ass to an old lime-liquor, being lifted the following day.)n the third they enter a stronger lime-liquor, "sharpened" y the addition of lime (36 kilos.) and realgar (2 kilos.), are ilted the next day, the pit is strengthened up on the fifth ay, and on the sixth the skins are washed off in lukewarm ater, unhaired, and fleshed; again washed, smoothed on e grain with a stone sleeker, and then passed to a bran rench employed in the usual manner.

Gambier Tannage.—The skins are coloured by paddling an old gambier liquor (22° Barkometer) for about 30 inutes, and then suspended for 12 days in liquor of which e strength is gradually raised to 12°. They are then essed and sorted. Fuller skins are obtained by adding lt to the first weak liquors, chiefly to suppress fermentation and decomposition of the tan, drumming or paddling r 2 days in 12° liquor, and laying away for 16 days in sh 34° liquor. The tanned skins are well washed, set t by the machine, oiled on the grain, and dried at 70°— ° F., in a dark room if good colour is desired.

Dongola Tannage.—The lightly tanned skins may be anned with such a mixture as (for 200 middle-weight ins): alum (2 kilos.), salt ($4\frac{1}{2}$ kilos.), flour (12 kilos.), g-yolks (10 doz.), olive oil ($\frac{1}{2}$ litre), and water (24 es), made into an emulsion, after which they are finished sumac. A simpler process is to dissolve salt and alum the gambier liquor (12°—24° Bk.), and add flour and -yolk to the fat-liquor. Also the skins may be first kled in salt and sulphuric acid, or salt and aluminium phate for 24 hours, neutralised, washed in brine of 25°, l then tanned with gambier liquor containing flour, -yolk, and some neatsfoot oil.

)ther Vegetable Tannages.—Canaigre extract followed l palmetto extract has been employed successfully on root- hier in the suspenders, with quebracho extract, or q bracho with hemlock, in the stronger liquors, and final t tment in sumac.

hrome Tannage.—A basic chromium liquor gradually i eased from 4° to 40° Bk., followed by drumming in s nger liquor, is sometimes used, but the two-bath process is ore usual. Chromed skins, when carefully neutralised, n be further tanned with mangrove (R. Catechu brand) o almetto extract.

inishing Processes.—Skins tanned with gambier are d ped down and washed over with dilute lactic acid (4 litres of per cent. acid in 200 litres of water per 80 kilos. of dry le er). They are then given a sumac bath. Fuller and so r leather is obtained if the skins are treated in this or after lying for some time, than if treated with sumac im ediately after the gambier tannage. After again lying co ed up with a cloth, they are fat-liquored with soap and su onated oil, or neutral soap and best French moëllon ($\frac{1}{2}$ lo. and 5 litres respectively per 80 kilos. leather), set ou n both sides, and hung up to dry. They may be fat-liq ed a second time, washed with lactic acid, and, before dy g, treated first with warm sumac and then tartar em c. They are dyed in a drum or paddle, set out, oiled on e grain with light seal oil, dried on frames, and glazed wit soap and casein finish.

cked Skins receive a further quebracho ($\frac{1}{3}$) and he ck ($\frac{2}{3}$) bath of 35° Bk. before being fat-liquored. Th llowing fat liquors are arranged each for 80 kilos. of dry ather.

(1) Water (100 litres), sod-oil (8 litres), hard soap (500 grms.), borax (300 grms.), calcined sodium carbonate (100 grms.).

(2) Brown cod-oil (4 litres), potassium carbonate (400 grms.), water (59 litres).

(3) Olive-oil (4 litres), cod-oil (4 litres), moëllon (2 litres), hard soap ($\frac{1}{2}$ kilo.), borax (300 grms.), water (100 litres).

(4) Egg-yolks (3 doz.), olive-oil (1 litre), soap ($\frac{1}{2}$ kilo.), water (16 litres).

(5) Neatsfoot oil (6 litres), sod oil (2 litres), borax (300 grms.), water (59 litres).

(6) Egg yolk (4 litres), cod-oil (6 litres), borax (300 grms.), water (100 litres).

After fat-liquoring, the leather is piled and allowed to lie for at least 14 days, then damped down again and treated with turmeric (5 kilos.) and sumac (5 kilos.) in water (100 litres per 140 kilos. of leather). This is drummed in at 36° for 30 minutes. The skins are washed off and then blacked. A first dressing is applied, made from potassium bichromate ($1\frac{1}{4}$ kilos.), ammonium chloride ($2\frac{1}{2}$ kilos.), and borax ($2\frac{1}{2}$ kilos.) in water (100 litres), to avoid the use of urine. Then follow two coats of the following: logwood extract (60 kilos.), calcined sodium carbonate (10 kilos.), fustic extract (10 kilos.) in water (1,000 litres), and a final coat of "copperas" (ferrous sulphate) solution or copperas with "blue vitriol" (copper sulphate). The blacked skins are then washed on the grain with cold water, set out on the machine, and oiled with neatsfoot oil. Mould is liable to form on damp skins left on the horse, but may be avoided by a weak coat of phenol. When dry the skins are damped down, smoothed on the grain, and glazed, usually with a final coat of tragacanth and mineral oil.—R. L. J.

Tanning Materials; Extraction of Vegetable ——. L. Manstetten. Collegium, 1904, 130—133, 145—151.

The author discusses the principles of the various methods used by tanners for extracting barks and other solid materials, and advocates systems that involve quiet maceration at carefully regulated temperatures (rather than violent agitation at higher temperatures), such, for instance, as the slow displacement, by steam pressure from above, of the warm liquor in the leaches.—R. L. J.

Palmetto Extract; Manufacture of ——. B. Kohnstein. Der Gerber, 1904, **30**, 112—113.

The white or scarlet-red roots of the feather-palm (*Sabal serrulata*), growing freely in Georgia and Florida, are collected and crushed between rolls. Usually old sugar-cane presses are employed. The roots contain about 40 per cent. of water, and the astringent juice is caught in vessels and concentrated in a vacuum pan to about 30° B. This method is preferable to extraction with water, because only foul swamp water, containing much salt in solution, is available.—R. L. J.

English Patents.

Tan and like Fuel; Furnaces for Burning ——. D. M. Myers. Eng. Pat. 5015, March 1, 1904. II., page 653.

Waterproofing of Materials, such as Tissues, Fabrics, Paper, Leather, and Cords. S. Serkowski. Eng. Pat. 8433, April 12, 1904. V., page 659.

United States Patent.

Bleaching Leather; Apparatus for ——. E. C. Amidon, Corry. U.S. Pat. 759,844, May 17, 1904.

The skins are attached to an endless carrier, which automatically immerses them in the bleaching vats for any required time, and then lifts and removes them.—R. L. J.

French Patent.

Skins and other Materials; Degreasing of —— by Carbon Tetrachloride or other Volatile Solvent. C. Lallemand. Fr. Pat. 338,495, March 28, 1903.

A self-contained and hermetically closed apparatus in which all the operations of extracting grease, drying the materials extracted, and recovering the solvent, are claimed to be conducted without loss of solvent or exposure of the workmen to its fumes.—R. L. J.

XV.—MANURES, Etc.

Rothamsted Experiments. Plans and Summary Tables arranged for Reference in the Fields, 1904, pp. 22. Lawes Agricultural Trust.

The pamphlet contains, in addition to the usual summaries relating to the continuous experiments on four-course rotation (57th year), on mangels (29th year), on grass land (49th year), on wheat (61st year), and on barley (53rd year), results obtained with unmanured wheat, grown for five years after various leguminous crops, and with unmanured barley, grown for two years on the old potato plots. The institution of new experiments on the cropping and disease-resisting powers of nine varieties of potatoes, and on mangels and swedes, in which the manurial effect of calcium cyanamide will be compared with sulphate of ammonia, are also recorded. An interesting illustration of the after-effects of manures is afforded by the experiments on unmanured barley on the potato plots, which had been variously manured for 26 years. Large yields of barley were obtained the first year (1902), and in 1903 the yield, although much less on all the plots than in 1902, was about twice as high on the plots to which ammonium salts or nitrate of soda had been applied for the last time in 1901, as on the continuously unmanured plot; whilst on the plots which had been furnished with a complete mineral fertiliser as well as with nitrogen, the yield was nearly three times as high. (See also this J., 1890, 871; 1891, 938.)—N. H. J. M.

Nitrous Acid; Formation of ——, and Nitrification as a Chemical Process in Culture Soils. F. Sestini. Landw. Vers.-Stat., 1904, **60**, 103—112. Chem. Centr., 1904, **1**, 1499—1500.

According to Bonnema (Chem.-Zeit., **27**, 148) ferric hydroxide is capable of oxidising free nitrogen to nitrogen trioxide. The author finds, however, that it is not the nitrogen of the air, but the ammonia present therein, which is oxidised by ferric hydroxide and converted into nitrogen trioxide. There is thus no increase of assimilable nitrogen, but only a change of form of the latter. From further experiments the author concludes that the whole of the nitrous acid present in soils is not produced by *Bac. nitrosomonas*, but that a part is produced in a purely chemical manner.—A. S.

French Patents.

Fish Oil and Fish Guano; Process and Apparatus for the Manufacture of ——. H. J. A. Pompe van Meerdervoort. Fr. Pat. 338,472, Nov. 18, 1903. XII., page 670.

Molasses and similar Substances [Fertilisers]; Process for Drying and Preserving ——. L. L. Honoré. Fr. Pat. 338,517, Dec. 30, 1903. Next col.

XVI.—SUGAR, STARCH, GUM, Etc.

Saturation; Double and Triple ——. K. Andrlik and V. Stanek. Z. Zuckerind. Böhmen, 1904, **28**, 381—404.

Neither in the laboratory nor in the works can any marked chemical difference be detected in the purification produced by double as compared with triple saturation, although in the latter case sulphurous acid gave a greater purification than carbonic acid in organic substances, but with an increase in inorganic constituents. In practice the view prevails that triple saturation is of great value in giving the best results and yielding fine products.—L. J. de W.

Molasses Waste Lyes; Preparation of Betaïne from——. K. Andrlik. Z. Zuckerind. Böhmen, 1904, **28**, 404—406.

Molasses lye at 70·4 Bg. from the strontium desaccharification process is used. The lye is gently boiled until the temperature rises to 144° C., when syrupy phosphor acid is added in quantity sufficient to form potassiu dihydrogen phosphate with the potash present. Aft cooling, the filtrate is concentrated until it boils at 152°– 153° C., cooled to 80° C., and 96 per cent. alcohol adde The mixture separates into a syrupy portion containing th amino-acids and an alcoholic solution rich in betaïne. (adding syrupy phosphoric acid to the warm alcohol solution, betaïne phosphate separates in distinct crysta When cold, the precipitate is washed with alcohol, d composed with milk of lime, and the remaining lin removed with carbon dioxide. The filtrate is concentrat on the water-bath and the betaïne obtained recrystallis from alcohol. Betaïne phosphate is soluble in water a easily crystallises in anhydrous granular crystals whi melt at 199°—200° C. to a clear liquid. At 234° C. deco position occurs with frothing and escape of gases whi smell of amines. The yield of betaïne is about 12 per ce on the dry solids of the molasses lye.—L. J. de W.

West Indian Starches. W. R. Buttenshaw. West In Bull., 1904, **5**, 1—10.

The author gives the results of the microscopic examinat of a large number of starches prepared from West Ind plants. A large majority of the specimens examined w "root" starches. Attention is drawn to the unsatisfact nature of the artificial methods of classification that are use at the present time. Several of the starches exam would probably be suitable for laundry purposes, whilst meal from some of the starch-yielding plants, *e.g.*, from cho-cho root and yam bean, forms an easily digested fo A short bibliography is appended to the paper.—A. S.

Sugars; Microchemical Detection of —— by Phenyl-hydrazine Acetate. E. Senft. XXIII., page 685.

Sugar Determination; Volumetric ——. L. Rosenthaler. XXIII., page 686.

United States Patent.

Organic Acid from Beetroot Molasses, and Process making same. H. Schrader, Honniegen. U.S. 761,412, May 31, 1904.

See Eng. Pat. 20,851 of 1902; this J., 1903, 920.—T. F

French Patents.

Evaporating Apparatus for Concentrating Syrups, Brine, &c. F. Meyer. Fr. Pat. 338,136, Nov. 19, 19

See Eng. Pat. 19,962 of 1903; this J., 1903, 1301.—T. I

Molasses and Similar Substances [Fertilisers]; Pro for Drying and Preserving ——. L. L. Honoré. Pat. 338,517, Dec. 30, 1903.

Molasses or other similar residues from the manufa of sugar are reduced to a state in which they contain a small proportion of water. They are then made alk by the addition of sodium carbonate and boiled for 10 minutes. A considerable deposit of nitrogenous ma then separates out, perfectly free from hygroscopic mu ginous matters. This deposit is dried and utilised fertiliser, whilst the liquid residue is mixed wi pulverulent material and the mixture dried, the re mass being also used for fertilising purposes.—J. F. B

XVII.—BREWING, WINES, SPIRITS, E

Culture Yeast; Vitality of certain Races [Frohberg, Race II. and Race XII.] of —— in the Moist St Low Temperatures, and the Influence of ca Organisms on these Yeasts. W. Henneberg. Wo Brau., 1904, **21**, 260—263, 288—290, 299—301, an —312.

The duration of vitality is shortest in the case of yeast, then follow Race II., Race XII., and Frohberg Low temperatures are especially favourable to prol vitality; at 7° C. in the case of Frohberg yeast one-f the cells were alive after 120 days, although the conc vere such that no reproduction had taken place during the eriod of storage. Some individual cells [reserve cells] xceptionally rich in fat and albumin, in the case of rohberg yeast, are endowed with a much longer life than he bulk of the yeast cells. The youngest, immature cells lways die first. The period of vitality depends also on the nanner of cultivation; prolonged contact with the fermented vort is unfavourable. In vessels containing large quantiies of yeast the cells generally die earlier than in those ontaining smaller bulks, owing to the accumulation of netabolic products. For the same reason the cells in the ottom layers die earlier than those near the surface; reservation in cotton wool is favourable. The gradual lrying of the yeast exerts at first a favourable influence, ut when the moisture falls below a certain point all the ells die. The addition of a large quantity of water is enerally very unfavourable; it intensifies the metabolism nd restricts respiration; in presence of water a growth of ew cells occurs at the surface. In closed vessels the yeast lies earlier than in open vessels, owing to the pressure of he carbon dioxide produced. In the early stages of storage he cells do not multiply, but later the products of autoligestion afford nourishment for a surface growth. The roduction of spores during storage was observed only in he case of Race II. Infection with lactic acid bacteria ppears to be without influence on the vitality of the yeast, ut *Oidium lactis* and *Penicillium glaucum* kill the yeast ells; the latter organism brings about the digestion of the ll membrane of the yeast. Infection with mould-yeasts lso reduces the period of vitality.—J. F. B.

Pressed Yeasts, with Squarrose Budding Chains.
P. Lindner. Z. Spiritusind., 1904, **27**, 225—226.

s a result of the observations recorded in a previous paper his J., 1904, 497) the author has put forward a proposal at all pressed-yeast factories should agree to use only ch yeasts as form squarrose budding chains when cultited for 24 hours in a hanging droplet (*loc. cit.*), in order facilitate the diagnosis of adulteration with bottommentation beer yeast. These observations have now en extended to several samples of pressed yeast manufacred in Vienna, with the result that the general law has en further confirmed. The introduction of a general stom such as that suggested would enable both the nufacturer and the analyst to pronounce on the purity l type of the yeast in the simplest manner. Figures are en illustrating more clearly the nature of the differences erved in the form of the budding chains.—J. F. B.

een Malt; Distribution of the Diastatic Enzyme in ——.
R. F. von Teichek. Chem. Ind., 1904, **27**, 270—275.

EEN malt corns, germinated until the length of the ospire reached three-quarters of that of the corn, were ected, and the component parts were dried over huric acid. From about 4,500 corns there were ined in the dry state, 169·5 grms. of endospermi and s, 11·02 grms. of acrospires and scutella, 10·95 grms. ootlets. Each product was finely ground with sand and ied with absolute alcohol; the enzymes were then acted by treatment with concentrated glycerin. The ed extracts were precipitated by alcohol, and the precates were washed with alcohol and ether. The dried arations were gelatinised but not really dissolved by r; they gave the characteristic enzyme reaction with acum tincture and hydrogen peroxide. Analysis having n that the three preparations (calculated ash-free) had ically the same composition, the relative yields were n as representing the relative distribution of the diastase e different organs. The yields on the dry substance :—2·83 per cent. from the endosperms, 5·57 per cent. the acrospires, and scutella, and 4·25 per cent. from ootlets. Calculated in terms of the total quantity of ise present in the whole corns, the distribution was:— 80 4 per cent. in the endosperm, 10·93 per cent. in the pire and scutellum, and 8·33 per cent. in the rootlet. numbers differ from those obtained by Brown and s, from the activity of aqueous extracts, chiefly in t of the values found for the rootlets. Those authors ed mere traces of diastase in the rootlets, owing to the fact that they based their conclusions solely on saccharifying powers. Mashing experiments showed that the components of the diastatic enzyme are unevenly distributed in the different parts. 50 c.c. of a 2 per cent. starch paste were treated at 25° C. with 0·05 grm. of the different diastatic preparations, and the temperature was continuously raised in 30 minutes to 55° C.

Diastase from the Endosperms.—Liquefaction was apparently complete after 20 minutes, and saccharification was complete after 30 minutes.

Diastase from the Acrospires and Scutella.—Liquefaction was complete after 14 minutes and saccharification after 35 minutes.

Diastase from Rootlets.—Liquefaction was complete in 5 minutes, but the iodine test showed the presence of starch after four hours. The filtered mash had absolutely no reducing action on boiling Fehling's solution. This preparation, moreover, completely liquefied a thick starch paste in a few minutes.

The above observations show conclusively that the starch-liquefying and the saccharifying powers of malt diastase are due to the presence of two distinct enzymes. The liquefying enzyme occurs in the rootlets in considerable quantities, and it is there accompanied by such small quantities of the saccharifying enzyme, that the latter is totally destroyed during the operations necessary for the isolation of the diastase.—J. F. B.

Green Malt; Starch Hydrolysing Enzymes in ——.
A. Pollak. Woch. f. Brau., 1904, **21**, 317—319.

Average samples of germinating barley were taken daily throughout the period of malting and the acidity, starch-liquefying power and saccharifying power of the samples were determined. The results are illustrated by means of curves, showing the values from day to day.

Sample 1 was a pale malt of Pilsen-type, prepared with the ordinary water-steep, prolonged cool growth and careful kilning. The acidity, saccharifying and liquefying powers increased steadily until the time of withering, at which stage the liquefying power rose, whilst the acidity and saccharifying power remained constant; towards the end of the kilning all three factors fell rapidly. The starch-liquefying power always remained below the saccharifying power.

Sample 2 was a Pilsen malt steeped with alternate aeration and immersion; it was treated on the kiln with sulphurous acid. All the factors rose more rapidly under the stimulus of aeration; the starch-liquefying power was, throughout, higher than the saccharifying power and increased all the time. This sample was grown at a higher temperature, and was allowed to "felt" earlier than Sample 1. During the "felting" the acidity remained constant, the saccharifying power decreased somewhat, and the liquefying power continued to rise. The sulphuring on the kiln, whilst the moisture was still considerable, caused a sudden rise in all three factors, followed by a considerable decrease towards the end of the kilning.

Sample 3 was a Bavarian malt, treated in the same way as Sample 2, and it showed the same tendencies but in a more exaggerated degree. The Bavarian system of kilning, accompanied by sulphuring, caused an initial increase of the saccharifying power and acidity and a steady decrease of the liquefying power, followed by considerable decreases of both kinds of diastatic power at the higher temperatures of kilning. The author concludes that the liquefying diastase is the first product of the metabolism; from the third to the sixth day the saccharifying diastase is produced with greater intensity, partly at the expense of the liquefying enzyme. During "felting" the production of saccharifying diastase slackens and enzyme formation only proceeds as far as the first of the two diastases, with perhaps even reversion from the saccharifying to the liquefying modification.
—J. F. B.

Barley and Malt; Nitrogen Content of ——. E. Prior.
Allgem. Zeits. f. Bierbrau., 1904, **32**, 231—235.

Referring to the proposals of Haase to utilise the nitrogen content of barley as a basis for estimating its malting value, the author states that, in his experience, the beers prepared from well modified malts rich in nitrogen, are better and more stable than those from imperfectly modified malts low in that constituent. He therefore concludes that a greater influence is exerted by the method of preparing the malt than by its nitrogen content. It would also appear that the character of the nitrogenous compounds affects the malting quality, since whilst Delbrück has found nitrogenous barleys exhibit a tendency to heat on the malting floor, the author has known others rich in nitrogen that gave rise to no objection on this score. The author also points out that the *circa* 10 per cent. limit of nitrogen was mentioned by Lintner in 1880, and that excellent malt is furnished by thin-skinned Austrian barleys containing more than the above percentage, from which the conclusion is drawn that the proposed standard is unsuitable for general application.—C. S.

Fermentation; Action of Phosphorescence on ——. A. Perret. La Bière, 1904, **12**, 33—34.

The influence of phosphorescence on fermentation has been investigated by Richet, the phosphorescent employed being calcium sulphide, and the organism the lactic ferment, owing to the ease with which the degree of fermentation can be determined. The calcium sulphide was contained in small flasks filled with cottonwool and immersed in the milk, forming the culture medium. Determinations of the acidity of the milk were made with nine samples, and showed that while, in comparison with similarly fermented check samples, the acidity of the milk increased more rapidly at the outset it afterwards declined (at the end of six to eight hours). The influence of phosphorescence is similar to that of any other cause threatening the vitality of an organism, the first result being to stimulate activity, which is afterwards crippled when the exposure is prolonged. The effects are intensified by an increased temperature. Richet admits that the phenomenon may be due to the action of X-rays, the actual luminosity of the calcium sulphide being too small to affect the organisms. The author considers that the fermentation industries may derive benefit from radio-active bodies by a suitable modification of methods.—C. S.

Fusel Oil formed by the Alcoholic Fermentation of Acorns; Composition of the ——. T. Rudakow and A. Alexandrow. J. russ. phys.-chem. Ges., 1904, **36**, 207—219. Chem. Centr., 1904, **1**, 1181.

The fusel oil from acorns is similar, qualitatively, to that from potatoes, rye, and maize. It contains about 2·7 per cent. of normal propyl acohol, 9·8 per cent. of isobutyl alcohol, and 87·4 per cent. of fermentation amyl alcohol; about one-quarter of the latter consists of optically active amyl alcohol. The fusel oil also contains small quantities of hexyl alcohol, acetaldehyde, esters, and furfural.—A. S.

Beer; Influence of Volume of Mashing Liquor on the Quality of ——. E. Jalowetz. Allgem. Zeits. Bierbrau., 1904, **32**, 7—10.

The author concludes that the volume of the mashing liquor has very little influence on the quantity and ratio of maltose and dextrin in the resulting wort, but that a slight increase in the dextrin content is observed as the concentration of the wort is diminished. For high-class beer it is undesirable to start with a wort of very high initial gravity, and the best relation between the main wort and the spargings is attained when the concentration of the first runnings is 1·3—1·4 times that of the final wort. With these proportions a good yield of extract can be obtained without so far washing out the grains as to bring undesirable constituents into the beer.—C. S.

Beer; Conditioning of —— by Bunging with Yeast. P. Lindner. Woch. f. Brau., 1904, **21**, 305—306.

The practice of conditioning beer by bunging it down with an addition of fresh yeast instead of "Kräusen" has met with considerable success. This treatment comes into greater prominence in view of the recent modifications introduced in the mashing process with a view of restricting the fermentability of the worts. In such worts the yeast settles out earlier than in those prepared by the old method and ceases to work as soon as the readily fermentable bodies have been consumed. The closer the approach t the final degree of attenuation which is obtained in th primary fermentation, the more difficult it becomes to bring about sufficient conditioning in the after-fermentation i cask. The addition of "Kräusen" is a ready means o surmounting this difficulty, but it has the defect of intro ducing raw wort to the beer, thereby not improving th flavour, and it sets up a violent agitation during its action By bunging with yeast instead of "Kräusen," sufficien carbon dioxide is produced by a gentle secondary fermenta tion, the head-retaining properties of the beer are increase and the liability to become turbid is reduced. The pro portion of pasty yeast added may vary from 1·5 litres p 50 hectolitres of beer to five times that amount. Th yeast should be well nourished and should be taken from primary fermentation which has not been too prolonged; should not be weakened by excessive washing. In th condition the yeast is not likely to withdraw extracti matter from the beer for its own nourishment, since n reproduction takes place at low temperatures. The carbo dioxide, which exerts such a favourable influence upon t stability and condition of the beer, is probably large produced by the fermentation of the glycogen stored up the yeast. The improvement in the permanence of t "head" is doubtless due to the separation of nitrogeno matters from the yeast which are favourable to th property. Finally the glutinous, flocculent condition fresh yeast exerts a powerful clarifying effect on the be treated with it.—J. F. B.

Beer; "Head" Retention in ——. W. Rössel. Mitt. V Stud. Lehr.- u. Versuchs-Anst. München. Allgem. Zei Bierbrau., 1904, **32**, 145—148.

Apart from the influence of the chemical constituents the beer, the retention of head depends on the method maturing and the cellar management. For example, li beers must not be over attenuated or left too long conditioning, or they will produce a frothy head wh quickly disappears, leaving the beer flat and thin flavour This is particularly the case in the warmer season of year. The defect of insufficient condition may be coun acted to some extent by the addition of fermenting wor the storage cask.—C. S.

Proteids and "Head" Retention in Beer. P. Schüle Gambrinus, 1904, **31** (Special No.), 22—23.

The peptones have but a very low "head"-forming po and being readily precipitable by hop tannin can be left of consideration. The influence of the amides in wo also small, as might be expected from the demonstr fact that the frothing power of the proteids increases the complexity of the molecule, and *vice versâ.* actual nitrogenous "head"-forming constituents are unpeptonised proteids which are precipitable by tannic a and therefore to ensure "head" retention in beer necessary to keep these proteids in solution. The suc of these attempts depends not only on the quantity of added, but also on the condition of the hops, containing modified tannic acid being calculated to an unfavourable influence on "head" retention. H gas pressure (carbon dioxide) produces cloudiness precipitating the proteids, and diminishes the "head." —C.

Beer recovered by Pressing Yeast. Thausing. Allg Zeits. Bierbrau., 1904, **32**, 17.

The beer recovered by passing barm through the press has a much smaller percentage of extract (*e.g.,* per cent., falling after 6 hours to 3·23 per cent.), that racked off into and matured in cask (5·9 per c In another case the ripe beer contained 4·16 per ce extract, but the barm beer only 2·94 per cent. Anal results are obtained in the beer from the cask "foots one case 2·9 per cent. of extract as compared with 3 cent. in the rest of the beer.—C. S.

Distillery Process; The New Somló ——. A. Mar Z. Spiritusind., 1904, **27**, 238.

The process first introduced by Somló consists in ste the green malt employed in the distillery by immersi solution of formaldehyde. The formaldehyde kills all bacteria present on the malt without impairing the diastatic power, which, in fact, is rather increased by the treatment. The formaldehyde solution is recovered for further use and the malt is washed with water. It has since been found that the formaldehyde treatment may be dispensed with and that efficient sterilisation of the malt can be obtained by steeping it for some time in water at a temperature of about 55° C. and then washing with cold water. Most of he bacteria are thus loosened from the green malt corns and washed away, whilst the adherent spores which remain are caused to germinate and exist in the subsequent mashing process only in the form of vegetative cells which are readily killed at the mashing temperature. The danger of subsequent infection of the malt during milling is voided by using a special centrifugal mill for kneading he green malt. This machine is sealed up and sterilised by steam under pressure before use. The fermentations btained by this process are exceptionally pure and are uperior to those in which hydrofluoric acid is employed, he yields of alcohol are such as have hitherto been btained only by the "amylo" process. Somló's process an be used either with maize or potato mashes, and the nal acidities are remarkably low (*e.g.*, 0·35).—J. F. B.

Instability and Activity; Connection between —— in Enzymes. O. Loew. XXIV., page 687.

Grain and Flour; Catalytic Properties of ——. N. Wender and D. Lewin. Next col.

Disinfectants; Testing the Action of Soluble —— on Micro-organisms. H. Zikes. XVIII. C., page 676.

English Patents.

ops; Apparatus and Process for Infusing and Extracting ——. A. E. Hewer, Sunderland. Eng. Pat. 21,580, Oct. 7, 1903.

ie apparatus consists of a cylinder of suitable material ntaining either a perforated plate on which the hops are aced, or perforated pipes or spargers through which the ort or beer is pumped; the cylinder is fitted also with a ovable cover and an overflow pipe for the liquor after ssing over the hops. The wort or beer, during or er fermentation, is pumped continuously or intermittently ough the hops, which are subsequently utilised as opper hops."—F. H. P.

ines, Effervescent; Process and Apparatus for the Manufacture of ——. E. W. Kuhn, Paris. Eng. Pat. 742, March 19, 1904. Under Internat. Conv., April 21, 903.

Fr. Pat. 331,382 of 1903: this J., 1903, 1144—T. F. B.

uid Refuse Discharged from Distilleries, Breweries, Paper Works, and other Places; Purification or Filtraion of ——. T. T. Street and H. Street. Eng. Pat. 461, April 13, 1904. XVIII. B., page 676.

United States Patents.

n; Apparatus for Extracting ——. W. A. Lawrence. ew York. Assignor to Continental Rubber Co., Jersey ity. U.S. Pat. 760,459, May 24, 1904.

apparatus consists of one part ("member") having curved exterior friction-surface and a hollow part ember") provided with a curved interior friction-ace, which operates in yielding and rubbing contact the exterior friction-surface, one of the surfaces being oth, and an opening at the apex of the interior friction-ace through the hollow member. The form of apparatus vn in the specification, consists of an inverted funnel, ugh the stem of which the liquid enters, and which ates upon a cone situated inside the funnel, the two g. adjustable relatively to each other, and having a d around the lower edges.—J. F. B.

Alcohol; Process of Making ——. S. J. Vance, Mountaingrove. U.S. Pat. 760,939, May 24, 1904.

Reduced amylaceous material, such as grain, is mixed with water and ammonia, the mash is brought to the boiling point, and the temperature is then lowered to 150° F., malt is added, and when conversion is complete, the mash is fermented and distilled.—J. F. B.

Concentrating Wine, &c.; Process of ——. E. Monti, Turin. U.S. Pat. 761,287, May 31, 1904.

See Fr. Pat. 324,474 of 1902; this J., 1903, 567.—T. F. B.

French Patent.

Wines; Process and Apparatus for Making Sparkling ——. E. W. Kuhn. Addition, dated Dec. 12, 1903, to Fr. Pat. 331,382, April 21, 1903. (See this J., 1903, 1144.)

The application of the apparatus, described in the main specification, is extended to the transference of the sparkling wine to casks.—T. H. P.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Grain and Flour; Catalytic Properties of ——. N. Wender and D. Lewin. Oesterr. Chem.-Zeit., 1904, **7**, 173—175. Chem. Centr., 1904, **1**, 1530.

In quiescent grain several enzymes have been detected, *e.g.*, diastases, glucases, and oxydases. Germination depends upon enzymic processes, many of the most important enzymes being formed during germination and increasing as the process goes on. The authors have, however, proved by measuring the amount of oxygen set free from hydrogen peroxide, that the enzymes possessing catalytic properties do not increase during germination. By heating to a suitable temperature the diastatic properties of grain may be destroyed, whilst the catalytic properties remain unaffected. Solutions of mercuric chloride (0·1 per cent.), silver nitrate (0·1 per cent.), caustic potash (0·2 per cent.), acetic acid (1 per cent.), and hydrochloric acid (1 per cent.), destroy the catalytic properties; 96 per cent. alcohol and ether are without influence. The ground grain has a powerful action on hydrogen peroxide. Bran possesses a considerably greater catalytic power than flour from the same kind of grain, and flour from the outer portions of the grain is distinctly richer in catalases than flour from the inner portions. A flour shows less catalytic action the finer it is, and the authors have based on this fact a simple method for distinguishing between commercial flours.—A. S.

Starch in Stale Bread; State of ——. E. Roux. Comptes rend., 1904, **134**, 1356—1358.

Although wheat starch, like potato starch, is partially converted into amylocellulose on standing for some days at 10° C., the formation of amylocellulose in bread after standing could not be detected. The amylocellulose was estimated by carrying out comparative saccharifications on the sample before and after heating in a sealed tube to 150° C.—T. F. B.

Butter; Keeping Quality of ——. I. Canned Butter. L. A. Rogers. U.S. Dept. of Agric., Bureau of Animal Ind., Bull. No. 57.

From the results of a large number of experiments, chemical and bacteriological, the author concludes that the changes which first occur in canned butter, producing more or less disagreeable flavours, are due to the formation of free acid by lipolytic enzymes. The enzymes may be produced in the milk, or secreted with the milk in the udder of the cow, and carried over into the butter, or may be produced in the butter itself through the activity of certain micro-organisms. The predominating species of yeast in the samples of butter examined was a kind of torula which was capable of forming a lipolytic enzyme. In the preparation of the butter the author recommends that the milk or cream be pasteurised at a temperature sufficiently high to destroy the enzymes, and that the "starter" be prepared and maintained in such a manner that danger of contamination by yeasts will be minimised.—A. S.

English Patent.

Blood, Desiccated; Apparatus for Preparation of ——. Union de la Boucherie en gros de Paris. Aubervilliers. Eng. Pat. 10,615, May 9, 1903. Under Internat. Conv., Jan. 30, 1903.

The blood is (1) lifted by suction from a collecting tank into a large rotating steam-heated drum, (2) coagulated under pressure or *in vacuo*; the product is then (3) squeezed under a press to remove moisture, and (4) passed by a lift and hopper to a chamber where it is dried *in vacuo*.
—R. L. J.

French Patents.

Flour from Wheat and other Grain; Process and Apparatus for Producing ——. E. F. Clark. Fr. Pat. 338,680, Oct. 20, 1903.

The mill consists of two parallel cylindrical rolls provided with spiral grooves cut in the same direction. When the rolls are rotated in opposite directions, the summits of the spirals approach each other at right angles and form a series of contacts which are only points. One roll is rotated at a higher speed than the other. When the grooves are comparatively far apart, the bran and the germs are removed with the slightest possible damage, and very little flour is mixed with the grist. The grist is then ground to fine flour in a similar mill provided with very fine grooves.
—J. F. B.

Phospho-organic Compound contained in most Vegetable Foodstuffs; Process for Preparing the Assimilable ——. S. Posternak. First addition, dated Oct. 24, 1903, to Fr. Pat. 318,311, Feb. 2, 1902.

See Eng. Pat. 24,692 of 1903; this J., 1904, 126.—T. F. B.

Whey; Process for Treating ——, to obtain a new Food Product. A. S. Ramage. Fr. Pat. 338,448, Dec. 5, 1903. Under Internat. Conv., May 27, 1903.

See U.S. Pat. 735,148 of 1903; this J., 1903, 1010.—T. F. B.

Sterilisation [of Foods, &c.] at a Low Temperature and under Reduced Pressure. L. A. Bruzeau. Fr. Pat. 338,573, Dec. 31, 1903.

The foods, such as milk, fruits, peas, fish and the like are heated in an autoclave to a temperature of 50° C. The pressure in the autoclave is reduced as low as possible by means of a pump, a condenser being placed between the latter and the autoclave. Various airtight devices for closing sterilised receptacles are also described.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

English Patents.

Liquid Refuse Discharged from Distilleries, Breweries, Paper Works, and other Places; Purification or Filtration of ——. T. T. Street and H. Street, both of Dunfermline. Eng. Pat. 8461, April 13, 1904.

The effluent is conducted on to a series of filter beds arranged on a declivity. The first beds contain coke, the second set coal, and the last sets gravel or sand. Perforated metal sheets cover the tops of the beds, which are also provided with distributing tip troughs and drains. After leaving the last bed the purified effluent is collected in a testing pond, from which it is run off by a pipe.—W. P. S.

Sewage or other Liquids; Purification of ——. W. O. Travis, Hampton, and L. Ault, London. Eng. Pat. 11,073, May 15, 1903.

The sewage is passed through a closed or open tank at such a speed that the solid matters, together with a small portion of liquid, collect in a space at the bottom of the tank, where prolonged bacterial action takes place. The effluents from the sedimentary space and the liquefying space then pass over suitable weirs and are subjected to upward anaërobic filtration. Where a closed tank is employed, the gases produced are exhausted by mechanical means. The sludge is removed from the tank when necessary by a pipe or pump.—W. P. S.

United States Patents.

Liquid [Sewage] Tanks; Apparatus for Emptying ——. M. J. Adams, Newcastle, Assignor to S. H. Adams, Harrogate. U.S. Pat. 760,770, May 24, 1904.

See Eng. Pat. 22,213 of 1902; this J., 1903, 508.—T. F. B.

Purifying Water; [Electrical] Method of ——. V. M. George, Youngstown. U.S. Pat. 761,044, May 24, 1904.

The water or other liquid to be purified is forced, under pressure, into a receptacle and there acted on by "energised" electrodes of different metals. Then, either at once or after passing through charcoal and a separator, it is subjected to the action of ozone, which is produced by subjecting the liquid to an electric current of sufficient voltage.—W. H. C.

French Patent.

Water and Effluents; Purification of ——. E. Serpin and A. Bertrand. Fr. Pat. 338,586, Dec. 31, 1903.

Aluminium sulphate is automatically added to the water to be purified. The treated water is then passed over a bed of alumina or bauxite and finally through a sand filter.
—W. P. S.

(*C.*)—DISINFECTANTS.

Disinfectants; Testing the Action of Soluble —— on Micro-organisms. H. Zikes. Allgem. Zeits. Bierbrau., 1904, **32**, 10—13.

Vigorous cells or germs of the micro-organism unde examination are placed in a suitable nutrient medium, th culture being afterwards shaken up with a small quantit of calcined talc powder in a test tube and centrifugalised. The tubes used for this purpose are provided with a loos capsule forming the bottom of the tube, and attached to the body of the latter by rubber tubing, so that the whole o the sediment can be easily separated from the liquid. Th capsule is next attached to a second tube and the sediment shaken up with sterilised water and centrifugalised, afte which it is connected to a third tube containing the antiseptic. The duration of exposure to the latter is 5—2 minutes; and the mixture is again centrifugalised, th sediment being afterwards washed and transferred to suitable nutrient medium. In the case of direct application to wort and beer, the antiseptic is added to the inita culture, and after a single passage through the centrifuga machine the deposit is washed and placed in a nutrien solution. The powdered talc does not exert any detectabl surface attraction on reagents or antiseptics, so no loca concentration of the latter is produced. The advantage claimed for the method are that the antiseptic can b brought and left in contact with the levigated organism o culture for a given time, in a manner that is not open t any objection; nearly the whole of the germs tested ca be returned to the medium for further investigation, afte having been freed from the antiseptic by repeated washings and, with rapid working and the usual precautions against infection, the operation can be carried through without lo of sterility.—C. S.

French Patent.

Vaseline, Soluble in, or easily Miscible with Water Process for Making ——*; also*

Hydrocarbons Soluble in Water [Disinfectants], i.e., capabl of easily forming Stable Emulsions; Process of Makin Derivatives of ——. Ges. z. Verwerthung der Boleg'schen Wasserlöslichen Mineralöle und Kohlenwasserstoff G. m. b. H. Fr. Pats. 338,640 and 338,738, Oct. 2 1903. III., page 655.

XIX.—PAPER, PASTEBOARD, Etc.

Writing Papers; Penetration of the Ink through ——. P. Klemm. Woch. f. Papierfab. 1904, **35**, 1620—1621.

Referring to the article on the transparency of German 'normal" writing papers (this J., 1904, 500), the author emarks that the appearance of the ink on the back of the aper does not depend only on the transparency. It epends to a great extent on the resistance of the paper to he action of the ink, and consequently on the hardness of be sizing and on the composition of the ink. The deternination of the opacity of a paper does not, therefore, by tself afford any guide as to its behaviour when written pon. The same remarks apply equally to printing papers, hich are frequently valued according to their opacity. Vith a bad printing ink an excess of oil may penetrate the aper beneath the impression, thereby destroying all its riginal opacity. Writing ink penetrates all papers to a reater or less extent. In order to test this, sections are ut through the writing by means of a razor, the paper eing clamped in a split cork. When these sections are ounted in oil and examined under a microscope it will found that only in very rare cases is the ink confined to e uppermost layer of fibres, and that it generally penetates to the second and frequently to the third or fourth yers. This examination, besides showing the extent of e impregnation of the fibres with the colouring matter due capillary penetration, affords a measure of the secondary emical reactions between the ink and the paper, as shown changes in the coloration of the ink in the deeper layers fibres.—J. F. B.

gnified Fibres [Mechanical Wood Pulp] in Paper; Colorimetric Determination of ——. E. Valenta. XXIII., page 686.

English Patents.

per Pulp; Apparatus for Straining ——. F. G. Busbridge, West Malling. Eng. Pat. 25,075, Nov. 17, 1903.

E strainer, the walls of which are provided with a series suitable slits, is situated in a vat containing the crude p. A vertical reciprocating motion is imparted to the ainer, so that the liquid enters it in the upward stroke l tends to be expelled in the downward stroke, thereby shing off any knots which may clog the slits. The ined pulp is withdrawn from inside the strainer by ans of a pipe situated below the level of the liquid, ich pipe partakes of the reciprocating motion of the ainer and communicates with the outflow by means of oint of flexible material. The draw-off pipe is surnded by a wider pipe which extends above the surface the liquid and prevents any floating impurities from ching the mouth of the draw-off pipe.—J. F. B.

terproofing of Materials such as Tissues, Fabrics, Paper, Leather, and Cords. S. Serkowski. Eng. Pat. ,433, April 12, 1904. V., page 659.

uid Refuse Discharged from Distilleries, Breweries, aper Works, and other Places; Purification or Filtraon of ——. T. T. Street and H. Street. Eng. Pat. 461, April 13, 1904. XVIII. B., page 676.

United States Patents.

Paper Machine. R. S. Case, Unionville. U.S. Pat. 759,862, May 17, 1904.

I a paper machine of the multiple-cylindrical type each n ing-cylinder, immersed in a separate vat, is composed o a number of independent, separate, annular, pulpg ering sections. The width of these sections increases p gressively from the first making-cylinder to the last, a they are so registered that the webs from each s essive cylinder-section are couched together on a felt, and form a series of independent, bevel-edged strips, in which condition they are finished in the usual way. —J. F. B.

French Patent.

Paper Pulp; Manufacture of —— *from Fibrous Tubers and Bulbs.* A. Badoil and J. E. Valadon. Fr. Pat. 338,177, Nov. 28, 1903.

It is proposed to utilise the bulbs of the daffodil, which grow to a large size in Corsica and Algeria, for the manufacture of paper pulp. The bulbs are harvested in the third year, when the sap has descended, the sugars are first extracted by cold water and converted into alcohol, the resin is separated in a second operation at a higher temperature, and the residue is converted into paper pulp. —J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Cerium Metals; New Method of Fractionation of Compounds of the ——. H. Lacombe. Bull. Soc. Chim., 1904, **31**, 570—573.

Welsbach's method of fractionating the double earth-ammonium nitrates fails when little or no lanthanum is present, as the salts do not crystallise, and Demarçay's method (this J., 1900, 462) of fractionating the double earth-magnesium nitrates from strong nitric acid solution, whilst it affords an excellent separation of the cerium earths proper from those of the yttrium earths lying between yttrium and samarium, does not afford a good separation of the constituents of didymium. The author finds that the earth-manganese nitrates of the type $2Di(NO_3)_3.3Mn(NO_3)_2.24H_2O$, afford an excellent means of separation, especially with earths rich either in neodymium or in praseodymium. The solvent is nitric acid of sp. gr. 1·3, and the mother liquors at each operation should be much less in quantity than the crystals. If any manganese peroxide should form, a few drops of fuming nitric acid will destroy it. To prevent supersaturation, seed with a crystal of the isomorphous bismuth manganese nitrate (this J., 1903, 1365).

Earths Rich in Neodymium.—Three fractions were obtained in two days; the last mother liquors were almost pure samarium, containing a mere trace of neodymium. After eliminating the samarium, eight successive fractions were obtained; the first six showed plainly the presence of praseodymium, but the seventh contained only a trace, and the eighth was spectroscopically pure neodymium.

Earths Rich in Praseodymium.—Ten fractions were obtained, the earlier being praseodymium without neodymium, the later neodymium without praseodymium. By successive working up of these fractions, almost the whole of the praseodymium and neodymium were separated, the ultimate intermediate portion being very small in amount. The small amount of lanthanum present accumulated in the early fractions.—J. T. D.

Basic Zirconium Sulphate. O. Hauser. Ber., 1904, **37**, 2021—2026.

The descriptions in chemical literature of basic zirconium sulphates are conflicting. The author attributes this to the varying (and unrecorded) physical conditions under which different authors have worked. He finds that water at 10° C. gradually dissolves anhydrous normal zirconium sulphate, converting it into $Zr(SO_4)_2.4H_2O$; and 100 parts of the saturated solution contain 59·3 parts of this salt. If this solution be diluted with water it remains clear up to a certain point, but beyond this undergoes hydrolytic dissociation with formation of $4ZrO_2.3SO_3.14H_2O$. This salt begins to separate after 4—5 hours, and its separation is complete when about 75 per cent. of the zirconium present is deposited, after about 30 hours. At 70° C. practically no such separation occurs, and at the ordinary temperature it takes place exceedingly slowly. The precipitated salt is crystalline (microscopic needles) and is of absolutely constant composition.—J. T. D.

Menthol; Products of the Reaction of Formaldehyde on ——. E. Wedekind and K. Greimer. Z. angew. Chem., 1904, **17**, 705—711.

Four products have been described as resulting from the reaction of menthol with formaldehyde :—(1) Methylene-dimenthyl ether, $C_{10}H_{19}.O.CH_2.O.C_{10}H_{19}$; (2) Chloromethyl-menthyl ether, $C_{10}H_{19}.O.CH_2Cl$; (3) Compounds produced by dissolving formaldehyde or trioxymethylene in liquefied menthol; (4) The compound $C_{10}H_{19}.O.CH_2OH$, said to be formed by heating menthol and aqueous formaldehyde solution with hydrochloric acid. The first is a well-defined and very stable substance, crystalline, melting at 56°—57° C.; and the second equally well defined though less stable, a liquid which boils at 160°—162° C. under 16 mm. pressure, and is readily decomposed by water, yielding menthol, formaldehyde, and hydrochloric acid. The authors find that the compounds mentioned under (3) are mere mixtures, and they have failed by any process to prepare the substance (4).—J. T. D.

Artemisia herba alba; Essential Oil of ——. E. Grimal. Bull. Soc. Chim., 1904, **31**, 694—697.

The fresh non-flowering herb of *Artemisia herba alba*, which is very common in Algeria, yielded 0·3 per cent. of a yellowish-green essential oil, having a pleasant aromatic odour and a powerful, slightly bitter, camphoraceous taste. It had the following characters :—Solubility, in 60 per cent. alcohol, 1:25; in 70 per cent. alcohol, 1:2—1:2·5, more alcohol causing a slight turbidity; very soluble in 80 per cent. alcohol. Sp. gr. 0·9456; $a_D = -15°\ 30'$; n_D 1·47274; acid value, 6·46; ester value, 89·23. It contained 31·15 per cent. of esters calculated as $CH_3.COOC_{10}H_{17}$; 12·65 of free alcohols, as $C_{10}H_{18}O$; *l* camphene, *d*-camphene, cineol, with esters of caprylic and capric acids.—J. O. B.

Apopin [Essential] Oil, Shu-yu; Further Notes on ——. Keimazu. J. Pharm. Soc. Jap., 1903 [250]; through Schimmel's Report, May 1904, 10—12.

Apopin oil is found to contain formaldehyde, pinene, and a new sesquiterpene alcohol, $C_{10}H_{18}O$, apopinol, in addition to the constituents previously recorded (this J., 1903, 1306). The presence of formaldehyde, which occurs in apopin oil in considerable quantity, and is not met with in true camphor oil, which contains only acetic aldehyde, will serve as a ready means of distinguishing the two oils.

—J. O. B.

Oil of Camphor; Presence of Borneol in Essential ——. Schimmel's Report, May 1904, 17.

Borneol has been isolated from the fraction of camphor oil boiling between 210° and 222° C.—J. O. B.

Cananga Flowers; Essential Oil of ——, *from Bangkok.* Schimmel's Report, May 1904, 18.

The oil distilled from the fresh and dried flowers of Cananga cultivated at Bangkok had the following characters:—Sp. gr. at 15° C., 0·920; $a_D = -51°\ 40'$; acid value, 1·82; ester value, 34·17. The oil was insoluble in 10 volumes of 90 per cent. alcohol, but dissolved in half a volume of 95 per cent. alcohol, separating, however, on the addition of more of the solvent.—J. O. B.

Acacia Farnesiana; Essential Oil of the Flowers of —— [*Oil of Cassie Flowers*]. Schimmel's Report, May 1904, 23—25.

Para-cresol has been recognised as a constituent of essential oil of cassie flowers, and the presence of anisic aldehyde has been confirmed.—J. O. B.

Cinnamon [Bark]; Essential Oil of ——. Schimmel's Report, May 1904, 25—26.

Stress is laid on the fact that cinnamic aldehyde is not the most important constituent of cinnamon bark oil; the characteristic aroma being due to the non-aldehydic constituents of the oil. Specimens of so-called cinnamon oil have lately occurred in commerce which contained from 80—85 per cent. of aldehyde and were obviously adulterated with cassia oil or cinnamic aldehyde. The average percen age of aldehyde in genuine cinnamon bark oil of know origin lies between 70 and 75 per cent., rarely fluctuatin from 65—77 per cent. In the genuine bark oil the amou of eugenol does not exceed 4—8 per cent.; any great proportion indicates admixture with the cheaper cinnamo leaf oil. The limit of specific gravity required by the Britis Pharmacopœia, 1·025—1·035, is found to be too high. O several occasions pure oils have been distilled, of whic the specific gravity fell below these figures. Low specit gravity coupled with freedom from excess of eugenol and cinnamic aldehyde indicate purity rather than sophisticatio

—J. O. B.

Cypress; Essential Oil of ——. Schimmel's Repor May 1904, 36—42.

In addition to *d*-pinene and cypress camphor, which ha been previously recorded, the following constituents a found in cypress oil. Furfural; *d*-camphene; *d*-sylvestren cymene; two ketones, as yet unidentified; an alcoh probably sabinol; a terpene alcohol; terpineol esters acetic and valeric acids, but no free terpineol. The are present in approximately the following proportions :- Terpenes, chiefly camphene and sylvestrene, 65 per cent cymene, 1—2 per cent.; alcohols, about 8 per cent esters, chiefly of terpineol, about 8 per cent; ketones, le than 1 per cent.; cypress camphor, 15 per cent.—J. O. B.

Eucalyptus Globulus; New Sesquiterpene Alcohol in t Essential Oil of ——. Schimmel's Report, May 1904, 5

In the last runnings of a distillation of the oil of *Eucalypt globulus* a crystalline body was separated in the for of almost odourless needles, m. pt. 88·5; b. pt. 283° C. $a_D = -35°\ 29'$. It is a sesquiterpene alcohol, $C_{15}H_{25}O$ By dehydration it yielded two isomeric sesquiterpene $C_{15}H_{24}$, one lævo-rotatory, $a_D = -55°\ 48'$, the other dextr rotatory, $a_D = +58°\ 10'$. The former boils at 247°—248° C the latter at 265·5°—266° C.—J. O. B.

Geranium; Essential Oil of Réunion ——. Schimme Report, May 1904, 55—56.

Amyl alcohol, pinene, phellandrene, and linalool have bee recognised as constituents of geranium oil.—J. O. B.

Ginger-grass; Essential Oil of ——. Schimmel's Repor May 1904, 56.

The examination of ginger-grass oil showed the presen of a large proportion of alcohols accompanied by a sma amount of esters. A little phellandrene was detected. T alcohols consisted of geraniol and another unidentifi alcohol having a linalool-like odour, and forming an acet with the odour of spearmint.—J. O. B.

Laurel [Laurus nobilis] Leaves; Essential Oil of —— B. Molle. Schimmel's Report, May 1904, 59.

From the essential oil of the leaves of *Laurus nobi* dissolved in ether, 2 per cent. sodium hydroxide solut removed free acetic, iso-valeric, and iso-butyric aci Eugenol was present to the extent of 1·7 per cent. in free state and 0·4 per cent. as esters. No aldehydes ketones were found. After removing the free acids a phenols, the esters present were saponified with alcoho potash, and the acids liberated from the resulting salts w identified as acetic and probably valeric and caproic aci as well as a trace of a monobasic solid acid, $C_{10}H_{14}$ m. pt. 146°—147° C. This is probably not present in oil, but may be formed from pinene by the action alcoholic potash. Cineol was present to the extent of ab 50 per cent. No methyl-chavicol could be isolated. T higher boiling fraction, 212°—230° C., contained gera and terpinene was obtained by dehydration, also terp hydrate by the action of dilute sulphuric acid. The high boiling fractions probably contain sesquiterpenes and ses terpene alcohols.—J. O. B.

Patchouli Leaves; Constituents of Essential Oil of — Schimmel's Report, May 1904, 68—71.

The oil examined, distilled at Miltitz, had the follow characters:—Sp. gr. at 15° C., 0·9769; $a_D = -55$ 4 acid value, 2·2; saponification value, 4·2; saponification value after acetylating, 15·4; one volume and over, of 90 per cent. alcohol gave a clear solution with the oil.

About 97 per cent. of normal patchouli oil consists of bodies of little or no odour value. Of this 40—45 per cent. distilled between 260°—270° C., and consisted mainly of one or more sesquiterpenes. The first fraction, b. pt. 228°—240° C., had an extremely unpleasant odour, not resembling that of patchouli. By extracting the odorous bodies with 70 per cent. alcohol, and distilling off the solvent, the following constituents were identified:—Benzaldehyde, eugenol, cinnamic aldehyde, a terpene alcohol, a ketone with a caraway-like odour, which formed a semi-carbazone, m. pt. 134°—135° C. Another compound is also formed with a higher m. pt., 246°—247° C., which may be Thiele's hydrazodicarbonamide, $NH_2CONH.NH.CONH_2$. A basic body is present in all the fractions of the oil, removed by shaking out with sulphuric acid; this body has a peculiar and characteristic odour. It is also found in the water of distillation. From the results of fractionation *in vacuo*, it appears that this base may be separated into two distinct bodies, one boiling between 80° and 130° C., the other from 135° to 140° C. under 3 to 4 mm. pressure. Patchouli lcohol, which is probably the major constituent of the oil, ccurs in the fraction boiling above 140° C. under 8 mm. ressure. It melts at 56° C. when repeatedly recrystallised rom light pretroleum spirit. Patchoulene obtained by he dehydration of this alcohol is a colourless liquid with a edar-like odour; b. pt., 255°—256° C.; $\alpha_D = -36° 52'$. It ave no solid derivatives; when distilled over sodium it had he sp. gr. 0·9334.—J. O. B.

Pimento; Constituents of Essential Oil of ——. Schimmel's Report, May 1904, 75—77.

HE following constituents have been identified in pimento il:—Cineol, phellandrene, caryophyllene, methyl-eugenol, ugenol, palmitic acid, with, probably, small amounts of erpene alcohols.—J. O. B.

bies Pectinata; Occurrence of Lauric Aldehyde in Essential Oil of ——. Schimmel's Report, May 1904, 77—79.

AURIC aldehyde has been isolated as the bisulphite ompound from the fractions of the oil of *Abies pectinata* oiling above 82° C. under 5 mm. pressure. The amount esent was only 0·3 per cent., but it has an important aring on the odour of the oil. A second aldehyde is also esent, probably decylic aldehyde.—J. O. B.

alyptranthes paniculata; Essential Oil of —— ("*May Oil*"). Schimmel's Report, May 1904, 95.

HE oil, derived from Porto Rico, resembles lemongrass oil character; sp. gr. 0·9509; $\alpha_D = -1° 52'$; readily soluble 80 per cent., but sparingly in 70 per cent. alcohol. contains 62·5 per cent. of citral.—J. O. B.

Mentha Citrata; Essential Oil of ——. Schimmel's Report, May 1904, 95.

entha citrata, known in Florida as "bergamot mint," lds about 0·2 per cent. of oil from the young, not flower-; but fresh plants. The oil had a pleasant odour, more embling lavender than bergamot. It had the following racters:—sp. gr. at 15° C., 0·8826; $\alpha_D = -5° 35'$; ester ue, 31·28, equivalent to 10·95 per cent. of linalyl acetate. e frozen leaves of the same plant gave about the same ld of oil, but this was much richer in esters, having the r value of 111·28, equivalent to 38·95 per cent. of lyl acetate.—J. O. B.

Ambrosia artemisiæfolia; Essential Oil of ——. Schimmel's Report, May 1904, 96.

NG plants, not in flower, yielded 0·15 per cent. of a en, aromatic oil; sp. gr. at 15° C., 0·876; $\alpha_D = -1°$; ester ue, 7·94. It gives a clear solution, with an equal volume 0 per cent. alcohol, which becomes cloudy with more ent.—J. O. B.

Hyptis spicata; Essential Oil of ——. Schimmel's Report, May 1904, 96.

Hyptis spicata, a labiate, common in Florida, yields 0·005 per cent. of a bright yellow oil with a faint mint-like odour. Sp. gr. at 15° C., 0·915; $\alpha_D = -27° 25'$; acid value, 2·17; ester value, 4·35. It is insoluble in 10 volumes of 80 per cent. alcohol. The oil probably contains small quantities of menthone or pulegone.—J. O. B.

Erythroxylon Monogynum; Essential Oil of the Wood of ——. Schimmel's Report, May 1904, 97.

THE wood of *Erythraxylon monogynum* gave 2·56 per cent. of a viscous crystalline essential oil with a pleasant odour resembling that of guaiacum-wood oil. It was lighter than water; m. pt. 42°—45° C.; acid value, 6·77; ester value, 1·56; ester value after acetylation, 131. Soluble with slight turbidity in an equal volume of 90 per cent. alcohol, and completely soluble in a larger volume. The crystalline alcohol, $C_{20}H_{32}O$, was isolated from the fraction boiling at 212°—216° C. under 8 mm. pressure by freezing out of solution in light petroleum spirit. It occurs in brilliant needles; m. pt. 117°—118° C. The acetic ester, recrystallised from alcohol, had the m. pt. 72°—73° C.

—J. O. B.

Hydragen Peroxide: Analysis of Commercial ——. P. Sisley. XXIII., page 685.

Formaldehyde and its Polymers; Determination of ——. A. Seyewetz and Gibello. XXIII., page 686.

Roses; Essential Oil of [Otto of Roses]; Iodine Absorption Test as a Factor in the Examination of ——. F. Hudson Cox and W. H. Simmons. XXIII., page 686.

Citronella Oil; Modified Schimmel's Test for, and Nature of Adulterant of ——. Schimmel's Report. XXIII., page 686.

Oil of Cassia; Detection of Rosin in Essential ——. Schimmel's Report. XXIII., page 686.

ENGLISH PATENTS.

Therapeutical Compound; Manufacture of a new ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine. Eng. Pat. 15,782, July 16, 1903.

EQUIMOLECULAR parts of butylchloral hydrate and 4-dimethylamino-1-phenyl-2.3-dimethyl-5-pyrazolone are heated together, alone, or in solution, and the product crystallised from benzene, &c. It is a white or yellowish powder, m. pt. 85°—86° C., soluble with difficulty in water, and is proposed as suitable for use as an anæsthetic.

—T. F. B.

o-Toluene Sulphonic Acid; Manufacture of ——. O. Imray, London. From Fab. Prod. Chim. de Thann et de Mulhouse. Eng. Pat. 16,299, July 23, 1903.

THE process described in Eng. Pat. 14,390 of 1901 (Fr. Pat. 312,797; this J., 1902, 112) for the separation of the ortho and para-toluene sulphonic acids from the products of sulphonation is modified by adding to the solution, after the separation of the para acid, a quantity of water (about 25 per cent. of that previously used) sufficiently small to cause the separation of the ortho acid at the ordinary temperature.

—J. F. B.

Distillation of Fats, Oils, Tars, and the like; Continuous Vacuum ——. G. Bokelberg and J. Sachse. Eng. Pat. 7204, March 25, 1904. III., page 655.

UNITED STATES PATENTS.

Titanic and Lactic Acids; Process of making Compounds of ——. C. Dreher, Freiburg. U.S. Pat. 760,319, May 17, 1904.

SEE Eng. Pat. 14,921 of 1902; this J., 1902, 1245.—T. F. B.

Formaldehyde [and Wood Tar]; Compounds of ——. W. Sternberg, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 761,260, May 31, 1904.

See Fr. Pat. 329,971 of 1903; this J., 1903, 1014.—T. F. B.

French Patents.

Cream of Tartar, Tartaric and Citric Acids, and Secondary Products; Manufacture of ——. L. Faucheux and A. J. Boissière. Fr. Pat. 338,735, April 14, 1903.

Wine lees, crude tartar, &c., are subjected to a preliminary slight degree of external roasting or scorching ("torréfaction") by means of hot gases, to decompose organic matter other than tartrates, and to render the iron and aluminium salts and phosphates insoluble; the product is converted into potassium bitartrate and washed with hydrochloric or sulphuric acid, and the solution filtered, decolorised, and treated with sodium carbonate; the mother liquors are precipitated with lime and the sodium chloride or sulphate recovered by evaporation. Tartaric acid is made from the roasted raw material by treatment with hydrochloric acid; calcium tartrate is precipitated from the solution, and is decomposed by means of sulphuric acid. Citric acid is produced in a similar manner by treating lemon juice with lime or calcium carbonate. In each case the crude tartrate or citrate as prepared may be purified by scorching or slight roasting, preferably with addition of small amounts of lime.—T. F. B.

Borneol, Isoborneol, and Camphor; Process for Preparing ——. Chem. Fabr. von Heyden, Act.-Ges. Fr. Pat. 339,504, Jan. 11, 1904.

See Eng. Pat. 26,785 of 1903; this J., 1904, 204.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographs in Colours; New Method of Obtaining ——. A. and L. Lumière. Comptes rend., 1904, **138**, 1337—1338.

Three equal quantities of particles of potato starch of 0·015 to 0·020 mm. diameter are coloured orange-red, green, and violet, and are then thoroughly mixed together, and spread in a thin layer by means of a brush on a glass plate coated with wax; the interstices between the particles are filled with a fine black powder, such as pulverised wood charcoal. The whole is now coated with a varnish having approximately the same refractive index as that of the starch, and finally a panchromatic silver bromide emulsion is applied. The plate thus prepared is exposed, with the film side away from the light, in the usual way, and developed; by reversing the image (dissolving out the reduced silver) and re-developing the plate, transparencies the correct colours are obtained.—T. F. B.

English Patent.

Intaglio Printing Forms on Cylindrical Surfaces; Art of Producing ——. H. H. Lake, London. From G. F. & J. W. McIndoe, Boston. Eng. Pat. 4206, Feb. 19, 1904.

The textile or other flexible material, a representation of which is required, is coated with size or other glutinous material and dried by being subjected to heat and pressure; a thin coating of some pasty material which is impervious to light (*e.g.*, printers' ink) is applied to the fabric, and transferred to the prepared cylinder, which is then exposed to light: the light-resisting coating is washed off by means of a suitable solvent, and the soluble portion of the sensitive coating is removed by washing; the cylinder is now heated "to a sufficient degree to render the remaining portions of the sensitised material acid-resisting," and etched, and the remainder of the sensitive material removed by some solvent. Compare Eng. Pat. 4207 of 1904; this J., 1904, 487.
—T. F. B.

United States Patent.

Stripping-film for Photographs; Positive ——. J. E. Thornton and C. F. S. Rothwell, Manchester. U.S. Pat. 760,585, May 24, 1904.

See Eng. Pat. 17,165 of 1899; this J., 1900, 68.—T. F. B.

French Patents.

Photographic Plates, &c.; Sensitive ——. E. F. Beckwith and T. A. Carten. Fr. Pat. 338,499, Dec. 15, 1903.

See Eng. Pat. 27,059 of 1903; this J., 1904, 268.—T. F. B.

[Photographic] Developer; Acid ——. G. Balagny. Fr. Pat. 338,650, Dec. 2, 1903.

The exclusive use of acid solutions of developers of the aromatic series is claimed. The following solution is an example of such an acid developer:—Diaminophenol, 1 grm.; bisulphite solution, 10—15 cc.; potassium bromide (10 per cent. solution), 5 c.c.; water, 150 c.c. The bisulphite solution consists of anhydrous sodium sulphite, 25 grms.; sodium bisulphite ("commercial, 35°"), 100 c.c.; water, 100 c.c. The image generally appears in four or five minutes, development being complete in 20 to 25 minutes. The use of this solution dispenses with the necessity for a ruby light after the plate is immersed, and softer results are said to be obtained than when alkaline solutions are employed.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

Explosives; New ——. A. Mikolajczak. Glückauf, 1904, **40**, 630. Chem.-Zeit., 1904, **28**, Rep., 174—175.

The freezing of explosives prepared with nitroglycerin forms a great disadvantage. The author states that he has prepared mono- and dinitroglycerin, and believes that the latter compound will form a valuable basis for explosives, free from this disadvantage. Dinitroglycerin is stated to be an odourless and unfreezable oil, less sensitive to percussion, friction, and increase of temperature, and possessing a greater solvent power for collodion cotton than ordinary nitroglycerin. It can thus be used for the preparation of explosives of high stability, which will maintain their plastic nature even in winter. The explosives can be mixed with those prepared from ordinary nitroglycerin, and are not inferior in power to the latter.—A. S.

English Patents.

Explosive Mixture. A. Fischer, London. Eng. Pat. 10,789, May 12, 1903.

Equal parts of di- or trinitrobenzene, or their chlorine derivatives, and an alkali salt of trinitrophenol (picric acid) are made into a paste with a solution of paraffin, and the resulting mass incorporated in the proportion of 5 to 20 per cent. with a mixture consisting of an alkali nitrate (preferably 80 parts), sulphur (preferably 4 parts), and a suitable form of carbon (preferably 16 parts).—C. A. M.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Viscosity of Pitch-like Substances. F. T. Trouton and E. S. Andrews. Phil. Mag., 1904, **7**, 347—355.

The authors use a torsion method for determining the viscosity of pitch-like substances. A constant torque is applied to a cylindrical bar of the material, and the relative motions of the ends are observed, from which and from the dimensions of the cylinder the viscosity is calculated. A shaft turning freely on anti-friction wheels has a pulley attached, from which is hung a weight for the purpose of applying the constant torque. The ends of the cylindrical bar of the material to be tested, are made square and tapering, and somewhat thicker than the cylinder itself. One end is fitted tightly into a square socket carried by the shaft, and the other into a similar but fixed socket. The cylinder can be surrounded by a jacket, and determinations made at different temperatures. The rate of rotation is observed by means of a divided circular disc carried on the shaft. It was assumed that any two planes in the body, lying at right angles to the axis of the cylinder, move over each other about the common axis, remaining plane all the while. The following formula was deduced for the coefficient of viscosity: $\mu = \frac{2T}{\pi U R^4}$, where T is the torque applied, U the relative angular velocity per cm. of length of the cylinder, and R the radius of the cylinder.

Pitch.—Tests with a material sold as "British pitch" showed that whilst the assumption that the rate of rotation is proportional to the torque applied, is sufficient for practical purposes, the phenomena are, in reality, more complicated. For small torques the rate of rotation is relatively less than for larger ones, but above a certain value the curve develops into a straight line. On first applying the torque there is a rapid flow or movement, which gradually diminishes and finally reaches a "steady" stage. If a white line be painted along the specimen before twisting, a spiral line of many twists is ultimately obtained. It was found that the coefficient of viscosity of bodies, such as pitch, is a function of the time, the velocity of flow for a given stress diminishing from its initial value down to a constant quantity. On removing the stress there is a flow back in the opposite direction, which gradually diminishes to zero with time. The strain energy thus shown to exist in a viscous substance when the latter is flowing, will disappear in course of time without there being any movement of the substance as a whole. The rate of dissipation of this strain energy can be determined by gradually diminishing the torque until a weight is obtained which will just suffice to hold the cylinder at rest; this weight must be continually diminished, and finally reaches zero. The fact that the strain energy can disappear without any deformation of the viscous body occurring, enables a distinction to be drawn between a viscous and a plastic substance, since when the latter is held under constant deformation beyond its elastic limit, the strain energy it then contains does not sensibly decrease with time.

Soda Glass.—The tests were made with a tube in which as inserted a thermo-electric junction. The tube was rrounded by a thick-walled iron pipe heated by a row of nall gas-jets. In this case R^4 in the formula for calculating the coefficient of viscosity must be replaced by $R_1^4 - R_2^4$), where R_1 and R_2 are the external and internal dii respectively, of the glass tube.

Shoemakers' wax was tested both by the authors' method d by Stokes' method (rate of sinking of a spherical body the material). A steel bicycle ball was used as the nere, and its position was observed from time to time by ans of X-rays. The value obtained for the coefficient of cosity by Stokes' method varied from 6 × 10^6 to 23 × 10^6, mean value being about 10 × 10^6, *i.e.*, of the same ler of magnitude as the value obtained by the authors' thod (see table below). The authors' result is probably low, because the sagging of the rod was so great that the que could not be applied long enough for the "steady" ge to be attained.

Modelling clay, when examined by the torsion method, aved quite differently to the other substances tested. ien subjected to a given torque, it moved slowly up to a en position and stopped there. On removing the stress, nade an immediate partial recovery to a point where it nanently remained.

he results obtained are given in the following table:—

Substance.	Temperature.	Coefficient of Viscosity.
	° C.	
P h	0	5·1 × 10
	8	9·9 × 10
	15	1·3 × 10
S glass	575	1·1 × 10
"	660	2·3 × 10
"	710	4.5 × 10^{10}
S im stearate	8	5·0 × 10
S nakers' wax	8	4·7 × 10

—A. S.

Pyrometer; New Form of ——. C. Féry. Bull. Soc. Chim., 1904, **31**, 701—702.

A TELESCOPE, the field of view of which is subdivided by means of two very fine wires (the "reticule"), one of iron, the other of "*constantan*," an alloy of copper and nickel, receives the radiations of the source of heat towards which it is directed. The point of intersection of the threads of the reticule, which constitutes one of the junctions of the thermo-electric couple thus formed, becomes heated, and the current which is set up deflects the needle of a dial galvanometer, which may be made registering. The known laws of radiation show that if the objective be composed of slightly absorbent material, such as rocksalt or a fluoride, the deviation obtained is proportional to the absolute temperature (ordinary temperature + 273 C.) of the heated body.

In the case of industrial pyrometers, the objectives of which are of glass, graduations are made by comparison with a standard pyrometer provided with a fluoride objective. The indications obtained are independent of the distance of the heated body and of its dimensions.—J. O. B.

Dephlegmator; New ——, *for Fractional Distillation and as a Reflux Condenser.* J. Houben. Chem.-Zeit., 1904, **28**, 525–527.

THE apparatus is a modification of that proposed by Winssinger (Ber., 1883, **16**, 2640). The distillation flask (see Fig. 1) has two necks, the shorter of which is fitted with a thermometer and carries a side tube for the condenser. Through a stopper in the longer neck of the flask passes the aluminium mantle-tube A, which is widened just above the stopper, and inside the widened portion is provided with spring clips which hold in position the brass cooler B. The latter consists of a tube open at the bottom, enclosed in an outer tube closed at the bottom, and provided with a side outlet-tube for the cooling water. When it is desired to distil under reduced pressure, the flask has a small tubulus through which passes the capillary tube. On starting the apparatus, the cooler B is pushed down to the bottom of the mantle-tube A, and the liquid in the flask is heated to vigorous boiling. The cooler is then gradually

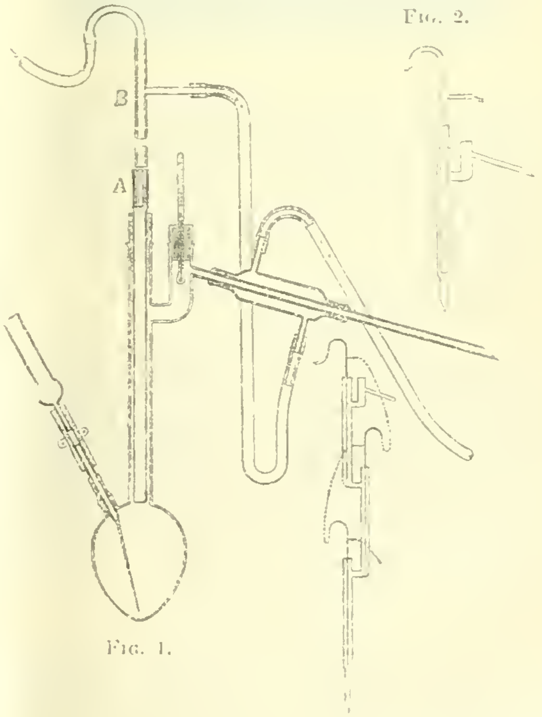


FIG. 1.

FIG. 2.

FIG. 3.

raised until the distillate passes over at the desired rate. The dephlegmator can also be fitted into a suitable glass still-head, as shown in Fig. 2, and can then be used with an ordinary short-necked flask. In Fig. 3 a combination of three dephlegmators is shown. The author has found the still-head shown in Fig. 4 especially suitable for distillation under reduced pressure. It consists of a bayonet-shaped tube with two side tubes, the upper one for the thermometer, and the lower one for the capillary tube. In order to prevent, as far as possible, contact of the vapour with the rubber stopper, the neck of the distillation flask, close to the bulb, is constricted, and the tube of the still-head is pushed down to the constricted part. The results of test experiments are given, showing the efficiency of the dephlegmator.—A. S.

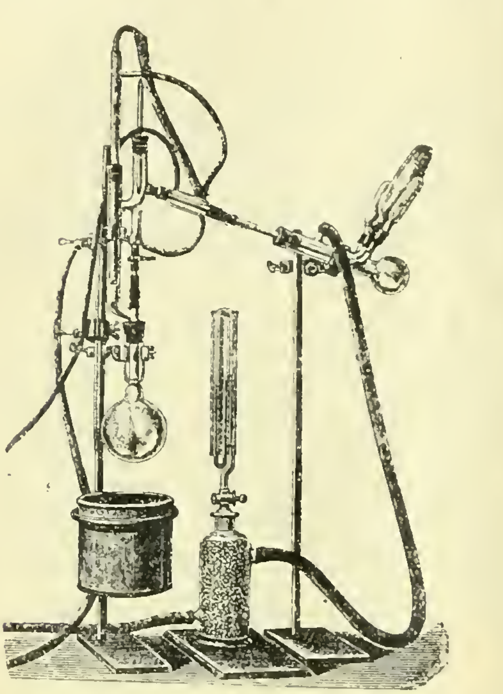


Fig. 4.

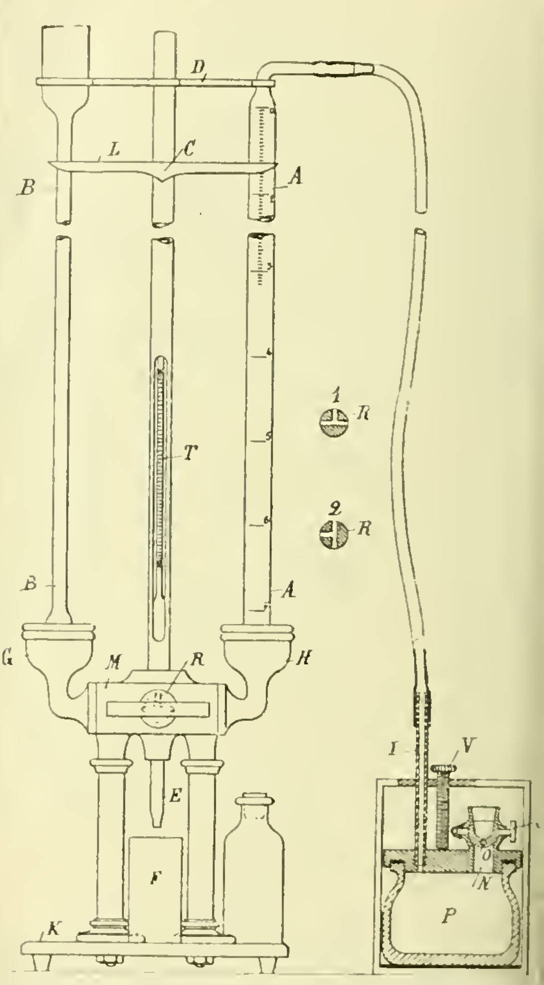
Paranitrophenol as Indicator. L. Spiegel. Z. angew. Chem., 1904, **17**, 715–716.

The author maintains, against the criticims of Lunge, his former statements (this J., 1900, 1040) as to the superiority of paranitrophenol to methyl orange as an indicator in alkalimetry, quoting experiments to show that it is equally insensitive to carbon dioxide, and as delicate in indicating excess of acid or alkali, in whichever direction the titration is effected. He attributes the difference between Lunge's results and his own to the fact that he uses a 2—3 per cent. solution of the indicator, whilst Lunge used one containing only 0·1—0·2 per cent., two or three drops in each case being added to 70 c.c. of the liquid to be titrated.—J. T. D.

French Patent.

Acidimeter; Universal ——. Soc. L. Legrand et Lafaverge. Fr. Pat. 338,634, Dec. 5, 1903.

The two-limbed tube, of which one limb, B, has a funnel-shaped top, and the other is graduated, and connected by a flexible tube to the reservoir P, has at the bottom of the bend, a 3-way cock R, which is so turned that both arms communicate, whilst mercury is poured into the arm B, until it rises in both arms to the height of the zero point in arm A. A measured quantity, such as 10 c.c., of the oil, vinegar, wine, or other acid liquid of which the acidity is to be determined, is then placed in the reservoir P, and the cover is screwed down air-tight. An excess of sodium-hydrogen carbonate is put into the cup, and, on turning the spherical tap J, falls into the cistern. The tap is then closed, and the reservoir is shaken. The carbon dioxide generated depresses the mercury in the limb, A, the mercury rising in the opposite limb. The tap R is then turned to allow mercury to escape through the tube E into the



receptacle F until equilibrium is established, the tap bein then closed for that outlet. This process is repeated a often as necessary until equilibrium is permanent, the leve of the mercury in the two limbs being shown by means o the sliding pointer C, carried by the centrally-placed meta tube enclosing the thermometer T. The temperature bein read, as well as the height of the mercury in the limb A the usual corrections and calculations are made by the a of tables annexed to the apparatus.—E. S.

INORGANIC—QUALITATIVE.

Sodium Picrate; Action of —— on Sodium Carbona Solutions. [Detection of Sodium Carbonate.] (Reichard. Z. anal. Chem., 1904, **43**, 269—275.

Normal sodium carbonate is the only sodium sa possessing the property of precipitating sodium picrate fro its solutions. Even quite dilute solutions (1 per cen of sodium picrate are rendered turbid by sodium carbona and a 10 per cent. solution solidifies to a jelly. The pr cipitation is always gradual and occurs also in solutio containing other salts. Sodium carbonate may, in this wa be detected in solutions in which other sodium salts a also present; the reaction may farther be used to indica the presence of sodium picrate in a liquid.—T. H. P.

Nickel Salts; Action of Alkali-metal Nitrites on ——. C. Reichard. Chem.-Zeit. 1904, **28**, 479—480.

It is well known that the separation of cobalt from nickel by precipitation with potassium nitrite in acetic acid solution cannot be accurately carried out in presence of alkaline earth compounds, as triple nitrites of nickel, potassium, and barium, strontium or calcium are precipitated with the cobalt compound. The addition, to a mixture of nickel salt and potassium nitrite, of the oxide, hydroxide, or peroxide of the alkaline earth metal, does not cause the formation of this compound, but precipitates nickel hydroxide (with evolution of oxygen when the peroxide is used). If the nitrite be substituted for the oxide, however, the triple salt precipitates after a short time. If the acetic acid be added before the nitrite no precipitation occurs. The precipitate dissolves in hot water to a bright green solution, and on cooling is deposited as a green powder, which slowly turns yellow. The calcium compound is more soluble than those of barium and strontium, and comes down much more slowly. No similar precipitates were formed by salts of magnesium, zinc, or cadmium, but beryllium salts formed a precipitate not yet investigated, perhaps a nickel beryllium potassium nitrite. If sodium nitrite be used instead of the potassium salt, in no case is a precipitate formed; even a mixture of sodium nitrite with another potassium salt is ineffectual. Potassium nitrate and a reducing agent can be used, but the reduction is apt to go too far. Like the double cobalt salt, these triple nitrites are all much less soluble in potassium nitrite solution than in water.—J. T. D.

Portland Cement and Blast-Furnace Slag; Action of Acetic Acid on ——. F. Hart. Thonind.-Zeit., 1904, **28**, 809.

To distinguish between Portland cement and blast-furnace slag, the following test is proposed: One grm. of the finely-powdered sample is well shaken up for 10 minutes in a corked flask with 100 c.c. of a 10 per cent. solution of acetic acid in alcohol. On allowing the undissolved residue to subside, the light-coloured, vitreous granules of blast-furnace slag will be readily distinguishable from the flocculent deposit of silica and the dark granules of undissolved particles of Portland cement. With a little experience, 5 per cent. of the former can be detected in mixtures.—C. S.

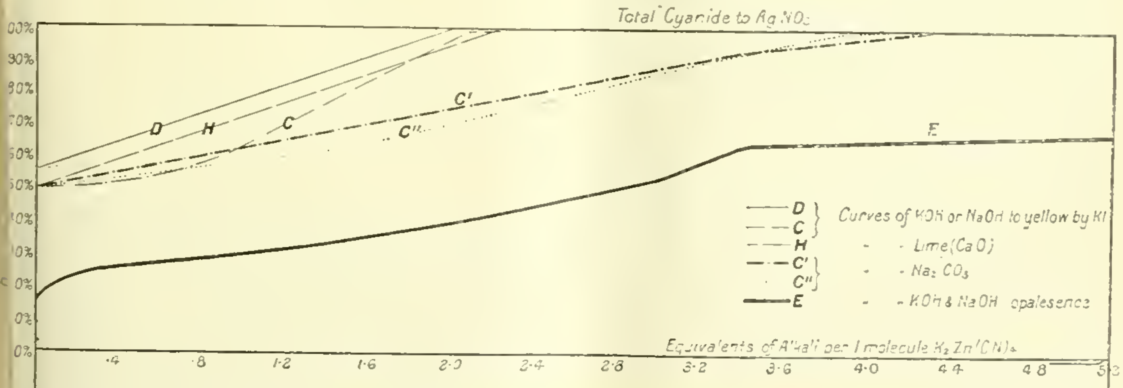
INORGANIC—QUANTITATIVE.

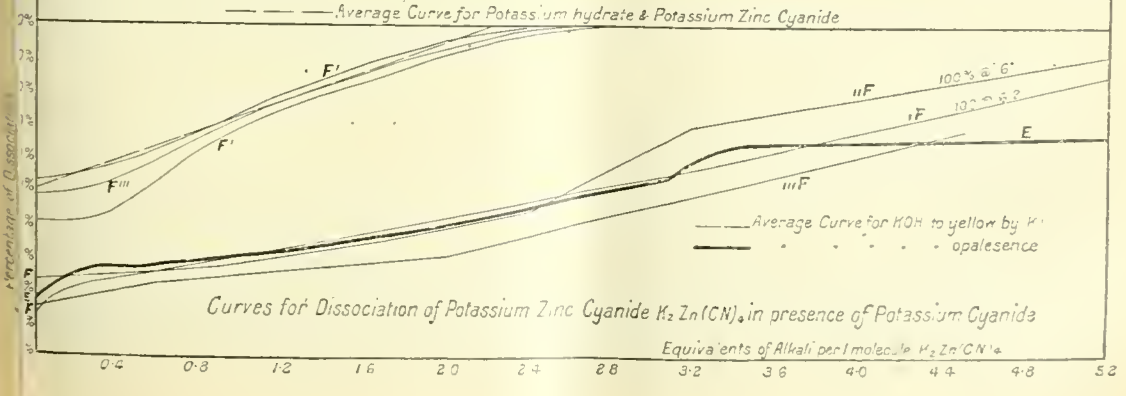
Sodium Nitrite; Analysis of ——. G. Lunge. Chem.-Zeit., 1904, **28**, 501—502.

The "diazo" method with the use of sulphanilic acid can be made to yield results equivalent in accuracy to those obtained by the permanganate method, but in most cases the latter method will be found to be more convenient. For the titration, 45 c.c. of N/2 permanganate solution are acidified with sulphuric acid and diluted to 400 c.c. with water at 40° C., then titrated with a solution of sodium nitrite containing 23 grms. per litre. In order to obtain accurate results with sulphanilic acid, this substance must be purified by recrystallisation, and the crystals must be dried for two days in the desiccator over sulphuric acid. The starch solution should be freshly prepared each day, and the end point should correspond with an immediate coloration of the iodide-starch paper permanent for some minutes.—J. F. B.

Cyanide Solutions; Determination of Constants in Working ——. G. W. Williams. J. Chem., Metall., and Min. Soc., S. Africa, 1904, **4**, 288—298.

The author has endeavoured to determine the degree of dissociation, and hence the gold-dissolving power of the double potassium-zinc-cyanide under various conditions. The method used was to titrate the solutions with silver nitrate, using as an indicator the permanent yellow developed by potassium iodide. It was found that under these circumstances the reaction cannot be represented as a simple interchange between the silver nitrate and the potassium cyanide of the dissociated double salt, for some of the zinc cyanide also reacted, and zinc nitrate remained in solution. Accordingly, the results were always too high





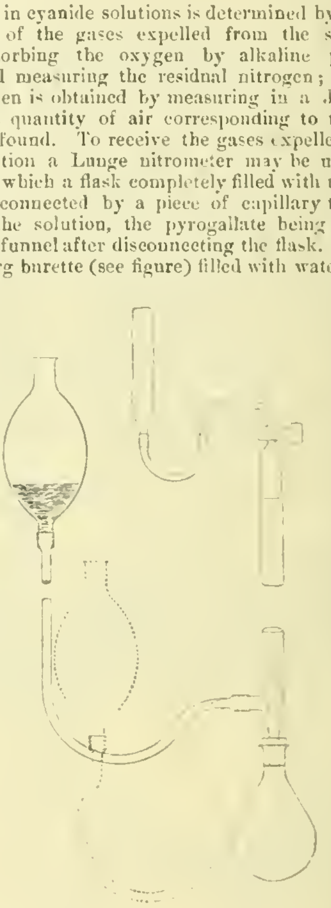
Curves for Dissociation of Potassium Zinc Cyanide $K_2Zn(CN)_4$ in presence of Potassium Cyanide (though comparable among themselves), and better results were obtained when the potassium iodide was omitted, and the appearance of opalescence, owing to precipitation of zinc cyanide, was taken as the end of the reaction. Dilution of the solution from 1/500 to 1/6000 produced gradually increasing dissociation from about 50 to 77 per cent. of the total double cyanide; further dilution produced no effect. In the later experiments the effect of dilution was eliminated. Addition of potassium cyanide not only reduced, as was to be expected, the degree of dissociation of the double cyanide, but the latter appeared to act in some way upon the added cyanide, for the amount of silver nitrate required was less than that calculated for the added cyanide alone. The addition of alkali was then investigated, and the results are plotted in the accompanying curves. The first set of curves show the effect of addition to the double cyanide solution of potassium or sodium hydroxide, lime or sodium carbonate, using potassium iodide as indicator (curves D, C, H, C′, and C″), and also the effect of alkali hydroxide when opalescence is taken as the indication (curve E). The general parallelism of E with the other curves is noticeable, and also the sudden lowering of slope at about 64 per cent. The second set of curves show the effect (by both methods of indication) of adding alkali hydroxide to mixtures of the double cyanide with potassium cyanide (molecules of $K_2Zn(CN)_4$: molecules of KCN = (I) 10 : 3·3, (II) 1 : 1, (III) 1 : 3·1 approximately; the average curve in each series is also drawn). The general similarity of the one average curve to D, C, or H, and of the other to F is obvious. The author's conclusions (in part to be seen from careful inspection of the curves) are as follows:—*In titrations with potassium iodide:* (I.) The silver nitrate enters into reaction with the zinc cyanide in part, forming zinc nitrate. (II.) The "free" cyanide (gold-dissolving cyanide) is proportional to the amount of alkali present. (III.) The effects of equivalent quantities of sodium, potassium, and calcium hydroxides are alike, save that zinc oxide is insoluble in lime, and that no soluble zincate is formed as with alkali hydroxide. (IV.) Alkali carbonates have only half the efficiency of the hydroxides. *In titrations to opalescence without potassium iodide:*—(I.) The free cyanide shown is, within limits, proportional to the amount of alkali, and the amount of dissociation indicated is about half of that shown with iodide. (II.) The limiting value of 64·4 per cent. indicated on the curve coincides with an amount of alkali hydroxide sufficient to form with the zinc oxide produced, the zincate $K_2ZnO_2 . 8 KOH$, shown by W. J. Sharwood (this J., 1903, 907) to exist. In general, the "free" cyanide present is a function of the ratio between zinc and alkali, and is not affected by the addition of potassium cyanide to the solution. Although the free cyanide increases with the addition of alkali, in practice the secondary effects of this free alkali on the solutions quickly impose a limit to the amount that can be added, and the bulk of the double cyanide present is inert and useless for the purpose of dissolving gold. Finally, the author emphasises the fact that the figures given are not to be regarded as accurately representing the degrees of dissociation, but merely as being proportional, and probably nearly approximate to them.—J. T. D.

Vanadium; Separation of —— *from Aluminium and Iron.* B. Glasmann. J. russ. phys.-chem. Ges., 1904, 36, 314—317. Chem. Centr., 1904, 1, 1537.

For the determination of vanadium in presence of aluminium and iron salts, the solution is treated with potassium iodide and sulphuric acid, the iodine set free removed by treatment with sulphur dioxide, the solution neutralised with potassium hydroxide, and the aluminium and iron precipitated by a mixture of potassium iodide and iodate. The reactions which occur are expressed by the equations:—$V_2O_5 + 4HI = V_2O_3 + 2H_2O + 2I_2$; $Fe_2(SO_4)_3$ or $Al_2(SO_4)_3 + 5KI + KIO_3 + 3H_2O = Fe_2(OH)_6$ or $Al_2(OH)_6 + 3K_2SO_4 + 3I_2$. The free iodine is removed by sodium thiosulphate, and the precipitated hydroxides are filtered off, washed and ignited. The filtrate is evaporated repeatedly with sulphuric acid, then with nitric acid to oxidise the vanadium trioxide, and then again with sulphuric acid. For the determination of the vanadium, it is reduced by sulphur dioxide, the excess of the latter removed and the solutio
titrated with potassium permanganate at 70° C.—A. S.

Oxygen in Working Cyanide Solutions; Industri
Method for the Determination of the ——. A. Priste
J. Chem. Metall. and Min. Soc., S. Africa, 1904, 4
364—369.

The oxygen in cyanide solutions is determined by measurin
the volume of the gases expelled from the solution o
boiling, absorbing the oxygen by alkaline pyrogallat
solution, and measuring the residual nitrogen; the weigh
of the oxygen is obtained by measuring in a Japp grav
volumeter a quantity of air corresponding to the volum
of oxygen found. To receive the gases expelled from t
boiling solution a Lunge nitrometer may be used, to th
side tube of which a flask completely filled with the cyanid
solution is connected by a piece of capillary tubing als
filled with the solution, the pyrogallate being introduce
through the funnel after disconnecting the flask. Or else,
Rammelsberg burette (see figure) filled with water free fro



air may be used to receive the gases, the side tube
the burette being connected to a vessel containing wat
whilst the upper end is joined, after the gases have be
expelled from the cyanide solution, to a U-shaped tu
containing the pyrogallate solution; the mixed gases a
forced to enter this tube repeatedly by raising and lowerin
the water reservoir. The boiling of the cyanide solutio
must in this case be continued until the water in th
burette becomes warm, when it may be assumed that
gases dissolved by it have been again expelled. Not les
than 300 c.c. of the solution should be taken for eac
test. Either modification of the method is said to gi
good results.—A. G. L.

Rotating Electrodes; Electrolytic Analysis with applic
tion of ——. R. Amberg. Z. Elektrochem., 1904, 1
385—386.

The author seeks for an explanation of the very favourab
effect of rapid rotation on the deposition of metals. T
current density cannot have such an important bearin
on the condition of the metal as is ascribed to it
ordinary cases of deposition, for with rapid rotation
can exceed 10 times that allowable in such cases, witho
any ill effects on the nature of the deposit. The auth
considers that the important factor is the relation of th
current strength to the "virtual" volume of the elec
trolyte; this apparent volume being proportional to t
velocity of rotation.—R. S. H.

Platinum; Determination and Separation of —— from various other Metals by means of Hydrazine in Ammoniacal Solution. P. Jannasch and C. Stephan. Ber. 1904, **37**, 1980—1992. (See also this J., 1898, 1157.)

From Potassium.—To the solution (containing about 0·15 grm. of platinum in a bulk of 30 c.c.) is added 0·5—1·0 grm. of hydrazine hydrochloride, and the whole is boiled for about 5 mins. Concentrated ammonia is now added till the yellow colour of the liquid just disappears, and the solution is vigorously stirred with a glass rod. If properly done, the platinum separates in a powdery condition, and does not adhere to the glass. About 5 c.c. of ammonia are now added, the liquid is boiled for 5—10 mins., and is then filtered through a double filter consisting of a small filter inside a larger one; care must be taken not to fill up over the edge of the small filter. Wash once or twice with hot water, then with warm nitric acid (1—5 per cent., free from chlorine); if water alone be used, some of the platinum invariably washes through towards the end. Place filter and precipitate in a porcelain crucible, burn off, ignite, and weigh. Evaporate the filtrate, expel ammonium salts, dissolve the residue, filter, evaporate and weigh as potassium chloride. *From Sodium.*—The process is worked exactly as in the case of potassium. *From Calcium, Strontium, and Barium.*—Proceed exactly as with potassium. In the filtrate, calcium is determined by precipitation as oxalate, strontium or barium as sulphate. *From Magnesium.*—Exactly as with potassium. The magnesium in the filtrate is determined as pyrophosphate. *From Manganese.*—The platinum is precipitated as above; as small amounts of manganese peroxide are formed by atmospheric oxidation, however, and adhere to the sides of the beaker and to the platinum precipitate, these must be washed with hot dilute nitric acid containing hydrogen peroxide, which reduces and dissolves the manganese compound, and does not affect the platinum. The manganese in the filtrate is determined by any usual method, the authors preferring precipitation by hydrogen peroxide. *From Tungsten.*—The platinum is precipitated as usual, but must be washed with dilute ammonia, not with nitric acid. The filtrate is evaporated to dryness with nitric acid, and the residue taken up with hot 10 per cent. nitric acid and well washed on a filter with the same. The tungstic acid in the filtrate is precipitated, according to Kehrmann's method, by means of quinoline acetate; the main quantity of tungstic acid is ignited gently, evaporated with hydrofluoric and sulphuric acids to remove silica, ignited, the quinoline precipitate added, and the whole ignited again and weighed. *From Copper.*—The whole of the copper, as well as the platinum, is precipitated if the quantity of hydrazine be sufficient; but the copper can be nearly all dissolved out from the washed precipitate by washing with hot dilute nitric acid, and treatment of the ignited platinum for a very short time with hot concentrated nitric acid removes the remaining traces without dissolving any of the platinum. *From Nickel.*—Some nickel goes down with the platinum, but can be completely removed by washing on the filter with hot 10 per cent. nitric acid. The filtrate is evaporated, ammonium salts removed, the residue dissolved n hydrochloric acid, filtered, and the nickel precipitated by sodium hydroxide. *From Cobalt.*—This metal behaved exactly like copper, save that not quite the whole of it was precipitated with the platinum. The separation of the cobalt from the precipitate was effected exactly as described under copper. If the platinum compounds, in these separations, contain any of the associated metals, some of these are not precipitated with the platinum, but go through into the filtrates.—J. T. D.

Hydrogen Peroxide; Analysis of Commercial ——. P. Sisley. Rev. Gen. Mat. Col., 1904, **8**, 164—165.

N a previous article (this J., 1901, 1028) the author pro-osed to detect oxalic acid in hydrogen peroxide by eutralising with ammonia, and adding acetic acid and alcium chloride. Recently, however, hydrogen peroxide ontaining fluorides has been put upon the market, and ich a product would give by the test a precipitate of alcium fluoride. The precipitate obtained with calcium chloride should therefore be examined as to whether it consists of fluoride or oxalate. The presence of a fluoride has no influence on the determination of oxalic acid in the precipitate by dissolving in dilute hydrochloric acid and titrating with permanganate.—A. S.

ORGANIC—QUALITATIVE.

Polyhydric Phenols and their Derivatives; Action of Molybdates on ——. [Distinguishing between m- and p-Phenylenediamine.] C. Frabot. Ann. Chim. anal. appl., 1904, **9**, 123—124. Chem. Centr. 1904, **1**, 1397—1398.

Pozzi-Escot has recently described a new reaction for molybdates with tannic, gallic and similar acids. The author finds that a solution of a molybdate acidified with sulphuric acid gives a blue coloration with a number of polyhydric phenols and derivatives of the same, substituted in the *p*-position. The molybdate solution (10 grms. of ammonium molybdate in 100 c.c. of water and 10 c.c. of concentrated sulphuric acid) may be used, for example, for rapidly distinguishing between *m*- and *p*-phenylenediamine. —A. S.

Fatty Acids; Process for Characterising ——. R. Locquin. Comptes rend. 1904, **138**, 1274—1276.

The hydroxyacetone esters of fatty acids R.CO.OCH$_2$.CO.CH$_3$, obtained by the action of the acid on hydroxyacetone or monochloro-acetone, give, with semicarbazide, very well defined semicarbazones, which are suitable for the characterisation of the fatty acids. One mol. of the acid under examination, dissolved in ether, is converted into its sodium salt by the addition of the calculated quantity of sodium; 1 mol. of monochloro-acetone is added, the ether is removed by heating on the water-bath, and the mixture is heated to 120°—130° C. for about 4 hours; the product is extracted with water and then with ether, and the ethereal solution is washed with sodium carbonate solution and water, and fractionated. The yield of ester is 70 to 75 per cent. of theory. The esters have boiling points several degrees higher than those of the parent acids. The semicarbazones of these esters are obtained in quantitative yield, are easily purified, and have sharply defined melting points.—T. F. B.

Sugars; Microchemical Detection of —— by Phenylhydrazine Acetate. E. Senft. Monatsh. f. Chem., 1904, **25**, 397—420.

In order to avoid the extractive action of aqueous reagents on the sugars, the author employs separate 10 per cent. solutions of phenylhydrazine hydrochloride and sodium acetate in glycerin. Two preparations of the tissue to be studied are made, by mixing one drop of each of the reagents on a glass slide, laying the object therein and covering with a glass slip. One of these preparations is maintained at the ordinary temperature and examined from time to time. The production of osazone generally occurs after one or two days, but earlier in the case of fructose than with glucose; in some cases, however, the period of examination may have to be prolonged to 14 days. The second preparation is heated on a boiling water-bath for half-an-hour, and is then examined after cooling. Saccharose is differentiated from glucose and fructose by the fact that the latter sugars form osazones at the ordinary temperatures if sufficient time be allowed, whereas saccharose yields an osazone only after heating. The test at the ordinary temperatures enables the localisation of the sugars in the tissues to be studied, whereas the hot test causes more or less diffusion. The crystalline form of the osazone, however, is not so striking in the cold tests as in the hot tests. In doubtful cases the osazone, after its formation, can be caused to crystallise more definitely by treatment with alcohol and evaporation of the solvent. The turbid preparations can be cleared by concentrated caustic potash or chloral solutions without injury to the osazone formations; the preparation may be mounted in glycerin jelly. In objects containing a certain amount of moisture, the sugars being in solution, the production of osazone in needle-shaped crystals is very rapid by the hot test. In dry objects containing the sugars in the solid state, the osazone forms slowly, and takes the form of granules, spheroids, or indefinite tufts. The author describes the application of the above tests to a large number of vegetable tissues, the description being accompanied by coloured illustrations.—J. F. B.

Citronella Oil; Modified Schimmel's Test for, and Nature of Adulterant of ——. Schimmel's Report, May, 1904, 27—33.

Nature of Adulterant.—Examination of large quantities of sophisticated citronella oil has failed to show any adulterated with resin spirit as stated by Parry and Bennett (this J., 1903, 163). In none of the lighter fractions obtained was metacymene found, which Kelbe has shown to be a normal constituent of resin spirit. All the specimens examined were adulterated with petroleum.

Modification of Schimmel's Test.—In view of the fact that certain more soluble kinds of Russian petroleum may be added to citronella oil to the extent of 5 or 10 per cent., without affecting its solubility in 80 per cent. alcohol, it is proposed to modify "Schimmel's test" as follows:—Two tests are made, one with the normal oil, the other with the oil to which 5 per cent. of Russian petroleum has been added; both should be soluble, neither should separate oily drops. [Schimmel's test is as follows:—The oil should yield a clear solution with one to two volumes of 80 per cent. alcohol. On increasing the volume of alcohol to 10, a slight turbidity may occur, but on standing in a closed vessel no oily drops should separate.]—J. O. B.

Oil of Cassia; Detection of Rosin in Essential ——. Schimmel's Report, May 1904, 19.

If added rosin be present in cassia oil a precipitate will be formed when a 25 per cent. solution in alcohol is treated with a freshly prepared saturated solution of lead acetate in the same solvent. Adulteration with colophony appears to be again prevalent, many specimens being met with which yield an unduly high residue on distillation.

—J. O. B.

ORGANIC—QUANTITATIVE.

Sugar Determination; Volumetric ——. L. Rosenthaler. Z. anal. Chem., 1904, **43**, 282—285.

The method devised by the author for determining dextrose and levulose, either separate or mixed, depends upon the fact that these reducing sugars, when oxidised with alkaline copper solutions, are transformed into acids which partially neutralise the alkalinity of the liquid. Experiment shows that 1 mol. of sugar yields eight equivalents of acid, and that each c.c. of the difference in volume between the normal acid required for neutralising the alkalinity before and after the reduction of the sugar, is equivalent to 0·0225 grm. of anhydrous dextrose or levulose. The alkaline copper solution employed, contains in every litre: crystallised copper sulphate, 17·5 grms.; glycerin, 75 grms.; sodium citrate, 125·0 grms.; 15 per cent. sodium hydroxide solution, 100 grms. This solution deposits a little cuprous oxide, which should be filtered off through asbestos after three or four days standing, or a few hours heating on a steam-bath. The alkalinity of the solution is measured by filtering 30 or 40 c.c. through a Gooch crucible, which is well washed through; to the filtrate and washings are added phenolphthalein and a slight excess of N/1 hydrochloric or sulphuric acid. The liquid is then boiled for 10 minutes over a naked flame, after which N/1 alkali is added until the solution becomes red, and then a drop of N/1 acid to produce decolorisation. In estimating dextrose or levulose, 5 c.c. of an approximately 1 per cent. solution are mixed with 20 c.c. of water and excess (30 c.c.) of the alkaline copper liquid, and the mixture heated to boiling, which is maintained for five minutes. The separated cuprous oxide is filtered off through a Gooch crucible, and washed with 150 c.c. of water. An excess of acid is then added to the liquid which is treated as in the alkalinity estimation described above. Many estimations can be made without renewing the asbestos of the Gooch crucible.—T. H. P.

Lignified Fibres [Mechanical Wood Pulp] in Paper; Colorimetric Determination of ——. E. Valenta. Chem.-Zeit., 1904, **28**, 502—503.

An ordinary colorimeter with two graduated tubes of 100 c.c. capacity, provided with stopcocks, and a horizontal reflector is required. A suitable reagent for lignified fibres having been selected, a mixture of coal tar dyestuffs having approximately the same spectroscopic value as the wood colour-reaction is prepared. This solution is standardised by means of sheets of thin paper, one containing 100 per cent. of mechanical wood, and the other a known lower percentage, *e.g.*, 50 per cent. Pieces of these papers are steeped for about ten minutes in the wood-pulp reagent in thin, flat-bottomed glass dishes, which fit between the tubes of the colorimeter and the reflector. One tube is filled with water and placed above the dish containing the stained paper with 100 per cent. of wood. Under the other tube is placed a dish containing the same paper soaked in water. The colour solution is then run into the second tube until the colour intensity is practically identical in the two tubes; the shade is then adjusted by the addition of very dilute solutions of other suitable dyestuffs, drop by drop. When the exact shade and intensity of colour have been established, the colour solution is diluted with water to the 100 c.c. mark. One c.c. of this solution should then correspond to one per cent. of wood, and the accuracy of the shade is tested, and adjusted if necessary, by comparison with the paper containing a known lower percentage of wood. For papers containing less than 10 per cent. of lignified fibres, the colour solution may be diluted with nine times its volume of water. A 10 per cent. solution of aniline sulphate is a convenient reagent for staining the paper, and the coloration so obtained, can be matched with "Naphthol Yellow S" or "Mikado Yellow," the shade being adjusted with dilute solutions of red and blue acid dyestuffs.—J. F. B.

Formaldehyde and its Polymers; Determination of ——. A. Seyewetz and Gibello. Bull. Soc. Chim., 1904, **31**, 691—694.

The method is based on the reaction—

$$6Na_2SO_3 + 2(H.COH)_3 + 3H_2SO_4 =$$
$$2[(NaHSO_3)_3 + (H.CHO)_3] + 3Na_2SO_4.$$

Although no reaction appears to occur between sodium sulphite and formaldehyde, on the addition of sulphuric acid and the consequent formation of sodium bisulphite, the aldehydic bisulphite compound is instantly formed, in the cold. The bisulphite compound being neutral to phenolphthalein, the sulphuric acid does not exercise its action on the indicator until sufficient bisulphite has been formed to combine with the whole of the aldehyde. The solution of sodium sulphite employed contains about 20 per cent. of the anhydrous salt. Its alkalinity towards phenolphthalein is first determined by titration with standard acid. A known weight of formaldehyde solution, or from 0·5 to 0·7 grm. of trioxymethylene is dissolved in 20 c.c. of the sulphite solution, after the addition of phenolphthalein, and the titration performed in the usual manner with standard acid. Although trioxymethylene is insoluble in water, it is readily dissolved by sodium sulphite solution. The method gives very exact results, and is available for very dilute solutions of formaldehyde. It compares favourably th methods of Legler, modified by Loesekann, and that of Craig.—J. O. B.

Roses, Essential Oil of [Otto of Roses]; Iodine Absorptio Test as a Factor in the Examination of ——. F Hudson Cox and W. H. Simmons. Analyst, 1904, **29** 175—178.

From 0·1 to 0·2 grm. of the sample to be examined dissolved in 10 c.c. of 90 per cent. alcohol is mixed wit 25 c.c. of Huebl's iodine solution and allowed to stand fo three hours at normal temperatures. The uncombine iodine is then titrated in the usual manner. Samples o genuine otto of rose are found, under these conditions, t show an iodine absorption value ranging from 187 to 194

Artificial otto, with stearoptene, has the values 224 to 254; without stearoptene, 261 to 279; palma-rosa oil, 296 to 307; African geranium oil, 213 to 225; Bourbon geranium oil, 213 to 215; Spanish geranium oil, 211; geraniol (apparently natural), 239; geraniol (apparently artificial), 307; Citronella oil, 217; citronellol, 187; linalol, 280; citral, 175; guaiacum wood oil, 298; stearoptene, none. All these bodies, which may be met with in adulterated rose oil, have iodine values well over 200, except citronellol and citral; geranium oils which have a relatively low iodine value have also a comparatively high ester content, so that heir presence would be at once detected by an abnormally igh ester value. A series of eight samples of doubtful purity had iodine values ranging from 133 to 234. Two, n which the addition of geraniol was suspected gave the odine values 219 and 212. The sample with the lowest odine value (133), contained ethyl alcohol. A mixture of wo parts of artificial otto and one part of genuine rose oil ad the value 215. It has been stated that temperature arkedly modifies the rate of iodine absorption in oils. In e case of rose oil this is not found to be so. Between 4° C. nd 27° C. no appreciable difference was observed. The ge of the reagent has a great modifying influence, older olutions being less active. In these experiments the ercuric chloride and iodine solutions were kept separate, ing mixed immediately before use. Titration was performed as rapidly as possible, since otherwise the colour found to be redeveloped. In the discussion following e above communication, A. C. Chapman suggested the bstitution for Huebl's reagent of a well cooled solution of omine in a suitable solvent, to be run into the cooled lution of essential oil under examination. This would nd to minimise intramolecular change, and to produce npler addition compounds. In that case, any difference the condition of saturation between various bodies would obably be more accentuated, and therefore more pronouncedly evident.—J. O. B.

XIV.—SCIENTIFIC & TECHNICAL NOTES.

dium in Uranium Compounds. B. B. Boltwood. Eng. and Mining J., 1904, **77**, 756.

om the results of the determination of the amount of io-active emanation from a number of minerals conning uranium, the author concludes that the amount of ium in a mineral varies directly with the percentage of nium present.—A. S.

con; Solubility of —— in Silver. A Variety of Crystalne Silicon Soluble in Hydrofluoric Acid. H. Moissan nd F. Siemens. Comptes rend., 1904, **138**, 1299—1303.

icon is much more soluble in silver than in lead or z (see this J., 1904, 374); moreover, the silicon which c tallises from the silver on cooling contains varying a unts of an allotropic modification soluble in hydrofl ric acid. In the subjoined table column I. shows the p entage of silicon dissolved in silver at various tempera s, and column II. the percentage of this dissolved silicon w h is soluble in hydrofluoric acid:—

Temperature.	I.	II.
° C.	Per Cent.	Per Cent.
970	9·22	58·02
1150	14·89	27·66
1250	19·26	19·00
1470	41·48	16·00

dissolving 2 to 4 per cent. of silicon in silver, and re ving the silver by means of nitric acid, specimens of th soluble variety of silicon were obtained; it remains un anged when heated in hydrogen or nitrogen to 1200° C., au onsists entirely of silicon; the density at 20° C. of a sample of which 99 per cent. is soluble in hydrofluoric acid was found to be, in water 2·3 to 2·38; in benzene, 2·42. —T. F. B.

Ferric Phosphate and other Phosphates; Soluble Colloidal Form of ——. W. J. Sell. Proc. Cambr. Phil. Soc., 1904, **12**, 388—390.

On treating 100 c.c. of a solution containing 50 grms. of anhydrous ferric chloride per litre, with 400 c.c. of a solution of diammonium hydrogen phosphate (100 grms. of the crystallised salt per litre), and, after shaking, making the mixture faintly ammoniacal, the white phosphate precipitate gradually became brown, and finally dissolved to a clear brown liquid. The solution was dialysed through parchment paper. The dissolved colloidal substance was found to consist of ferric phosphate ($FePO_4$), together with a little ferric hydroxide. When the dialysed solution was evaporated on the water-bath, the residue consisted mainly of the compound $2FePO_4.H_2O$, together with some hydroxide. This colloidal solution of ferric phosphate is tasteless, without action on litmus, and is gelatinised by various salts. Silver nitrate and potassium ferrocyanide merely coagulate the solution; potassium thiocyanate does not give a red coloration. The electric conductivity of the solution is very low. Colloidal phosphates of aluminium and chromium having analogous properties were also prepared.—A. S.

Formaldehyde in the Atmosphere; Determination of ——. H. Henriet. Comptes rend., 1904, **138**, 1272—1274.

Air was filtered through glass-wool and passed through a U-tube containing mercuric oxide, heated to about 250° C., to oxidise the formaldehyde to carbon dioxide; the air was then passed through potash bulbs. The difference between the amounts of carbon dioxide obtained by this method, and by the usual method, omitting the mercuric oxide tube, corresponds to the amount of formaldehyde in the atmosphere, which is found to be 2—6 grms. per 100 cubic metres.—T. F. B.

Enzymes; Connection between Instability and Activity in ——. O. Loew. Pflüger's Arch., 1904, **102**, 95—110. Chem. Centr., 1904, **1**, 1435—1436.

In the author's opinion the free chemical energy of enzymes depends upon the fact that they contain labile groups of atoms. In studying the nature of these labile groups the two labile forms and the stable form of the enzyme must be distinguished. The one labile form, the *zymogen*, is much more stable than the other, the peculiar *enzyme*, produced from it. The conversion of the zymogen into the enzyme is probably due to a chemical alteration within the molecule, possibly a breaking of a lactam linking. The mother substances of the zymogens, the *prozymogens*, are insoluble; they are probably compounds of the zymogens with nucleoproteids. From a consideration of the effect of various agents on the enzymes, the author concludes that the instability of the latter depends upon the presence of keto- and amino-groups.—A. S.

Castor-Seeds [Ricinus communis]; Hydrolysing Properties of ——. E. Urbain and L. Saugon. Comptes rend., 1904, **138**, 1291—1292.

Castor-seeds were heated with ten times the weight of starch and a small quantity of acetic acid. After 24 hours it was found that 10·9 per cent. of the starch was saccharified. Saccharose (about half the weight of castor-seed used) was then substituted for starch, with the result that 33 per cent. of the saccharose was inverted in 24 hours. Fatty oils are also hydrolysed by castor-seeds; in one case 90·8 per cent. of fatty acid was formed. It was found that cytoplasma could be substituted for the castor-seeds with success in all these experiments.—T. F. B.

Hydrolytic Properties of the Cytoplasma of Castor-Seeds are not due to a Soluble Ferment. M. Nicloux. Comptes rend., 1904, **138**, 1352—1354.

Cytoplasma, prepared from castor-seeds, was freed from oil, dried, and extracted with water, and also with dilute acetic acid. In neither case had the extract or the residue the hydrolytic power possessed by the cytoplasma in the first place (see this J., 1904, 614; and preceding abstract), showing that the hydrolytic action is not due to a soluble ferment, and that water destroys the hydrolysing power of the substance in the absence of oil.—T. F. B.

"*Flocculation*" ["*Ausflockung*"] *Phenomena.* M. Neisser and U. Friedemann. Münch. Med. Wchschr., **51**, [11]; Chem. Centr., 1904, **1**, 1387—1388.

An emulsion of mastic was prepared by pouring an alcoholic solution of the latter into distilled water. In such an emulsion, the particles of mastic have an electro-negative charge, as is shown by the fact that if the emulsion be brought between the platinum electrodes of a battery of high E.M.F., the particles travel to and are deposited at the anode. The addition of small quantities of salts or acids to the emulsion causes, as is known, the separation of the particles in flocks. Experiments with aluminium sulphate, ferric chloride, ferric nitrate, colloidal ferric hydroxide, arsenic trisulphide, and ordinary ferric hydroxide, showed that when colloids and suspensions carrying opposite electric charges, are brought together in certain proportions, they are simultaneously separated in the form of flocks. Aniline dyestuffs behave like colloids, the acid dyestuffs bearing electro-negative and the basic, electro-positive charges. The basic dyestuff causes the "flocculation" of a mastic emulsion. With an excess of the negatively-charged mastic, arsenic trisulphide, Benzopurpurin, and Eosin, or of the positively-charged colloidal ferric hydroxide, Bismarck Brown, Neutral Red, and Methylene Blue, a so-called "checking" occurs, *i.e.*, flocculation no longer takes place; even the colloid present in smaller proportion is not separated. This "checking" is due, in the authors' opinion, to the envelopment of the one colloid (or suspension) by the other. Albuminoid colloids, such as gelatin, serum, and bacteria, also protect negatively-charged suspensions and colloids from the action of those precipitants, by which they are not themselves precipitated. These latter colloids, which by themselves are not capable of causing flocculation of suspensions and colloidal solutions, acquire that property when a quantity of a salt insufficient in itself to cause flocculation is added to them. The albuminoid colloids may be regarded as mixtures of colloids, or as colloids which, unlike the metallic colloids, possess both electro-positive and electro-negative properties. A small addition of a salt is sufficient to change the amphoteric colloid into one carrying only either an electro positive or electro-negative charge; the colloid then behaves like the metallic colloids, *i.e.*, in small quantities it causes the flocculation of oppositely-charged colloids or suspensions, whilst in large quantities it prevents flocculation.—A. S.

Crystals; Formation and Transformation of Fluid Mixed ——. A. C. de Kock. Z. physik. Chem., 1904, **48**, 129—176.

It is known that *p*-azoxyanisol and *p*-methoxycinnamic acid melt to the fluid-crystalline state, and at higher temperatures become isotropic liquids. Mixtures of the two fluid crystals exist in all proportions, and pass into or from isotropic liquids like a single body; an eutectic mixture was observed. Quinol (hydroquinone) or benzophenone, mixed with either of these bodies, forms a fluid crystal, but only up to a certain concentration, and equivalent quantities depress the solidifying point to the same extent. The behaviour of these mixtures supports the view that fluid crystals consist of a homogeneous phase and not of an emulsion.—W. A. C.

Alcoholates. J. W. Brühl. Ber., 1904, **37**, 2066—2068.

The method of Biltz and the author (this J., 1891, 568) for obtaining alcoholates free from alcohol of crystallisation, by boiling a solution of the alcohol in toluene or xylene with metallic sodium is exceedingly slow, for the metal is melted and exposes only a limited surface, and the alcohol is in large excess till towards the end of the operation, so that the crystallised alcoholate is first formed, and has to be gradually decomposed. The author's new process is as
follows:—The sodium is pulverised under boiling xyle
(Brühl, Ber., **35**, 3516) in a roomy flask, and more xyle
added so as to make about 250 c.c. to 23 grms. of sodiu
The flask is fitted with a cork carrying a Brühl's stir
and a reflux condenser with a soda-lime guard tube and
dropping funnel, and is placed in cold water. T
calculated quantity of the alcohol is now very slow
dropped in, and the reaction, if not complete when t
addition is finished, is readily completed by warming for
short time. The alcoholate formed can be used either
suspension in the xylene, or the latter can be filtered off
the pump, leaving a paste of alcoholate and xylene.
desired, benzene, petroleum spirit, or ether can be us
instead of xylene, after pouring off the xylene that was u
to pulverise the sodium.—J. T. D.

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ahrbuch der Elektrochemie. Begründet und bis 1901 herausgegeben von Profs. Dr. W. Nernst und W. Borchers. Berichte über die Fortschritte des Jahres 1902. Unter Mitwirkung der Herren Dr. P. Askenasy, W. Borchers, K. Elbs, F. Harms, M. Mugdan und O. Saekur. Herausgegeben von Dr. H. Danneel. IX. Jahrg. W. Knapp's Verlag, Halle a/S. 1904. Price M. 24.

arge 8vo volume, containing 678 pages of subject-matter, ith 137 illustrations, and followed by alphabetical indexes authors and subject-matters. The subjects dealt with e the following:—I. Scientific Part. (i) General; i) Conductivity and State of the Solutions; (iii) Chemical nergy and Electrical Energy; (iv) Polarisation and lectrolysis. (v) Electrical Phenomena in Gases. II. pplied Electrochemistry. (i) Current-production;) Inorganic Electrochemical Processes and Products; i) Organic Compounds. (iv) Electrolysis of Alkalis d Bleaching Agents. (v) Apparatus for Electrochemical echnology. Bibliography and Journals.

Compendium of Chemistry, including General, Inorganic, and Organic Chemistry. By Dr. Carl Arnold, Prof. of Chemistry in the Royal Veterinary College of Hanover. Translated by John A. Mandel, D.Sc. First Edition. John Wiley and Sons, New York. 1904. Price 3.5 dols. Chapman and Hall, Ltd., London.

volume, containing 572 pages of subject-matter, with habetical index, and divided into the following branches: General Chemistry; II. Inorganic Chemistry; and III. ganic Chemistry.

nual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions, 1903. Volume II. [Cd. 2081.] Price 5*s.* Eyre and Spottiswoode.

s is the second volume of the Annual Statement of de, the first volume having been noticed on page 285 of *Board of Trade Journal* for May 12. This volume tains statements of the trade of the United Kingdom each foreign country and British Possession during years 1899–1903, and of the imports and exports at British port during the same period, as well as ounts of transhipment, warehousing, and goods passing ansit.

es and Quarries: General Report and Statistics r 1902. Part IV. Colonial and Foreign Statistics. Cd. 2084.] Price 1*s.* 8*d.* Eyre and Spottiswoode.

T return, which is compiled annually in the Home e, contains statistics of the number of persons em- ed, of accidents, and of the output of minerals at mines quarries in British Colonies and foreign countries. It ars from the statistics contained in the report that the amount of coal produced in the world in 1902 unted to 800 million tons, the value of which is ated at more than 270 million pounds sterling. The ving figures show the main sources from which the supply of the world is obtained:—

Country.	Met. Tons.	Value.
		£
United States	273,600,000	75,373,000
Great Britain	230,739,000	93,521,000
Germany	150,600,000	52,654,000
Austria-Hungary	39,479,000	10,528,000
France	29,997,000	17,459,000
Belgium	22,877,000	12,081,000

Trade Report.

I.—GENERAL.

Trinidad; [Chemical] Trade of ——.

U.S. Cons. Reps., Nos. 1967 *and* 1968, *June* 1 *and* 2, 1904.

Petroleum of good quality is found in Trinidad, but up to the present it has not been produced in any quantity; attempts are being made to establish the industry on a commercial basis. Kerosene is obtained entirely from the United States, and imports are increasing. Asphalt was exported to the value of 162,000*l.* in 1903. The quantities of the various kinds were—"crude," 145,000 tons; "epuree," 11,000 tons; liquid, 20,000 galls. Manjak has recently been found in considerable quantity.

About 10,000,000 cocoanuts are exported annually, 6,000,000 going to England last year, and the remainder to the United States. 25,000 galls. of cocoanut oil, and 1,325,000 lb. of copra (containing 65 to 75 per cent. of oil) were also exported last year. Soap is manufactured locally to a small extent, and about 2,000 tons (mostly blue mottled soap) were imported in 1903.

48,000 barrels of cement were imported in 1902–3, about 36,000 barrels coming from England.

68,000*l.* worth of balata was exported from Trinidad in the year 1902–3; of this quantity, nearly 52,000*l* worth was received from Venezuela and re-exported; the greater part goes to Holland.

The exports of sugar amounted, in 1903, to 47,000 tons. The value of the product is rapidly decreasing, being 394,000*l.* in 1903, as against 594,000*l.* in 1900, and 768,000*l.* in 1880. 310,000 galls. of molasses and 213,000 galls. of rum were exported last year.

Italy; Chemical Industry of ——.

Foreign Office Miscellaneous Series, No. 610

A notable increase in the importation of the following raw materials has taken place:—Coal, roots for dyeing or dressing, phosphates, manures, and india-rubber. There has also been an increase, but to a less degree, in the importation of gums, resins, and oleaginous seeds.

Among partly manufactured materials there has been a more or less marked increase in the case of the following articles:—Heavy mineral oils, potash, caustic soda, alkaloids, carbonates, oxides, chlorides, nitrates, sulphates, paraffin, wood-pulp, pig iron, copper, lead, zinc, and tin, and iron and zinc in sheets. The importation of acids, dressed hides, palm and cocoanut oil has remained stationary, whilst there has been a decline in cements and hydraulic lime.

There has been a marked decline in the importation of terra-cotta, majolica, and plate-glass. A diminution, though to a less degree, has also taken place in the importation of wrought iron, forged iron, wrought copper, earthenware, and glasswork; whereas the importation of petroleum, soap, and paper has remained stationary. On the other hand, there has been an increase in the importation of varnishes, bricks, porcelain, starch, and india-rubber.

The importation of foodstuffs has increased in the case of olive oil, cotton oil, and lard, and decreased in the case of beer and sugar.

With regard to exports :—

Of raw materials the exportation of raw hides, mineral ores, marble, cement, hydraulic lime, and sulphur is increasing; whereas the exportation of tartar and roots remains stationary.

Partly manufactured materials showing a general increase in their exportation are the following:—Essential oil of orange, unpurified gallic and tannic acid, tartaric acid, liquorice juice, tanned hides, and lead in ingots. The exportation of boric acid has remained stationary.

Among manufactured goods an increased exportation has taken place in matches, writing and wrapping paper, tiles, bricks, and worked india-rubber. The exportation of soap and wrought lead remains stationary.

In foodstuffs there is an increased exportation of wine in bottles, oranges and lemons. The exportation of wine and olive oil fluctuates considerably, depending on the yearly home crops. During the last few years the exportation of wine has been declining owing to a decreasing demand from the Austro-Hungarian market. The increased importation of potash, caustic soda, alkaloids, carbonates, chloride of lime, copper sulphate, and oxides of zinc and lead, points to the fact that home production is still inadequate to meet the growing demands of Italian industry for these products. The increased importation of nitrate of soda and chloride of potash may be accounted for by the fact that these chemicals are being increasingly used in Italy for agricultural purposes. The increase in the importation of solid paraffin, gums and resins, points to an increased consumption of these articles for the manufacture of candles, soap, and paper respectively. There has been a considerable increase in the importation of scrap and pig iron. The production of the latter in Italy does not yet reach 25,000 tons annually, whereas its consumption is computed at between 180,000 and 190,000 tons. Two new blast furnaces, however, one of which has already commenced operations at Portoferraio, are capable of yielding about 100,000 tons of forged pig iron annually. The amount of iron and steel produced annually is now estimated at about 190,000 and 115,000 tons respectively. The importation of copper, lead, tin and zinc in ingots and in sheets has increased, whilst that of copper manufactures has diminished. The exportation of lead in ingots has increased; that of lead manufactures, however, has remained stationary.

The native production of lead has steadily increased since the year 1890. The importation of the mineral has, however, undergone no material change, whilst its exportation has been gradually declining. There has thus been an increasing quantity of this mineral at the disposal of the home market, and the native production of lead in ingots has consequently made an important advance.

The increased importation of tin in ingots may be ascribed to the development of the tin plate industry in Italy.

Very little zinc is produced in Italy, although large quantities of the ore are mined and exported. There is a growing demand for foreign zinc in ingots. For zinc in sheets Italy is entirely dependent on foreign production.

The advance made in the paper industry accounts for the increasing importation of wood-pulp. The export of both writing and wrapping paper is rapidly increasing.

Both the importation and exportation of raw hides and skins have increased to a like degree, but those of dressed hides have not varied. The export of articles manufactured from skins is brisker than their import, and the importation of articles required for tanning and dressing hides is increasing. Italian trade in hides and skins is making substantial progress.

Marble quarries have been more productive of late years, and there has been an increased export both of the raw and worked material.

The abolition of the export duty on sulphur and the formation of the Anglo-Italian Sulphur Company, have favoured the sulphur industry, and since the year 1896 a great increase has taken place in the exportation of this substance in all its forms.

The increased exportation of bricks from Italy corresponds to the increase in home production. Between 1890 and 1902 the total output of bricks increased from 3,605,509 to 4,643,569 tons. The cement industry is also sharing in the general progress. From the year 1890 onwards importation has decreased and exportation has greatly augmented. In the pottery industry since the year 1890 the national production of terra-cotta has advanced from 63,996 to 78,184 tons; majolica and earthenware from 24,458 to 37,242 tons; porcelain from 1,378 to 4,026 tons. The importation of pottery has considerably diminished of late years, whilst its exportation is steadily increasing.

In 1890 the home production of glass and crystal in sheets, &c., was computed at 9,854 tons; that of articles made of glass and crystal at 31,546 tons. In 1902 the figures were 17,050 and 45,220 tons respectively. The importation of glass and glassware is diminishing.

The quantity of soap imported is still three times i excess of the amount exported; but the increasing importa tion of soda, fats, and other materials used in the manufacture of soap is a sign that the industry is beginning to develop, though it will doubtless be many years befor it can be in a position to supply the demands of the hom market. Greater activity is likewise being displayed i the manufacture of candles, as the quantity imported i decreasing, whilst a small export trade is commencing The progress achieved in this branch is confirmed by th increase in the importation of candle ingredients, such a stearic acid and paraffin.

The manufacture of matches in Italy is progressing bot in quantity and quality. The amount exported increase annually.

The starch industry, although progressing, has hither been unable to compete with the imported article, especiall that of fine quality.

The increasing demand for guttapercha and india-rubbe as insulating materials has helped to foster the industry i Italy. There has been a great increase in the importatio of the raw material, but at the same time there are a numb of gutta and rubber articles which are not yet produce in Italy.

During the last few years there has been a marke increase in the importation of linseed, rape seed, and colz

The manufacture of beet sugar has progressed ve rapidly. The production is now about sufficient to supp the requirements of the home market. 1,000,000 tons raw sugar were produced in Italy in the year 1902, a before long it is probable that there will be a surpl for export.

Native beer is being brewed in larger quantities, a foreign importation has declined proportionately.

The following table shows the values of some of the abov mentioned products in Italy in 1903 :—

	£		£
Sulphur	1,720,000	Sulphuric acid	357,30
Iron	140,000	Copper sulphate	351,50
Zinc	480,000	Calcium carbide	115,20
Bricks	1,635,360	Lead carbonate	102,60
Lime	800,000	Ballistite	89,04
Cement	218,000	Dynamite	72,64
Glass	680,000	Other explosives	68,2
Porcelain	143,680	Nitric acid	38,84
Plaster of Paris	113,800	Potassium nitrate	32,00
Superphosphates and other manures	1,030,800	Hydrochloric acid	18,44

UNITED KINGDOM; TRADE OF —— WITH SOME FOREIGN COUNTRIES.

Pharm. J., June 11, 1904.

The following table shows the value of certain classes articles (of interest to British chemical manufactur imported into Great Britain from certain foreign countr and exported from the United Kingdom to certain fore countries during the years 1902 and 1903.

Country.	Imports from Various Countries to Great Britain.			Exports from the United Kingdom to Various Countries.		
	Article.	1902.	1903.	Article.	1902.	1903.
		£	£		£	£
Holland	Chemical manufactures and products	355,055	360,668	Chemical manufactures and products	163,688	175,119
	Drugs	89,152	56,810	Soap	33,360	38,310
Belgium	Chemical manufactures and products	162,981	169,904	Chemical manufactures and products	116,641	130,617
	Drugs	33,576	41,035	Soap	58,792	72,532
	Castor oil	47,727	35,810			
France	Chemical manufactures and products	374,378	402,109	Chemical manufactures and products	543,317	628,219
	Drugs	88,953	66,061	Medicines and drugs	25,962	38,277
	Castor oil	65,047	32,630			
	Perfumed spirits	84,095	82,637			
Russia	Drugs	6,651	7,760	Chemical manufactures and products	156,913	132,581
weden	Chemical manufactures and products	28,071	30,333	Chemical manufactures and products	90,348	88,638
Norway	Drugs	24,227	9,272	Chemical manufactures and products	50,590	43,811
	Chemical manufactures and products	9,688	22,956			
enmark	Chemical manufactures and products	5,692	7,702	Chemical manufactures and products	33,315	32,962
ermany	Chemical manufactures and products	601,569	599,780	Chemical manufactures and products	239,197	252,380
	Drugs (including quinine)	157,241	81,836	Drugs and medicines	76,815	76,445
	Methyl alcohol	13,113	10,573			
	Perfumery	4,015	6,070			
ortugal	Chemical manufactures and products	10,694	20,400	Chemical manufactures and products	94,623	130,396
				Medicine and drugs	3,464	3,375
pain	Chemical manufactures and products	39,911	31,543	Chemical manufactures and products	236,746	240,659
	Drugs of all sorts	3,920	5,462	Drugs and medicines	15,415	14,811
aly	Chemical manufactures and products	234,152	226,293	Chemical manufactures and products	486,822	554,669
	Drugs of all sorts	27,103	19,160	Drugs and medicines	12,634	16,649
ina	Drugs	50,468	27,586	Chemical manufactures and products	55,247	80,093
				Soap	89,465	99,454
pan	Chemical manufactures and products	4,466	13,302	Chemical manufactures and products	232,323	212,814
	Drugs	79,122	146,690	Medicines and drugs	13,261	9,251
nited States of America.	Chemical manufactures and products	962,112	953,215	Chemical manufactures and products	792,466	763,051
	Drugs	246,050	246,255	Soap	50,146	53,618

II.—FUEL, GAS, AND LIGHT.

GAS TESTING; REPORT OF COMMITTEE ON ——.

Times, June 8, 1904.

The departmental committee appointed by the Board of ade to inquire as to gas testing in the metropolis, recom- nd that the standard burner to be used for testing the minating power of all qualities of gas should remain, as present, the Sugg's London (No. 1) Argand burner, and t the chimney to be used therewith should be of uniform —namely, 6 ins. long and $1\frac{7}{8}$ ins. internal diameter; that the purpose of determining the nominal illuminating ver of gas of any quality, the gas should be burnt in the ndard burner at the rate of five cubic feet an hour; t t provision should be made for official testing of i minating power in a flat flame burner of a kind to be scribed by the gas referees, and that the result of such t s be recorded and notified to the various authorities a companies concerned and to the Board of Trade; that c ial tests of the calorific power of the gas supplied by e company should also be made, recorded, and notified a above; that the existing statutory provision which r ires the gas to be wholly free from sulphuretted h rogen (which is, in fact, impracticable) should be n ified, and that for the future the test which the gas s ld be required to pass should not be more severe than t specified in the schedule to the Gasworks Clauses Act, l ; that the obligation placed upon the companies with r rd to the removal of sulphur compounds (other than s huretted hydrogen) should be abolished, but that test- ir for information only should continue to be made in su manner and to such extent as may be prescribed by tl gas referees; that the gas to be tested should be brought di t from the main to the testing-room by a single service p , without tap, branch, or connection; that in case of di rence between the gas companies and the gas referees as the reasonableness of any requirements of the referees th lecision of the chief gas examiner should be conclusive; that, except as may be involved in the foregoing recommendations, the powers and duties of the gas referees should remain as at present; that it should not be obligatory upon the controlling authority to test on Sundays; and that the duties of the chief gas examiner should include the hearing of all applications by the controlling authority for the recovery of forfeitures in respect of illuminating power, purity, or pressure, and the assessment of the forfeitures to be paid by the company in all cases except those in which he is unable to certify that the default is not substantial, or that it is not due to careless conduct of the works.

TAR FOR MANUFACTURE OF BRIQUETTES IN RUSSIA; DUTY-FREE ADMISSION OF ——.

Bd. of Trade J., June 2, 1904.

With reference to the notice which appeared at page 278 of this Journal for the 15th March last, relative to the probable reduction or abolition of the Russian import duty on coal tar, the Russian Government has authorised the duty-free importation of that article for the purpose of manufacturing briquettes for a period of 10 years, under regulations to be framed by the Minister of Finance in consultation with the Minister of Agriculture.

III.—TAR PRODUCTS, PETROLEUM, Etc.

PETROLEUM INDUSTRY; THE CAUCASIAN ——.

S. Bartoszewicz. Naphta, 1904, **12**, 119—121.

The number of producing wells at Balakhany is diminishing, the figures in 1901 being 817, in 1902, 729, and 673 in 1903. The average output per well has declined, being 16·1, 14·3, and 13·5 thousand poods in the respective years. The number of new borings continues to decrease, being only 76 in 1903, as compared with 97 in the preceding year and 187 in 1901; and there is an increase in the number of pumping wells, 475 in 1903 against 262 in 1901. The total monthly output has fallen away to a corresponding extent, from an average of 9,815,000 poods in 1901, to 8,458,000 in 1902, and 7,784,000 in 1903. The estimate for the present year is 8 million poods per month.

The Sabountchy district is also considered to show signs of exhaustion, though the output is now estimated at 22 million poods per month, against 20—21½ million in the last few years.

The small Romany field is expected to yield an increased output, estimated at 9 million poods per month. At Bibi-Eibat there has been an increase in the number of producing wells and new borings, the former numbering 143 in 1902 and 164 in 1903, whilst the latter amounted to 72 and 98 respectively. The average output for the current year is taxed at 13 million poods a month, which, with the other fields already mentioned, gives a total of 54 million poods per month, or 640 to 650 million for the whole year. To these figures must be added the oil furnished by spouters; and as the yield on this head for the past eight years has never been less than 67·8 million poods, an estimate of 60 million poods is considered reasonable. This raises the total to over 700 million poods, which, with 40 million from the Grosny field, makes a grand total of nearly 760 million poods for the current year.

The capacity of the Baku refineries is set down as half as much again as the estimated output. Of the crude oil produced in the district, 610 million poods are refined on the spot, yielding about 175 million poods of refined oil. The total consumption, for the home and export trades, is 150 million poods.—C. S.

X.—*METALLURGY.*

TRANSVAAL MINERAL PRODUCTION IN 1903.

Bd. of Trade J., June 2, 1904.

The following table showing the value of the mineral output of the Transvaal during the six months and year ended 31st December last, is compiled from the half-yearly report of the Transvaal Government Mining Engineer :—

—	Jan. to June, 1903.	July to Dec., 1903.
	£	£
Gold	5,587,510	7,040,547
Silver	15,974	20,771
Coal	412,474	465,502
Diamonds	43,956	195,796
Chemicals	10,962	13,608
Stone, lime, bricks, &c.	103,816	155,480
Total	6,174,692	7,891,704

The total value of the minerals produced in the year 1903 was, therefore, 14,066,396*l*.

The total output of gold from all sources in the Transvaal for the half-year ending 31st December, 1903, amounted to 1,657,485 oz. fine, an increase over the preceding half-year of 342,072 oz.

The figures of the gold output since the resumption of mining operations subsequent to the war are as follows :—May to December, 1901, 1,097,219*l*.; January to December, 1902, 7,301,501*l*.; January to December, 1903, 12,628,057*l*.

The value of gold produced during the past year is therefore at the rate of 1,052,338*l*. per month.

The estimated quantity of silver contained in the gold bullion declared for the half-year under review, amounted to 194,788 fine oz., as against 155,282 fine oz. for the previous half-year.

STEEL-HARDENING METALS IN THE UNITED STATES.

Bd. of Trade J., June 2, 1904.

The following is given by the *Iron Age* (New York) of 12th May from the preliminary report of the United States Twelfth Census :—Under the head of steel-hardening metals are included metals used or experimented with in the hardening of steel, although some of them are used more generally for other purposes. The metals included in this class are nickel, chromium, tungsten, molybdenum, titanium, uranium, and vanadium. There is still another metal that naturally comes under this head, namely, manganese; but on account of its comparatively large production it is treated separately. The statistics for these metals during 1902 state the number of mines at 12, with a product of 4,444 tons (of 2,000 lb.), valued at 83,717 dols.

Of the 12 mines, four were producing tungsten ores; three, uranium and vanadium ores; one each, chrome ore, molybdenum ore, and rutile; and two, nickel and cobalt ores. Nickel and cobalt ores were concentrated into a matte. Tungsten ores were concentrated more or less. The value of the other ores is the value as mined. One chrome ore mine in California, four tungsten mines in Arizona, Colorado, Nevada, and Wisconsin, and two uranium and vanadium mines in Colorado were reported idle during 1902.

Manganese Ore.—The statistics include those ores carrying over 44·3 per cent. of metallic manganese. At the eleventh census the number of mines was not stated, but the product was given as 24,197 long tons, valued at 240,559 dols. The production reported was in Arkansas, California, Georgia, Nevada, North Carolina, South Carolina, Tennessee, Vermont, and Virginia. The statistics for the year 1902 make the number of mines 19, and the product 16,477 long tons, valued at 177,911 dols. The preparation usually given the ore at the mine is crushing, washing, and screening. There were 68 mines—in Arkansas, California, Georgia, Indian Territory, Maine, Montana, North Carolina, South Carolina, Tennessee, Virginia, West Virginia, and Wisconsin—reported idle during 1902, and three in Colorado, Utah, and Virginia, at which development work was reported.

XV.—*MANURES, Etc.*

CHEMICAL MANURES IN THE CANARY ISLES.

Bd. of Trade J., June 2, 1904.

The French Consul at Las Palmas reports that the development of the agricultural resources of the Canary Isles is causing a large demand for chemical fertilisers Liverpool, London, and Hamburg are the principal sources of supply.

The kinds most in request are: ammonium sulphate sodium and potassium nitrate, superphosphates, potassium sulphate, and vitriol.

CHEMICAL MANURES IN ITALY.

Bd. of Trade J., June 2, 1904.

The "Bollettino Ufficiale del Ministero d'Agricoltura, &c.," publishes a report on the consumption of chemical manures in Italy, which contains the following particulars :—

Superphosphates.—The most widely used chemica manures are superphosphates. The annual consumptio of these is about 4,000,000 quintals (quintal = 220·4 lb avoirdupois), mostly manufactured in Italy. The importa tion from the United Kingdom, France, and Belgium i very slight.

Thomas Slag.—About 700,000 quintals of Thomas sla were consumed in 1903, a figure which shows a larg advance on previous years. Most of it was imported fro Luxemburg, Germany, and Belgium: a small quantity cam from the United Kingdom.

Nitrate of Soda.—For various reasons, scientifi agriculturists have not availed themselves of this fertilise so much in Italy as in other countries; its use is, however becoming more general. In 1903, 200,000 quintals wer consumed, the whole of which came from Chile.

Sulphate of Ammonia.—About 125,000 quintals o sulphate of ammonia are used annually, the major portio coming from the United Kingdom. Only one-third of th amount consumed is produced in the country.

Potassic Manures.—Up to the present, the use o potassic manures has been somewhat restricted, as com pared with other manures. The demand for them i however, certain to increase greatly, more particularly fo the cultivation of beetroot, in which salts of potash ar largely used. About 30,000 quintals were imported in 19 from Stassfurt.

The following table gives a rough estimate of the uantity and value of chemical manures annually consumed u Italy :—

——	Quantity.	Value.
	Quintals.	Lire.
Mineral superphosphates	3 700,000	26,400,000
Bone superphosphates	300,000	3,000,000
Thomas slag	700,000	3,600,000
Nitrate of soda	200,000	4,600,000
Ammonium sulphate	125,000	4,100,000
Potassium salts	50,000	1,250,000
Total	5,075,000	42,950,000

XX.—*FINE CHEMICALS, Etc.*

CAMPHOR AND CAMPHOR OIL.

Schimmel's Report, April—May 1904.

The new Japanese Act regulating the monopolisation of ie camphor and camphor oil production in Formosa and apan has now been published in the "Deutsches Handels-rchiv," 1904. It reads as follows :—

Crude Camphor and Camphor Oil Monopoly.

(Japanese Gazette, 17th June 1903.)

Par. 1. The Government has the right of monopoly of ude camphor and camphor oil.

Par. 2. Whoever produces camphor and camphor oil, ust deliver the crude camphor and camphor oil to the overnment.

The time and place of delivery are fixed by the vernment.

Par. 3. The Government pays an indemnity for the crude mphor and camphor oil delivered. The amount of the lemnity is fixed by the Government, and must be blished beforehand.

Par. 4. In so far as it is not a question of crude camphor camphor oil sold by the Government, no one is allowed have these articles in his possession, or to hold, transfer, othecate, or use them; nor to ship them abroad, or from l Japan to Formosa, or *vice versa*. This does not apply, wever, to the possession of holding prior to the date of ivery to the Government, or if this delivery has been ayed for legitimate reasons.

ar. 5. Camphor and camphor oil may only be exported, shipped from Old Japan to Formosa, or *vice versa*, from ports indicated by the Government.

ar. 6. Whoever desires to produce crude camphor or c phor oil, or to purify crude camphor, must fix the place o production, the number of furnaces, the weight and q ntity of the estimated annual production, and also the d of the commencement of the manufacture, and must a ly to the Government for permission therefor.

f it is desired to make a change on any of the points for w ch under the foregoing paragraph permission has been g nted, or to discontinue the manufacture, permission must fi be obtained from the Government.

r 7. When a person has taken over the manufacture of ca phor or camphor oil by right of succession, he must gi notice of the fact to the Government.

hen a person otherwise than by way of succession de es to take over the manufacture, he must apply to the G ernment for permission.

r. 8. No person carrying on the manufacture of crude ca hor and camphor oil, is allowed to carry on at the sa time the purification of crude camphor.

ar. 9. The Government has the power of limiting the pr uction of crude camphor and camphor oil, in accordance wi the relation between supply and demand of camphor an amphor oil.

r. 10. When a person to whom permission for the ma facture of camphor and camphor oil has been granted act ontrary to the provisions of the present Act, or of the reg ations issued in accordance with this Act, or when he do not fulfil the conditions which have been determined in advance, the Government has the right to withdraw the permission granted.

When in view of the situation in the district of the Savages it is considered necessary for the purpose of maintaining public order, the Government may temporarily suspend the manufacture of crude camphor or camphor oil, or withdraw the permission to manufacture.

Par. 11. The producers of camphor and camphor oil must, in accordance with the regulations, enter in their business-books all facts concerning the manufacture.

Par. 12. The competent officials have the right to examine all business books relating to the production of camphor and camphor oil, and to make an inspection of all places where camphor or camphor oil are, or are suspected to be, produced or stored, and further to take all other steps required for the exercise of control.

Par. 13. Camphor and camphor oil are as a rule sold at a fixed price, but where necessary the sale takes place by auction instead.

Par. 14. Crude camphor or camphor oil which have not been sold by the Government are subject to seizure by the Government when found in possession of any person who holds them without conscious infringement of the present Act. In such case indemnity is paid in accordance with par 3, unless it is a question of crude camphor or camphor oil which have been mixed with other substances.

Pars. 15 to 23. (Articles dealing with penalties.)

Par. 24. With regard to the regulations required for carrying this Act into effect, the Governor General of Formosa decides in Formosa all questions which (in Old Japan) appertain to the department of the competent Minister.

Supplementary Regulations.

Par. 25. This Act comes into operation on the 1st of October, 1903.

The Regulations concerning the camphor and camphor oil monopoly in Formosa,* and also the Regulation concerning the manufacture of camphor and camphor oil in Formosa† are abrogated.

Par. 26. Crude camphor and camphor oil which in Old Japan, at the time this Act comes into operation, are the property of producers of or dealers in camphor and camphor oil, must, in accordance with the present Act, be delivered to the Government in accordance with the regulations which shall be published hereafter.

Par. 27. The provisions of this Act do not apply to crude camphor and camphor oil, which in Old Japan, at the time this Act comes into operation, are the property of other persons than producers of or dealers in camphor and camphor oil.

Par. 28. Whoever, at the time this Act comes into operation, produces in Old Japan camphor or camphor oil, must obtain before the 1st November 1903 permission (for continuing his trade). Up to that date he may continue the production as hitherto.

Par. 29. Whoever, in accordance with the regulations concerning the production of camphor and camphor oil in Formosa, has obtained permission, will be considered, until the expiration of the said permission, as having obtained it in accordance with the present Act.

ROSE OIL [OTTO OF ROSES]; COMMERCIAL POSITION OF ESSENTIAL ——.

Schimmel's Report, May 1904, 79—80.

The otto market has been very dull this year. The abundant rose harvest of 1903 stopped any manipulation of prices, and trade has also been upset by the troubles in the Balkans. Although otto has been plentiful, parcels of high quality have been rare. Exports in 1903 amounted to 6,210 kilos. as compared with :—1902, 3,676 kilos.; 1901, 3,028 kilos.; 1900, 5,346 kilos.; 1899, 3,534 kilos. Of last year's exports, 1,054 kilos. went to the United Kingdom, 1,027 kilos. to Germany, 1,456 kilos. to the United States, and 1,870 kilos. to France.—J. O. B.

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* D. Hand.-Arch., 1899, I., p. 840. † *Ibidem*, p. 841.

CITRONELLA OIL; COMMERCIAL POSITION OF ——.

Schimmel's Report, May 1904, 27.

Conditions limiting the production have caused a marked rise in the price of citronella oil, the advance being from 9*d*. to 1*s*. 1½*d*. per lb. Last year's export showsa considerable decrease, being the lowest recorded since 1896. The figures for the last three years are :—1901, 1,430,168 lb.; 1902, 1,294,750 lb.; 1903, 1,062,594 lb.—J. O. B.

PEPPERMINT OIL; JAPANESE ——.

Schimmel's Report, May 1904, 72.

The harvest of peppermint last year was good, the crop being estimated in October at 200,000 catties, or about 120,000 kilos. From official data, the total exports of dementholised oil for the year 1903 amounted to 31,021 catties, of which 12,735 catties came to London, 9,900 to Hamburg, and 1,790 to New York. The export of peppermint crystals for the same period amounted to 46,410 catties, London taking 14,895 and San Francisco 900 catties. The total export amounted to 77,341 catties, or 103,340 lb. Probably the stock on hand in Japan is not more than 50,000 catties.—J. O. B.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 12,253. Barnes and Tory. Pyrometers. May 30.

„ 12,358. Soc. l'Air Liquide and Lévy. *See under* VII.

„ 12,541. Montlaur. Employment of X rays and cathode rays in chemical reactions produced by electric discharges. [Fr. Appl., June 3, 1903.]* June 2.

„ 12,606. Proctor and Morgan. Method of heating or cooling fluids. June 3.

„ 12,639. Robson. *See under* VII.

„ 12,964. Heneke. Process of and contrivances for evaporating and drying various materials and substances. June 8.

„ 13,186. Neel. Desiccation of liquids.* June 10.

„ 13,227. Lennox. Evaporator for evaporating the liquid in brewers' wash, sewage, waste or spent dyes, &c., and concentrating the solids in the same. June 11.

[C.S.] 14,195 (1903). Abel (Siemens and Halske Act.-Ges.). Process and apparatus for the separation of different liquids from each other, and also for separating liquids from bodies suspended or dissolved therein. June 15.

„ 15,862 (1903). Boult (Meyer's Sohn). Centrifugal machines and the like. June 15.

„ 23,909 (1903). Harvey. Crucible furnaces. June 15.

„ 6822 (1904). Murphy. Furnaces. June 8.

„ 9038 (1904). Krause. Process and contrivance for solution with the aid of compressed air of chemicals for the rectification of water. June 8.

„ 9853 (1904). Espenhayn and Hunger. Chemical heating device. June 8.

[C.S.] 10,753 (1904). Johnson and S. H. Johnson and Co., Ltd. Process and apparatus for filtering liquids. June 15.

II.—FUEL, GAS, AND LIGHT.

[A.] 12,221. Deschamps. Gas producers.* May 30.

„ 12,231. McLean and Paterson. Treatment of peat. May 30.

„ 12,247. Carolan (Gen. Electric Co.). Electrodes and lamps for arc lighting. May 30.

„ 12,361. Tobiansky. Refuse-consuming and gas-producing furnaces. May 31.

„ 12,659. Redman. Gas washers or scrubbers. June 4.

„ 12,854. Robel. Mantles or incandescence bodies for gas lighting. June 7.

„ 13,161. Carolan (Gen. Electric Co.). Manufacture of filaments for incandescent lamps. June 10.

„ 13,253. Crawford. Manufacture of filaments fo incandescing electric lamps. June 11.

„ 13,271. Cherry. Producer- and furnace - ga cleansing plant. June 11.

[C.S.] 14,529 (1903). Smith. Apparatus for generating and burning gas, and utilising the heat thereof June 8.

„ 15,060 (1903). Imray (Burgemeister). Constructio of gas washers. June 8.

„ 16,497 (1903). Woodall and Duckham. Manufacture of gas. June 15.

„ 16,908 (1903). Lake (Petit and Co.). Manufactur of briquettes of fuel. June 8.

„ 6540 (1904). Brookes (Makeever). Means an apparatus for treating and enriching gas. June

„ 9912 (1904). Boutillier. Gas generating apparatu for producing poor gas, free from tarry matters June 8.

„ 10,123 (1904). Addicks. Apparatus for the manufacture of carburetted water gas. June 15.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[C.S.] 17,266 (1903). Schulze and Chem. Fabr. Ladenbur Separation of the phenols of coal tar from th neutral constituents thereof. June 8.

„ 17,585 (1903). Schwab. Saturators for sulphat of ammonia. June 15.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 12,270. Lake (Oehler). Sulphur dyes.* May 30

„ 12,512. Newton (Bayer and Co.). Manufactur of new colour lakes. June [illegible]

„ 13,227. Lennox. *See under* [illegible]

[C.S.] 15,700 (1903). Imray (Meist[illegible] und Brüning). *See under* XI.

„ 16,581 (1903). Newton (Bayer and Co.). Manufacture of new azo colouring matters and of ne intermediate products therefor. June 8.

„ 16,684 (1903). Imray (Ritsert). Manufacture o alkyl esters of 3.4-diamidobenzoic acid. June

„ 17,347 (1903). Johnson (Badische Anilin un Soda Fabrik). Manufacture of oxybenzalde hydes and oxybenzoic acids and intermediat products. June 15.

„ 17,565 (1903). Newton (Bayer and Co.). Manufacture of new anthraquinone derivatives. June

„ 17,768 (1903). Johnson (Badische Anilin un Soda Fabrik). Manufacture of colouring matters of the acridine series. June 15.

„ 17,805 (1903). Meyenberg and Clayton Aniline Co Ltd. Manufacture of sulphur dyestuffs. June 1

[C.S.] 17,965 (1903). Newton (F. Bayer and Co.). Manufacture of new derivatives of the anthracene series. June 15.

„ 18,131 (1903). Imray (Meister, Lucius and Brüning). Manufacture of indoxyl and its homologues. June 15.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 12,397. Textile Fibres, Ltd., and Tickel. Treating rhea, ramie, or China grass, flax, and other similar vegetable fibres. June 1.

„ 12,630. [illegible]. Detergent for degumming fibres. June [illegible]

„ 12,631. Wo[illegible]. Method of refining and separating vegetable fibres and a mixture therefor. June 3.

„ 12,632. Wohle. Detergent for scouring wool. June 3.

„ 13,090. Haddan (Elosegui). Fulling of woollen fabrics and other fibres or compositions adapted to be felted.* June 9.

„ 13,110. Girdwood. Preparing flax and similar fibres and means therefor. June 10.

C.S.] 12,342 (1903). Lumb, Walshaw, and White. Machines for milling or fulling and washing and scouring textile piece goods. June 8.

„ 14,840 (1903). Imray (Peterhauser and Rechberg). Process for improving the fastness of indigo-dyed woollen goods to wear. June 8.

„ 2680 (1904). Johnson (Goldman). Manufacture of felted or matted goods or fabrics from fibres or fibrous material. June 8.

„ 2681 (1904). Johnson (Goldman). Manufacture of felted or matted goods or fabrics from fibres or fibrous material. June 8.

„ 2682 (1904). Johnson (Goldman). Manufacture of felted or matted goods or fabrics from fibres or fibrous material. June 8.

„ 2683 (1904). Johnson (Goldman). Treatment of fibres or fibrous materials to form felted or matted goods or fabrics. June 8.

„ 2684 (1904). Johnson (Goldman). Production of felted or matted goods and fabrics from fibres or fibrous materials. June 8.

„ 8107 (1904). Ostersetzer. Process for finishing woven and other textile fabrics printed with patterns in metal powder. June 15.

VII.—ACIDS, ALKALIS, AND SALTS.

A.] 12,358. Soc. [illegible]'Air Liquide and Lévy. Method of separat[illegible] air and gaseous mixtures into their el[illegible]nd apparatus therefor. [Fr. Appl., [illegible]3.]* May 31.

, 12,[illegible] [illegible]m (Tcherniac). Treatment of ferrocyanides to obtain hydrocyanic acid. June 3.

, 12,639. Robson. Apparatus for vaporising ammonia and re-absorbing ammoniacal and other gases soluble in water. June 3.

, 12,694. Wheelwright. Manufacture and application of a new form of amorphous phosphorus. June 4.

13,140. Von Grätzel. Process and apparatus for the manufacture of sulphuric acid. June 10.

[S.] 8117 (1903). Tee. Manufacture of salt. June 15.

12,391 (1903). Monin. Treatment and utilisation of artificial sulphates and carbonates of lime. June 8.

17,449 (1903). Tcherniac. Manufacture of cyanides. June 8.

17,585 (1903). Schwab. *See under* III.

[C.S.] 17,981 (1903). Johnson (Badische Anilin und Soda Fabrik). Manufacture of a sulphate of a higher oxide of manganese. June 15.

„ 1066 (1904). Niedenführ. Process and arrangement for manufacturing sulphuric acid. June 8.

„ 9619 (1904). Parker. Production of Glauber salts and ferrous sulphate from nitre cake or acid sodium sulphate. June 8.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 12,201. Fidler. Continuous kilns for burning blue and salt-glazed and vitrified bricks, tiles, pipes, and terra cotta and like goods. May 30.

[C.S.] 12,861 (1903). Diaz. Drying- and baking-kilns for ceramic ware and the like. June 8.

„ 9295 (1904). Rowart and Francq. Apparatus for the manufacture of sheet glass. June 8.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 12,570. Winstanley. Machines and process for making bricks. June 3.

„ 12,707. Akerman. Kilns for burning cement and other substances. June 4.

„ 12,708. Thompson (Chem. Elekt. Fabr. "Prometheus"). *See under* XI.

„ 12,940. Vokes. Artificial granite, and process for the manufacture of the same. June 8.

[C.S.] 7068 (1904). Mahieux. Non-inflammable composition for use as a protective coating. June 8.

„ 9444 (1904). Jacobs. Coating bricks, plastering, &c. June 8.

„ 9765 (1904). Denaeyer. Cements and limes. June 8.

„ 9963 (1904). Imray (Carborundum Co.). Manufacture of carborundum articles. June 8

X.—METALLURGY.

[A.] 12,269. Eskuchen und Georgs-Marien-Bergwerks und Hütten verein Act.-Ges. Process of and apparatus for the production of pig iron by reduction and smelting. May 30.

„ 12,347. Steuart. Apparatus for the extraction of metals from their ores. May 31.

„ 12,507. Thorpe. Process of etching and apparatus therefor. [U.S. Appl., June 4, 1903.]* June 2.

„ 12,603. Evans. Treatment of minerals. June 3.

„ 12,621. Bailey. Sea-gold recovery. June 3.

„ 12,785. Fleischer. Process for the manufacture of iron. June 6.

„ 12,797. Leduc and Griffiths. Process for the enriching of calcareous ores.* June 6.

„ 12,816. Brayshaw. Melt or bath for hardening steel. June 7.

„ 12,817. Brayshaw. Process of hardening high-speed steel. June 7.

„ 12,976. Cutler. Furnace for calcining quicksilver ores. [U.S. Appl., June 10, 1903.]* June 8.

„ 13,121. Nicholas. Treatment of zinc ores. June 10.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 12,433. Brit. Thomson-Houston Co. (Allgem. Elektricitäts Ges.). Process for the production of insulating materials. June 1.

„ 12,541. Montlaur. *See under* I.

„ 12,633. Alton and Ramsay. Separating zinc by electrolysis. June 3.

[A.] 12,707. Thompson (Chem. Elekt. Fabr. "Prometheus"). Production of electrical resistance bodies from amorphous or crystalline carbide of silicon or boron or of silicon, &c. June 4.

„ 12,844. Franklin and Furnival. Bunsen semi-dry battery. June 7.

[C.S.] 13,182 (1903). Croucher. Electro-deposition of metals upon aluminium, alloys of aluminium and other metals. June 15.

„ 15,700 (1903). Imray (Meister, Lucius und Brüning). Process for reducing organic substances in electrolytic bath. June 8.

„ 9523 (1904). Duntley. Galvanic battery cells. June 8.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[C.S.] 8233 (1904). Nicloux. Material for saponifying fats and oils and method for obtaining it. June 8.

„ 9018 (1904). Van Meerdervoort. Process and apparatus for the continuous manufacture of sterilised fish oil and fish guano. June 8.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

[A.] 12,512. Newton (Bayer and Co.). *See under* IV.

[C.S.] 17,120 (1903). Kollinger. Binding media for oil colours. June 8.

(*B.*)—Resins, Varnishes.

[A.] 12,663. Melville, Rees, and Rees. Substitute for oilcloth or linoleum.* June 4.

(*C.*)—India-Rubber.

[A.] 12,273. Richter. Manufacture of artificial india-rubber. May 30.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

[A.] 12,388. Tullis. The tanning of hides into leather. June 1.

[C.S.] 21,379 (1903). Weiss. Detanning mineral-tanned leather or leather waste or the like for the manufacture of gelatin and glue. June 15.

XV.—MANURES, Etc.

[A.] 12,573. Beater and Toppin. Fertiliser. June 3.

[C.S.] 9018 (1904). Van Meerdervoort. *See under* XII.

XVI.—SUGAR, STARCH, GUM, Etc.

[A.] 12,385. Weiss. Saccharometers. June 1.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 12,417. Storrier. Method of producing non-deposit beers and stouts for bottling. June 1.

[A.] 12,718. McKenny. The maturing of whiskey an other spirituous liquors. June 6.

„ 12,917. Hemming. Aerated beverages.* June 7.

„ 12,962. Vignier. Materials for the production o whiskey and beer. June 8.

„ 13,227. Lennox. *See under* I.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—Foods.

[A.] 12,754. Oetker. Manufacture of substitutes fo honey. June 6.

„ 13,159. Spurge. *See under* XX.

„ 13,266. Craveri. Process of preserving meat.* June 11.

(*B.*)—Sanitation; Water Purification.

[A.] 12,232. McLean and Paterson. Treatment of sewage.* May 30.

„ 13,227. Lennox. *See under* I.

[C.S.] 13,560 (1903). Hewes. Method and means fo treating sewage. June 8.

„ 14,536 (1903). Cameron. Treatment of distillers refuse, sewage, and the like. June 8.

„ 21,668 (1903). Boudry. Process for the simultaneous production of purified and sterilise water as well as of distilled water. June 8.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 12,576. Dobson. Method of and means for removing sand and like foreign matter from pape pulp, &c. June 3.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 12,440. Newton (Bayer and Co.). Manufacture o a pharmaceutical compound. June 1.

„ 13,159. Spurge. Treatment of fruits and the production of scents or flavours therefrom. June 1

„ 13,171. Hunter. Machine for extracting oil fro the rind of limes and other citrous fruits. June 10.

„ 13,285. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new derivatives of lecithins. June 1

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 13,179. Gem Dry Plate Co., Ltd., and Bake Method of photographing coloured objects i monochrome. June 10.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 12,627. Hough. Nitrated carbohydrates. [U. Appl., June 13, 1903.]* June 3.

„ 12,637. Weiller and Weiller. Explosives. June

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Notices.

ANNUAL GENERAL MEETING, NEW YORK, 1904.

The Annual General Meeting will be held in New York City on Thursday, Sept. 8th, and following days. Members who propose to attend the meeting are requested to inform the General Secretary, as soon as possible, by what steamer they will travel. The principal boats will be met on arrival at New York by a representative of the Reception Committee, who will escort the guests to the Hotel Seville, Madison Avenue and 29th Street, which will be the Society's Headquarters in New York. A similar system will be observed at all the other cities visited by the special train. A revised programme appeared in the March 31st issue.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Mr. Wm. H. Nichols has been nominated to the office of President under Rule 8; Dr. Edw. Divers, Prof. W. R. Eaton Hodgkinson, Mr. Max Muspratt, and Mr. T. J. Parker have been nominated Vice-Presidents under Rule 8; and Sir Wm. Ramsay has been nominated a Vice-President under Rule 11.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the ordinary members of the Council. Forms for this purpose can be obtained, on application, from the General Secretary, or from the Hon. Local Secretaries of the Canadian, New York, and Sydney Sections.

Extract from Rule 18 :—"No such nomination shall be valid unless it be signed by at least ten members of the Society who are not in arrear with their subscriptions, nor unless it be received by the General Secretary, at the Society's Office, at least one month before the date of the Annual General Meeting at which the election to which it refers takes place. Nor shall any such nomination be valid if the person nominated be ineligible for election under Rules 12 or 15. No member shall sign more than one nomination form."

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

Battle, Alf. E., l/o Cape Town; 18, Clarendon Road, Leeds.

Burn-Murdoch, J. V., l/o Chihuahua; Neuck, Larbert, Stirlingshire.

Craig, T. J., l/o Manchester; 21, Dunard Road, Rutherglen, N.B.

Doidge, H., l/o Church Street; Mountain Rise, Maritzbu Natal.

Dyson, Septimus, l/o New York; 8, Belmont Aven Harrogate, Yorks.

Elworthy, H. S.; all communications to Battlefield Ro St. Albans, Herts.

Fogetti, L., l/o Woodland Park; 3722, Lake Aven Chicago, Ill., U.S.A.

Gamer, A. C. C., l/o Bellingham; P.O. Box 772, Taco Wash., U.S.A.

George, W. K.; Journals to c/o Standard Silver Co., L 35, Hayter Street, Toronto, Canada.

Gimmingham, Edw., l/o Cranbourn Street; 28, Stamf Hill Mansions, Stamford Hill, N.

Green, G. F. Dudbridge; all communications to c/o Da and Co., Gainsbro' Road, Hackney Wick, N.E.

Halliwell, Edw., l/o Walton's Parade; Ribble Joint C mittee, 2, Stanley Place, Preston.

Hunter, Prof. A. G. Kidston; communications to c/o A. Kidston & Co., 81, Great Clyde Street, Glasgo Journals as before.

Jadhava, K. B., l/o Baroda; Nausari, Bombay, India.

King, Sidney L., l/o Barnsbury; 1, Russell Villas, Pop Grove, Strawberry Hill, Middlesex, Analytical Chem

Macdonald, J. W., l/o Silvertown; all communication Cleveland, The Glebe, Blackheath, S.E.

McKillop, Jno., l/o 99; 93, Brook Green, London, W.

Perkins, F. G., l/o Florida; Planters' Manufacturing 192, Fulton Street, New York City, U.S.A.

Rawson, C., l/o Ludwigshafen; c/o Kuttroff, Pickha and Co., Duane Street, New York City, U.S.A.

Rix, Wilton P., l/o Newcastle; Frocester House, Kingh Road, Egremont, Cheshire.

Saniter, E. H., l/o Middlesbrough; Strafford Villa, M gate, Rotherham.

Sawin, L. R., l/o Brooklyn; Office of Sanitary Pat Katonah, N.Y., U.S.A.

Shields, Dr. Jno., l/o Rio Tinto; 4, Stanley Garde Willesden Green, N.W.

Taylor, A. P., l/o Jarvis Street; (Journals) c/o John Tay and Co., 531, Front Street East, Toronto; and (co munications) 110, Madison Avenue, Toronto, Cana

Wesson, D., l/o Savannah; c/o Southern Cotton Oil 24, Broad Street, New York City, U.S.A.

Woolcott, H., l/o Highbury; 44, Zinzan Street, Reading

MEMBER OMITTED FROM LIST.

1902. Bousfield, E. Geo. P., c/o Henry Leetham and S Hungate Mills, York, Electro-Chemist.

Deaths.

Aspinwall, Capt. H. C., of Haskell, N.J., at New Y June 28.

Hunt, Edwin, of Wood Green, Wednesbury, at Edgbas July 5.

London Section.

CORRECTION.

THE LOSS OF NITRE IN THE CHAMBER PROCESS.

BY J. H. K. INGLIS.

(This J., June 30th, 1904, 643—645.)

In the remarks of Mr. Oscar Guttmann, in discussion 645, col. 1), the following sentence occurs:—"Dr. schig, in the presence of Prof. Lunge and others, had monstrated the correctness of his theory by analyses on e large scale."

Prof. G. Lunge writes, under date July 5th, that it might em from the above that he had, by his silence, conceded e correctness of Raschig's views, but that this was not so. the annual meetings of the Society of German Chemists, pers were only exceptionally followed by discussions, and this particular case, the lateness of the hour precluded y discussion whatever.

New York Section.

Meeting held at Chemists' Club, on Friday, May 20th, 1904.

DR. V. COBLENTZ IN THE CHAIR.

METHODS FOR THE RAPID ESTIMATION OF BORIC ACID.

BY DR. MILTON F. SCHAAK.

The estimation of boric acid has, until recent years, been nded by many difficulties. This has been chiefly owing he fact that none of its compounds appear to possess properties necessary for a satisfactory separation or vimetric estimation.

o mineral analyses it was customary to determine the on indirectly, or to estimate all the constituents of the eral, and calculate the difference as boric acid.

Methods for the titration of boric acid were also lacking l it was observed by Thomson (this J., 1893, 433) that addition of glycerol to solutions increased the acidic ure of boric acid to such a degree that accurate titrations d be made by using phenolphthalein as the indicator.

he method most in favour at the present time for the vimetric estimation appears to be that of Gooch (Amer. r. of Science, 1899, 34; see also this J., 1887, 385). this method the boric acid is liberated from its compounds by acetic acid, and heated with methyl alcohol, forming the volatile ester trimethyl borate, which is completely removed by distillation. The distillate is collected over a weighed amount of calcium oxide or sodium tungstate, by which the ester is decomposed; the boric acid becomes fixed, and, after ignition, is calculated from the increase in weight. This method, while appearing simple, yet requires great skill and patience for the attainment of accurate results.

he method of Berzelius, by which the potassium borofluoride is separated and weighed, was selected by Thaddeeff (this J., 1898, 953) after an extended investigation of other methods. He recommends the isolation of the boric acid by distillation with sulphuric acid and methyl alcohol, collecting the distillate in aqueous solution of potassium hydrate, treating with hydrofluoric acid, potassium acetate, and alcohol for the separation of the potassium borofluoride, which is then weighed. Since the borofluoride is not entirely insoluble in the mixture used, very accurate results cannot be expected; besides which, the operations are tedious.

Partheil and Rose (Ber., 1901, 3611) have suggested extracting the boric acid from its aqueous solutions by means of ether in a perforator, and weighing. The extraction requires 18 hours, and easily becomes complicated by the presence of other substances.

The most recent attempt to effect a gravimetric determination is that of Mylius and Meusser (Ber., 1904, 397; this J., 1904, 269), who sought to utilise the fact that boric acid possesses basic properties, and will react with acids. They selected a compound with phosphoric acid, boryl phosphate (BPO_4) and proceed as follows:—An aqueous alcoholic solution of boric acid is treated with ammonia and phosphoric acid, evaporated to dryness, and finally heated in an atmosphere of steam to assist in removing the excess of phosphoric acid before weighing as BPO_4. The method has not yet been perfected, their results being only approximately accurate.

It is evident from the foregoing that the gravimetric methods available at the present time are not suited to the rapid estimation of boric acid, and recourse must therefore be had to volumetric methods.

As is well known, aqueous solutions of boric acid are but slightly dissociated, and alkalis have an uncertain action in the presence of phenolphthalein as indicator, while methyl orange is practically not affected, and solutions containing free boric acid will react neutral with it.

The observation of Thomson, already mentioned, led to the use of glycerol to increase the acidic properties sufficiently for the titration in the presence of phenolphthalein.

Since that time the action of glycerol upon boric acid has been investigated at various times, and it has been shown that substances having hydroxyl groups all acted upon boric acid to a greater or less degree, and that it is probable that alkyl compounds are formed which are highly dissociated in the solvent, and which, according to the law of mass-action, are stable only in concentrated solution of the reacting substance; it is therefore necessary to employ a large excess of the alkyl base in proportion to the water present.

Glycerol and mannitol are the polyatomic alcohols most available for the purpose of the titration mentioned.

It has been shown by Jones (Amer. J. of Science, 1899, 127) that the alkyl compound with mannitol acts quite as energetically upon a mixture of potassium iodide and iodate as a mineral acid in liberating iodine according to the equation—

$$5KI + KIO_3 + 6HBO_2 = 3I_2 + 6KBO_2 + 3H_2O.$$

He has made this fact the basis of a method for the iodometric determination of boric acid (this J., 1899, 947).

Jones has also used a mixture of potassium iodide and iodate in conjunction with sodium hyposulphite to neutralise the free mineral acid in a borate solution previous to the titration with mannitol and phenolphthalein. The method has no advantage over the use of methyl orange to indicate the neutral point, and it is more complicated, and this is especially the case with his iodometric method.

A solution of boric acid in methyl alcohol acts almost like an aqueous solution, and can be titrated only after the addition of a polyatomic alcohol. Gladding (J. Amer. Chem. Soc., 1898, 288) has used this method for titrating the distillate obtained by distilling a borate with syrupy phosphoric acid and methyl alcohol.

The application of this method is rather limited, as no provision is made for operating in the presence of carbonates or volatile mineral acids.

The general application of the methods for the volumetric determination of boric acid in minerals and in presence of other substances is very desirable, and it is my purpose to point out several sources of possible error, and to present methods by which the interfering substances may be eliminated and correct results attained.

Of the methods thus far proposed for the volumetric determination of boric acid, it appears to me that the employment of methyl orange to indicate the point at which all the boric acid in a borate solution has been liberated, and the subsequent addition of glycerol for the titration of the acid in the presence of phenolphthalein, can be relied upon to give results with rapidity and accuracy in all cases where the solution to be titrated is free from interfering substances. A type of this class of titration may be illustrated by the method now in general use.

I. To about 50 c.c. = 1—2 grms. borax, 1—2 drops solution methyl orange are added and standard acid until all the boric acid has been liberated, when the solution will react acid with the indicator. In the presence of a carbonate the acid solution is heated a short time with a reflux condenser until the carbon dioxide is removed. The solution is cooled and made exactly neutral to methyl orange, and an amount of neutral glycerol, equivalent to fully one third the volume of the solution at the finish, is added together with about ½ c.c. solution phenolphthalein. The titration is then finished with standard alkali, which must be free from carbonate. The calculation is based upon the following equation :—

$$B_2O_3 + 2NaOH = 2NaBO_2 + H_2O.$$

Borates insoluble in water are dissolved in dilute hydrochloric acid, in the cold or with a reflux condenser, and treated as in the foregoing.

This method will not give accurate results when aluminium salts are present, as the solution when neutral to methyl orange will contain free alumina, which will combine with the alkali when titrating with phenolphthalein and glycerol, and thus be calculated as boric acid. Iron salts, when present in considerable proportion, also interfere by obscuring the colour reactions of the indicators. There appears to be no combination of indicators known which will serve to prevent this error, and it therefore becomes necessary to separate the iron and aluminium from the solution before titrating.

Most of the minerals containing aluminium also contain small amounts of silica, and when an attempt is made to remove the aluminium by means of alkali carbonates, insoluble borates are formed, and therefore this method is unsatisfactory for the removal of the disturbing elements.

I have found that when barium carbonate in excess is added to a solution containing free boric acid with aluminium and iron salts, all the latter will be precipitated and can be removed by filtration, while only a slight portion of the free boric acid will react with the barium carbonate and pass into solution as borate, and this can again be decomposed by the addition of acid. Upon this observation I have based the following method (II.) :—

A convenient amount of the substance is placed into a flask with an excess of dilute hydrochloric acid, and heated with a reflux condenser for solution. After cooling, the solution is brought to a definite volume and filtered. 100 c.c. of the filtrate, which may represent 2—4 grms. substance, are brought almost to the neutral point of methyl orange with alkali, 2—3 grms. barium carbonate are then added, and the solution warmed on the steam-bath ½ hour, cooled, brought to 200 c.c., and filtered. The solution will then be free from the interfering substances, and may be titrated as in I.

This method has been found to be well suited for the rapid assay of the various natural compounds of borate of lime, such as colemanite and pandermite, which usually contain small amounts of alumina and silica, iron, magnesia, and gypsum.

In cases where it is desirable to have the boric acid free from other substances before titration, I have found, after investigation, that distillation with methyl alcohol and titration of the distillate can be accomplished with rapidity and accuracy, and that the interference of volatile mineral acids or carbon dioxide can be eliminated.

A study of the properties of methyl borate shows that it is immediately decomposed into its components upon contact with water. This fact led to the introduction of water into the receiver, which at once leads to the formation of free boric acid, and the chances for loss at this point are thus minimised. It also suggests that the use of concentrated sulphuric acid and the exclusion of water during the distillation will secure freedom from hydrolytic action an thus lead to the greatest rapidity of distillation.

As already mentioned, solutions of boric acid in methy alcohol may be titrated like aqueous solutions. Whe however, mineral acids or carbon dioxide are present, the cannot be eliminated as in water solutions.

I find that mineral acids in the methyl alcohol distillat may be neutralised with alkali, previous to the titration c the boric acid in presence of glycerol, by the use of methy orange or Congo red test-papers. By spotting upon Cong red test-paper, 0·1 c.c. N/5 acid to 100 c.c. methyl alcoh may be detected. Organic acids which would interfere ca readily be excluded from the substance. The carbo dioxide can be removed by heating the substance wit sulphuric acid before the distillation.

III. The apparatus for distillation may conveniently b arranged as follows :—A long wide-necked 200 c.c. Kjeldal flask may serve as the decomposing flask. This flask fitted with a stopper carrying three tubes, one of whic serves to connect it with a condenser in such a manner to avoid any of the acid liquid being carried over durin the distillation. Another tube is to be connected with flask for supplying a current of methyl alcohol vapou which is to be conducted to the bottom of the decomposin flask, thus serving to keep the mixture agitated and avo bumping during the distillation. The third tube serves t introduce the methyl alcohol needed to form the mixtu with the sulphuric acid and the substance, and may also b fitted with a clamp and valve for equalising the pressur when needed. The receiver which is to be connected wit the condenser is trapped with a Mohr's bulb.

For the estimation a portion of the dry, finely pulveris substance is placed into a long narrow tube and weighe The contents are then emptied into the decomposing flas without allowing any of the substance to remain in the nec of the flask. The tube is now weighed again, the differen being the amount of substance used for the estimation.

A sufficient amount of concentrated sulphuric acid added to form a thin paste with the substance, and th flask heated gently to expel carbon dioxide or other volat acids, and cooled.

About 60 c.c. of water are placed in the receiver, th terminal tube of the condenser being made to dip into th water. The Mohr's bulb is also filled with water an attached as a trap to the receiver. The decomposing flas containing the cold mixture of the substance and sulphur acid, is now connected with the flask for the generation methyl alcohol vapour, and with the condenser, all th connections being air-tight.

The distillation is then started by adding to the decomposing flask, in one portion, sufficient cold methyl alcoh to equal about 20 times the amount of free sulphuric aci present. Methyl alcohol vapours are then passed from th generating flask until the boric acid has all passed into th receiver.

During the distillation the decomposing flask is heated a temperature sufficient to prevent any marked change volume of the methyl alcohol which was originally added.

The distillation will usually be complete in abo 30 minutes, when the receiver can be changed, and, ensure complete removal of the boric acid from the su stance, a further distillate collected and tested.

The water from the Mohr's bulb is added to the distillat which is then neutralised with alkali, when necessary, the aid of Congo-red or methyl orange test-paper. Th titration is then completed after the addition of neutr glycerol and phenolphthalein as in I.

When pure methyl alcohol is used and care is taken n to allow the mixture with sulphuric acid in the decomposi flask to become concentrated, accurate results can attained, even in the presence of large amounts of chlorid and carbonates. Fluorine, when present in large amou must be removed from the substance before distillatio Borates which are not decomposed by concentrated su phuric acid are treated by suitable methods of fusion befo distillation.

The following results of the assay of several samples commercial borate of lime will serve to illustrate the val of the three methods. The results by Method I. s erroneous, except with the crystal colemanite, which is free from the impurities mentioned:—

Substance.	Methods. I.	II.	III.
	B_2O_3.	B_2O_3.	B_2O_3.
Colemanite (impure)	41·2	40·7	40·68
„ „	33·12	32·46	32·34
„ „	34·61	34·12	34·00
„ „	40·00	38·31	38·38
„ (transparent crystal)	50·71	50·70	50·78
Pandermite (impure)...........	27·81	27·24	27·10
„ „	44·11	44·06	43·86

Nottingham Section.

Meeting held at Nottingham, on Wednesday, March 30th, 1904.

MR. J. T. WOOD IN THE CHAIR.

NOTES ON PETROLEUM SPIRIT OR BENZINE.

BY H. STANLEY GARRY AND H. J. WATSON.

The distillation fractions of crude petroleum which are collected between certain arbitrary ranges of temperature yield a variety of products which are sold in commerce under the trade names of petroleum ether, gasoline, benzine, ligroin, or light petroleum. These are colourless mobile liquids used as solvents for gums and resins, for removing grease from textile fabrics, wool washing, paint mixing, and in preparation of varnishes, manufacture of oil-cloth, preparation of alkaloids, extraction of oils and fats in the leather and rubber industries, and in dry cleaning. The requirements of these trades vary considerably as to the character of spirit required, but it is more especially with regard to the range of boiling points of the spirit than the specific gravity of it that this variance exists, and to this particular phase of industrial requirements we would direct attention in this discussion.

Speaking generally, those qualities of naphtha which have come into the most common use are the naphthas of medium gravities and in which the range of boiling points is limited to about 40° C. In dealing with petroleum spirit for extractive purposes there is very considerable difficulty in arriving at any satisfactory basis of examination of samples. Specific gravity is of little assistance, as the effect of the spirit depends principally on the range of boiling points. The success of the operation in bulk depends on the restriction of the boiling points to the possible temperatures at which the operation can be conducted in the first place, and secondly to the recovery of the spirit from the extract.

It is practically impossible to obtain a petroleum spirit possessing the special range of boiling points suitable to any particular material to be treated unless the spirit has been prepared by a special distillation beforehand and the extremes eliminated. It is possible, however, to obtain a petroleum spirit which will either commence fractionating

TABLE A.

	1. American Benzoline.	2. American Benzine.	3. Sumatra Spirit.	4. Scotch Shale.	5. Borneo Spirit.
Specific gravity at 15° C........	0·697	0·727	0·710	0·739	0·782
Condensation commenced at .	54° C.	84 C.	60° C.	65 C.	65 C.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Volume distilling below 60° C.	1	..	..	..	..
„ „ „ 70 C.	5	0·5	15	0·5	1·5
„ „ „ 80 C.	18	1·5	17	1	1·5
„ „ „ 90° C.	36	8	20	1·5	3
„ „ „ 100° C.	14	18	9	5	14
„ „ „ 110° C.	8	36	14	12	26
„ „ „ 120° C.	6	16	9	24	22
„ „ „ 130 C.	6	8	3	18	12
„ „ „ 140° C.	3	6	2	20	10
„ „ „ 150° C.	2	1	1	10	6
„ „ above 150° C.	1	2	..	8	4
	100	100	100	100	100

Apparatus.—Glinsky's dephlegmator—rate, one drop per second. Liebig condenser; flask, 200 c.c. capacity; thermometer in vapour; sand-bath with flask immersed to height of liquid in flask: Bunsen burner.

TABLE B.

Spirits generally described as Deodorised, &c., but no Special Designation.

Specific gravity.............	0·680	0·680	0·700	0·700	0·700	0·739	0·730	0·740
Condensation commenced at	42° C.	37° C.	45 C.	44° C.	39° C.	82° C.	70° C.	80° C.
Per cent. under 50° C.	3·6	9	2	1	5	..	..	..
„ „ 60° C.	10·4	15	3	3	10	..	..	..
„ „ 70° C.	17	18	14	16	11	..	..	..
„ „ 80° C.	15	18	23	21	14	..	2	..
„ „ 90° C	17	12	21	20	13	..	2	..
„ „ 100° C.	12	7	17	18	11	6·8	13	3
„ „ 110° C.	9	8	10	9	9	30·2	19	15
„ „ 120° C.	11	4	3	4	9	34	17	25
„ „ 130° C.	4	5	5·5	6·5	4	16	16	14
„ „ 140° C.	..	3	..	..	4	9	15	21
„ „ 150° C.	..	..	..	..	5	3	8	11
„ „ 160° C.	..	..	..	..	3	..	4	5
„ above 170° C.	1	1	1·5	1·5	2	1	4	6
	100	100	100	100	100	100	100	100

Apparatus.—Wurtz flask, 3 bulbs; rate of distillation, one drop per second; ordinary condenser.

at the minimum of the range required, in which case the heavier portion of the spirit may be rejected by stopping the distillation at the maximum temperature; or, alternatively, a spirit may be obtained finishing at the maximum temperature, in which case the distillate up to the minimum of the range is rejected.

Tables A and B give comparative analyses by fractional distillation of samples of petroleum spirit from different sources, showing the variations in range of boiling points of the principal grades of petroleum spirit now on the market.

Table B gives typical analyses of a number of benzines of different specific gravities, and is a fair experience of the variations in boiling point to be met with in commercial spirit.

Taking the limit of the range of boiling points at 40° C., it will be seen that none of these samples in Table A will satisfy this requirement, there being an excess under and over this range. In many cases the only solution of the matter is for the purchaser to distil the spirit to his own requirements. The effect of different designs of apparatus for conducting the fractional distillation, both in samples and in bulk operations, is very marked, as is shown by Tables C and D.

The following table shows shows the difference resulting in the employment of three different vessels for distilling the same spirit in simultaneous distillations:—

TABLE C.

Specific gravity, 0·700.

—		A.	B.	C.
		Per Cent.	Per Cent.	Per Cent.
Per cent. distilling below	60° C.	6·5	12·8	20·9
" " "	70° C.	40·1	40·7	43·7
" " "	80° C.	76·1	65·1	66·0
" " "	90° C.	85·0	84·4	84·7
" " "	100° C.	93·0	92·6	92·1

A. Ordinary flask 2¾ inches from side tube to swell of sphere.

B. Wurtz flask, 3 bulbs, 6 inches in length from side tube to swell.

C. Plain tube, 24 cms. from side tube to swell, and having a distance of 8·5 cm. of glass beads in tube.

The rate of distillation in each case was 1½ to 2 c.c. per minute.

It was found in practice that the effect of the glass beads was analogous to the return tubes, but that the retention of the heavier volumes was considerably facilitated by the obstruction of the beads. Care, however, is required in manipulation or there is a rush of spirit when nearing the end of the distillation.

TABLE D.

Tests on a Sample of Spirit, 0·730 sp. gr., with different Forms of Apparatus.

—	N.	O.	P.	Q.	R.	S.	T.
Condensation commenced at	63° C.	68° C.	58° C.	58° C.	73° C.	64° C.	88° C.
Below 70° C.	0·5	0·5	2·5	2	..	1	..
" 80° C.	3·5	2·5	9·5	17	4	12	..
" 90° C.	40	44	37	26	38	35	1
" 100° C.	32	28	27	30	34	28	44
" 110° C.	16	15	15	15	15	15	43
" 120° C.	5	5	3	4	5	4	5
" 130° C.	1	3	3	2	2	2	2
" 140° C.	1	2	2	2	1	2	2
" 150° C.	1	1	1	2	1	1	1
Above 150° C.	0	0	0	0	0	0	2
	100	100	100	100	100	100	100

N.—Engler flask: 3¾ inches from side tube to swell of sphere. Fixed in sand bath. Vapour readings.

O.—Ladenburg's flask: 7½ inches from side tube to swell of sphere. Fixed in sand-bath. Vapour readings.

P.—Le Bel-Henninger's dephlegmator (three bulbs), with a glass bead to substitute platinum gauze cones: 15 inches from side tube to bottom of dephlegmator. Flask fitted in sand-bath. Vapour readings.

Q.—Le Bel-Henninger's dephlegmator (three bulbs), no obstruction whatever. Flask fitted in sand-bath. Vapour readings.

R.—Bannow's method: 4¾ inches from side tube to bottom of dephlegmator. Vapour readings.

S.—Glinsky's dephlegmator (five small bulbs): 11 inches from side tube to bottom of dephlegmator. Flask fitted in sand-bath. Vapour readings.

T.—Glinsky's dephlegmator, as above. Liquid readings.

The rate of distillation in each case, 2½ c.c. per minute condensation commenced, taken from appearance of first drop of distillate.

There are also marked variations in the distillations of the same spirit taken at different fractions and at one continuous distillation due to the carrying over of the heavier spirit at the earlier stages. Of this Table E gives a striking illustration.

The distillates from eight separate distillations of the same spirit were collected between the following ranges of temperature:—Below 70° C., between 70° C. and 80° C., between 80° C. and 90° C., above 90° C. These were marked V, W, X, and Y, and subjected to distillation in the same apparatus. Below is the result of these distillations with the fractional distillation of the original spirit, and the calculation back from the distillates to the original spirit:—

TABLE E.

—	U. Original Spirit.	V. Fraction below 70° C., 42 per Cent. of Original.	W. Fraction between 70°–80° C., 21 per Cent. of Original.	X. Fraction between 80°–90° C., 17 per Cent. of Original.	Y. Fraction above 90° C., 20 per Cent. of Original.	Z. Calculated from Distillates to Original Spirit.
Specific gravity	0·697	0·675	0·697	0·713	0·737	..
Condensation commenced at	47° C.	45° C.	47° C.	60° C.	78° C.	..
Below 50° C.	0·5	29	0·5	..	..	12·285
" 60° C.	12·5	19	2·5	..	..	8·505
" 70° C.	29	25	28	3	..	16·89
" 80° C.	21	14	11	28	0·5	19·35
" 90° C.	17	7	17	39	4	13·91
" 100° C.	8	3	7	17	43·5	11·32
" 110° C.	6	2	2	8	34	9·42
" 120° C.	5	1	2	3	9	3·15
Above 120° C.	1	0	0	2	9	2·14
	100	100	100	100	100	100

Apparatus. Glinsky's dephlegmator; 200 c.c. flask embedded in sand bath; working on 100 c.c. of spirit

The comparative test of the eight separate distillations with the distillation of 500 c.c. of the original spirit compared as follows :—

Specific Gravity, 0·697.

—	Volume per Cent.	Eight Fractions.
Commenced at……………	38° C.	47° C.
Below 50° C. ……………	0·6	0·5
„ 60° C. ……………	14	12·5
„ 70° C. ……………	27	29
„ 80° C. ……………	17·4	21
„ 90° C. ……………	19·4	17
„ 100° C. ……………	9	8
„ 110° C. ……………	6·6	6
„ 120° C. ……………	4	5
Above 120° C. ……………	2	1
	100	100

Considerable diversity of opinion exists as to whether the thermometer readings should be taken with the thermometer in the vapour or in the liquid. In Table F. these differences are fully set out by simultaneous observation.

TABLE F.

Sp. Gr.	—	Vapour.	Liquid.	Per Cent. by Volume of Distillate.
		° C.	° C.	
A	Distillation started	65	85	..
0·730	Fraction below ….	90	100	50
	„ „ ….	100	109	22
	„ „ ….	110	118	14
	„ „ ….	120	131	7
	„ above ….	120	131	7
B	Distillation started.	65	110	..
0·726	Fraction below ….	90	114	6
	„ „ ….	100	120	11
	„ „ ….	110	126	20
	„ „ ….	120	138	23
	„ above ….	120	138	40
C	Distillation started	90	102	..
0·777	Fraction below ….	90	102	0
	„ „ ….	100	110	45
	„ „ ….	110	117	42
	„ „ ….	120	132	6½
	„ above ….	120	132	6½

The fractional distillation of the spirit on small lots, owing to the effect of these variations, renders it generally desirable for the purchaser to arrange for the distillation of the spirit to his special range of boiling points beforehand in order that it may be carried out on a large scale, and so give a fairly average distillate.

There are a number of firms who undertake the distilling of spirit, but the experience of the writers is that no two firms can agree upon the range of boiling points, and there is considerable discrepancy in the results obtained.

There is urgent necessity for the adoption of a standard test for petroleum spirit similar to that adopted for benzol, which would considerably simplify the labour of further researches into the characteristics of the spirit.

The carrying out of experiments or tests of the range of boiling points should in all cases contain the particulars of the volume of the distillate as compared with the original sample and should be possible of comparison as set out in Table E.

There are very considerable differences in the working characteristics of petroleum spirit, which are not measurable either by specific gravity or range of boiling points and which are due both to blending and to inefficient distillation of the original spirit. The principal variations in petroleum spirit occur up to 100° C., as appear from the foregoing tables, as also from Sidney Young's results given in his book on "Fractional Distillation." An apparatus constructed for laboratory tests, should as far as possible approximate to the apparatus for bulk operations, and the adoption of the form of still should provide for such construction and obstruction as will retard the passing of the heavier portions with the more volatile vapours. In large scale operations this is to a large extent provided by the material operated upon.

In the selection of a spirit for the special requirement of an extractive process the conditions of the bulk operating should as far as possible be reproduced in the laboratory, the moisture in the material, density and obstructions to vaporisation in bulk plant should be taken into consideration.

DISCUSSION.

The CHAIRMAN said that he had had some experience in the use of petroleum spirit for taking out grease from skins and leather. The advance made in degreasing skins was due in the main to the experiments carried out by Mr. F. N. Turney, which resulted in the erection of the plant at Whitemoor. The work that had been done in England had not been fully recognised. The main point of the paper so far as the use of petroleum spirit was concerned, was to be found in the sentence "there are very considerable differences in the working characteristics of petroleum spirit, which are not measurable, either by specific gravity or range of boiling points, but which are due both to blending and to inefficient distillation of the original spirit." This was a very abstruse question which had been partly discussed by Professor Young in his book on Fractional distillation, but he (the Chairman) could confirm what the authors of the paper said on the point. He had collected some figures from analyses made eight or ten years ago. The vapour tension of the spirit was more important than any other of the physical properties. He had made a great number of tests in the vapour-tension of spirits of varying gravities, and in some cases the spirit with the highest vapour tension had also the highest gravity, and a spirit with low gravity might have also a low vapour-tension. In certain mixtures the vapour given off was of less tension than one would anticipate from the gravity. Had Mr. Garry any data bearing upon that part of the question? He had had no practical experience with Russian petroleum, but in the Compagnie de Degraissage de St. Denis, he believed, they used a Russian spirit coming over below 110°, and so far as he knew they had no difficulty with it. The point he mentioned about the vapour-tension or vapour pressure, was important in the recovery of the spirit. In the apparatus in question there was a large tank in which skins were suspended, they were washed with spirit, and then dried in a current of warm air. When they were thoroughly dried the valve between the tank and the spirit was shut off preparatory to opening the tank and getting the skins out. Enclosed in the tank was a certain amount of vapour, which it was impossible to condense. The amount of this vapour depended of course upon the vapour pressure of the spirit used. The tank must be opened to the air to get the skins out. There were perhaps several hundred cubic feet of air charged with the vapour of petroleum, that was all lost. The smaller the vapour-tension in the spirit, the less they lost in that way, and if they were opening seven or eight tanks a day, they lost a great deal of spirit, although the apparatus might be in perfect working order. In working with chloroform, the solvent had been recovered by passing the vapour through a tower in which oil was falling. The oil absorbed the vapour which was afterwards recovered by distillation.

Dr. KIPPING and Messrs. ARCHBUTT and TROTMAN agreed that the adoption of a standard method for the distillation test was desirable. There should be no difficulty about this, as Mr. Archbutt pointed out that years ago the most minute directions were laid down for the distillation test of coal-tar benzenes.

Mr. H. S. GARRY, in reply, said, so far as he knew, most of the research work done in England had been done at Whitemoor. All he knew about the matter from a commercial standpoint had been gained by experience and not from college study. He had not seen any literature on the subject up to the time Professor Young published his book. There was a good deal about petroleum spirit which nobody seemed to understand. The notes were put forward in order to urge the necessity in having a reliable method for estimation for boiling points. The petroleum trade had, so far, adopted no specific method.

Scottish Section.

Meeting held at Glasgow, on Tuesday, Dec. 1st, 1903.

MR. H. BUMBY IN THE CHAIR.

A COMPARISON OF DIFFERENT TYPES OF CALORIMETER.

BY THOMAS GRAY, PH.D., D.Sc., AND JOSEPH G. ROBERTSON, PH.D.

The experiments here recorded were instituted with the object of ascertaining the degree of accuracy of the calorific values of coal obtained by the Lewis Thompson and Wm. Thomson calorimeters by comparison with those determined by combustion in compressed oxygen. Some of the results of the work were communicated to the Scottish Section on Dec. 1, 1903, but publication was delayed in order to complete the series. Whilst the experiments were in progress, a paper dealing with the same subject appeared in this Journal (Brame and Cowan, 1903, 1230); but although our conclusions were largely anticipated by these authors, we decided to complete the work, as the experience gained with a larger number of coals of a different character would probably prove of general interest. As the previous publications referring to the comparative values obtained with different calorimeters have already been reviewed by Brame and Cowan (*loc. cit.*), we may proceed at once to give the results of our experiments.

The designations and sources of the coals used are given below (page 707). Numbers are attached for purposes of reference.

The samples were passed through a hand mill, thoroughly mixed, and air-dried to prevent, as far as possible, any change of composition on exposure to air in the subsequent operations.

The Lewis Thompson Calorimeter.—A standard thermometer graduated in 1/10° C. was used with this instrument and the temperature was read to 0·01° C. The coals were very finely ground to facilitate complete combustion, and at least four experiments were made in each case with 11 parts of the oxidising mixture to 1 part of coal. Coals 1 to 8 burned quietly and regularly, with 9, 10, and 11 the combustion was very rapid, but attempts to burn the anthracite were all unsuccessful. In some experiments the coal failed to ignite, and when ignition did take place the combustion stopped before the mixture was completely burned. The combustion was finally effected by using a mixture of equal parts of the anthracite and a bituminous coal, the calorific value of the latter as determined with the Lewis Thompson calorimeter being used in calculating the value for the anthracite. As the object of the experiments was to ascertain the degree of accuracy of the method as it is usually carried out, the amount of unburnt carbon was generally not determined. This determination complicates the method and removes the only advantage which can be claimed for the Lewis Thompson apparatus, viz., simplicity of manipulation. Except in the case of the anthracite the amount of unburnt carbon was small. Further reference to this point will be made under the discussion of the results.

The proportion of oxidising mixture was increased in the case of the quicker burning coals, but the calorific value was not raised thereby. Seven experiments with Kilsyth coking coal, using 11 to 13 parts of the mixture per 1 part of coal, gave results varying to the extent of 88 calories = 1·2 per cent., whilst the mean was 7 per cent. below that obtained by the bomb. This difference between the extreme results is not greater than that observed using a fixed pr portion of the oxidising mixture. In the case of the samp of anthracite, on the other hand, a higher value was obtaine by increasing the proportion of the oxidising mixture. Th figure in the table (page 707) is the mean obtained usin the ratio 13:1. As the combustion of the Kilsyth cokin coal proceeded very rapidly there was a possibility of lo of heat through imperfect cooling of the products. Fou estimations were accordingly made with the addition to th mixture of 1 to 2 grms. of ignited kaolin; the rate o combustion was reduced thereby, but the mean result wa slightly lower than that previously obtained.

The differences between the extreme values in each serie varied in the case of the bituminous coals from 0·5 t nearly 3 per cent. These differences are smaller than thos observed by Brame and Cowan, and this result is probabl due to the difference in the character of the coals exper mented on, and partly also to the finer state of division i which they were used. With the sample of anthracite th difference between the extreme results reached 4·5 pe cent., which agrees more closely with the observations o the authors referred to.

The William Thomson Calorimeter.—The water valu was calculated from the weights and specific heats of th various materials. For the estimation of the weight of th glass beaker in contact with the water the method used b Thomson (this J., 1886, 584) was followed, the level o the water in the calorimeter-beaker having been marke with the combustion chamber and stand immersed.

The coal was burned in the form of compressed pellet in order to prevent the irregular combustion which was observed when the coal was used in the powdered form the danger of loss through particles of coal being blown ou of the crucible by the rapid current of oxygen was als avoided in this way. The coals all readily cohered on pressing, with the exception of the anthracite, which was compressed with admixture of an equal weight of Kilsyth coking coal.

The ignition of the coal was effected electrically. Fo this purpose two insulated copper wires were passed through the bottom of the metal stand into the glass combustion chamber, with the ends about half-an inch apart and level with the top of the platinum crucible. The ends of the wire were connected by means of a piece of fine platinum wire to which a piece of cotton yarn was fixed, the other end of the cotton being tied round the coal pellet. The combustion chamber was allowed to stand in the water for 10 minutes, after which the coal was ignited by the passage of an electric current sufficiently strong to fuse the platinum wire instantaneously. By this arrangement errors due to handling the apparatus before immersion in the water were avoided, and the ignition of the coal was effected with greater certainty. A correction was made in each case for the heat of combustion of the fuse.

In one series of experiments a standardised Beckmann thermometer graduated in 1/100° C. was used. A thermometer of this type is, however, not always available, and is rather delicate for technical work. For the sake of comparison a series of experiments was therefore carried out, using the thermometer reading directly to tenths, already referred to under the description of the Lewis Thompson method.

The Cooling Correction.—This is determined by Thomson (*loc. cit.*) by allowing the apparatus to stand at the end of the experiment for a period equal to the duration of the combustion; the fall of temperature which takes place is added to the observed rise. This correction assumes the temperature to have its maximum value during the whole period of the combustion, and is therefore obviously too high. With an imperfectly insulated vessel, such as that under discussion, an exact estimation of the loss of heat in the course of an experiment extending over 8 to 10 minutes is scarcely practicable. As the temperature rises uniformly during the combustion, the method of compensation first proposed by Rumford is applicable, and by starting with water having a temperature as much lower than that of the room as it will be above that of the surroundings at the end of the experiment, the necessity of applying a correction for loss of heat is obviated. The rise in temperature is usually known approximately, and in any case can be determined by a preliminary experiment. This method of operating is sufficiently accurate for all practical purposes if an ordinary thermometer with a small mercury reservoir is used, as the maximum temperature is quickly attained; but with a Beckmann thermometer a slight modification is advisable on account of the lag caused by the large volume of mercury. In the latter case the rise in temperature at the end of the combustion was noted before the water was admitted to the combustion chamber, and from this the initial temperature of the water to be chosen in future determinations was fixed; the time which elapsed before the thermometer indicated the maximum temperature, after admission of the water to the chamber, was observed; and the fall of temperature which took place when the apparatus was allowed to stand for the same period after the maximum had been reached, was added to the observed rise. Thus correction was usually 0·010° to 0·015° C.

The oxygen used for the combustion was saturated with water vapour by passage through a wash-bottle, followed by a tower containing pumice soaked in water. As the oxygen entered the calorimeter at the mean temperature prevailing during the experiment, it may be assumed without appreciable error that it gave up to the calorimeter during he first half of the combustion as much water vapour as he products of combustion carried away during the second half while the temperature of the water was in excess of hat of the surrounding air. Even when water of the air emperature is used at the beginning of the experiment, no considerable error is committed by neglecting this orrection. If we suppose that oxygen saturated with water apour at 15° enters water at the same temperature and that he temperature at the end of the operation is 19° C., we nay assume that the oxygen leaves the water with an verage temperature of 17°, and on this basis calculate pproximately the loss of heat due to evaporation. One ubic metre of oxygen saturated with water vapour at 15° nd at 17° C. contains respectively 12·74 and 14·38 grms. f water, and the amount of heat necessary to convert the ifference between these two weights of water into vapour t ordinary temperature is 1·64 × 600 = 984 calories. he amount of oxygen used for the combustion may be taken to be about 10 litres, and the heat loss due to evaporation under these conditions will therefore be approximately 10 calories. The amount of heat necessary to raise the temperature of the excess oxygen and the products of combustion through 2° C., calculated from the specific heats O_2 0·217, CO_2 0·202, and water vapour 0·480, does not exceed 10 calories, so that the total correction to be applied for these two losses will be less than 20 calories. As has been already explained, loss of heat from these two causes was obviated by the method of working.

Three determinations were made with each coal, using the fine thermometer. The difference between the extreme values obtained for the individual coals varied from 0·3 to 1·5 per cent. The average difference for the 12 samples was 1 per cent.

The differences observed with the thermometer graduated in 1/10° C. were somewhat greater, as was to be expected. The temperature in this case was estimated to 1/100° C., and assuming reading errors of this order at the beginning and end of the experiment in opposite directions, the value for the observed rise of temperature would be infected with an error of ± 0·02; there is thus a possible difference of 0·04° C. between the results of two experiments due to incorrect reading, and this is equivalent to rather more than 80 calories. Although this is an extreme case, such differences from this cause alone are possible, and this additional error necessitates a larger number of experiments. In all cases at least four determinations were made, and in some cases six to eight were necessary. The mean of all the results was taken.

The mean results obtained with the two thermometers are given below, and in the third column are tabulated the mean calorific values calculated from the water equivalent of the apparatus, based on the results of the combustion of Kilsyth coking coal in the bomb and Wm. Thomson calorimeters; six combustions were made with the latter, and the mean result was adopted. This method of determining the water equivalent of the Wm. Thomson apparatus gives a high result, as there is unmistakable evidence of incomplete combustion in every case, but the adoption of the value thus obtained approximately corrects for the small quantity of gas which escapes unburnt.

——	1.	2.	3.	4.	5.	6.
Thermometer in 1/100° C.	5,990	6,352	6,662	6,658	6,965	7,134
Thermometer in 1/10° C.	6,013	6,386	6,616	6,690	6,939	7,174
Using water value from combustion results	6,065	6,432	6,739	6,742	7,053	7,224

——	7.	8.	9.	10.	11.	12.
Thermometer in 1/100° C.	7,223	7,288	7,419	7,308	7,699	7,699
Thermometer in 1/10° C.	7,206	7,290	7,420	7,315	7,649	7,619
Using water value from combustion results	7,314	7,380	7,512	7,394	7,800	..

The mean values with the different thermometers show irly close agreement, and indicate that perfectly servicele results may be obtained with the help of an accurately ide thermometer reading directly to tenths, where a high gree of accuracy is not required. The results in the rd line of the table are all higher, and approach more sely those obtained by the bomb. The first series only included in the final statement of the comparative ues.

The Bomb Calorimeter.—For the determination of the orific values by combustion in oxygen under pressure, modification designed by Langbein and Hugershoff was d in conjunction with the Stohmann calorimeter; both these are fully described by Langbein (Zeits. angew. em., 1900, 1236). This bomb resembles the well-known hler form; the chief difference, apart from certain chanical alterations which facilitate the manipulation, is lining of platinum foil in place of enamel. The ignition the substance is effected by means of a short piece of ing cotton, which is fixed to a fine platinum wire necting the two pole pieces; the thread may either be l round the pellet or simply allowed to rest in contact with the coal. On making the current the platinum wire fuses and ignites the thread, which falls on to the coal and ignites the latter. The use of iron wire is inadvisable, on account of the danger of perforation of the platinum lining by fused particles of iron oxide.

A thermometer of the Beckmann type standardised by the Physikalische Reichsanstalt was used; the corrections were given to the nearest 0·001° C.

The Cooling Correction.—The accurate methods of correcting for loss of heat proposed by Berthelot, and by Regnault and Pfaundler, as modified by Stohmann, are much too complicated for technical work. Langbein (*loc. cit.*) applied the formula $\Sigma \Delta t = n v' + \frac{v + v'}{2}$, in which n is the number of minutes which elapse after ignition before the maximum temperature is indicated, and v and v' respectively the average differences of temperature per minute before ignition and after the maximum has been reached. This correction is obviously too high; if we suppose the temperature to be constant before the combustion, *i.e.*, $v = o$, the correction then becomes $n v' + \frac{v'}{2}$; and this value is greater than that of the loss of heat which the apparatus would suffer if the temperature were at the maximum for the whole duration of the combustion. In calculating the cooling correction we made use of the formula $\Sigma \Delta t' = (n - 1) v' + \frac{v + v'}{2}$, which gives a result sufficiently near the truth for all practical purposes. The figures given below may be taken to represent a typical case. A glance at these will show that, although the highest temperature was not reached till the third minute after ignition, the temperature at the end of the first minute did not fall much short of the maximum. In supposing the heat loss during the second and third minutes to be the same as that observed per minute after the combustion, and taking the correction for the first minute to be the mean of the heat changes before and after the combustion, no serious error is committed.

Corrections were also applied for the nitric and sulphuric acids formed in the combustion. In all cases 10 c.c. of water were placed in the bomb at the beginning of the experiment. The excess of heat developed by the sulphur over that obtained in practice, *viz.*, that due to the reaction $SO_2 + O + x$ aqua, is corrected for with sufficient accuracy, according to Langbein (*loc. cit.*), by deducting from the calorific value found 22·5 calories per 1 per cent. of S, if the amount of water is 10 c.c. For the estimation of the acids, the contents of the bomb were washed out, boiled to expel CO_2, and titrated with 1/10 N $Ba(OH)_2$, using phenolphthalein as an indicator. Excess of sodium carbonate solution containing 3·706 grms. per litre (1 c.c. neutralises an amount of HNO_3 in the formation of which 1 calorie is developed) was added to convert the barium nitrate into carbonate, the solution was filtered, and the excess of sodium carbonate titrated with 1/10 N HCl with addition of Methyl Orange.

The following results are given to illustrate the method:—

Weight of Coal used, 1·0058.

Temperature before Ignition.		During Combustion.		After Maximum.	
0 min.,	1·072	6 mins.,	3·[illegible]	9 mins.,	3·691
1 „	1·075	7 „	3·689	10 „	3·689
2 mins.,	1·077	8 „	3·693	11 „	3·686
3 „	1·080			12 „	3·684
4 „	1·082			13 „	3·680
5 „	1·084				

$v = -0·0024$: $v' = 0·0026$: $n = 3$: cooling correction = 0·005.

Observed rise	2·609
Cooling correction	0·005
Thermometer correction	0·001
Corrected rise	2·615

In titration were used 13·6 c.c. of $Ba(OH)_2$, 20 c.c. of Na_2CO_3, and 5·4 c.c. of HCl.

Corrections for HNO_3, 12 : for S, 19 calories.

Heat developed, 2,500 × 2·615°	6,537·5	calories.
Correction for HNO_3 …… 12 „ „ fuse……… 16	28·0	„
Heat evolved by 1·0058 grms. of coal	6,509·5	„
Heat of combustion per grm. = $\frac{6509·5}{1·0058}$	6,472	„
Correction for S (0·79 per cent.)	19	„
Calorific value	6,453	„

The water value of the apparatus was calculated from the results of the combustion of pure naphthalene (9692), phthalic anhydride (5300), salicylic acid (5269) and cane sugar (3955), using the values given in brackets. The mean of a number of closely agreeing results was adopted. The corrections in 40 estimations had the following extreme values:—Cooling correction, 0° to 0·015° C.; mean, 0·005° C.; HNO_3 correction, 10 to 18 calories; mean, 15.

The value of the sulphur correction depends on the quantity of that element present in the coal (22·5 calories per 1 per cent. S), and in the case of coals rich in sulphur the omission of this correction may involve a considerable error. For technical purposes an average value for the nitric acid correction might be adopted, but there is no advantage in omitting the titration of the contents of the bomb, as the estimation of the sulphur, which is usually necessary, is most easily effected in this way.

The difference between the extreme values obtained for the individual coals varied from 0·06 to 0·7 per cent., the average for the 12 series being 0·35 per cent.

Discussion of Results.—The values directly obtained with the Lewis Thompson instrument neglecting the unburnt carbon are much too low. The deficit varies, with the coals investigated, from 1 to 13 per cent., and, generally speaking may be said to increase with the carbon content of the coal. As has been already shown by Thomas, the results obtained with anthracite coals are absolutely unreliable. Scheurer Kestner, in a series of determinations with twelve coals, found the 10 per cent. correction to be too small, and suggested an increase to 15 per cent. The present experiments confirm the first conclusion, but it is evident from a glance at the figures that it is not possible to arrive at accurate values by applying any constant correction. By taking account of the carbon which escapes combustion, results nearer the truth may be obtained. As a mean of two experiments with coals II., XI., and XII., the values 6521, 7755, and 7691 were obtained, assuming the substance which remained unburnt to be carbon having a calorific value 8140. These numbers agree very much better with the bomb results 6439, 7801, and 7912 in the two last cases; the value for coal II. is higher than that obtained by the bomb. The estimation of the unburnt carbon involves a considerable expenditure of time, and the results arrived at by applying this correction are still unreliable: Brame and Cowan (*loc. cit.*) find in the case of coal B a difference of 6·2 per cent. At best the method may be taken to give a very rough indication of the heating values of bituminous coals. The directly determined numbers in such a case may deviate from the absolute heating values by as much as 8 per cent.

The Wm. Thomson Calorimeter.—The chief difficulty in operating with this instrument consists in regulating the current of oxygen so as to avoid loss of heat through imperfect cooling of the products, and at the same time to ensure that the combustion shall be as complete as possible. The rate of flow of the oxygen should be adjusted so as to reduce to a minimum the formation of smoke which is always observed at the beginning of the operation; and the tube should be kept well up in the glass bell till the volatile matter has been burned, as recommended by Thomson. The figures obtained with the 12 coals examined are from 0·7 to 2·9 per cent. lower than those determined by the bomb, the mean deficit being 1·8 per cent. Our experience of the method is more favourable than that of Brame and Cowan, who found differences with 5 coals of 1·8 per cent. (coal E) to 6·9 per cent. (coal B), mean 3·6 per cent. The use of the coal in the form of compressed pellets, which ensures more uniform combustion, probably explains this result to some extent, and this mode of operating is certainly to be recommended. In using the method we suggest that the constants of the apparatus should be determined from the combustion of a sample of coal of average composition and of known calorific value. In the present series of experiments one of the coals was chosen at random for this purpose. The results agree very well with those obtained by the bomb; only in one case—coal 10—is there any considerable difference, and here also the error has been reduced by the use of this water value in place of that calculated from the weights and specific heats of the materials. From the results of our experiments we conclude that numbers sufficiently accurate for most practical purposes may be obtained from the Wm. Thomson calorimeter by careful attention to the regulation of the oxygen supply. The determination of the water value of the apparatus by the combustion of a sample of coal in the calorimeter may be objected to on the ground that the amount of unburnt gases varies with different coals; but it should be recognised that the method is only an approximate one, and that absolutely reliable results can only be obtained by the use of some form of bomb calorimeter.

Analysis of Coals.

—	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
C	62·55	65·50	68·64	69·50	72·14	73·77	74·99	74·57	77·00	76·71	78·80	85·70
H	5·87	4·23	4·33	4·12	4·10	4·55	4·66	4·74	4·51	4·67	4·92	2·97
S	1·62	0·67	1·33	0·67	0·61	0·41	0·55	0·47	0·78	0·73	0·50	0·62
H_2O	8·63	7·92	8·96	9·28	8·34	7·99	7·21	6·95	2·31	1·91	2·72	3·15
Ash	11·78	10·15	6·90	5·97	4·22	1·76	2·68	1·37	7·17	8·49	4·18	3·59
O + N	11·55	11·53	9·84	10·16	10·29	11·52	9·91	11·90	8·23	7·46	8·88	3·97
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Coke	61·74	61·06	57·53	59·12	58·47	56·93	56·59	56·84	74·61	72·32	66·43	92·03
Fixed carbon	49·96	50·92	50·63	53·15	51·25	55·17	53·91	55·47	67·44	63·83	62·25	88·44

Calorific Values to Liquid Water.

Bomb	6,133	6,439	6,708	6,792	7,099	7,270	7,340	7,392	7,509	7,527	7,801	7,912
Calculated	6,007	6,354	6,731	6,801	7,003	7,132	7,341	7,246	7,530	7,592	7,785	7,887
Wm. Thomson	5,989	6,352	6,662	6,658	6,965	7,134	7,223	7,288	7,419	7,308	7,699	7,700
Lewis Thompson	5,945	6,380	6,560	6,520	6,775	6,958	6,790	6,940	6,880	6,910	7,255	6,880

Differences from Bomb Results per Cent.

Calculated	− 2·0	− 1·3	+ 0·3	+ 0·2	− 1·3	− 1·9	+ 0·0	2·0	+ 0·3	+ 0·9	− 0·2	0·3
Wm. Thomson	− 2·3	− 1·3	− 0·7	− 2·0	− 1·9	− 1·9	− 1·4	− 1·4	− 1·2	− 2·9	− 1·3	− 2·7
Lewis Thompson	− 3·1	− 0·9	− 2·2	− 4·0	− 4·6	− 4·3	− 7·5	− 6·1	− 8·4	− 8·2	− 7·0	− 13·0

Wm. Thomson's Values, using Water Equivalent calculated from Results of Combustion of Coal.

Calorific values	6,065	6,432	6,739	6,742	7,053	7,224	7,314	7,380	7,512	7,394	7,800	..
Difference from bomb per cent.	− 1·1	− 0·1	+ 0·5	− 0·7	− 0·6	− 0·6	− 0·3	− 0·2	+ 0·04	− 1·8	0·0	..

Formula for calculated values $$\text{C.V.} = \frac{1}{100}\left[8{,}140\,C + 34{,}500\left(H - \frac{(O+N)-1}{8}\right) + 2{,}220\,S\right].$$

1. Splint coal, Lochgelly, Fife.
2. Boiler fuel (a mixture), Fife.
3. Ell coal, Bothwell.
4. Main coal, Bothwell.
5. Pyotshaw coal, Bothwell.
6. Dunfermline splint, Cowdenbeath, Pit 10.
7. Splint coal, Bothwell.
8. Dunfermline splint, Cowdenbeath, Pit 7.
9. Boiler fuel, Aitken Pit, Kelty.
10. Haughrigg coking coal, Kilsyth.
11. Coking coal, Kilsyth.
12. Anthracite, Kilsyth.

Calculation of Calorific Values from the Results of Ultimate Analyses.—Before referring to the figures in the bove table we will consider the possible differences in the alues calculated by means of the modified Dulong formula hich may result from errors in analysis. From the xample which follows it will be evident that differences of ± 50 calories are well within the limits of experimental rror :—

—	I.	II.
	77·20	77·00
	4·56	4·51
	0·78	0·78
O	2·41	2·31
sh	7·20	7·17
+ N by difference	7·85	8·23
lculated calorific value	7577	7530

The differences between the calculated and bomb values ary in our tests from + 65 to − 146 (+ 0·9 to − 2·0 per nt.), and are distinctly greater than the possible experiental error in three cases only. Considering that the lues for free carbon and hydrogen are used in the rmula, and that the oxygen is assumed to be present as ater—which is certainly not the case—the close agreement tween the calculated and directly determined values is rprising. A further comparison of the figures in the ble shows that the calculated values approach more osely to the bomb results than those obtained by the illiam Thomson calorimeter, but that they are, taken as a hole, rather less accurate than the William Thomson values sed on the water equivalent determined by the combustion coal.

Brame and Cowan find differences in five coals of − 0·7 − 4·8 per cent. To the summary of previous work en by these authors may be added the results of the periments of Bunte (Schilling's J., 1901, 34, 21), which show differences of − 3·7 to + 2·0 per cent. A full discussion of this subject lies outside the scope of the present paper; but it is evident that the method of calculation from analytical results only gives approximate values, and that it should only be employed in cases where a direct determination is not possible.

Obituary.

CAPT. H. C. ASPINWALL.

Capt. HENRY CHAPPELL ASPINWALL was born on Nov. 19, 1855, at Epsom, Surrey, and died June 28, 1904, at the Post-Graduate Hospital, New York City. He was general superintendent of the smokeless powder department of the Dupont Powder Co., residing at Haskell, N.J., and was unmarried. He was educated partly in England and partly in America. In 1879 he entered the Twenty-Second Regiment of New York State, and subsequently joined the Twelfth Regiment, leaving the service in 1893 with the rank of captain. During his career he devoted his studies to the improvement of explosives for military purposes, and was well known as a smokeless powder expert. He was a member of the American Chemical Society and the Society of Chemical Industry, and at his death was Vice-President of the New York Section of the Verein Deutscher Chemiker.

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I.—PLANT, APPARATUS, AND MACHINERY.

English Patents.

Filters. G. Lebedinsky, Kieff, Russia. Eng. Pat. 16,760, July 30, 1903.

A horizontal, double-walled sieve drum, with corrugated outer surface, is mounted in a casing and is filled to a certain height only with granular filtering material such as sand or porcelain beads, &c. The fluid to be filtered flows from the outside to the inside, but for washing, the water flows in the opposite direction. During the washing operation the sieve drum is rotated, so that the filtering material may be shaken about and be thoroughly cleansed. —W. H. C.

Filtering Apparatus. J. Wetter, London. From E. Boellinghaus, Hamburg. Eng. Pat. 27,287, Dec. 12, 1903.

A number of superposed filtering chambers are connected with the liquid supply-, discharge-, and rinsing-canals, situated in a tube common to all, by means of openings controlled by annular slides. Each chamber may act independently, and the filtration may take place, and the filtering medium be washed, in either an upward or downward direction, as desired.—W. H. C.

United States Patents.

Drying-kiln. F. Meyer, Assignor to E. J. Kirby and the Chicago American Fuel Briquetting Co., all of Chicago. U.S. Pat. 761,088, May 31, 1904.

The material to be dried is passed through the drying-chamber by a horizontal conveyer consisting of a number of open buckets, and is agitated by blades fixed to rotating shafts placed transversely across the conveyer. Hot air is admitted to the chamber, and suitable means are provided for rotating the shafts.—L. F. G.

Drying Powders; Apparatus for ——. H. Croizier, Paris. U.S. Pat. 761,763, June 7, 1904.

See Eng. Pat. 18,661 of 1901; this J., 1902, 1178.—T. F. B.

Still. F. B. Merrill, Jonespoint, New York, Assignor to Merrill Process Co., New York. U.S. Pat. 761,315, May 31, 1904.

The still is horizontal, and of egg-shaped cross-section, the wider part being at the bottom; and is provided with a pendent swinging agitator, fixed to a horizontal axis nea the top of the still.—L. F. G.

Calcining Apparatus. D. L. Kibler, Acme, Texas. U.S. Pat. 761,684, June 7, 1904.

A semi-cylindrical, horizontal shell or kettle, situated i a furnace, has flues traversing it. An oscillating agitato is arranged in the shell to keep both the flues and shel free from deposit.—W. H. C.

Muffle Roasting-Furnace. F. Meyers, New York. U.S. Pat. 761,691, June 7, 1904.

A series of vertical furnaces, each consisting of a meta shell with refractory lining and superposed hearths, similar to the Herreshof furnaces, are connected together. A heating furnace is common to the series, and suitable flues are provided for conveying the hot gases through the series to the stack.—W. H. C.

Extracting Apparatus. H. J. P. Hampton, Albany, New York. U.S. Pat. 761,828, June 7, 1904.

The combination is claimed, in the case of a steam-boiler, of a cylinder, pipe-connections between the steam and water space of said boiler and cylinder, a cup detachably secured to the lower end of the said cylinder, a strainer forming a bottom for the cup, and an agitator arranged within the cup. —W. H. C.

French Patents.

Vapour from a Liquefied Gas such as Ammonia or Methylamine, &c.; Production of ——. J. B. Fournier. Fr. Pat. 338,706, April 11, 1903.

A reservoir containing the ammonia or other liquid communicates with a tubular vaporiser by means of a piston, actuated by the pressure of the vapour and regulated by a spring.—W. H. C.

Crystals; Process for Obtaining Good, Chemically Pure ——. V. Schütze. Fr. Pat. 339,896, Jan. 26, 1904.

The liquid to be crystallized is made to flow slowly through a double-walled tube, whilst warm or cold water or other liquid is circulated through the annular space in an inverse direction. The liquid in the inner tube is slowly and progressively cooled, and pure regular crystals are deposited. Means are provided for watching the progress of the ɔeration, for regulating the temperature and flow of the ɔoling liquid, and for filling and emptying the apparatus. —W. H. C.

Furnace; Rotary ——. W. S. Rockwell. Fr. Pat. 339,768, Jan. 21, 1904.

:E Eng. Pat. 1503 of 1904; this J., 1904, 443.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Combustion: Mechanism of ——. H. B. Dixon. J. Gas Lighting, 1904, **86**, 715—753.

HE author discusses the chemical processes in flames, the :bject being treated under the following headings:—unsen's theory of discontinuous combustion; pressures odnced in explosions; influence of aqueous vapour on mbustions; rate of explosion in gases; photographic ıalysis of explosion flames; velocity of a sound-wave in e flame of exploded gases; initiation of the explosion-ave.—A. S.

russian Blue in Spent Oxide, &c.; Determination of —— *by Feld's Method.* R. Witzack. XXIII., page 728.

English Patents.

istillers' Refuse, Sewage, or the like; Treatment of —— [*Fuel Briquettes*]. L. Cameron. Eng. Pat. 14,536, June 30, 1903. XVIII. B., page 721.

riquettes for Fuel; Manufacture of ——. H. H. Lake, London. From A. Petit and Co., Verviers, Belgium. Eng. Pat. 16,908, Aug. 1, 1903.

:E Fr. Pat. 334,301 of 1903; this J., 1904, 54.—T. F. B.

vens for the Manufacture of Ovoid or other Shape Smokeless Briquettes. J. W. Mackenzie, London. From La Comp. des Charbons et Briquettes de Blanzy et de l'Ouest, Nantes, France. Eng. Pat. 9483, April 25, 1904.

IE ovens have a number of openings running longitudin-y entirely through the partitions between them. These enings increase in size from the central partition to the d walls, and are placed in zig-zag form to increase the aught and allow the vapours to escape easily. —W. H. C.

eating and Enriching Gas; Means and Apparatus for use in ——. A. G. Brookes, London. From M. M. Makeever, Boston, Mass. Eng. Pat. 6540, March 17, 1904.

CASING is divided by means of a horizontal partition into ɔ chambers, each of which is divided by means of vertical rtitions into several compartments which communicate th each other alternately at opposite ends, so that the ;, in flowing through the apparatus, must pursue a zig-; course first in the lower and then in the upper com-tments. The lower compartments, in which the car-etting liquid is maintained at a certain level by means a suitable reservoir, are packed with wicks in rope form, de from hemp or the like; whilst the upper compart-nts, which serve to filter the carburetted gas, are packed h ropes made of wood-fibre and asbestos.—H. B.

s Generating or Gasogen Apparatus for Producing Poor Gas free from Tarry Matters. L. Boutillier, Paris. Eng. Pat. 9942, April 30, 1904. Under Internat. Conv., Aug. 14, 1903.

SHORT "distilling retort," open at the top, extends up ɔugh the centre of the grate of the generator into the ıdescent zone of fuel. The fuel supply to the generator ed upwards through the retort, by means of a screw veyor or otherwise, at such a rate that the fuel remains the retort long enough for all the tarry matters to be en off before the residue mingles with the incandescent . The tarry matters are decomposed during their sage upwards through the hot zone. Steam and air are introduced at the base of the generator, and the gases are led off at the top as usual.—H. B.

Gas Washers; Construction of ——. O. Imray, London. From F. Burgemeister, Celle, Germany. Eng. Pat. 15,060, July 7, 1903.

SEE Fr. Pat. 333,726 of 1903; this J., 1903, 1342.—T. F. B.

Gas; Process for Making ——. W. Kent, New York. Eng. Pat. 15,645, July 15, 1903.

SEE U.S. Pat. 735,272 of 1903; this J., 1903, 990.—T. F. B.

Feeding and Distributing of Material in Gas Producers, Furnaces, and the like; Apparatus for the Continuous ——. C. W. Bildt, Stockholm. Eng. Pat. 9376, April 23, 1904.

THE invention relates to fuel-feeding devices in which a distributing disc rotates beneath the lower end of the feed hopper. To prevent the fuel (waste wood, bark, peat, &c.) from sticking or locking in the hopper, two or more upright pins of sufficient length are attached rigidly to the upper side of the disc, extending up into the lower part of the hopper.—H. B.

Incandescence Bodies for Electric Glow Lamps; Manufacture of ——. C. D. Abel, London. From Siemens and Halske, Act.-Ges., Berlin. Eng. Pat. 26,776, Dec. 7, 1903.

SEE Fr. Pat. 337,608 of 1903; this J., 1904, 484.—T. F. B.

United States Patents.

Coke-Oven. J. S. Maxwell, Cumberland, Md., U.S.A. U.S. Pat. 761,521, May 31, 1904.

AT either side of a long series of coke-ovens, are arranged a pair of coke-ovens with straight end walls, and straight front and rear walls, the roofs of the ovens being arched. Suitable tie-rods and beams brace the ovens together, a central vent is provided in each, and car-tracks are laid on the top of all the ovens.—L. F. G.

Coke-Oven. C. Schroeter, Chicago. U.S. Pat. 761,789, June 7, 1904.

THE coking chambers are surrounded by heating flues, which also pass beneath the retorts. Means are provided for introducing gaseous fuel and air under pressure, and for isolating any retort.—W. H. C.

Coal Gas; Process of Manufacturing ——. T. Settle and W. A. Padfield, Exeter, England. U.S. Pat. 762,495, June 14, 1904.

SEE Eng. Pat. 12,552 of 1902; this J., 1903, 789.—T. F. B.

French Patents.

Briquettes from Powdered Fuel; Manufacture of ——. R. Middleton. Fr. Pat. 339,370, Jan. 6, 1904.

A STARCHY paste is obtained by adding the minimum amount of boiling water to cereals, old potatoes, or the like, and the paste is mixed while hot with coal tar or Stockholm tar. The product is incorporated with pulverised fuel, and the mixture is compressed into blocks.—H. B.

Fuel; Artificial —— *and its Manufacture.* E. J. Hoffman and N. J. Clark. Fr. Pat. 339,859, Jan. 25, 1904.

SEE Eng. Pat. 1887 of 1904; this J., 1904, 483.—T. F. B.

Coal, Minerals and Similar Substances; Process and Apparatus for Drying ——. F. Baum. Fr. Pat. 339,952, Jan. 27, 1904.

SEE Eng. Pat. 2485 of 1904; this J., 1904, 539.—T. F. B.

Illuminating and Heating Gas; Manufacture of ——. Deutsche Continental Gas Ges. and J. Bueb. Fr. Pat. 339,534, Jan. 12, 1904.

VERTICAL retorts, the diameter of which increases gradually from top to bottom, are arranged within the furnace so that they may be strongly heated over their whole exterior. Having been brought to a high temperature, they are filled almost completely from above with the coal to be carbonised, the heat being well maintained. Gas is given off rapidly from the fuel contiguous to the retort walls, and a layer of compact impermeable coke is formed immediately. The gas passes up through the comparatively cool central part of the coal to the gas exit at the top of the retort, being kept from contact with the hot walls by the crust of coke. Distillation gradually proceeds towards the centre. The coal dust which is produced is retained by the column of fuel through which the gas has to ascend. It is claimed that the formation of naphthalene is thus prevented, and that the tar is obtained as a fluid brown oil, containing little coal.—H. B.

Generator for Low-grade Gas. Lerouge, Fornas and Cie. Fr. Pat. 339,817, Jan. 22, 1904.

At the base of the column of fuel in the producer, steam alone is admitted; at the upper end, at the foot of a cylindrical charging hopper, air, or a mixture of air and steam, is admitted; whilst the gas generated is drawn off from an intermediate point. By this arrangement the tarry matters distilling from the fresh fuel are caused to pass down through the incandescent zone before reaching the outlet, whilst the steam entering the lower region of the fuel prevents clinkering, utilises the heat of the cinders, and forms water-gas with any carbon remaining unburnt in the latter.—H. B.

Calcium Carbide; Agglomerating ——. L. Leinss. Fr. Pat. 339,492, Jan. 11, 1904.

For mixture with 400 kilos. of calcium carbide, 100 kilos. of molasses, containing about half its weight of sugar, is deprived of water as far as possible by heating to about 100° C., a small proportion of potassium permanganate is added with agitation, then 5 kilos. of dry sodium carbonate, 2 kilos. of zinc oxide, and 1 kilo. of finely-powdered lime. The crushed calcium carbide is then worked into the mass, whilst the temperature is kept at not below 90° C. The agglomerated mass is then moulded under pressure, and the cakes are rolled. Many advantages are claimed for this mixture over calcium carbide by itself, especially in reference to the application to the production of acetylene gas.—E. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM AND MINERAL WAXES.

Indophenine Reaction. L. Storch. XXIII., page 730.

English Patents.

Phenols of Coal Tar; Process for the Separation of the —— from the Neutral Constituents of the Latter. E. Schulze and Chem. Fabr. Ladenburg, G. m. b. H., Ladenburg, Germany. Eng. Pat. 17,266, Aug. 8, 1903.

See Fr. Pat. 334,525 of 1903; this J., 1904, 55.—T. F. B.

Protective Coating [from Tar]: Non-inflammable Composition for use as a ——. G. MaLieux, Asnières, France. Eng. Pat. 7068, March 23, 1904. Under Internat. Conv., March 26, 1903.

See Fr. Pat. 330,608 of 1903; this J., 1903, 1081.—T. F. B.

United States Patent.

Mineral and Rosin Oils; Process of Making Watery Solutions of ——. F. Boleg, Esslingen, Germany, Assignor to Ges. z. Verwertung der Bolegschen Wasserlöslichen Mineralöle und Kohlenwasserstoffe, Ges. m. beschr. H., Berlin. U.S. Pat. 761,939, June 7, 1904.

See Eng. Pat. 12,349 of 1899; this J., 1900, 526.—T. F. B.

French Patent.

Peat Wax and Analogous Products; Manufacture of —— E. Bouchaud-Praceiq. Fr. Pat. 338,736, April 14, 1903.

Peat, lignite, &c., are extracted with suitable volatil solvents, *e.g.*, alcohol or ethylic esters, and the extrac evaporated. The residual wax-like substance, which resembles beeswax, is hard and has a high melting point an a specific gravity above 1·000.—C. A. M.

IV.—COLOURING MATTERS AND DYESTUFFS.

Rosanilines; Polyacid Salts of ——. J. Schmidlin. Comptes rend., 1904, **138**, 1508—1510.

The existence of triacid derivatives of rosanilines wa asserted by Hofmann, who prepared brown substances t which he assigned that composition: but his analytica figures did not support the conclusion very strongly. Th author finds that by placing these substances *in vacu* over potassium hydroxide for a month they lose complete the excess of acid which they contain, and the brown mas becomes quite black and inodorous. The substances thu obtained are exceedingly stable, and their analysis give figures agreeing exactly with the composition of tri-hydrochloride of rosaniline, pararosaniline, and hexamethyl pararosaniline respectively. They dissolve in alcohol an in water with the same colour as the corresponding monaci salts, and the colouring properties are not lessened by th saturation of all the basic functions in the molecul In the case of pararosaniline, Rosenstiehl obtained tetrahydrochloride by saturating with hydrochloric aci gas and removing the excess by means of a current of air but the author finds that the evolution of hydrochlori acid does not cease at this point, for the tetrahydrochlorid still gives off the gas to the atmosphere. The substanc saturated with hydrochloric acid gas at the ordinary temperature and pressure is red, and contains hydrochlor acid more than corresponding to a pentahydrochloride but as the temperature is lowered more gas is absorbed and the colour fades through orange and yellow, till in bath of liquid air it is perfectly white.—J. T. D.

Triphenylmethane Series; Some Reactions in the —— E. Vongerichten and K. Weilinger. Z. Farben- u Textil-Chem., 1904, **3**, 217—218.

When *p*-triaminotriphenylmethane and *p*-triaminotritolyl methane are heated respectively with toluidine and anilin hydrochlorides, transformation occurs, toluidine being replaced by aniline, or *vice versa*. When *p*-diaminoditolylmethane and the corresponding diphenylmethan derivative are treated in a similar manner, howeve Vongerichten and Bock (Z. Farben- u. Textil-Chem., 19 **2**, 249) have shown that the final product in either case i *p*-diaminophenyltolylmethane. The authors have no examined the behaviour of *p*-diaminotriphenylmethan and find that when heated with a strong excess of toluidine hydrochloride and *o*-toluidine, it is convert into *p*-diaminoditolylphenylmethane; and also that th latter when heated with aniline hydrochloride and anilin is again converted into *p*-diaminatriphenylmethane.—A. S.

Naphthyldiphenylmethane, Dinaphthylphenylmethane, an Trinaphthylmethane Series; Dyestuffs of the —— E. Noelting. Ber., 1904, **37**, 1899—1920.

The author obtains dinaphthylphenylmethane dyestuffs b condensing dimethyl-*p*-aminobenzaldehyde and its nitro derivatives with secondary alkylnaphthylamines and oxidising the leuco bases so obtained, and also by preparin diaminonaphthylphenylketones and condensing these wit secondary α-naphthylamines. Naphthyldiphenylmethan dyestuffs were obtained by condensing the above-mentione ketones with tertiary amines of the benzene series an dyestuffs and leuco bases of the trinaphthylmethane grou by the action of carbon tetrachloride on secondar α-naphthylamines or their *o*-formic acid esters. Th diaminonaphthylphenyl ketones were obtained by heatin econdary α-naphthylamines with dimethyl-*p*-aminobenzo-ethylanilide and phosphorus oxychloride and hydrolysing e aurammonium compound so formed with alcoholic alkali ydroxide or concentrated sulphuric acid according to the uations:—

$$(1)\ 3(CH_3)_2NC_6H_4.CO.N(CH_3)(C_6H_5) + 3POCl_3 = 3(CH_3)_2NC_6H_4.CCl_2.N(CH_3)(C_6H_5) + 2P_2O_5\,;$$

$$2)\ (CH_3)_2NC_6H_4.CCl_2.N(CH_3)(C_6H_5) + C_{10}H_7.NHR = (CH_3)_2NC_6H_4.C\vdots\{N(CH_3)(C_6H_5)(Cl)\}\{C_{10}H_6.NHR\} + HCl\,;$$

$$(3)\ (CH_3)_2NC_6H_4.C\vdots\{N(CH_3)(C_6H_5)(Cl)\}\{C_{10}H_6NHR\} + H_2O = (CH_3)_2NC_6H_4.CO.C_{10}H_6.NHR + C_6H_5NHCH_3 + HCl.$$

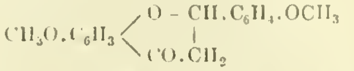
These ketones are weakly basic and dye in yellow shades, it cannot be considered to be real dyestuffs. They are duced by sodium amalgam in alcoholic solutions to the rresponding hydrols (carbinols) which dye silk and tannin-ordanted cotton in violet blue to green shades. On treating e aurammonium compounds with ammonia or the ketones th ammonium chloride and zinc chloride, Auramines are tained, dyeing in yellowish-orange shades, which are more able to acids than ordinary auramine but are readily nverted by alkalis into the corresponding ketones. yestuffs of the dinaphthylphenylmethane and trinaphthyl-ethane series have no practical importance on account of eir insolubility and relatively high cost of production. he replacement of one benzene nucleus by a naphthalene cleus in Crystal Violet changes the shade to blue. On placing the second and third benzene nuclei by naphtha-ne nuclei, the blue becomes greener at each step, but the fference in shade is not so marked as at the first stage. he presence of a nitro group in the benzene nucleus renders e shade of the dyestuff more violet. When naphthyldi-enylmethane dyestuffs are treated with acetic anhydride d sodium acetate, or acetic anhydride and a little sul-uric acid, the secondary aminonaphthyl group is acetylated d green dyestuffs are obtained, the solubility in water ing considerably increased. The acetyl group is split off acids or alkalis. The nitrosamine of Victoria Blue is own to be a green dyestuff. The author finds that the trosamines of the three other naphthyldiphenylmethane estuffs prepared by him are also green in shade. Thus e shade is changed to green on either acetylating or trosating a secondary amino group, and the relations are actly analogous to those observed with Pentamethyl iolet. On acetylating dinaphthylmethane dyestuffs which ntain two secondary amino groups with acetic anhydride d a little sulphuric acid, red diacetylated dyestuffs are rmed. On acetylating with acetic anhydride and acetic id, green mono-acetylated dyestuffs are obtained. Similar lations were also observed with the trinaphthylmethane estuffs. Both groups of dyestuffs also yield red dye-uffs with 2 mols., and green dyestuffs with 1 mol., of trous acid.—E. F.

iphenylmethyl. M. Gomberg. Ber., 1904, **37**, 1626—1644. This J., 1903, 1343 and 621; also 1901, 33 and 114.

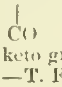
a solution of tri-*p*-tolylcarbinol chloride, prepared from bon tetrachloride and toluene with aluminium chloride an inert solvent such as benzene, be treated with molecular ver in absence of air, the solution acquires an orange our, and an unsaturated compound is formed. On naining for some time in absence of air, the solution es its colour, and hexatolylethane, $(CH_3.C_6H_4)_3\vdots C.(C_6H_4.CH_3)_3$, is formed by polymerisation of the tri-olymethyl, which is presumably formed in the first tance. When tri-*p*-tolylcarbinol chloride is acted on by lecular silver, in presence of a current of air, in benzene ution, the orange-coloured substance is decolorised ost as fast as it is formed, and a crystalline deposit of a oxide $(CH_3C_6H_5)_3.C.O.O.C.(C_6H_5.CH_3)_3$, is obtained. can be separated from the carbinol and hexatolylethane dissolving the latter substances in ether, and can n be recrystallised from benzene. The same peroxide s obtained in fairly good yield by treating tri-*p*-tolylcarbinol chloride in benzene solution with an aqueous sodium peroxide solution in presence of a little acetic acid. The peroxide is readily hydrolysed by means of aceto-sulphuric acid to the corresponding carbinol, whilst with hydrochloric acid tri-*p*-tolylcarbinol chloride is regenerated. Di-*p*-tolylphenylcarbinol chloride was prepared from *p*-bromotoluene and methyl benzoate. Its behaviour towards metals is quite analogous to that of the tritolyl compound. By the action of air and molecular silver, 70—80 per cent. of the peroxide can be obtained. The solutions of di-*p*-tolylphenylmethyl are less red (more orange) in shade than those of tri-*p*-tolylmethyl. This peroxide can also be obtained by the action of sodium peroxide on the carbinol chloride. Diphenyl-*p*-tolylcarbinol chloride was found to be best prepared by the Friedel-Crafft reaction from toluene and benzophenone dichloride. The latter substance reacts in this manner with exceptional ease, forming analogous derivatives with chloro-, bromo-, and iodo-benzene, naphthalene, &c., and substituted benzophenone dichlorides show a similar activity, so that the most diverse derivatives of triphenylcarbinol chloride may be conveniently prepared in this way. Diphenyl-*p*-tolycarbinol chloride resembles in its action on metals the triphenyl compound rather than its higher homologues. With zinc it reacts energetically, forming a syrupy double salt and an unsaturated compound which absorbs iodine and is quickly oxidised in the air to a peroxide. A solution of the carbinol chloride treated with molecular silver acquires an orange yellow shade rather darker than that from the triphenyl- and less red than that from the di-*p*-tolyl-phenyl-compound. The peroxide was prepared by both methods used in the case of the two other tolyl-derivatives; *p*-chloro-, *p*-bromo-, and *p*-iodotriphenylcarbinol chlorides were obtained by the action of chloro-, bromo-, and iodobenzene on benzophenone dichloride in presence of aluminium chloride; *p*-chlorotriphenyl carbinol chloride was also prepared by the action of benzene on *p*-chlorobenzophenone chloride, and was identical with the substance obtained by the other method. All three *p*-halogen-substituted triphenylcarbinol chlorides behave towards metals in a manner analogous to the tolyl-compounds. With molecular silver the chloro-compounds yielded a wine-red, and the bromo- and iodo-compounds an orange-red coloration. On exposure to air these unsaturated compounds formed peroxides insoluble in ether. Tri-*p*-chlorotriphenylcarbinol chloride was obtained by the action of chlorobenzene on carbon tetrachloride. With molecular silver a benzene solution of this substance gives a Bordeaux Red coloration, finally changing to a Magenta violet which is so deep that a three per cent. solution is quite opaque. In presence of air the colour disappears and a powdery product can be isolated, probably the peroxide. Diphenyl-α-naphthyl carbinol chloride was obtained by the action in carbon bisulphide solution, of naphthalene on benzophenone dichloride in presence of aluminium chloride. With molecular silver in benzene solution it yields a deep brownish-yellow solution with green fluorescence. It is decolorised by the air with astonishing rapidity, and a crystalline peroxide is deposited. Trinaphthylcarbinol and its chloride were obtained by the action of naphthalene on carbon tetrachloride in presence of aluminium chloride, but could not be obtained in a colourless form, so their behaviour was not further studied. Tri-*p*-nitrotriphenylcarbinol chloride was obtained in an impure form from its carbinol, by the action of phosphorus oxychloride or pentachloride in nitrobenzene solution. The carbinol is not acted on by dry hydrochloric acid gas in benzene solution, nor by acetyl chloride. The carbinol chloride gives with molecular silver in benzene solution, on gentle warming, a blue green liquid, and on further warming, the colour changes to magenta violet. On cooling, the bluish-green coloration returns. On exposure to air the corresponding peroxide is formed. All the triphenylmethyl derivatives described above, with the possible exception of the tritolyl compound, absorb iodine, forming colourless compounds. As the faculty of forming peroxides disappears, for instance, by polymerisation on standing, the faculty of absorbing iodine disappears also, and the solutions become colourless. The author finds that triphenylmethyl exists in its solutions in a dimolecular condition, but he considers this to be merely a case of association and formulates it as $(C_6H_5)_3:C-$ and the peroxides as $R_3C.O.O.CR_3$.—E. F.

2.2′-Dihydroxyflavonol; Synthesis of ——. A. Katschalowsky and St. v. Kostanecki. Ber., 1904. **37**, 2346—2351.

On condensing quinacetophenone monomethyl ether with *o*-methoxybenzaldehyde, 2.2′-dimethoxyflavanone—

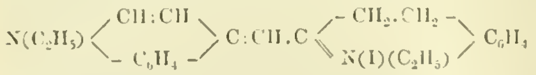


$$CH_3O.C_6H_3\left\langle\begin{array}{l}O - CH.C_6H_4.OCH_3\\ \qquad\quad | \\ CO.CH_2\end{array}\right.$$

is produced. Isonitroso-2.2′-dimethoxyflavanone, obtained by treating this compound with amyl nitrite and hydrochloric acid, is converted by treatment with sulphuric acid into 2.2′ dimethoxyflavonol, which is demethylated by means of hydriodic acid, 2.2′-dihydroxyflavonol being formed. It dyes mordanted cotton much deeper shades than do 2.3′- or 2.4′-dihydroxyflavonol (see this J., 1901, 367). The mordant-dyeing properties of this compound show that those of Morin are due, not only to the chromogen group  $\begin{array}{c}C.OH\\ | \\ CO\end{array}$ and to the hydroxyl group in the *peri* position to the keto group, but also to the *anchi*- (or 2′) hydroxyl group.—T. F. B.

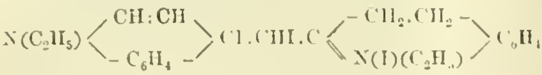
Cyonine Dyestuffs; Constitution of ——. A. Miethe and G. Book. Ber., 1904, **37**, 2008—2022.

The authors find that Ethyl Red, the dyestuff obtained by the action of alkali hydroxide on a mixture of quinoline ethyl iodide and quinaldine ethyl iodide in alcoholic solution, has the formula $C_{23}H_{25}N_2I$. The best yield is obtained by using a mixture of 2 mols. of quinoline ethyl iodide with 1 mol of quinaldine ethyl iodide. An alcoholic solution of quinoline ethyl iodide alone yields no dyestuff with alkali hydroxide. Ethyl Red combines with 2 atoms of iodine to form a perfectly stable compound, soluble with difficulty in water and in alcohol, but readily soluble in acetone to a deep red solution. This addition compound possesses none of the properties of a periodide such as quinoline periodide. For instance, its solution in acetone shows no blue coloration with starch solution. From the above considerations the authors deduce the constitutional formulæ—



$$N(C_2H_5)\left\langle\begin{array}{c}CH:CH\\ \\ -\,C_6H_4\,-\end{array}\right\rangle C:CH.C\left\langle\begin{array}{c}-\,CH_2.CH_2\,-\\ \\ N(I)(C_2H_5)\end{array}\right\rangle C_6H_4$$

for Ethyl Red ; and



$$N(C_2H_5)\left\langle\begin{array}{c}CH:CH\\ \\ -\,C_6H_4\,-\end{array}\right\rangle CI.CHI.C\left\langle\begin{array}{c}-\,CH_2.CH_2\,-\\ \\ N(I)(C_2H_5)\end{array}\right\rangle C_6H_4$$

for the iodo-addition product. By the action of alkali hydroxide in alcoholic solution on quinaldine ethyl iodide alone, a homologue, $C_{21}H_{27}N_2I$, of Ethyl Red is formed, which differs from the latter in shade and is a far less efficient sensitiser of a silver-bromide-gelatin plate. By the action of 1 mol. of silver nitrate, Ethyl Red is converted into the corresponding nitrate $C_{23}H_{25}N_2\ (NO_3)$ which is an excellent sensitiser for photographic plates, which it clouds far less than the original Ethyl Red, and has the further advantage of being very soluble in water and in alcohol.

—E. F.

English Patents.

Disazo Colouring Matters [*Azo Dyestuffs*]; *Manufacture of* ——. G. W. Johnson, London. From Kalle and Co., Biebrich-on-the-Rhine. Eng. Pat. 12,120, May 27, 1903.

See Fr. Pat. 332,714 of 1903; this J., 1903, 1290.—T. F. B.

Azo Colouring Matters; Manufacture of New ——, *and of Intermediate Products for the Production of such Colouring Matters.* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 16,581, July 28, 1903.

See Fr. Pat. 331,140 of 1903; this J., 1904, 16.—T. F. B.

Anthraquinone Derivatives; Manufacture of New —— [*Nitroanthraquinonesulphonic Acids*]. H. E. Newtor London. From Farbenfabr. vorm. F. Bayer and Co. Elberfeld, Germany. Eng. Pat. 17,565, Aug. 13, 1903.

See Fr. Pat. 334,576 of 1903; this J., 1904, 57.—T. F. B.

Azo Dyestuffs: Manufacture of New ——, *and of Product to be used in the said Manufacture.* J. Y. Johnson London. From The Badische Anilin u. Soda Fabrik Ludwigshafen-on-the-Rhine, Germany. Eng. Pat. 16,995 Aug. 4, 1903.

The new azo dyestuffs are 2-hydroxy-1-azo derivatives o naphthalene, and are prepared from 2-4 dichloro-1-naphthyl amine, by acetylating it, sulphonating, splitting off the acetyl group, diazotising the dichloronaphthylaminemonosulphonic acid, and treating the diazo solution with a substance capable of neutralising the acid, *e.g.*, sodium acetat or carbonate, chalk, magnesia, whereby one of the chlorin atoms is replaced by a hydroxyl group, and a hydrox chlorodiazonaphthalenesulphonic acid or its inner anhydrid is produced. The latter, when coupled with β-naphthol gives a dyestuff which is soluble in water, and dyes wool i an acid bath brownish-violet shades, changing on treatmen with potassium bichromate or a mixture of a chromate an a chromium salt, into a deep bluish-black, having a blu "overhand" appearance, and very fast to washing, milling "potting," and light. Other hydroxy derivatives o naphthalene, *e.g.*, the 2.7- or 1.5-dihydroxynaphthalene may be substituted for the β-naphthol.—A. S.

United States Patents.

Orange Sulphur Dye [*Sulphide Dyestuff*]. W. Emmeric Assignor to Farbw. vorm. Meister, Lucius und Brüning Hoechst-on-the-Maine, Germany. U.S. Pat. 760,11 May 17, 1904.

"Toluylene-diurea" is heated with sulphur. The product is a dark reddish-brown powder, soluble in sodium hydroxide solution and in sodium sulphide solution with brown colour. On evaporating the sodium sulphide solution the dyestuff is obtained in a form soluble in wate the solution dyeing cotton in fast, bright, orange shades.

—E. F.

Azo Dyestuffs: Preparation of ——. W. Loeb, Bonn Assignor to C. F. Boehringer und Soehne, Mannheim Waldhof, Germany. U.S. Pat. 761,310, May 31, 1904.

A mixture of an aromatic amine, potassium nitrite, an an acid "coupling compound," or one of its salts, i submitted, in aqueous solution, to the anode action of a electric current. For example, "Ponceau 2 G." is prepare by electrolysing a mixture of 10 parts of aniline, 9·1 part of potassium nitrite, 32·7 parts of β-naphtholdisulphon acid, and 100 parts of water, using a platinum cathode.

—T. F. B.

Indoxyl, &c.: Process of making ——. A. Bischle Assignor to Basle Chemical Works, Basle, Switzerlan U.S. Pat. 761 410, May 31, 1904.

Indoxyl, its homologues and their derivatives are pr duced by melting the alkali salt of the corresponding ar glycin compound with alkali hydroxide, an alkali metal, an a small quantity of the product obtained by dissolvin sodium in alcoholic potash, and distilling off the alcoh An alkali sulphite may also be added to the mixture.

—T. F. B.

French Patents.

Dyestuff obtained from Asphodel Roots. A. Badoil an J. E. Valadon. Fr. Pat. 333,178, Nov. 28, 1903.

The material is washed, divided, and extracted with wate at a temperature of 30—60° C. The extract is fermente and used for spirit manufacture. A resin is then extracte from the residue by boiling with water in contact with th air. This resin decomposes under these conditions, and dyestuff solution is formed of a bright reddish-black sha which changes to pure black under the action of ferro sulphate and other mordants. The residual fibre is use for paper-making.—E. F.

kes [from Azo Dyestuffs]; Process for Preparing New ——. Soc. Anon. Prod. F. Bayer et Cie. Fr. Pat. 339,606, Jan. 14, 1904.

n lakes, fast to light, are obtained by precipitating on a table substratum the dyestuff obtained by coupling zotised anthranilic acid with α-naphthol sulphonic acids ., naphthol sulphonic acids 1.3, 1.3.6, 1.3.8, &c.).
—T. F. B.

o Dyestuff and Lakes derived from it; Production of New ——. F. Bayer et Cie. Fr. Pat. 339,947, Jan. 27, 904.

e sodium salt of *m*-aminobenzoic acid is diazotised and nbined with 2-naphthol-3.6.8-trisulphonic acid. The our is precipitated with salt, and dyes wool from an acid h in orange shades. The colour lake which is prepared precipitation with a salt of calcium, barium, strontium aluminium, &c. in the usual way, is fast to light.
—A. B. S.

V.—PREPARING, BLEACHING, DYEING, RINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

-Cocoon; Destruction of the Chrysalis of the —— the Action of Cold. J. de Loverdo. Comptes rend., 904, **138**, 1434—1436.

: destruction of the chrysalis may be effected as certainly exposure to cold as by the hot process. The cocoons allowed to remain for about a month in a dry atmoere maintained at a constant temperature below 0° C. action of temperatures between 0° and −8° C. is tically the same, but the lower temperatures are always ferable. The cocoons can be placed in the cold chamber soon as they are ready, and require no attention, as in case of hot stoving, and the waste which occurs the old methods is avoided.—J. F. B.

English Patents.

ed or Matted Goods or Fabrics; Manufacture of —— om Fibres or Fibrous Materials. J. Y. Johnson, ondon. From G. Goldman, Baltimore, U.S.A. Eng. ats. 2680; 2681; 2682; 2683; and 2684; Feb. 3, 1904.

U.S. Pats. 758,243; 758,245; 758,246; 758,244; and 247 of 1904; this J., 1904, 544.—T. F. B.

ling or Fulling and Washing and Scouring Textile iece Goods; Machines for ——. T. Lumb, T. Walaw, and D. White, Morley, England. Eng. Pat. 12,342, ay 30, 1903.

pressure of the upper squeezing roller is regulated, rding to the cloth under treatment, by means of levers adjustable weights. A pair of vertical corrugated rs are placed between the "draught board" and the ezing rollers; these serve to break up longitudinal es in the cloth. The draught board is connected by s with a clutch on the driving pulley, and if a knot in abric prevents it passing freely through the openings, e draught board, the latter is moved and throws the ng pulley out of gear and thus stops the machine. leaving the squeezing rollers, the cloth is again ed out by an arrangement of "rams" which works versely. When used as a milling machine, the hinged is held up to form a trough under the squeezing s; for use as a scouring machine the hinged floor at right angles, so that the piece can travel round endless band.—A. B. S.

o-dyed Woollen Goods; Process for Increasing the stness to Wear of ——. O. Imray, London. From Peterhauser, Höchst-on-the-Maine, and F. Rechburg, rsfeld, Germany. Eng. Pat. 14,840, July 3, 1903.

wool is mordanted with metallic salts, such as potasbichromate, before dyeing with indigo.—A. B. S.

Designs Impressed on Fabrics; Method of Fixing or Protecting ——. L. J. Chischin, Moscow. Eng. Pat. 18,599, Aug. 28, 1903.

See Fr. Pat. 335,238 of 1903; this J., 1904, 115.—T. F. B.

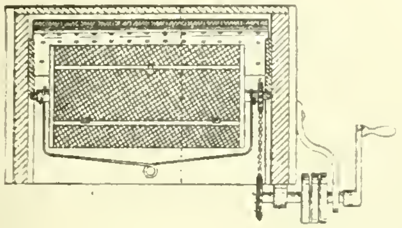
Soap for Dyeing and Cleaning; Manufacture of ——. A. J. Boult, London. From C. W. Horton, Cleveland, U.S.A. Eng. Pat. 28,508, Dec. 28, 1903.

A mixture of water and a coal tar dyestuff is incorporated with the soap while still in a plastic condition.—C. A. M.

United States Patents.

Dyeing; Machine for ——. C. W. Herbine and H. Rech, Reading, Pa., U.S.A. U.S. Pat. 760,118, May 17, 1904.

A machine for dyeing hosiery or yarn, comprising a tank with a curved bottom, a perforated false bottom, a removable perforated cylinder revolving in guide-bearings in either end of the tank, with a handle for lifting the cylinder, and machinery for revolving it.—E. F.



Wool-Fat; Process of Recovering ——. C. E. Swett, Assignor to R. H. Hutchison. U.S. Pat. 761,265, May 31, 1904. XII., page 719.

French Patents.

Dyeing, Bleaching, &c., Yarns; Method of and Apparatus for ——. W. Reid. Fr. Pat. 339,322, Jan. 2, 1904.

Yarns are spirally wound upon two reels fitted into a frame, which is capable of being revolved while it is moved along above, or is immersed in a dye- or other bath. Springs or other devices are employed to maintain the yarns—*e.g.*, wool yarns—under a constant degree of tension, while allowing them to contract, during any of the operations to which they are subjected. Two grooved shafts, placed on opposite sides of the dye- or other tank, cause a number of the frames successively first to advance some distance, and then to return almost the same distance, until the carriage which conveys them has reached the ends of the shafts, when the movement is reversed, and the frames are caused to return in the same manner. The reels may be made flat to facilitate their passage, in the frames with the yarns upon them, between squeezing rollers, for the purpose of removing the excess of liquor from the yarns, or they may be hollow and perforated, to admit of the introduction of a closed steam pipe into them for drying purposes. Arrangements for simultaneously raising or lowering a number of frames out of or into a dye, &c. tank, are also claimed.
—E. B.

Textiles in Hanks; Machine for Mechanically Dyeing ——. E. Dittmar. Third addition, dated Jan. 11, 1904, to Fr. Pat. 315,658, Nov. 6, 1901.

The rods which carry the hanks (see this J., 1902, 547, and 1903, 416) are made of bamboo or rice-cane.—T. F. B.

Dyeing with Aniline Dyestuffs; Solid Compound for ——. G. Rowland. Fr. Pat. 339,869, Jan. 25, 1904.

See Eng. Pat. 1502 of 1904; this J., 1904, 543.—T. F. B.

Dyeing and Bleaching of Cotton in Bobbins; Machine for ——. Soc. Schwcb. Frères and A. Wioland. Fr. Pat. 339,946, Jan. 27, 1904.

The bobbins are arranged side by side in a closed vessel. The spaces between the bobbins are filled by means of

diaphragms, so that no liquid can pass, except through the substance of the bobbins. The closed vessel is exhausted by an air pump, and then the dyeing or bleaching liquid is run in and circulated continuously by means of a pump. The dye vessel can be heated if desired by a steam pipe.
—A. B. S.

Rice Flour; Treatment of —— for use in Finishing Yarns and Textiles. Soc. anon. des Rizeries Françaises. Addition to Fr. Pat. 334,369, Aug. 1, 1903. XIX., page 725.

VII.—ACIDS, ALKALIS, AND SALTS.

Alkali Carbonate and Calcium Carbonate; Decomposition of Mixtures of ——, at High Temperature in vacuo. P. Lebeau. Comptes rend. 1904, **138**, 1496—1498.

The dissociation of alkali carbonates, which occurs when they are heated *in vacuo* (this J., 1904, 60) is facilitated by admixture with calcium carbonate. Complete dissociation of the carbonates of cæsium, rubidium, potassium, and sodium, occurs under these circumstances at 1000° C. This temperature is above that at which calcium carbonate alone dissociates, and the dissociation pressure throughout is lower than that of calcium carbonate at the same temperatures, suggesting the existence of double carbonates of the alkali metal and calcium. The residue after complete dissociation consists of pure lime (the alkali metal oxide having volatilised) in irregularly shaped transparent fragments, without action on polarised light, much less readily attacked by reagents than that obtained by simple calcination of the carbonate. Mixtures of lithium and calcium carbonates give a different result, the residue always containing lithia as well as lime.—J. T. D.

Barium Sulphate of the Lozère District. Guédras. Comptes rend., 1904, **138**, 1410.

The most distinctly crystalline deposits of barytes in the Lozère district are found near Altier, arrondissement de Mende. The mineral is very rich in copper, containing up to 10 per cent. of that metal, and also contains considerable quantities of tin. The vein is a very thin one. In the commune of Villefort there is a vein of barytes charged with galena; this barytes occurs in form resembling chalk. A portion of this vein is poor in galena and assumes a very definite form; the cleavages are perfect and show a vitreous, pearly lustre, which is lacking in the other barytes of the district; this lustre contributes largely to its industrial value. In both these deposits the embedding rock is composed of silky schists, stained with malachite in contact with the vein of barytes.—J. F. B.

Basic Ferric Phosphite. E. Berger. Comptes rend., 1904, **138**, 1500—1501.

Freshly precipitated ferric hydroxide dissolves in phosphorous acid, but the solution is decomposed completely by water in sufficient excess, giving a white precipitate. This precipitate, washed with water, slowly gives up phosphorous acid, and the residue when no more phosphorous acid can be washed out, dried first on a porous plate, and finally *in vacuo* over sulphuric acid, has a perfectly fixed composition. The results of analysis, and the reducing action of the salt on permanganate prove that no ferrous salt is present, and that the substance is basic ferric phosphite, $(PO_3H)_6Fe_4.Fe(OH)_3.5H_2O$.—J. T. D.

English Patents.

Sulphuric Anhydride; Manufacture of ——. W. P. Thompson, London. From G. Wischin, Munich, Germany. Eng. Pat. 12,419, May 30, 1903.

The mixture of sulphur dioxide and air or oxygen is led through an annular section containing contact material, the outside of which section is exposed to a cooling atmosphere, and then consecutively through a similarly packed wider annular section, enveloped by the first section, with or without the interposition of a comparatively narrow intervening space. No external source of heat is used, except that the gases are admitted in a hot state. Several forms of apparatus are described, but in all, the first, relativel narrow annular section (in which the reaction is mo vigorous) serves as a heating jacket to the wider, interic annular section or sections.—E. S.

Sulphuric Acid; Manufacturing ——. H. H. Niedenfüh Berlin. Eng. Pat. 1066, Jan. 15, 1904.

The gaseous sulphurous acid used in the chamber proce of manufacturing sulphuric acid is cooled before enteri the chamber by being utilised in concentrating the chamb acid, or by special cooling devices, and is purified, especial from arsenic, &c., by passage through washers, filters, or tl like. The denitration is effected by the action of cool sulphurous acid gases. A pressure generator is arrange before a special denitrating device, and between that a the part of the plant in which the acid is concentrated, order to increase the relative efficiency of the denitrat and " of the nitric acid in the chamber, and for decreasi the quantity of nitric acid necessary for carrying ou t reaction."—E. S.

Cyanides; Manufacture of ——. J. Tcherniac, Freibu Germany. Eng. Pat. 17,419, Aug. 11, 1903.

In manufacturing cyanides by oxidising a thiocyan (sulphocyanide) by nitric acid, &c., as directed in Eng. P 17,976 of 1902 (this J., 1903, 1045), it is now directed pass the washed gaseous mixture, containing hydrog cyanide and nitric acid vapour, over a salt or oxide (su as anhydrous sodium sulphate or alumina) which reacts combines with nitric acid, but has little or no effect hydrogen cyanide. The absorption of the hydrogen cyani is effected by an alkali hydroxide heated to a temperatu below its melting point, but above that at which the wat generated by the reaction is completely vaporised. using caustic soda for this purpose, it is first heated about 200° C., and finally to about 300° C.—E. S.

Glauber Salts and Ferrous Sulphate; Production of — from Nitre-cake or Acid-sodium-sulphate. C. L. Park London. Eng. Pat. 9619, April 27, 1904.

Iron, or iron oxide, or spathic iron ore, is added in exc to solution of nitre-cake (acid sodium sulphate) of sp. 1·275—1·300. Glauber's salt is crystallised out of t settled and cleared solution, and the mother liquid concentrated to obtain crystalline ferrous sulphate. T process may be modified by neutralising the acid liq by the iron or the like, at two stages of the operati Reference is made to Eng. Pat. 24,639 of 1903; this 1904, 252.—E. S.

French Patents.

Ammonium Nitrate; Process for Extracting —— fr Sodium Nitrate and Ammonium Sulphate. E. Nauma Fr. Pat. 339,733, Jan. 20, 1904.

A mixture of solutions of sodium nitrate and of ammoni sulphate is boiled, and the sodium sulphate which salts is removed. At a certain stage of the process the solu is cooled sufficiently to become saturated with ammoni nitrate: a double salt containing ammonium sulphate th separates, and the mother-liquor, after concentration desired, is rapidly cooled in a prescribed manner, subject to external disturbance, to obtain a deposition ammonium nitrate, which may be refined.—E. S.

Zinc Sulphide and other Sulphides; Process of Extract ——. G. D. Delprat. Fr. Pat. 339,920, Jan, 26, 19

See Eng. Pat. 27,132 of 1903; this J., 1904, 610.—T. F.

Sodium Ferrocyanide; Manufacture of ——. Administion des Mines de Bouxviller. Fr. Pat. 339,996, Jan. 1904.

Sodium chloride is added to a hot, strong solution calcium ferrocyanide, and the crystals of sodium fer cyanide that form are salted out from the mother-liq of calcium chloride formed; or may be crystallised fr the concentrated liquor on cooling. Reference is mad Fr. Pat. 156,416 of 1883.—E. S.

des of Nitrogen; [Electrical] Manufacture of ——. iemens Bros. and Co. Fr. Pat. 339,730, Jan. 20, 190 I. A., page 717.

VIII.—GLASS, POTTERY, ENAMELS.

ta Pottery; Body of ——. H. Matsumoto. Mem. oll. Science and Eng. Kyoto Imp. Univ., 1903, 1, —86.

ata pottery body is composed of Shigaraki, Majeko, aye, and Mitsuishi clays, fired at the temperature of r cone 020—022; and the glaze is compounded of kusa stone and the ash of *Distylium racemosum*, and ed at cone 7. The ware is pale straw colour, the body us and non-transparent but hard, and the glaze is tely crazed (or "shivered"). In analysing the materials, lays were washed through a sieve with 60 meshes per cm. ted in this manner Shigaraki clay leaves 30 per cent. of ue, whilst the washed portion consists of 63·13 per . of clay substance, 12·19 per cent. of quartz, and 8 per cent. of felspathic detritus. Shiraye clay leaves er cent. of residue, and contains 97·05 per cent. of substance, 1·22 per cent. of quartz, and 1·73 per cent. elspar; whilst Majeko clay, which is sandy, leaves er cent. of residue, and is composed of 90·83 per cent. lay substance, 5·58 per cent. of quartz, and 3·6 per . of felspar. The author found it advantageous to omit Mitsuishi clay-stone. The Awata glaze consists of:— a, 53·00 per cent.; alumina, 11·11; iron oxide, 1·41; 14·24; magnesia, 0·30; soda, 2·53; potash, 2·32; on ignition, 14·77 per cent. On making up a series of es of the foregoing materials and a very pure quartz, uthor found that to give a good glaze the body should ain 30—40 per cent. of quartz to 20—12 per cent. of ar; or 40—50 per cent. when the felspar is between nd 6 per cent. On the other hand, the poor colour and of plasticity preclude the use of these bodies for fine . If, however, the ware is fired in the biscuit kiln at 11, it will carry the glaze without crazing, provided the contains 56·38—64·77 per cent. of kaolin, 7·11—8·21 lspar, and 36·51—27·02 of quartz. Thus, the relative ortions of quartz and felspar of those bodies which the glaze without "crazing," are:—"For 2·5—6 per of felspar, more than 10—30 per cent. of quartz, but han 30—45 per cent. of quartz; for 6—12 per cent. of ar, more than 30 per cent. of quartz."—C. S.

English Patents.

Glass; Apparatus for the Manufacture of ——. Rowart, Anvelais, and L. Francq, Obourg, Belgium. g. Pat. 9295, April 22, 1904. Under Internat. Conv., ril 27, 1903.

wer chamber, in which air is maintained under com- on, contains a vessel charged with molten glass, and unicates at the top by a long narrow opening with an chamber, which is exhausted and kept cold by a rating liquid circulating in compartments on each Through stuffing-boxes in the detachable top cover chamber pass vertical rods carrying clamps at their end, which carry between them a strip of glass. The containing the melted glass is carried by the plunger draulic cylinder, which raises it in the chamber until rrow opening of the top is slightly immersed in the At the same time, the rods in the upper chamber wered, so as to cause the glass strip held by the to pass through the opening and dip into the melted which adheres to it. On raising the rods, the glass ill draw up a portion of the melted glass through the g, the glass being at the same time forced upwards difference of the air pressures in the two chambers. glass rises in the form of a thin sheet, it is quickly d, and is then detached from the melted glass by g the vessel containing the latter. The rods, r with the formed glass sheet, are removed from the hamber by taking the cover off it. (See also Eng. 33 of 1904, this J., 1904, 660.)—A. G. L.

Drying and Baking Kilns for Ceramic Ware and the like. F. Dinz, St. Jean des Vignes, France. Eng. Pat. 12,861, June 8, 1903. Under Internat. Conv., Dec. 17, 1902.

Trucks filled with the products to be baked are pushed into a tunnel kiln in a continuous train. Each truck is provided with a grate and ash pit, to prevent the fuel from coming into contact with the material to be baked. Blinds are introduced between the trucks before their admission and discharge, so as to avoid loss of heat and entry of cold air. Two galleries are arranged laterally, through which a current of air circulates, which is heated by contact with the hot walls of the kiln, and serves both for the combustion of the ignited fuel in the grates, to which it is guided by special covers, and also to the storing of the products awaiting admission to the kiln. A part of this air-current is also used to dry materials arranged in suitable galleries.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

English Patents.

Carborundum Articles; Manufacture of ——. O. Imray, London. From the Carborundum Co., Niagara Falls, U.S.A. Eng. Pat. 9963, April 30, 1904.

In making carborundum articles, the use of a binding agent may be dispensed with by adding sufficient water to the carborundum—part, at least, of which should be in the form of fine powder—moulding and drying the articles as usual, and then subjecting them for some time to the action of an oxidising flame at a temperature of 2500° F., whereby the grains become oxidised superficially, and adhere together. Either crystalline or amorphous carborundum may be used. Bricks, &c., may be faced with carborundum in a similar manner.—A. G. L.

Cement and Limes; Impt. relating to ——. A. Deuaeyer, Brussels. Eng. Pat. 9765, April 28, 1904.

Five per cent., or more of sodium or potassium silicate is added to the Portland or other cement, either before or after burning; in the latter case the silicate should be in the form of a fine powder.—A. G. L.

United States Patent.

Fireproofing Solutions [for Wood]; Process of Making ——. A. W. Baxter, London. U.S. Pat. 761,870, June 7, 1904.

See Eng. Pat. 20,592 of 1902; this J., 1903, 998.—T. F. B.

French Patents.

Fireproof Varnish: Manufacture of ——. Eymer-Ges. Fr. Pat. 339,641, Jan. 16, 1904.

The varnish consists of alkali silicates ("soluble glass") and asbestos or other fireproof material mixed with vegetable or mineral oils, or with oily substances such as glycerin.—A. G. L.

Building Materials, Artificial; Mechanical Manufacture of ——. P. Deuil père and P. Deuil fils. Fr. Pat. 339,727, Jan. 23, 1904.

The moulding of the bricks, &c., is effected in a hydraulic press. The size and form of the mould can be altered by means of suitable packing material, an even pressure being exerted by employing, at will, one or more compressing pistons.—A. G. L.

X.—METALLURGY.

Gold on the Rand Goldfields; Metallurgy of ——. C. Dixon and M. Torrente. Electrochem. Ind., 1904, 2, 215—220.

The authors give a full account of the recent advances and present position of the treatment of gold on the Rand.

The treatment of slimes, the zinc and electrolytic precipitation of the gold from the cyanide solutions, and the working up of by-products such as occur particularly in the cyanide treatment, are all dealt with.—R. S. H.

Gold-Silver Alloys; Solubility of —— in Potassium Cyanide Solutions. J. Yokobori. Mem. Coll. Science and Eng., Kyoto Imp. Univ., 1903, **1**, 65–71.

In view of the fact that native gold invariably contains a certain proportion (varying from 6 to 60 per cent.) of silver, the author examined the action of potassium cyanide solutions of different strengths (from 0·1 to 0·5 per cent.) on pure gold, gold-silver alloys containing 10, 20, 30, 40, 50, 60, 70, 80, and 90 per cent. respectively of silver and pure silver. The results are given in a series of tables. In the weaker solutions (0·1 and 0·2 per cent.) the amounts of gold and silver dissolved from the alloys vary in an irregular manner, except that with 0·2 per cent. cyanide solution the percentage of gold and silver dissolved in a given time appears to decrease gradually as the proportion of silver in the alloys increases. With the stronger cyanide solutions the solubility of both gold and silver appears to be nearly at the maximum when the alloy contains equal proportions of the two metals. The author also examined the effect of zinc shavings upon cyanide solutions. 5 grms. of the shavings were immersed in 100 c.c. of the cyanide solution, and the strength of the latter determined after 24 and 48 hours. With a 0·1 per cent. solution, the strength, after 24 and 48 hours' contact with zinc, varied from 0·070 to 0·077 and 0·064 to 0·072 per cent. respectively, whilst without zinc the corresponding figures were 0·096 and 0·092. With a 0·216 per cent. solution the figures were 0·163—0 164 and 0·08—0·136 per cent. with zinc, and 0·210 and 0·202 without zinc. With a 0·3 per cent. solution, the figures were 0·228—0·23 and 0·112—0·180 per cent. with zinc, and 0·290 and 0·274 without zinc.
—A. S.

Zinc Blende; Smelting of ——. C. Ritter. Z. angew. Chem., 194, **17**, 774.

The elimination of sulphur during the roasting of blende depends largely upon the state of division of the ore, which should be in grains not larger than 1—3 mm. in linear dimensions. If finer than this it lies light and requires more room in the furnace. This preliminary treatment of the blende before reduction is more costly than that necessary for calamine; but unless it be thoroughly carried out, much zinc remains in the residues. The addition of calcined calamine to roasted blende in the melting furnace seems to assist in expelling the zinc; for while a 25 per cent. blende smelted alone yielded 81 per cent. of its total zinc, a mixture of this blende with an equal weight of a 15 per cent. calamine yielded 91 per cent. of the total zinc. Flue-dust, or zinc-white, similarly smelted, yielded practically all its zinc; so that the fineness of division of the ore in the smelting furnace has an important bearing on the yield.—J. T. D.

Aluminium; Alloys of —— with Bismuth and with Magnesium. H. Pécheux. Comptes rend., 1904, **138**, 1501—1503.

By the method formerly used (this J., 1904, 577), bismuth-aluminium alloys were obtained containing 75, 85, 88, 91 per cent. of aluminium; densities 2·86, 2·79, 2·78, 2·74 respectively. The alloys are sonorous, brittle, fine-grained and homogeneous, silver-white, and have melting-points between those of their constituents, nearer that of aluminium. They are not oxidised in air at the temperature of casting; but are rapidly attacked by acids, concentrated or dilute, and by potassium hydroxide solution. The filed alloys behave like those of tin-aluminium (this J., 1204, 603), but still more markedly. Magnesium-aluminium alloys were obtained with 66, 68, 73, 77, 85 per cent. of aluminium; densities 2·24, 2·27, 2·32, 2·37, 2·47. They are brittle, with large-granular fracture, silver-white, file well, take a good polish, and have melting-points near that of aluminium. They are difficult to cast, being viscous when melted; and when slowly cooled form a grey spongy mass which cannot be re-melted. They do not oxidise in air at the ordinary temperature, but burn readily at a bright red heat. Th are attacked violently by acids and by potassium hydroxi solution; decompose hydrogen peroxide, and slowly deco pose water even in the cold.—J. T. D.

English Patents.

Alloys having Pyrophoric Action; Manufacture Metallic ——, and their Application to the purposes Ignition and Illumination. C. F. A. von Welsba Vienna. Eng. Pat. 16,853, July 31, 1903.

See Fr. Pat. 337,320 of 1903; this J., 1904, 484.—T. F.

Melting Furnaces. J. B. Orbison, San Francisco. Eng. Pat. 9445, April 25, 1904.

The furnace, which is especially adapted for melting br and like alloys, with the use of liquid or gaseous fuel mounted on trunnions, one of which is hollow for introd tion of a jet of flame, and has arrangements permitting to be mechanically oscillated. A gaseous fuel burner co municates with the hollow trunnion, and the bottom of furnace is provided with a dam disposed longitudina opposite a charging way at the top of the furnace, o which dam the metals flow alternately from right to and the reverse, as the furnace oscillates, until they thoroughly mixed.—E. S.

United States Patents.

Metals; Extracting —— from Ores. W. E. Greenaw Denver, Col., U.S.A. U.S. Pat. 761,164, May 31, 190

Chlorine, obtained by electrolysing sodium chloride absorbed by water; the chlorine solution is agitated w the ore in a closed vessel for some time; the solutio then displaced by fresh chlorine solution injected u pressure, followed by agitation. Finally the "desi metals" are precipitated from the solution filtered from ore.—E. S.

Gold Separating and Recovering Apparatus. W. Land San Francisco. U.S. Pat. 762,174, June 7, 1904.

The apparatus for the separation of gold from sand c prises a chamber containing mercury having a co bottom with a discharge passage, a receptacle fitted to depending from the conical bottom, and having cocks opposite ends; a vertical cylinder of smaller diame through which material is delivered and submerged in mercury; revolving scrapers extending over the up edge of the mercury chamber, and by which the mate after rising through the mercury, is discharged; an exte annular receiving trough, and an air-tube located wit and above the trough, having jet openings through w an air-blast may be discharged outwardly.—E. S.

Minerals; Apparatus for the Concentration of —— means of Oil. J. W. van Meter and M. P. Boss, Francisco. U.S. Pat. 762,774, June 14, 1904.

Oil, pulped ore, and water, are supplied by a rotary di butor, divided into two compartments, to the first of a se of communicating vessels, each of which has a bo discharge for the water and gangue, and means for m taining a water-bed to support the oil in its course. distributor is disposed in the upper part of the vesse discharge near its axis, so that the rotary movements of contents induced by the distribution of the material tend to throw the pulp outwardly against the walls of vessel, and facilitate the separation of the gangue. Th are means at the end of the series of vessels to separate upper and lower portions of the oil, the upper oil b returned to the first vessel by a pipe communicating the lower compartment of the distributor.—E. S.

French Patents.

Steel and Armour Plates; Process for Treating —— E. Engels. Fr. Pat. 339,987, Jan. 28, 1904.

See Eng. Pat. 1842 of 1904; this J., 1904, 374.—T. F.

inc and Lead from Minerals; Process for Obtaining ——. E. H. Miller. Fr. Pat. 339,752, Jan. 20, 1904.

E Eng. Pat. 20,465 of 1902; this J., 1901, 188.—T. F. B.

lloy; Manufacture of a Metallic ——. T. Prescott and E. Green and Son, Ltd. Fr. Pat. 339,994, Jan. 28, 1904. Under Internat. Conv., March 11, 1903.

E Eng. Pat. 5683 of 1903; this J., 1904, 413.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

romoform; Electrolytic Preparation of ——. E. Mueller and R. Loebe. XX., page 725.

English Patents.

sulating Purposes; Materials Suitable for Electric ——. E. A. Carolan, London. From the General Electric Co., Schenectady, New York. Eng. Pat. 12,312, May 29, 1903.

REFRACTORY fibrous binding material, such as asbestos mineral wool, is mixed with a comparatively soluble comund of an alkaline earth, such as calcium hydroxide, with without the addition of about 10 per cent. of borax glass. e mixture, after shaping into articles of the desired form der pressure, is treated with a solution of a soluble rbonate through which carbon dioxide gas is passing, in ler to form the insoluble carbonate of the alkaline earth, d the articles are finally washed and dried.—B. N.

ectric Batteries; Secondary ——. E. Commelin and R. Vian, Paris. Eng. Pat. 6619, March 18, 1904. Under Internat. Conv., March 18, 1903.

E Fr. Pat. 330,376 of 1903; this J., 1903, 1092.—T. F. B.

ducing Organic Substances in an Electrolytic Bath; Process of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine, Germany. Eng. Pat. 15,700, July 15, 1903.

E U.S. Pat. 742,797 of 1903; this J., 1903, 1355.—T. F. B.

United States Patents.

citing Fluid for Electrical Batteries. G. F. Atwood, Assignor to Primary Power Co, Wakefield, Mass. U.S. Pat. 761,641, June 7, 1904.

Eng. Pat. 28,057 of 1903; this J., 1904, 377.—T. F. B.

citing Fluid for Electrical Batteries. G. F. Atwood, Assignor to Primary Power Co., Wakefield, Mass. U.S. Pat. 761,642, June 7, 1904.

E solution in which the positive pole is immersed is the ne as that described in Eng. Pat. 28,057 of 1903 (see J., 1904, 377), except that instead of 16 lb. of nitric l and 4½ lb. of sulphuric acid, 142 lb. of nitric acid are d.—T. F. B.

ode and Process of Making same. H. Blackman, New York. U.S. Pat. 762,227, June 7, 1904.

: anode for electrolytic apparatus consists of a cast e of iron that has been exposed at a high temperature uperheated steam until the exterior is converted into gnetic oxide of iron of sufficient thickness to protect the erlying iron during electrolysis. A protecting layer of s, or a vitreous glaze, is fused as a band around the tracted portion of the anode which is to be exposed at surface of the electrolyte.—E. S.

attery; Electrical ——. J. R. Lord, San Francisco. U.S. Pat. 762,425, June 14, 1904.

: anode is composed of an electrical conductor upon or nd which is placed, or deposited during the previous of the battery, a quantity of a compound of an anode al. The conductor serves as the negative pole, and is placed in such a position that any solids, chemically precipitated from the electrolyte, may fall upon or in electrical proximity to it, and thus form additional anode active material. The electrolyte is composed of one or more salts of one or more anode metals, together with one or more salts of one or more alkali metals in solution. Any suitable compound is used as a depolariser, and the cathode may be of any conducting substance chemically unattacked by the electrolyte, the whole of the materials being placed in a suitable containing vessel.—B. N.

French Patent.

Oxides of Nitrogen; Manufacture of —— [*Electrical*]. Siemens Bros. and Co. Fr. Pat. 339,730, Jan. 20, 1904.

AIR, or a mixture of nitrogen and oxygen, is caused to traverse an electric arc formed between electrodes of carbon combined with metallic salts, and especially with calcium fluoride. To avoid, as far as possible, the formation of carbon monoxide, the electrodes are formed with only enough carbon, mixed with the fluoride or other salt, to render them sufficiently conducting: or the gaseous mixture is so directed as to ensure the least possible contact of the mixture with the incandescent points of the carbons. Compare Fr. Pat. 335,453, 1903; this J., 1904, 193.—E. S.

(*B.*)—ELECTRO-METALLURGY.

Gold; Electrolytic Refining of ——. F. Wohlwill. Electrochem. Ind., 1904, **2**, 221—224.

A SOLUTION of gold chloride containing free hydrochloric acid or a suitable chloride is used as electrolyte. If the temperature is kept up to the normal value (67° C.) and sufficient free acid is present, no chlorine appears at the anode but the gold goes regularly into solution. Moreover, when these conditions are fulfilled, a sufficiently high current density can be used to make the operation of refining as rapid as the old chemical process, which it has entirely displaced in Germany and in the U.S.A. Mint at Philadelphia. The present paper refers chiefly to the separation of gold and platinum, which is readily effected by the electrolytic method. Any platinum present in the impure gold anodes passes into solution, but is not deposited at the cathode, and consequently accumulates in the electrolyte; it is removed by precipitation with ammonium chloride from time to time. Platinum is said to be much more widely distributed than is generally supposed, and occurs in small but appreciable quantities in nearly all silver Palladium can be separated in a similar manner, and in view of its occurrence in the Sudbury nickel ores attention is drawn to this point.—R. S. H.

Siemens Process for Winning Copper; Studies on the ——. M. De K. Thompson, Jr. Electrochem. Ind., 1904, 2, 225—231.

THE Siemens and Halske process of recovering copper from roasted sulphide ores, consists in leaching the finely powdered ore at 90° C. with ferric sulphate solution, containing free sulphuric acid. The ferric sulphate is reduced to ferrous salt, and copper enters solution as sulphate. Subsequent electrolytic treatment in a diaphragm cell deposits copper at the cathode and oxidises ferrous to ferric sulphate at the anode. (See Eng. Pats. 14,033 of 1886 and 3533 of 1889; this J., 1887, 734; 1890, 396.) The author has carried out a laboratory investigation of the several stages of this process. The dissolving action of ferric sulphate on cupric and cuprous oxides and sulphides was studied in detail, and then a natural copper ore was submitted to treatment. Copper pyrites before roasting is not appreciably attacked by ferric sulphate, but after roasting, in which it seems to be converted chiefly into oxide, it dissolves readily. The electrolytic treatment was carried out separately to study the anode and cathode reactions. At the cathode it was found that copper could be deposited in a firm adherent form from an acid solution of ferrous and copper sulphates until the concentration reaches a very low value, *e.g.*, with a current density of 0·47 amp. per 100 sq. cm., until the concentration of copper in solution was 0·5 per cent., at which point the metal begins to be spongy. The oxidation at the anode, using carbon electrodes, is at first very efficient, but as the concentration of ferrous sulphate decreases, the process gradually falls off in efficiency.—R. S. H.

Fused Zinc Chloride; Preparation of Pure ——, and its Electrolysis. S. Gruenauer. Z. anorg. Chem., 1904, **39**, 389—476.

Lorenz (this J., 1896, 279) has shown that zinc chloride, even after it has been kept in the fused state until evolution of steam can no longer be detected, still retains a certain proportion of water and cannot be satisfactorily electrolysed.

Preparation of Pure Zinc Chloride.—The author finds that by the following method pure anhydrous zinc chloride can be prepared, which on electrolysis behaves quite satisfactorily, giving at once zinc and chlorine. 40 grms. of zinc chloride are dissolved in 20 c.c. of hydrochloric acid of sp. gr. 1·19 and the solution evaporated in a tube of refractory glass, through which a current of dry hydrochloric acid gas is passed at the rate of 350 bubbles per minute. The temperature is gradually raised, and after some time the mass solidifies; at the moment of solidification, hydrochloric acid gas is evolved from the mass. The solid zinc chloride is fused as rapidly as possible, and the current of hydrochloric acid gas kept passing through. Any steam which condenses in the apparatus is driven over by means of a second gas burner. The dehydration of the zinc chloride is complete in 75 minutes. Attempts to substitute carbon dioxide and air for the hydrochloric acid gas gave unsatisfactory results, and the author considers it probable that the zinc chloride forms with the hydrochloric acid an addition compound, which is again split up at the temperature at which the mass solidifies. This method of dehydration can be applied to concentrated solutions of zinc chloride, and is not affected by the presence of foreign substances. It is probably applicable for the preparation of all anhydrous hygroscopic chlorides, *e.g.*, carnallite, calcium chloride, and the chlorides of the rare earths.

Electrolysis of Pure Anhydrous Zinc Chloride.—The carbon electrodes used should be dried in an air-bath, not by ignition in the Bunsen flame. The current-yield increases with increasing current-density, but the differences are very small with currents of more than 1·5 ampères. With increase of temperature (from 525° C. to the boiling point of zinc chloride, 732° C.) the current-yield falls, the more rapidly the nearer the boiling point of the electrolyte is approached. By fractional electrolysis of a mixture of iron and zinc chlorides, pure iron and pure zinc can be obtained, but the complete separation of the iron only takes place gradually, the last traces of iron being especially difficult to separate. With a mixture of equimolecular amounts of zinc and potassium chlorides the current-yields are much higher than with pure zinc chloride; for example, with 0·5 ampère, the yields were 59 and 23 per cent. respectively. This increased yield is due to the fact in the presence of alkali chlorides, the formation of "metal fog" in the electrolyte is prevented. The current-yield increases with increasing current-density, but the differences are inconsiderable with a current of more than 2 ampères. This mixture of zinc and potassium chlorides gives yields which approach those required by Faraday's law. With a mixture of equimolecular amounts of zinc and sodium chlorides, the current-yields are higher than with pure zinc chloride, but not so high as with the corresponding mixture of zinc and potassium chlorides. The variation of yield with current-density is the same as with the latter mixture. A mixture containing 35·36 per cent. of sodium chloride gives better yields at the higher current densities (1 ampère and above) than the equimolecular mixture. The fact that the addition of sodium chloride to zinc chloride improves the current-yield is of importance, as it points to the advantage of recovering zinc electrolytically from the waste zinc chloride liquors from dyeworks, which contain considerable quantities of sodium chloride.

Formation of "Metal Fog" in the Electrolysis of Fused Zinc Chloride.—The conditions which most favour the formation of "fog" are low temperature and high current-density. By raising the temperature a melt containing "metal fog" becomes clear, but the "fog" appears agai if the temperature be lowered. (See also this J., 190 670, 1001, 1021; 1902, 975; 1903, 1053.)—A. S.

ENGLISH PATENTS.

Electro-depositing Metals on Parabolic Reflectors an Analogous Articles; Improved Method of, and Mean for ——. B. J. and A. Round, Birmingham. Eng. Pa 9531, April 28, 1903.

The parabolic reflector, or other article with a concave analogous form, is made the cathode and rotated in th electrolyte, or a relative rotary motion is maintained betwe the cathode and anode, the latter consisting of a sheet silver beneath and extending into the crown of the anod and made to conform in shape with the inside contour the surface of the article to be silvered. The cathode suspended in the electrolyte in an inverted position, and, means of a small vent in the crown, the escape of gas provided for, and the space between anode and cathod remains filled with the electrolyte.—B. N.

Tantalum and like difficultly Fusible Metals: Manufactu of Homogeneous Masses of ——. C. D. Abel, Lond From Siemens and Halske Act.-Ges., Berlin. Eng. P 26,775, Dec. 7, 1903.

See Fr. Pat. 337,607 of 1903; this J., 1904, 494.—T. F.

UNITED STATES PATENT.

Furnace; Electric ——. C. P. E. Schneider, Le Creu France. U.S. Pat. 761,920, June 7, 1904.

See Eng. Pat. 28,805 of 1903; this J., 1904, 549.—T. F.

FRENCH PATENTS.

Electric Arc Furnaces. Soc. de Métal. Électro-Thermiqu Fr. Pat. 339,593, Jan. 14, 1904.

In order to concentrate the heat from open arcs upon a material to be heated by radiation, the cover of the furna is brought as near the electrodes and the hearth of t furnace as possible. A double-walled cover is provid with a closed gas space between the two sections, the in wall being made of graphite, the outer of refractory brick The material to be fed into the furnace passes down lo inclined shoots at each end of the furnace, which serve al for leading off the gases from the heated zone. Two a are employed, one towards each end of the furnace, so th their heating effect serves both for the material on t hearth of the furnace and for that passing down the shoo towards this hearth.—R. S. H.

Furnace; Rotatory and Oscillating Electric ——. I. Braun. Fr. Pat. 339,942, Jan. 27, 1904.

An inner retort is made of refractory material and h protuberances on its inner surface to assist in the mixing the materials during the rotation of the furnace. T retort is surrounded by the resistance material, the latt being made in the form of plates so as to ensure the ce axis of the retort being kept in its true position during t movement. The resistance material is in contact wi electrodes of graphite, which are separated from o another by insulating walls of highly refractory mater such as carborundum or "siloxicon," and the furna is finally surrounded by a water jacket. The furnace provided with an air-box communicating by blast p with the interior of the retort, so as to supply materia with or without air, capable of assisting in the reactio By means of wheels gearing with endless screws, the f nace may be given two movements, one of rotation arou the axis of the furnace, and an oscillatory movement arou an axis at right angles to the axis of the furnace.—B. N.

Metals, such as Lead and Silver: [Electrolytic] Extr tion of —— from their Ores. Accumulatoren.-fabr Act.-ges. Fr. Pat. 339,849, Jan. 23, 1904.

Sulphide or other ores either before or after oxidation treated with such a molten halogen salt as is capable reacting with them to form the corresponding zinc or sil compound. The fused product is submitted to electroly and the metal collected at the cathode.—R. S. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Mustard Oil as a Lubricant. A. Rohrbach. Organ f. Oel- u. Fett-Handel., 1904, **57**, [24].

Tests of mustard oil gave the following results:—Sp. gr., 0·916 at 15·5° C. Viscosity (Engler), 0·90 at 20° C., 0·40 at 40° C., 0·21 at 60° C., 0·14 at 80° C., 0·11 at 110° C., 0·09 at 150° C. The lubrication tests in the Martens' machine gave the following increases in temperature:—Under a load of 10 kilos. per sq. cm., at a peripheral velocity of 0·5 metre per second, 2·9° C., and at 2 metres 2·7° C.; under a load of 40 kilos., 9·8° C., and 22·1° C. respectively. At 9° C. the oil becomes slightly turbid. The flashing point (Pensky) is above 220° C.; acidity, 0·062 per cent. calculated as sulphur trioxide. The oil will stand heating to 180° C. without frothing. It furnishes a clear solution in benzene, and does not "gum" when spread out in thin layers and exposed to the air for 6 days.—C. S.

English Patents.

Fish Oil and Fish Guano: Process and Apparatus for the Continuous Manufacture of Sterilised ——. H. J. A. Pompe van Meerdervoort, Haag, Netherlands. Eng. Pat. 9018, April 19, 1904.

See Fr. Pat. 338,472 of 1903: this J., 1904, 670.—T. F. B.

Soap for Dyeing and Cleaning; Manufacture of ——. A. J. Boult. From C. W. Horton. Eng. Pat. 28,508, Dec. 28, 1903. V., page 713.

Saponifying Fats and Oils; Material for ——, *and a Method for Obtaining it.* M. Nicloux, Paris. Eng. Pat. 8233, April 19, 1904. [Specification dated April 9, 1904.] Under Internat. Conv., Oct. 14, 1903.

ee Fr. Pat. 335,902 of 1903; this J., 1904, 327.—T. F. B.

United States Patents.

Vool-fat: Process of Recovering ——. C. E. Swett, Providence, R.I. Assignor to R. H. Hutchinson, New York. U.S. Pat. 761,265, May 31, 1904.

he washings from the wool are treated with an alkali anganate or permanganate and then with an acid, and the agma rising to the surface is freed from excess of water nd extracted with a volatile solvent.—C. A. M.

Extracting Oil: Apparatus for ——. M. Kirshner, ynchburg, Va., U.S.A. U.S. Pat. 761,686, June 7, 1904.

rotating drum is situated in an outer casing. On the urface of the drum are a number of pockets to receive the aterial, which is compressed by plungers, situated in the ckets. Means are provided for actuating the plungers, r collecting the expressed oil, and for removing the sidue.—W. H. C.

atty Acids; Process of making ——. W. Connstein, Assignor to Verein Chem. Werke Act.-Ges., Charlottenburg, Germany. U.S. Pat. 762,026, June 7, 1904.

ee Fr. Pat. 328,101 of 1902; this J., 1904, 69.—T. F. B.

French Patent.

ats; Process of Treating —— *in the Stearine Industry.* L. F. Fournier et Cie. Fr. Pat. 339,385, Jan. 6, 1904.

current of compressed air is passed through the fatty ubstance heated to about 115° C. This is stated to celerate the process and improve the yields when used conjunction with different methods of saponification.
—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

russian Blue in Spent Oxide, &c.; Determination of —— *by Feld's Method.* R. Witzack. XXIII., page 728.

English Patent.

Binding Media for Oil Colours. J. E. Kollinger, Munich, Germany. Eng. Pat. 17,120, Aug. 6, 1903.

See U.S. Pat. 738,456 of 1903; this J., 1903, 1096.—T. F. B.

French Patent.

Lakes [from Azo Dyestuffs]: Process for Preparing New ——. Soc. anon. Prod. F. Bayer et Cie. Fr. Pat. 339,606, Jan. 14, 1904. IV., page 713.

(B.)—RESINS, VARNISHES.

Colophony: Distillation of —— *with Zinc Dust.* C. Stiepel. Augsburger Seifensieder-Zeit., 1904, **31**, 262. Chem.-Zeit., 1904, **28**, Rep., 179.

A quantity of colophony was melted, the amount of zinc dust necessary to neutralise the resin-acids (about 10 per cent.) added, and the mixture distilled in a small cast-iron retort. The course of the distillation and the products obtained were the same as by the usual distillation process, but the distillate was almost entirely free from acid.—A. S.

French Patent.

Fireproof Varnish: Manufacture of ——. Vymer-Ges. Fr. Pat. 339,641, Jan. 16, 1904. IX., page 715.

(C.)—INDIA-RUBBER, &c.

Litharge and Vulcanisation. E. Schulze. Gummi-Zeit., 1904, **18**, 749—751.

The rôle litharge plays in rubber mixings, to which it is added to aid vulcanisation, is commonly supposed to be that of a sulphur carrier, but, in the author's opinion, the effect is to be traced to purely physical causes. On the mixing rolls the sulphur and litharge particles become surrounded by a film of rubber. Where a sulphur particle alone is enclosed, the sulphur would combine with the rubber, forming normal soft rubber, and if more sulphur than is necessary for vulcanisation be present, the excess dissolves in the rubber substance, passes through without further combination, and is absorbed on coming into contact with particles of litharge. In the case of particles of sulphur and litharge being enclosed together, the sulphur will first combine with the litharge. The lead sulphide formed has no effect on the vulcanisation, but both it and litharge hasten vulcanisation very considerably by acting as conductors of heat. That such a mixing is a good conductor (comparatively) is shown by the fact that motor tyres made therewith become hot in use much more quickly than other tyres. The hardening effect of litharge is due probably to the saponification of the rubber resins, lead salts being formed of a higher melting point than the original resins.—J. K. B.

United States Patent.

Vulcanised Rubber: Regenerating ——. R. B. Price, Chicago. U.S. Pat. 762,843, June 14, 1904.

Ground waste rubber is boiled with a saturated or supersaturated solution of caustic alkali with or without pressure.
—J. K. B.

XIV.—TANNING; LEATHER, GLUE, SIZE.

Tanning Materials: Composition of Liquors of similar Concentration from different ——. J. Paessler. Günther's Gerber-Zeit., 1904, 21—23. Z. angew. Chem., 1904, **17**, 789.

In liquors of 2° Baumé were determined the contents of tannin and of non-tannin substances, and in liquors containing 2 per cent. of the tannin substance were determined the content of non-tannin substance and the specific gravity. It was found that:—1. The specific gravity is dependent upon the content both of tannin- and of non-tannin substance; the ratio of tannin- to non-tannin substance varies widely in different materials. 3. The specific gravity of the non-tannin substances is higher than that of the tannin-substances.—J. T. D.

Pickling Method; Improved ——. A. Seymour-Jones. Collegium, 1904, 186—187.

Formic and acetic acids are proposed as substitutes for sulphuric acid in the usual acid and salt pickle, so as to avoid the destructive action of the last-named acid. Skins were limed and carried to the drenching and scudding stage, and then paddled in 0·25 per cent. solution of formic acid at 70° F., and left to soak in the acid for 24 hours. They were then paddled in a saturated solution of common salt and again left to soak for 24 hours. The result, as regards colour, was excellent. These skins were sent on a journey of 57 days, and all the time exposed to the worst conditions. Half the skins were then tanned out under the conditions laid down in the Society of Arts Report on Leather for Bookbinding (this J., 1901, 819, and 1902, 128), and proved most successful. The remainder, after eight months, were still unchanged, and no mould appeared at any time. The cost of this process is about the same as when sulphuric acid is used. White pyroligneous acid (distilled to free it from iron), diluted to contain 0·1 to 0·2 per cent. of acetic acid, has proved equally efficient and somewhat cheaper.—R. L. J.

Tannin Determination [*Filtration of Quebracho and Mangrove Extracts*]. K. Schorlemmer. XXIII., page 730.

Chromic Oxide in Chrome Leather; Note on the Determination of ——, *and Separation of the same from Aluminium Oxide in presence of Aluminium Salts.* H. R. Proctor. XXIII., page 729.

United States Patent.

Paper Pulp; Manufacturing —— [*and Extracting Tannin*]. O. Carr. U.S. Pat. 762,139, June 7, 1904. XIX., page 725.

French Patents.

Tannage of Skins: Process and Plant for Quick ——. H. de Marneffe. Fr. Pat. 339,428, Jan. 8, 1904.

Hollow box-like structures are formed by attaching the skins to deep rectangular frames. These are packed into a closed casing or container, each box being connected to a vent pipe passing outside the container. Tanning liquors are pumped into the container, percolate through the skins and pass by the vent pipes into a tank, from which the pump again circulates them. When tanning is complete, the skins are stuffed, fat-liquored, &c., in a similar manner, without further disturbance or handling.—R. L. J.

Rice Flour; Treatment of —— *for Use in Finishing Yarns and Textiles.* Soc. anon. des Rizeries Françaises. Addition to Fr. Pat. 334,369 of Aug. 1, 1903. XIX., page 725.

XV.—MANURES, Etc.

Commercial Manures; Influence of Lime on the Efficiency of the Phosphoric Acid of ——. B. Schulze. Fühling's Landw.-Zeit., 1904, **53**, 183; Chem.-Zeit., 1904, **28**, Rep., 158—159.

The author's experiments give the following results:—(1) The phosphoric acid of bone-meal (whether free from gelatin or not) exerts on a soil poor in lime an action similar to that of the phosphoric acid soluble in citric acid. (2) Simultaneous liming influences the action of the phosphoric acid soluble in water but little, that of the acid soluble in citric acid more, and that of the phosphoric acid of bone-meal still more. (3) When the phosphoric acid manure is applied in the spring, the greatest harm is effected by the use of quicklime in the spring, then comes autumn application of quicklime, next the use of calcium carbonate in spring, and finally calcium carbonate applied in the autumn, which has the least injurious action. (4) The phosphoric acid of bone-meal varies in its action according to the time and form of the liming, yet the beneficial action of the phosphoric acid and the amount of it assimilated are always so much diminished as to show that bone-meal and lime should never be applied to the same crop. (5) One of the causes of the diminution in crop produced by lime lies in the action of the latter on the phosphoric acid of the soil, which is rendered difficultly soluble. Experience shows that the acid compounds of the soil are indispensable in rendering useful difficultly soluble phosphates.—T. H. P.

Calcium Sulphide for the Destruction of Cuscuta [*"Dodder Weed"*] *and other Parasites in Agriculture.* F. Garrigou. Comptes rend., 1904, **138**, 1549—1550.

The author has employed powdered calcium sulphide with great success for the destruction of blights and parasitic weeds among vegetables, fodder, and garden plants. For the "dodder weed" in fields of lucerne calcium sulphide is superior to any other destructive agent, and kills the weeds in 48 hours. It kills insects on beans, peas, and rose-trees. In order to ensure its full activity it is necessary either that the weather should be moist, or that the powder should be moistened after it has been applied, thereby liberating sulphuretted hydrogen.—J. F. B.

French Patents.

Ammonium-Magnesium Sulphate: Manufacture of ——, *and the Application of this Salt as a Manure in Agriculture.* J. D. D. Thierry. Fr. Pat. 339,116, Jan. 7, 1904.

Ammonium-magnesium sulphate is formed by passing ammonia gas into a strong solution of magnesium sulphate, mixed with the proper proportion of sulphuric acid, and removing the crystals that form. Or, solution of ammonium sulphate and of magnesium sulphate, in atomic proportions, are mixed, and the crystals that form are withdrawn, the mother-liquor being used in making fresh solutions. The application of the salt as a fertiliser is also claimed.—E. S.

Sodium Bisulphate: Industrial Utilisation of —— [*Manure*]. L. A. Angibaud. Fr. Pat. 339,820, Jan. 2 1904.

Fish waste, or other animal garbage, is immersed in boiling strong solution of nitre-cake, or in the same in a molten state. The syrupy liquid thus produced is worked up with powdered fossil or other phosphates, and the mass is allowed to cool and consolidate in heaps, when it may be powdered for use as a manure.—E. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Diffusion; Chemical Treatment during ——. A. Besson. Bull. Assoc. Chim. Sucr. et Dist., 1904, **21**, 1126—1133.

The author determined the quality of diffusion juice when the chips had been subjected to preliminary treatment or when chemicals had been added to the water used. Diffusion with ammoniacal or amine solutions has practical interest in consequence of the tendency to use for diffusion the alkaline condenser waters in order to save the heat. The introduction of ammoniacal waters was found to be prejudicial, the purity of the raw juice being sensibly diminished and the defecation and carbonatation scums being increased in quantity and in viscosity, although the juice is slightly lighter in colour than ordinarily. Pure amines act favourably on the juice, but the ordinary amines containing ammonia produce unfavourable effects. Certain factories use sodium bisulphite as an antiseptic in the diffusion battery, chiefly at rasping stations, to disinfect the battery, render the juice more stable and diminish the production of gas. The first effect of bisulphite solutions is to decolorise the chips and the juice; the purity is not decidedly altered, and no invert sugar is formed. In carbonated juice a little more lime is present, and the juices frequently become cloudy after filtration and possibly have a greater tendency to form incrustations. It would be better to use a solution of sulphurous acid made on the spot; 0·4—0·5 grm. of sulphur dioxide may be used without fear of inversion. The rendering of juice neutral by the addition of chalk does not appear to give purer juice. Sodium bicarbonate (0·5 grm. per litre) gives a slight improvement in purity, but when the chips are made alkaline with sodium carbonate or aluminate, the purity is diminished. The effects obtained by using alkaline and acid oxidising reagents may be explained by the above results. Chips treated with carbon dioxide give up an enormous amount of gas during diffusion, and the purity is sensibly lowered. The abundant disengagement of gas in carbonic diffusion may serve to explain abnormal evolution of gas when beetroots that have been long stored are worked up. The lessened vitality of the beets in silos badly ventilated, allows of an accumulation of the gas produced by the respiration of the roots, and this gas is subsequently given off in the battery.—L. J. de W.

Incrustation [Sugar Works]; Use of Aluminium and its Compounds for Preventing ——. A. Besson. Bull. Assoc. Chim. Sucr. et Dist., 1904, **21**, 1136—1137.

As the efficacy of aluminium salts in preventing the formation of an incrustation during concentration is dependent on the alkalinity of the juice, it is preferable to use some compound containing a feeble and volatile acid, and bisulphite of aluminium specially prepared in concentrated solution is found to answer, while at the same time the juice gets the benefit of a slight sulphiting. The quantity to be added to second carbonated uice with an alkalinity of 0·15 to 0·20 is 0·01 to 0·02 grm. of alumina per litre, the juice being then concentrated vithout further filtration. The larger amount of reagent liminishes the alkalinity about 0·07. The lime and silica ıre thrown out as a granular, non-incrustant silico-aluminate of lime.—L. J. de W.

Mangifera Indica" L. [Mango Tree]; The Gum of ——. P. Lemeland. J. Pharm. Chim., 1904, **19**, 584—593.

The gum of the mango tree is sold as an astringent drug n India. It occurs in lumps varying in size from that f a nut to that of a small egg, of an amber to reddish-ellow colour, almost transparent and showing a brilliant onchoidal fracture. The sample studied contained 16·57 er cent. of moisture and the mucilage was only partially oluble in water. Calculated on the dry substance, the oluble portion amounted to 39·36 per cent. The soluble ortion possessed a rotatory power $[\alpha]_D = -25·33°$. The um contains a directly oxidising enzyme (aëroxydase). Vhen hydrolysed by 3 per cent sulphuric acid, the gum, in ne air-dry state, yielded 71·42 per cent. of reducing sugars lculated as invert sugar, which included 73·33 per cent. f galactose and 35·09 per cent. of pentoses. Arabinose as isolated from the latter in the crystalline condition. The ortion of the mucilage insoluble in water yielded 86·28 er cent. of reducing sugars, calculated on the substance ontaining 10·51 per cent. of moisture. These sugars in-uded 32·08 per cent. of galactose and 42·87 per cent. of entoses.—J. F. B.

United States Patent.

chroo-dextrin; Process of Making ——. G. Reynaud, Paris. U.S. Pat. 761,542, May 31, 1904.

chroo-dextrin, it is stated, may be prepared from "acid ats" by mixing the peat with 3—5 times its weight of ıter and heating the mixture under a low pressure in a gester to a temperature of 110°—150° C. for 30—60 inutes, according to the degree of acidity of the peat, ereby converting the amylaceous matters of the peat into xtrin.—J. F. B.

French Patent.

ar; Boiling and Crystallisation of ——, *at a High Temperature.* J. B. L. Aurientis and R. Fontenilles. Addition, dated Nov. 11, 1903, to Fr. Pat. 326,433, Nov. 18, 1902. (See this J., 1903, 812.)

e present addition deals with the crystallisation of sugar tained in saturated syrups at a temperature higher than C., with the addition of grain sugar ("semoule") in ying proportions according to the degree of saturation the syrup. The residual syrup from each operation is ed for melting a fresh quantity of sugar similar to that ich yielded it, so as to avoid second and third runnings gars.—T. H. P.

XVII.—BREWING, WINES, SPIRITS, Etc.

Enzyme, [Anaëroxydase]; Study of the Action of an Indirect Oxidising ——. E. Bourquelot and L. Marchadier. Comptes rend., 1904, **138**, 1432—1434.

The oxydases proper [aëroxydases] take up oxygen from the air and transfer it to certain oxidisable bodies; the indirect oxydases [anaëroxydases] on the other hand only exert an oxidising action in presence of hydrogen peroxide or similar bodies, which they decompose. The authors have studied the action of the anaëroxydase present in an infusion of oatmeal upon vanillin in presence of hydrogen peroxide. The experiments were carried on at a temperature of 30°—33° C. for 24 hours. The product of the oxidation was identified as *dehydrodivanillin*, which is the same product as is formed by the action of the aëroxydase of gum upon vanillin. The aëroxydases and anaëroxydases possess certain other properties in common; in particular, the presence of as much as 50 per cent. of alcohol does not interfere with their activity, but minute proportions of hydrocyanic acid paralyse them. The authors take the view that the aëroxydases are composed of a mixture of two enzymes, one a *hydroxydase*, capable in presence of air of converting water or certain other bodies into the corresponding peroxides, and the other an indirect oxydase decomposing these peroxides with liberation of active oxygen (compare this J., 1903, 384).—J. F. B.

Yeast; Toxic Action of Chromium Compounds on ——. E. Pozzi-Escot. Bull. Assoc. Chim. Sucr. et Dist., 1904, **21**, 1141—1142.

Experimenting on a bottom fermentation beer yeast at 19°—20° C., the author finds that the toxic action of chromium compounds depends on the nature of the combination of the chromium in the compound, the action being a maximum for chromic acid and a minimum for salts of chromium. The effect of 0·1 grm. of chromic acid per litre is clearly marked even in presence of a large quantity of yeast; chrome alum only begins to produce an effect when 3·5 grms. per litre are added, and the growth is still active when 10 grms. are present.—L. J. de W.

Zymase and Alcoholic Fermentation. P. Mazé. Comptes rend., 1904, **138**, 1514—1517.

The decomposition of sugar into alcohol and carbon dioxide is a very general phenomenon in living cells under normal conditions. Zymase is an enzyme of aerobic life and its action on sugar is to be regarded as a digestive phenomenon. In *Eurotiopsis Gayoni* (see also this J., 1902, 287) the zymase is found exclusively in contact with air in strictly aërobic cells; their richness in zymase decreases with the age of the cells, and it soon disappears entirely. The formation of zymase in absence of air, in plants which apparently have lost their zymase, should be considered not as the result of an effective production, but as a regeneration, more or less slow and incomplete, of zymase which has lost its activity. In normal life the zymase is destroyed after it has acted, probably by oxidation, and alcoholic fermentation in anaërobic life is to be regarded as the continuation of an enzymic action originally aërobic. Under anaërobic conditions the zymase is enabled to accumulate, and continues to produce alcohol after the yeast has ceased to multiply and assimilate that product. As regards the mechanism of the action of zymase, the author expresses a view identical with that formulated by Buchner and Meisenheimer (this J., 1904, 252).—J. F. B.

Pure Yeast System; Application of Hansen's —— *for English Stock Beers.* N. H. Claussen. J. Fed. Inst. Brewing, 1904, **10**, 308—315.

The system of single-cell yeast has not hitherto gained a footing in England for the manufacture of stock beers, owing to the fact that the type of secondary fermentation peculiar to English beers cannot be effected by the same yeast as carries out the primary fermentation. Hitherto, the existence of specific secondary yeasts has only been assumed, but the author has now discovered a new, non-

sporulating, budding fungus, belonging to the Torula group, which possesses the peculiar property of conditioning beer in such a way as to create the typical English flavour and condition. This fungus, to which the name of Brettanomyces is given, exists in several varieties, some of which are harmful. It produces a slow fermentation in wort or in beer fermented by ordinary brewers' yeast; the carbon dioxide produced by its action is retained very firmly, and forms a copious and lasting foam. A somewhat considerable amount of acid is formed, accompanied by ethereal substances, which at once call to mind the flavour of stored English beer. If a few drops of a pure culture of Brettanomyces be sown in a bottle of pasteurised beer and stored at a temperature of 75°—85° F. for 10—14 days, the beer acquires the English character. The beer employed for this purpose should have reached a certain limit of attenuation during primary fermentation. The author suggests that Brettanomyces is a minor constituent of English pitching yeast, or may enter the beer at some stage as an infection, and that its presence is indispensable for the secondary fermentation. He proposes that the question of single cell yeast for English beers should be re-opened, that the primary fermentation should be conducted with pure beer yeast, and that pure cultures of selected varieties of Brettanomyces should be employed for secondary fermentation.
—J. F. B.

Malting and Brewing; Transformation of the Albuminoids during ——. F. Weis. Z. ges. Brauw., 1904, **27**, 385—389, 405—407, 420—423, 440—445.

After giving an account of the nature and proportions of the different nitrogenous constituents of barley and malt, so far as they are known, the author discusses the action upon them of the proteolytic enzymes of the malt. Green malt contains a coagulating enzyme, similar to rennet, which coagulates milk, and two proteolytic enzymes, one resembling pepsin and the other trypsin. Referring to a previous paper (this J., 1901, 141), written before the dual nature of the proteolytic enzymes of malt was recognised, the author describes how he now uses stannous chloride for precipitating the true albumins, zinc sulphate for precipitating the albumins and albumoses, and tannic acid for precipitating all albuminoid derivatives higher than the amides and similar simple products. The comparison of the nitrogenous contents of the filtrates from each of these precipitates then enables him to differentiate between the products of the action of the peptic enzyme and those of the tryptic enzyme. The first stage of proteolysis [of wheat glutin] by malt, corresponding to the action of the peptase (degradation down to albumoses), proceeds with considerable rapidity; the action is notable even at low temperatures and acquires its greatest intensity at 51° C., at which temperature it is nearly twice as strong as it is at 35° and at 60° C. The tryptic proteolysis (degradation from albumoses down to products unprecipitated by tannic acid, *e.g.*, amides) takes place very much more slowly than the peptic proteolysis. The action at temperatures below 15° C. is almost *nil*, and it proceeds with greatest intensity at 45°—50° C., but the action at 35° C. is very little weaker than at 47° C. Both enzymes cease to act at temperatures about 70° C. In practice, therefore, the result of the proteolysis will be different according to whether the mash is started at 35° C. and raised only slowly or whether it is started at 50°—60° C. The proteolytic enzymes are unaffected by the kilning process; their action is not confined to albumins of the same origin but extends to other albumins, of animal or vegetable origin, which may be added to the mash. There is little doubt that the germinating power of barley depends to a great extent on the activity of the proteolytic enzymes, and these should therefore play a part in the determination of the malting value of barley. Analyses of malt mashes on the large scale, starting at 35° C. and rising only slowly, showed that no notable increase in the proportion of albumoses took place during mashing. The proteolytic action was most intense during the second and third hours of the mashing, but the increase of total nitrogen was mainly accounted for by an increase of products of the lowest types [amides and the like]. A considerable amount of soluble albumin survived the mashing, whence it is concluded that a portion of the malt-albumin is practically unattackable by the proteolytic enzymes. It may b assumed that the rapidly acting peptase has converted al that it is capable of attacking during the period of germination on the floor and that the bulk of the proteolysis durin mashing is performed by the tryptase. The slow metho of mashing with low initial heats is not favourable to th presence of a high proportion of albumoses in the wort; i albumoses be required, all the above observations indicat that Windisch's high temperature, rapid-mashing proce should be followed. Another possible means of raising th proportions of albumoses is to add to the mash unmodifie materials of an albuminoid nature capable of proteolys by the peptase. The author found that the addition o wheat flour did indeed increase the proportions of solubl albumins and albumoses in the worts whilst decreasing th proportion of amides, the total nitrogen remaining the sam as with malt alone. The addition of maize flour, on th other hand, caused a decrease of the amounts of tota nitrogen, soluble albumins, and albumoses, whilst increasin relatively the proportion of amides. It is pointed out tha from a practical point of view the addition of wheat flour out of the question, but if it be desired to brew a wort containing a minimum proportion of total nitrogen withou reducing that of the amide yeast-foods, the addition of ra maize may lead to that result.—J. F. B.

[Wort] Coolers; Use and Abuse of ——. L. Briant. J. Fed. Inst. Brewing, 1904, **10**, 286—298.

The results of the passage of the wort through the op cooler are discussed under the following heads:—

Infection.—The temperature at which the wort is gen rally discharged from the cooler is 165° F., but after abo two-thirds of the total quantity have run off, the temperatur will have sunk to 140° F., and the last few barrels may hav cooled down to 120° F. before they are discharged. Th number of infecting organisms which enter the wort in th cooler is enormous, even under favourable conditions, bu the damage done by infection does not become serio unless the temperature becomes dangerously low befor the wort has been run off. It is advisable, therefore, sterilise the last few barrels of wort from the cooler by re boiling before passing on to the refrigerator. The chi sources of infection are the proximity of orchards an stables and the entrance of dust from the barley and ma machinery; it is sometimes advantageous to enclose th cooler room and to admit to it nothing but filtered air.

Deposition of Sludge.—The wort leaves the hop-back a clear condition, but as the temperature falls a floccul deposit separates out in variable amounts. This depo contains, in addition to mechanical impurities, albumino matters, hop-resins, and mineral matters. It is desirabl but not perhaps absolutely essential, that this sludg should not be allowed to pass on to the fermentation tuns.

Hot Aëration.—One of the most important objects the cooler is to enable the wort to combine at a high temperature (180°—190° F.) with a suitable quantity of oxyg This object can, however, be attained very effectively b the injection of air into the main through which the h wort is being pumped. In large ordinary coolers it sometimes advisable to run the wort continuously thro them, withdrawing it at the surface. In the case of do coolers, a thin film of wort may be exposed to the air in th top vessel, whilst it is run continuously into the deep protected, lower vessel for sedimentation.—J. F. B.

Top-Fermentation Beers; Chilling and Filtering of —— *III.* H. van Laer. J. Fed. Inst. Brewing, 1904. 1 347—355.

The author describes, and reports favourably on, the Wittmann system of collecting the aromatic gases of ferment tion, and applying them for the carbonation of beer (th J., 1904, 618). In order to obtain a fine aroma in chille and carbonated beers, the author strongly recommends th Continental practice of passing the boiling wort from th coppers on to dry hops in the hop-back.—J. F. B.

Fermented Beverages: Native African ——. H. van Lae Ann. de la Brass., 1904, **7**, 241—244.

The natives of Africa prepare a number of fermente drinks by spontaneous fermentation, the yeasts being eith present in the raw materials used or introduced by insects. The author divides these drinks into two classes—"wines" from materials containing directly-fermentable sugars; and "beers," the preparation of which entails the collaboration of an amylase. *Masanga* is a wine made from sugarcane by the natives of the Upper Congo. Just before the flowering season, ripe juicy canes are cut into 2-inch lengths, and crushed in a mortar, the pulp being strained, and the filtered juice diluted with water, and left to ferment spontaneously, in jars, for 24 hours, in a shady place. The product is sweet, with a small amount of gas, very agreeable flavour, although rarely bright. Left for a day in bottle, it acquires good condition, but it soon turns sour. The sample examined by the author contained 14·72 grms. of dry extract per litre, 25 of alcohol, 1·656 of mineral matters, 2·4 of volatile acids (as acetic acid), 9·3 of non-volatile acids (as lactic acid), no saccharose, and only traces of glucose and proteids. It manifested slight dextro-rotation. The sediment contained numerous microbes, and a small spherical yeast with thick-walled cells, often grouped in pairs and fours. *Malafou* is the fermented juice of the oil palm, from incisions in the bark. The wine is colourless, opalescent, and contains 16·86 grms. of dry extract per litre, 38·2 of alcohol, 2·9 of mineral matters, 4·2 of volatile acids, 9·99 of non-volatile acids, and 7·1875 of proteids, but no saccharose or glucose. The gravity at 15° C. is 1·00168, and it has a slight dextro-rotation. The sediment consisted of microbes and various yeasts with granular cell contents. *Tokko* is a sorghum or millet beer prepared by the Sakarras, the grains being malted in a primitive fashion, dried in the sun, crushed with a little water, and afterwards diluted and heated in earthen pots. This treatment seems to facilitate conversion, the malt having only a feeble diastatic power. When cold, the mass is left to ferment spontaneously for 24 hours. The beer contains 31·87 grms. per litre of dry extract, 31·12 of alcohol, 5·687 of proteids, 0·36 of acetic acid, and 1·665 of lactic acid, but no reducing substances. It is yellow in colour, with peculiar odour and acid flavour. The sediment contains microbes, yeast cells, and cells of Schizosaccharomyces Pombe, with numerous unaltered granules of starch, indicating the absence of any high temperature in the manufacturing process. The first stage of fermentation is evidently alcoholic, the diastase and ferments acting concurrently, until the increased acidity cripples the small amount of amylase present; and the fatty acids in the beer are probably due to lactic ferments, since Mycoderma aceti would have reduced the proportion of alcohol. The Matabele boil a mash of sorghum, millet, or maize in large earthen pots. After cooling for 24 hours, and when fermentation has commenced, a quantity of malted sorghum, equal to about one-third of the original raw material, is added, and fermentation proceeds briskly. In three days after boiling, the liquid is strained through hempen bags, and is ready for consumption. The taste is acid and refreshing, something like weak cider. The author has malted sorghum and millet by steeping for three days in a 0·5 per cent. solution of salicylic acid at 25° C. Spread out to a depth of 8—10 cm. between filter paper, the grains begin to "chit" in two days. In nine days the malt is finished, and when dried in the air, crushed, and mixed with water, gives only a very imperfect conversion, even after five days at 60—68° C.—C. S.

Wine Brandies; their Derivation, Adulterations, and Analysis according to "Chemical Functions" by the Paris Municipal Laboratory Method. J. Pharm. Chim. 1904, **19**, 484—491 and 593—604. (See also this J. 1903, 433).

Spirits may be classified under two heads:—natural alcohols and industrial alcohols. The natural alcohols are distilled from the fermented juices of grapes and other fruits and sugar cane: their character depends on the romatic "impurities" derived from the plants from which hey are prepared. The industrial alcohols are used only in heir purified form as "neutral alcohol"; they are obtained rom beet-root, potatoes, grain, and other amylaceous materials.

Wine Brandies.—These are produced mainly in the West and South of France; the most famous are those made in the Charentes district from white wines yielded by grapes of the "Folle blanche" variety, the best being the *Grande Champagne* of the Cognac district. The Charentais stills are of a special type, and the method of distillation is characteristic of the district (see also *loc. cit.*). The brandy "*bonne chauffe*," leaves the stills at an alcoholic strength of 70°; it then undergoes an ageing process for five years in presence of air, during which period its alcoholic strength decreases by volatilisation to about 50°. In other districts of France, brandies are made on a different principle, mainly from grapes of the Picpoul variety. Wine brandies contain all the volatile principles of the grape; the "Folle blanche" grape, especially, is very rich in a perfumed essential oil consisting of ethyl and amyl esters of the higher acids of the fatty series, and a small proportion of hydrocarbons. This oil is also prepared commercially as a "sauce" or Cognac bouquet for aromatising the industrial alcohols. It is prepared by distilling the lees and pips of the grapes with steam; also synthetically from castor oil. The natural brandies also contain volatile by-products [higher alcohols, esters and acids], formed by the action of the yeast and bacteria, also furfural produced during distillation. These latter products are present in very small quantities, and their proportions are always well balanced in a normal spirit. From the oak casks are extracted astringent [tannin], colouring, and aromatic [vanillin] matters. A little cane-sugar is generally added after the ageing period. The proportion and nature of the above "impurities" determine the value of the brandy, and afford a basis for the diagnosis of adulteration. Genuine Cognac, being intensely aromatic, is generally blended with industrial alcohol to an extent depending on the price at which it is to be sold. This adulteration never escapes detection by the Paris method, which is also perfectly certain in the detection of brandies compounded artificially.

Marc Brandies and Mixed Fruit Brandies.—Marc brandies are absolutely toxic on account of the exceptionally heavy proportions of impurities. The methods employed for their distillation vary greatly, and their composition varies correspondingly. Two sorts of marc are treated; the residue remaining after the wine has been racked off is distilled direct, whilst the marc from which the juice has been expressed before fermentation is broken up, treated with water, and fermented before being distilled. Adulteration rarely proceeds beyond blending with neutral alcohol. Artificial marc brandies are always compounded with the "head" products from the distillation of natural marcs, which are readily detected by analysis.

—J. F. B.

Alcohol; Denaturing ——. R. Duchemin. Rev. Gén. de Chim., March, 1904.

After discussing the merits and disadvantages of the various denaturing agents for alcohol which have been proposed, it is concluded that "methylene 90° regie" (a product of wood distillation of sp. gr. 0·830, and containing 65 per cent. of methyl alcohol) is preferable to any other agent hitherto suggested. It is proposed to add 10 per cent. of this product to the alcohol, and it is adduced that the denaturation could be profitably carried out; the denaturing agent costing about 100 frs. per hectolitre. Other advantages claimed are, that it cannot be separated from the denatured spirit; it does not affect the wicks of alcohol lamps; it possesses a very dissagreeable taste without having a very bad odour. It is also pointed out that it would encourage the wood distilling industry.—T. F. B.

Brandy; its Relation to the British Pharmacopœia and Chemical Valuation. J. C. Umney and C. T. Bennett. Chemist and Druggist, 1904, **64**, 968—970.

It has recently been decided in law that as brandy is largely used as a medicine, it ought to comply with the definition given in the "B. P.," *viz.*, "a spirituous liquid distilled from wine and matured by age, and containing not less than 36½ per cent. by weight or 43½ per cent. by volume of ethyl hydroxide." It was also recommended that the maximum proportion of esters in brandy should be 80 parts per 100,000 of absolute alcohol. Results obtained by the authors and given in the following table show, however, that the commercial value of brandy is in no way proportional to the amount of esters it contains.

Description.	Money Value.	Volatile Esters per 100,000 of absolute alcohol.
Splendid old Petite-Cognac champagne, vintage 1875	100	132
A leading Cognac shipper's three star brandy..	56	92
" " " " ..	50	121
Two-thirds high class Cognac, one-third medium value wine-brandy other than Cognac	25	94
Superior Cognac brandy, vintage 1900..	23	115
All pure wine-brandy (75 per cent. Cognac, 25 per cent. other than Cognac)	20	81
Two-thirds high class Cognac brandy, one-third high-class wine-brandy other than Cognac ..	20	133
Medium pure Cognac	20	106
Low-grade pure Cognac	17	92
Half wine brandy, Cognac, half wine brandy other than Cognac	17	72
Low-grade Cognac brandy, vintage 1900	15	60
Half Cognac wine-brandy, low grade, half wine-brandy of other countries, very low grade	15	77
25 per cent. wine brandy, Cognac, 75 per cent. guaranteed (but very low grade) wine-brandy other than Cognac	10	47
33·3 per cent. wine-brandy, Cognac, 33·3 per cent. wine-brandy other than Cognac, 33·3 per cent. grain spirit	10	61
Half low-grade wine-brandies, Cognac, half ditto other than Cognac	7	66
Guaranteed wine brandy of very low grade ...	6	37
All grain spirit flavoured to represent brandy..	5	13

It is pointed out also that it would be very difficult to distinguish between a genuine brandy and one prepared by the addition of blended synthetic esters to a mixture of genuine brandy and so-called "silent" spirit. For judging as to the genuineness of a sample of brandy, it is necessary to make determinations of all the "impurities," *viz.*, higher alcohols, aldehydes, acidity and esters.—A. S.

Suspensions or Colloids; Flocculation of, and Agglutination of Bacteria. H. Bechhold. XXIV., page 730.

Glycerin [in Wine]; Determination of ——. J. Schuch XXIII., page 730.

ENGLISH PATENT.

Distillers' Refuse, Sewage and the like: Treatment of ——. L. Cameron. Eng. Pat. 14,536, June 30, 1903. XVIII. B., next column.

FRENCH PATENTS.

Mineral Enzymes; Preparation of Artificial ——. J. Bonnet. Fr. Pat. 339,460, Jan. 9, 1904.

WHEN a solution of a manganese salt is made slightly alkaline in the presence of an organic colloid, capable of preventing the precipitation of the manganese hydroxide, a product is obtained which behaves as a carrier of oxygen in a manner similar to that exerted by an oxidising enzyme. These artificial oxydases are prepared by mixing a solution of an albuminous substance (*e.g.*, white of egg, gelatin, serum, &c.) or of certain colloids (*e.g.*, gums, dextrins, &c.) with a solution of a metallic salt (manganese, iron, copper, &c.) in presence of a small quantity of alkali, alkaline-earth salt, or organic base. The products may be employed either in the de-oxidised state, in the oxidised state, in a state of sterilisation after heating, or in the solid state as obtained by precipitating the solutions by means of alcohol. —J. F. B.

Fermentation of Liquids. G. Johnson and P. R. Hare. Fr. Pat. 339,513, Jan. 14, 1904. Under Internat. Conv., May 4, 1903.

SEE Eng. Pat. 10,093 of 1903; this J., 1904, 499.—T. F. B.

Dyestuff [and Spirit] from Asphodel Roots. A. Badoil and J. E. Valadon. Fr. Pat. 333,178, Nov. 28, 1903. IV., page 712.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Coffee Berry; Composition of the Inner Husk of the ——. B. von Bittó. J. Landw., 1904, **52**, 93. Chem.-Zeit., 1904, **28**, Rep., 159.

ANALYSIS of the inner husk of the coffee berry (*Coffea arabica*), which contained 11·18 per cent. of moisture, gave the following percentage numbers, calculated on the dry matter:—Ash, 2·96; ethereal extract, 1·29; nitrogenous substances, 6·19; nitrogen-free extractive matters, 23·26; crude fibre, 66·28; crude protein (by Stutzer's method), 4·43. The fat is faint yellow in colour, and when melted only solidifies gradually. On analysis the following results were obtained:—Köttstorfer's (saponification) value, 141·2; acid value, 82·7; free fatty acid, expressed as palmitic acid 37·81 per cent.; glycerides, as tripalmitin, 28·03 per cen The husk contains no cholesterin, but gives 0·022 per cent of organic phosphorus, corresponding with 0·58 of lecithin. The caffeine present amounts to 0·35 per cent. of the dry matter, and the pentosans to 21·50 per cent. The ash is very hygroscopic, and at the ordinary temperature dissolves in water to the extent of 48·59 per cent.—T. H. P.

ENGLISH PATENTS.

Meat Preparations; Manufacture of ——. A. R. da S. Braga, Sao Paulo, Brazil. Eng. Pat. 7896, April 5, 19

A QUANTITY of the fruit of the papaw family (*Car papaya*), cut into small pieces, is placed in water containing one per 5,000 parts of hydrochloric acid, and after some time the liquid is squeezed out. To this liquid minced meat is added, and after disaggregation of th fibres, which may be hastened by stirring, has taken place the mass is dried by heating in a current of air, an pulverised. The proportions of water and fruit vary, according to the quantity of the meat, but the acid must always be used in the smallest possible proportion t facilitate pulverisation. Such a meat preparation, whether powdered or not, is said to keep well.—T. H. P.

(*B.*)—SANITATION; WATER PURIFICATION.

ENGLISH PATENTS.

Sewage; Method and Means for Treating ——. J. Hewes Leicester. Eng. Pat. 13,560, June 17, 1903.

THE crude sewage is passed through a small chamb provided with valves into settling-tanks, preferably arrange side by side. The clear liquid passes over a weir at th other end of the tanks into a precipitation tank, where it treated with suitable chemicals. The sludge from th settling-tanks is allowed to pass into chambers arranged a the side of the tanks, where it is dried. The dry sludge incinerated in closed retorts, and the products of distillat collected. Lime is added to the incinerated retort resid and the mixture used as a sewage precipitant or "bo powder."—W. P. S.

Distillers' Refuse; Sewage and the like; Treatment of —— L. Cameron, London. Eng. Pat. 14,536, June 30, 19

THE liquid is aerated in a rectangular tank, wherein it circulated by means of a paddle-wheel. The tank has partition down its centre, but not extending the who length of the tank, thus leaving a space vacant at each end The paddle-wheel is placed in one of the side spaces. Whe oxidation is complete, the acidity of the liquid is neutralise with lime, and alum is added. After settling, the sludge removed, mixed with peat, sawdust, or coal dust, and form into bricks for use as fuel.—W. P. S.

Filter [for Water]; High Pressure ——. W. S. Haws London. Eng. Pat. 12,297, May 29, 1903.

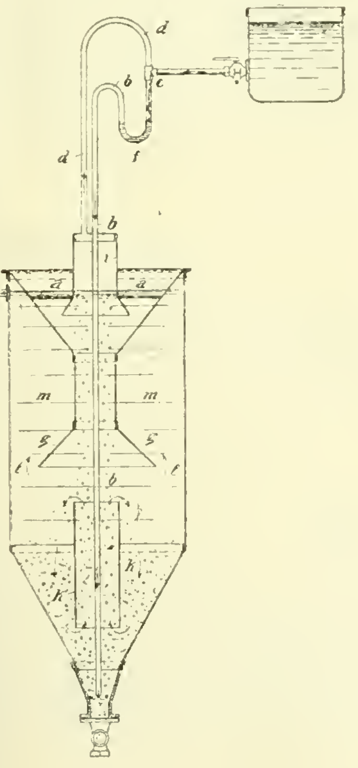
SEE Fr. Pat. 335,676 of 1903; this J., 1904, 265.—T. F. B.

urified and Sterilised Water, as well as of Distilled Water; Process for the Simultaneous Production of ——. A. Baudry, Kieff, Russia. Eng. Pat. 21,668, Oct. 8, 1903.

HE water is passed down a fractionating column, steam eing passed in near the bottom. The volatile impurities long with any oily matter in the steam pass away at the p, whilst the solids separated are drawn off at the bottom. he sterilised and purified water is drawn off at an interediate stage. The steam passing away is sent through a econd column, where it is partially condensed, and distilled ater is obtained. The rest of the steam along with the olatile impurities serves for a preliminary heating of the ater to be treated and then passes away. Should the volatile npurities be valuable they can be recovered by means of a pplementary condenser. The process of drawing off the quid from an intermediate section of the column can be plied to the separation of mixtures of liquids of different iling points, such as crude petroleum, &c.—W. H. C.

ectification of Water; Process and Contrivance for the Solution, with the aid of Compressed Air, of Chemicals for the ——. E. Krause, Düsseldorf, Germany. Eng. Pat. 9038, April 20, 1904.

IE cylindrical solution vessel, with a conical bottom and th the internal construction shown, is utilised as follows. e water passes from a store tank through the U-bend *c*, *b*, at such a rate that it draws air from the pipe *d* with it.



s air then passes to the bottom of the vessel, and in ng, agitates the hydroxide of lime or barium used, and motes solution. The rising bubbles of air are caught by inverted funnels *g*, *g* and *i*, and pass up to the pipe *d*, be used over again. The solution clarifies in rising ough the undisturbed portion *m*, *m*, and overflows through The same air being used over and over again, obviates difficulties due to the presence of dissolved carbon ide, this being absorbed by the lime at the beginning. —W. H. C.

XIX.—PAPER, PASTEBOARD, Etc.

English Patent.

Sulphates and Carbonates of Lime; Treatment and Utilisation [in Paper Manufacture] of Artificial ——. A. Monin, Lyons, France. Eng. Pat. 12,391, May 30, 1903.

See Fr. Pat. 320,430 of 1902; this J., 1903, 42.—T. F. B.

United States Patents.

Paper Coating or Enamelling Composition. W. A. Hall, Bellows Falls, Vt., U.S.A. U.S. Pat. 761,374, May 31, 1904.

The coating composition consists of a solution of casein in alkali, mixed with a solution of modified starch, serving as an adhesive or binder for the enamel base, *e.g.*, china clay. —J. F. B.

Paper Pulp; Manufacturing ——. O. Carr, Buenavista, Va., U.S.A. U.S. Pat. 762,139, June 7, 1904.

The process for extracting tannin and manufacturing paper-pulp from woods containing tannin consists in reducing the wood to chips having a length of fibre sufficient for paper-making and fine enough parallel to their fibres for efficient diffusion. The tannin is then extracted and recovered, and the exhausted chips are converted into pulp.—J. F. B.

French Patents.

Dyestuff [and Fibre for Paper Making] from Asphodel Roots. A. Badoil and J. E. Valadon. Fr. Pat. 333,478, Nov. 28, 1903. IV., page 712.

Rice-Flour; Treatment of ——, *for Use in Finishing Yarns and Textiles.* Soc. Anon. des Rizeries Françaises. Addition, dated Dec. 2, 1903, to Fr. Pat. 331,639, Aug. 1, 1903. (See this J., 1904, 59.)

This addition deals with the application of rice-flour, prepared as described in the original specification, to the sizing and smoothing of paper pulp, the couching of paper in white or coloured sheets, leather dressing, the preparation of vegetable gums in the form of paste and generally for all dressings of a similar kind.—T. H. P.

Viscose; Heater for the Treatment of ——. Soc. Franc. de la Viscose. Fr. Pat. 339,564, Jan. 13, 1904.

In the purification of viscose, by heating it at a definite temperature for a certain time until it coagulates and becomes insoluble in the saline washing liquids employed for extracting the by-products, it is essential that every portion of the mass should be continuously subjected to an invariable temperature. The apparatus in which this treatment is effected consists of a hemispherical vessel surrounded by a water-bath which is heated by a steam coil. In the vessel is mounted a vertical shaft carrying three superposed stirring arms provided with scrapers, and designed in such a way that the mass, as it coagulates, is reduced to fine granules. The water in the water-bath is likewise agitated mechanically in order to ensure uniform distribution of the heat. The saline solution is introduced just before the mass coagulates.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Chloroform; Preservation of ——. Témoin. Chem. and Druggist, 1904, **64**, 973.

The author states that chloroform to which 0·4 per cent. of sulphur has been added, undergoes no alteration on keeping, even when exposed to light.—A. S.

Bromoform; Electrolytic Preparation of ——. E. Müller and R. Loebe. Z. Elektrochem., 1904, **10**, 409—415.

The authors have improved upon the method of Coughlin (this J., 1902, 186) in dispensing with a porous septum. The most favourable composition of the electrolyte is

125 grms. of potassium bromide, 375 c.c. of water, 50 c.c. of acetone, 5 grms. of potassium bicarbonate, and 1 grm. of potassium chromate. The latter ingredient serves to inhibit cathodic reduction. A good current-efficiency (90—95 per cent.) can only be secured by allowing free bromine to separate out with the bromoform, and to this end a plentiful supply of carbon dioxide is bubbled through the liquid during electrolysis.—W. A. C.

Guaiacol with Lead Peroxide; Distillation of ——. R. Pschorr and M. Silverbach. Ber., 1904, **37**, 2149—2152.

When phenol is distilled with lead peroxide, diphenylene oxide is produced. The authors have found, however, that when guaiacol is subjected to the same treatment it is converted into veratrol, with the simultaneous formation of catechol (pyrocatechin), the bulk of which remains behind in the form of the lead salt and is carbonised, whilst the veratrol distils over. The lead peroxide acts in this case merely as a base, and the same reaction takes place on the distillation of the sodium salt of guaiacol, but with a smaller yield. By an analogous process the lead salt of ethyl vanillate yielded the corresponding ester of veratric acid, and the lead salt of the monomethyl ether of resorcinol yielded the dimethyl ether on distillation.—J. F. B.

Lupinidine and Sparteïne. R. Willstätter and W. Marx. Ber., 1904, **37**, 2351—2357.

In 1880, Liebscher isolated from the seeds of the yellow lupin two alkaloids—the crystalline oxygenated lupinine and the liquid, oxygen-free lupinidine to which the formula, $C_8H_{15}N$ was assigned. The authors have prepared the latter base from the mother-liquors after the separation of the lupinine. From their analyses of the pure alkaloid they conclude that the above formula is erroneous, and that lupinidine has a composition corresponding to the formula $C_{15}H_{26}N_2$. They also find that lupinidine is identical with the alkaloid sparteïne isolated by Stenhouse in 1851 from the broom tree. The alkaloids occurring in the various species of lupin are as follows:—Lupinine, $C_{10}H_{19}ON$, in *Lupinus luteus* and *L. niger*. Sparteïne, $C_{15}H_{26}N_2$, in *L. luteus* and *L. niger*. Lupanine, $C_{15}H_{24}ON_2$ [racemic and lævorotatory forms] in *L. albus*, *L. angustifolius* [blue lupin], and *L. perennis*.—J. F. B.

Orange Flower; Distribution of Certain Organic Matters in the ——. E. Charabot and G. Laloue. Comptes rend., 1904, **138**, 1513—1514.

The greater portion of the essential oil of the orange flower is located in the petals, which also contain the highest percentage of oil. During the period of blossoming the percentage of oil in the flower and the weight of oil contained in a single flower increase considerably; the formation or accumulation of the odorous substances in the flower is most intense when that organ is in the stage of full development. During the development of the blossom the essential oil becomes richer in terpenic esters, methyl anthranilate, and total alcohol; the esterification continues in the blossom, but with far less intensity than in the leaf and stem. The proportion of geraniol in the oil increases during blossoming, whilst that of the linalool decreases. In the full-blown flowers there is no marked difference in composition between the oil extracted from the petals and that obtained from the other parts of the blossom, but the former is slightly richer in methyl anthranilate than the latter.—J. F. B.

Camphor Group; Investigations in the ——. J. W. Brühl. Ber., 1904, **37**, 2156—2178.

A contribution to the study of the simplest substitution compounds of camphor, especially the halogen derivatives, their synthesis and orientation. A comparison is drawn between the action of bromine and iodine on oxymethylene-camphor in presence of an excess of alkali. The first product in either case is bromo- or iodo-formyl-camphor, but the bromo-formyl-camphor is less stable in presence of excess of alkali than the iodo derivative. The former breaks down with the production of *o*-mono-bromo-camphor and alkali formate, and addition of more bromine has no further effect; the iodo-formyl-camphor, on the other hand, resists the action of the alkali and yields *o*-*o*-diiodo-camphor when the equivalent quantity of iodine is added, no trace of the mono-iodo-camphor being produced.
—J. F. B.

Camphor Derivatives; Physiological Action of Certain ——. J. W. Brühl. Ber., 1904, **37**, 2178—2183.

Camphocarboxylic acid is practically devoid of physiological properties, but the action of its esters in an homologous series resembles that of camphor, and increases in inverse proportion to their solubility in alkali (see this J., 1902, 1409). The present paper deals with the action of the homologous series of oxyalkylidene camphors [acylcamphors]. The lowest member, oxymethylene-camphor, is readily soluble in an equivalent quantity of alkali; the sodium salt is poisonous in a general manner, but it is totally devoid of the specific properties of camphor, and is to be classed with camphocarboxylic acid. It possesses a feeble bactericidal action. The solubility of the next members of the series in alkali decreases with increase of the molecular weight, and these bodies are comparable with the esters of camphocarboxylic acid. Like the latter, oxyethylidene-camphor and oxypropylidene-camphor, possess the specific toxic properties of camphor. They are nerve poisons, and set up the typical "cramping" actions; they take effect more rapidly than camphor. Oxyethylidene-camphor is the more powerful of the two. Mono- and di-iodo-camphor were tested for their antiseptic properties, both being odourless bodies. Mono-iodo-camphor acts as an irritant towards the more sensitive mucous membranes, but its antiseptic power is only slight. Di-iodo-camphor is more powerfully irritant, and cannot be used on open wounds; it might possibly be of value when an initial irritant and a secondary resorbent action is required.—J. F. B.

Oxalacetic Ester; Product of Spontaneous Decomposition of [Detection of] ——. L. J. Simon. XXIII., page 730.

"Mangifera Indica," L. [Mango Tree]: The Gum of ——. P. Lemeland. XVI., page 721.

English Patent.

3.4-*Diamidobenzoic Acid; Manufacture of Alkyl Esters of* ——. O. Imray, London. From E. Ritsert, Frankfurt-on-Maine, Germany. Eng. Pat. 16,684, July 29, 1903.

See U.S. Pat. 761,998 of 1904; following this.—T. F. B.

United States Patents.

Halogen Tertiary Butyl Alcohol; Process of Making ——. T. B. Aldrich, Detroit, Mich., U.S.A. U.S. Pat. 761,188, May 31, 1904.

A ketone, or a mixture of ketones such as is produced by dry distillation of salts of monobasic fatty acids, is halogenised (*e.g.*, with a hypochlorite) in such a way as to produce a mixture of about equimolecular parts of free ketone and substitution product, which is then condensed to form the halogenated tertiary butyl alcohol. Thus, trichlorotertiary-butyl alcohol is produced by treating acetone with bleaching powder in presence of water, and condensing the product with alkali hydroxide.—T. F. B.

Halogen Tertiary Butyl Alcohol; Process of Making ——. T. B. Aldrich, Detroit, Mich., U.S.A. U.S. Pat. 761,189, May 31, 1904.

A ketone and a halogen substitution derivative thereof is condensed, by means of less than 10 per cent. of alkali hydroxide, to a halogenated tertiary butyl alcohol. By condensing a mixture of acetone and bromoform with less than 10 per cent. of sodium hydroxide, distilling the mixture under reduced pressure to remove the excess of acetone and bromoform, and then distilling the residue with steam, tribromotertiary butyl alcohol is produced.—T. F. B.

.4 - *Diaminobenzoic Acid; Alkyl Esters of ——, and Process of Making same.* E. Ritsert and W. Epstein, Frankfort, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst on the Maine, Germany. U.S. Pat. 761,998, June 7, 1904.

(4-)Aminobenzoic acid is esterified, and an acidyl group ntroduced, and the acidyl compound then nitrated, 3-nitro-acidylaminobenzoic ester resulting; the acidyl group is liminated and the product reduced, 3-4-diaminobenzoic sters being produced as white, easily crystallised substances, arly easily soluble in water, and readily soluble in alcohol nd in ether.—T. F. B.

icorice Root; Process for Extracting Juice from Dried ——. F. Evers, Düsseldorf, Germany. U.S. Pat. 762,032, June 7, 1904.

ee Eng. Pat. 1180 of 1904; this J., 1904, 383.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Cyanine Dyestuffs: Constitution of ——. A. Miethe and G. Book. IV., page 712.

French Patent.

igment [Photographic] Process: Film for the ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 339,654, Jan. 16, 1904

elluloid or collodion is incorporated with oils, fats, axes, resins, high boiling-point hydrocarbons, &c., and rmed into sheets, which are covered with a film of gmented gelatin in the usual manner. For example, kilos. of celluloid and 600 grms. of castor oil are mixed gether in presence of alcohol, acetone, &c., and formed to sheets. Photographs produced by this method, when ripped from their celluloid backing and fixed to paper, do t present the excessive glossiness exhibited by prints oduced on prepared celluloid.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

Explosives: Twenty-eighth Annual Report of His Majesty's Inspector of ——. 1903.

ere have been no modifications of the law during the ar. The number of deaths (5) from accidents by fire explosion in the manufacture of explosives was below average for the decade (6·4). The total number of tories under continuing certificate or license is 1 7. e quantity of foreign blasting explosives imported during past two years was as follows:—

—	1902.	1903.
	Lb.	Lb.
roglycerin explosives.....	1,839,277	2,330,582
er explosives............	12,000	168 + 2 cases

f the above 2,330,582 lb. of nitroglycerin explosives orted during 1903, however, 1,460,000 lb. were transpped from British ports for other countries. The nber of detonators imported during the year was over millions, of which more than 4 millions were tranpped for other countries. Dr. Dupré's report shows t of 379 samples of licensed explosives examined by , 339 were passed and 49 rejected. He has continued work on the sensitiveness of nitroglycerin to shock. en placed between sheets of lead it does not explode n struck by a 2 lb. weight falling from a height 46 inches. Sheet lead of even 0·01 inch thickness tly reduces its liability to explosion. Picric acid, on other hand, when placed upon a steel anvil could not exploded by a blow from a 2 lb. weight falling from a ght of 46 inches. When thin sheet lead (0·01 inch) placed upon the anvil and the picric acid put on this, a w from a 2 lb. weight falling from a height of only 18 inches readily exploded it. An investigation was made as to the effects of heat, of acids, and of alkalis on trinitrotoluene and Aniline Black. The former, when heated, takes fire at about the temperature at which gunpowder explodes. The latter has to be heated to dull redness before it fires. A mixture of the two substances, however, takes fire at a temperature lower than either of its constituents separately. The addition of sulphuric acid or of solid caustic potash to trinitrotoluene just melted over a steam bath produced no appreciable rise of temperature. Should, however, the trinitrotoluene be raised to 160° C. the addition of caustic potash produced instant ignition and sometimes an explosion. Two new tests are described for investigating the stability of nitro explosives. The first consists in heating from 2—2·5 grms. of dry guncotton, contained in small weighing bottles, to a temperature of 130° C. Two equal portions are heated for half an hour, the bottles fitting fairly well into copper tubes immersed in an oil-bath. After weighing, the bottles are replaced in the bath and again heated and weighed, one after the lapse of 2 hours, the other after 4 hours. The loss in weight will, it is anticipated, give a measure of the stability of the explosive. In the second test the explosive (2—2·5 grms.) is introduced into a glass tube, 12 ins. long, 0·6 ins. diameter, and of about 50 c.c. capacity. This tube is connected with a receiver kept exhausted to 1 m.m. of mercury, and also with a barometer tube dipping into mercury. After the tube containing the explosive has been exhausted it is placed in an oil-bath at 130° C. The mercury in the barometer tube soon begins to fall, and after the lapse of ¼ hour the vacuum is restored. This process is repeated after the lapse of another ¼ hour. The results of the first half hour, though noted, are usually not included in the subsequent records. After this, however, the real test begins, and the number of mm. the mercury falls every ¼ or ½ hour is recorded, the vacuum being restored after each observation. The time allowed to elapse between the observations is governed by the amount of gas evolved, the object being to retain a moderate vacuum (from 1/100—1/50 of an atmosphere) throughout the experiment. By a simple cooling arrangement applied to the upper part of the heating tube, any nitroglycerin in the explosive is condensed, and the test is thus applicable to nitroglycerin explosives.

Captain Desborough's report on the Testing Station, Woolwich, shows that out of 22 explosives submitted, 13 successfully passed the test. A gas-leak detector has been added to the gallery in order to locate the actual places at which leakage occurs, and it has also been useful in detecting the presence of unconsumed coal-gas after a shot has been fired in which there has been doubt as to ignition. The only new departure in explosives has been the combination of nitroglycerin with ammonium nitrate. The only notable change with accessories has been the substitution of a waxed for an ordinary paper wrapper in a non-detonating explosive, and it was found that the wax-coated explosive was much less sensitive to ignition from an external spark. Experiments were carried out as to the physical effect produced on ammonium nitrate explosives by subjecting them to extreme cold—in surrounding the cartridges with solid carbon dioxide for 12 hours. The results obtained, showed that when the explosive was contained in a paper wrapper it became so hard as to render the insertion of a detonator impossible, whereas the samples contained in metal wrappers did not change their physical condition. From experiments carried out the conclusion is drawn that the visibility of sparks or glow on firing an explosive in a bore-hole is not of necessity any criterion as to the liability to fire gas, but the appearance of flame (as opposed to glow) or of sparks due to the combustion of projected explosive indicates the existence of a very grave danger.—G. W. McD.

Explosion of Gunpowder; Circumstances attending an ——, which occurred in the Mixing House of the Factory of Messrs. Curtis and Harvey, Ltd., at the Marsh, Faversham, on Feb. 2, 1904. By Capt. M. B. Lloyd, H.M. Inspector of Explosives.

800 lb. of roughly mixed powder exploded in the mixing machine. It is considered that "the explosion was most probably caused by a foreign substance introduced into the ingredients in course of being mixed in the machine, and

that this was most likely to have been a small piece of cement from the lining of the wall which was detached from a faulty place." The possibility of lubricating oil, in the present case, olive oil, in contact with ground charcoal having caused spontaneous ignition of the charcoal was investigated. Two thermometers, one clean and one oiled with the olive oil, were placed in charcoal contained in cardboard cylinders surrounded with cotton wool, but no increase of temperature could be detected.—G. W. McD.

Explosion of Nitroglycerin; Circumstances attending an ——, *in the Separating House of the Factory of Messrs. Curtis and Harvey, Ltd., at Cliffe, Kent, on Feb.* 18, 1904. By Major A. Cooper-Key, H.M. Inspector of Explosives.

About 2,000 lb. of nitroglycerin were in the house at the time, and dense nitrous fumes were noticed coming from the building for some seconds before the explosion took place. It is considered probable "that the accident was caused by the spontaneous decomposition of the charge of nitroglycerin in course of separation owing to the presence in one of the ingredients of an impurity undiscoverable by the analysis of a sample, and that the fatal results were due to the men in charge failing to make use of the drowning tank until the heat from the decomposition caused an explosion." Experiments showed that the gases evolved in the "fuming off" of nitroglycerin consisted of nitrogen trioxide and peroxide (48·7 per cent.), nitric oxide (40·7 per cent.), carbon monoxide (3·2 per cent.), carbon dioxide (1·4 per cent.), and nitrogen (6 per cent.), and Major Cooper-Key considers that the failure to drown the charge was not due to the workmen being instantaneously and unexpectedly overcome by the carbon monoxide in the fumes. It is recommended that arrangements should be made in nitroglycerin works to enable a charge to be drowned in a period measured by seconds instead of by minutes.—G. W. McD.

United States Patent.

Gunpowder. A. H. Robinette, Fostoria, Ohio, U.S.A. U.S. Pat. 761,403, May 31, 1904.

"An explosive powder, consisting of nitrate of potash, ferrocyanide of potash, chlorate of potash, yellow prussiate of potash, and granulated sugar.—C. A. M.

Explosive Cartridge. G. Cornara, Mantova, Italy. U.S. Pat. 762,229, June 7, 1904.

See Eng. Pat. 30,253 of 1898; this J., 1899, 175.—T. F. B.

Explosive Compound. W. A. Spore, Argenta, Ill., U.S.A. U.S. Pat. 762,446, June 14, 1904.

The explosive consists of corn-pith, potassium chlorate, and a nitrated-turpentine binding material.—G. W. McD.

Explosive, and Method of Making same. E. Steele, Mill Valley, Cal., U.S.A. U.S. Pat. 762,447, June 14, 1904.

See Fr. Pat. 336,783 of 1903; this J., 1904, 386.—T. F. B.

Nitrocellulose; Art of Purifying ——. F. I. du Pont, Wilmington, U.S.A. U.S. Pat. 762,757, June 14, 1904.

Nitrocellulose is immersed in water, and is subsequently brought in contact with a further amount of water containing a gas in solution, under pressure, in such a manner that the escaping gas passes through the nitrocellulose.
—G. W. McD.

French Patent.

Explosive. J. Bührer. Fr. Pat. 339,552, Jan. 13, 1904.

Paraffin (6 parts) is heated to 65° C., and mononitrotoluene (7 parts) is dissolved in it at this temperature. Trinitrotoluene (1 part), iron filings (16 parts), and potassium chlorate (70 parts), are then added successively, and incorporated at a temperature of 55° C. Other metals, in a fine state of division, such as copper, zinc, &c., may be used in place of iron.—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Soapstone Fibres. K. E. Guthe. Nature, 1901, 70, 132 Pharm. J., 1904, 72, 852.

If steatite or soapstone be fused in a gas-oxygen jet, clear bead is obtained from which very fine fibres can easil be drawn. These fibres show approximately the sam elastic fatigue and tensile strength as fused quartz fibres the same dimensions, and can be used instead of the latte for suspensions.—A. S.

INORGANIC—QUALITATIVE.

Indium [*Separation from Aluminium*]. C. Renz. Be 1904, 37, 2110—2112.

The author draws attention, in view of recent publicatio to his former work on indium. Indium chloride in solutio in absolute alcohol gives, with pyridine, a crystalline precip itate of $InCl_3.3C_5H_5N$, slightly soluble in alcohol, insolub in ether, melting at 253° C. Indium hydroxide, in presen of a little ethylamine hydrochloride, is insoluble in ethy amine (the presence of the hydrochloride prevents th hydroxide from passing through a filter), and this insol bility can be used to separate indium from aluminium. I ammonia, however, indium hydroxide is somewhat solubl The author first described the preparation of crystallise indium oxide and its volatility at high temperatures. Whe heated strongly in an iridium capsule, it sublimes percep tibly without previous fusion, and the residue contai brilliant minute crystals belonging to the regular system, well as crystals of another shape. Possibly the two a In_3O_4 and In_2O_3, corresponding to Fe_3O_4 and Fe_2O_3. Th crystalline form of In_2O_3 is distinguished from the amo phous by being quite insoluble in hot concentrated su phuric acid. Metallic indium combines readily wit selenium and tellurium.—J. T. D.

INORGANIC—QUANTITATIVE.

Prussian Blue in Spent Oxide, &c.; Determination of — *by Feld's Method.* R. Witzeck. J. Gasbeleucht., 190 47, 545—547.

The author confirms Feld's observation that methods for th determination of Prussian blue, in which the crude cyanid material is first decomposed by heating with a solution caustic alkali, give results which are too low, on account the formation of thiocyanate. Feld (this J., 1903, 106 has described processes which are applicable to the ex amination of such materials. These methods have bee largely used by the author, and are recommended as acc rate and rapid. The formation of thiocyanate is entirel avoided. The author uses a simple distillation apparatu the distillation flask being furnished with a tap-funnel an the main receiver connected to a safety bulb-tube. F determining the total cyanogen content, 2 grms. of th sample of spent oxide (or 0·5 grm. in the case of cyanid mud) are rubbed down finely with 1 c.c. of N/1 ferro sulphate solution and 5 c.c. of 8N sodium hydroxide solutio for five minutes. 30 c.c. of 3N magnesium chloride solutio are then added slowly, with continuous stirring, and th whole is washed into the distillation flask (which is of 700 c. capacity), with enough hot water to bring the volume about 200 c.c. After five minutes' boiling, 100 c.c. boiling N/10 mercuric chloride solution are added the boiling liquid, and the mixture is boiled 10 minut longer. All the cyanogen present is now in the form mercuric cyanide. The flask is attached to the condense 30 c.c. of 4N sulphuric acid are added, and the liquid distilled for 20—30 minutes, the receiver and bulbs contai ing 20 c.c. of 2N sodium hydroxide solution. If the distilla be turbid, owing to the presence of sulphur, about 0·5 grm. lead carbonate is added, the liquid is agitated, filtered, an an aliquot portion taken for titration. The titration is pe formed by adding 5 c.c. of 4N potassium iodide solution an then N/10 silver nitrate solution, until a yellowish turbidi appears. 1 c.c. of N/10 silver nitrate solution = 0·009556 grm. of Prussian blue (Fe_7Cy_{18}). The whole analysis takes about 1½ hours.—H. B.

Calcium; Separation of —— from Magnesium. C. Stolberg. Z. angew. Chem., 1904, **17**, 741—744 and 769—771.

A critical bibliography is given of the methods of separation of calcium and magnesium which have been more or less widely adopted, and experiments are quoted which show that the almost universal oxalate method gives accurate results, provided that:—(1) The solutions are sufficiently diluted; (2) a sufficient quantity of ammonium chloride is present; (3) the precipitation is effected at the boiling temperature, and a large excess of ammonium oxalate is used; (4) the precipitate is allowed to stand for 12 hours before filtering; (5) the precipitate is redissolved in hydrochloric acid and reprecipitated in the same manner as at first. The time required for this method, however, induced the author to investigate the method based on the different solubilities of the sulphates in alcohol; and after many attempts with ethyl alcohol of various strengths, and with mixtures of methyl and ethyl alcohols, the following method was adopted:—The mixed salts, in not too dilute solution, are evaporated with excess of sulphuric acid and the whole of the excess of sulphuric acid is driven off by careful heating. The sulphates are digested on the water bath with water more than enough to convert the magnesium sulphate into the hydrated salt $MgSO_4.7H_2O$, and when this is complete, methyl alcohol, to which has been added 10 per cent. by volume of absolute ethyl alcohol, is added, in quantity sufficient to dissolve the magnesium sulphate. After a few minutes the whole is iltered, and the filter thoroughly washed with a mixture of 5 volumes of absolute alcohol and 95 volumes of methyl lcohol. The magnesium sulphate is completely dissolved; whilst the calcium sulphate remains absolutely insoluble. The filter is dried at 105° C., separately incinerated, the ash gnited with 2—3 drops of sulphuric acid, the precipitate dded, ignited, and weighed. The filtrate is diluted with water (to prevent separation of difficultly soluble lower ydrates, which is apt to occur if the alcohol be at once vaporated), heated on the water-bath till the alcohol is all riven off, and the magnesia either determined as pyrohosphate or calculated from the determination of the lphuric acid as barium sulphate. The results are accurate, d a calcium determination can be easily carried out in an our.—J. T. D.

ercury; Separation of —— from Molybdenum and Tungsten, by means of Hydrazine. P. Jannasch and W. Bettges. Ber., 1904, **37**, 2219—2228.

rom Molybdenum.—To the solution contained in a deep rcelain basin add 2—3 grms. of tartaric or citric acid, d make up to about 100 c.c. Heat the covered basin to out 80° C., add 2 grms. of hydrazine sulphate dissolved 30—45 c.c. of strong ammonia, and heat for 15 minutes, rring frequently. Pour off through a double filter, wash decantation with a solution of 1 grm. of hydrazine phate in 100 c.c. of water to which 20 c.c. of strong monia have been added, and determine the mercury in filtrate. Collect the precipitate on the filter, add c.c. of strong ammonium sulphide solution, keep warm the colour changes from yellow to red, and cautiously l excess of hydrochloric acid; heat, with stirring, for —15 minutes on the water-bath, filter, wash with water taining hydrochloric acid and hydrogen sulphide, dry; arately incinerate the filter at a low temperature in a celain crucible with perforated lid, add the precipitate, e the crucible in a nickel dish, and ignite in a stream oxygen till the sulphide is completely converted into xide.

rom Tungsten—Proceed, for the mercury, exactly as a ve, save that the addition of tartaric or citric acid is not n essary. Boil down the filtrate to 50 c.c., add, very c iously, fuming nitric acid till the hydrazine is destroyed, b down, transfer to a weighed porcelain crucible, com e the evaporation to dryness, heat in an air-bath, and th to redness over a flame, and weigh. This method is obviously available only when the filtrate from the mercury contains no fixed substance other than tungstic acid. Attempts to determine tungsten in tungstates by precipitation as sulphide, or as tungstic acid or anhydride by direct precipitation with acids, all failed. With the aid of hydrazine, however, the latter mode of precipitation was made quantitatively accurate. The tungstate is dissolved in about 50 c.c. of water, heated to boiling, and a mixture of 2 grms. of hydrazine hydrochloride dissolved in 10 c.c. of water with 22 c.c. of concentrated hydrochloric acid, is added. (The acid may be added first and the hydrazine solution immediately after, but the hydrazine must not be added before the acid.) A precipitate forms, at first, whitish, but gradually becoming deep yellow, citron-yellow, and green. The liquid is gently boiled, with frequent stirring, for 20—25 minutes, and evaporated to about half its bulk. The precipitate is allowed to settle, poured through a double filter (putting back any turbid filtrate till quite clear), washed thoroughly with 1:10 nitric acid, the filter and moist precipitate ignited in a porcelain crucible, and the residue moistened with a few drops of nitric acid, and again ignited till constant in weight.—J. T. D.

Palladium; Determination of —— and Separation from other Metals by Means of Hydrazine. P. Jannasch and W. Bettges. Ber., 1904, **37**, 2210—2219.

Pure palladium was prepared from the commercial metal by dissolving in nitrohydrochloric acid, evaporating to dryness, taking up with water and hydrochloric acid, diluting considerably, and precipitating at the boiling temperature with hydrazine sulphate. After digesting at 100° C. for some time, the precipitate was filtered off, dried and ignited. This precipitate, however, contained copper (which was removed by a repetition of the process) and oxygen, the latter in variable amount, corresponding in some instances with Pd_2O. By ignition in hydrogen the oxygen is removed, and pure silver-grey metallic palladium obtained. For the determination of palladium, 0·3—0·5 grm. of the pure metal is dissolved in *aqua regia*, the solution evaporated, and the residue taken up with a little water, and 20 drops of dilute hydrochloric acid, heated till solution is complete, diluted to 120 c.c., and heated to boiling. The solution of 1 grm. of hydrazine sulphate in 20 c.c. of water is added, the liquid heated on the water bath for 20 minutes, allowed to stand in the cold for two hours, filtered through asbestos in a hard-glass tube, the precipitate well washed with hot water, dried at 120°—130° C., and ignited in hydrogen. When water ceases to be formed, the hydrogen stream is stopped, and the palladium allowed to cool in the desiccator and weighed.

Separation from Potassium or Sodium.—Proceed exactly as above. Boil down the filtrate to 50 c.c., add cautiously a few c.c. of fuming nitric acid to destroy the hydrazine, evaporate to dryness, take up with a little dilute sulphuric acid, and evaporate, weighing the potassium or sodium as sulphate.

Separation from Magnesium or Zinc.—The palladium is determined as above. The magnesium or zinc can be precipitated directly by means of sodium phosphate and ammonia or sodium carbonate respectively, without removing the hydrazine.

Separation from Iron.—Determine palladium as above. Destroy the hydrazine, and precipitate the iron with ammonia.—J. T. D.

Chromic Oxide in Chrome Leather; Note on the Determination of —— and Separation of the Same from Aluminium Oxide in the Presence of Aluminium Salts. H. R. Procter. Collegium, 1904, 192.

The Procter and Griffith method of fusing the ash from chrome leather with a mixture of sodium carbonate and *magnesia levis* (this Journal, 1900, 223) has been thoroughly confirmed as regards accuracy, and for convenience and rapidity leaves little to be desired. Should aluminium be present it is perfectly easy to reduce the solution with alcohol, weigh the mixed oxides, and deduct the weight of chromium calculated from titration as stated by Appelius (this Journal, 1904, 552); or precipitate the alumina at once from the acid solution by ammonia and ammonium chloride, with the usual precautions to avoid precipitation of chromic acid.—R. L. J.

ORGANIC—QUALITATIVE.

Indophenine Reaction. L. Storch. Ber., 1904, **37**, 1961.

The effect of oxidising agents in promoting this reaction for thiophene (blue coloration with isatin and pure sulphuric acid) seems to be solely due to the heat developed. The same effect is produced by adding water or by simply warming the mixture without addition of water.—E. F.

Oxalacetic Ester; Product of Spontaneous Decomposition of —— [Detection of]. L. J. Simon. Comptes rend., 1904, **138**, 1505—1508.

Oxalacetic ester on keeping undergoes spontaneously a change, resulting, in the probable formation of a dihydroxyquinonic derivative. Such a sample gives with alkalis a deep violet coloration, which deepens gradually, and is destroyed by excess of the reagent. The same coloration can be obtained at once by substituting alkali borate or formate for the hydroxide, and the solution can then be boiled with excess of the reagent without fear of destroying the colour. This reaction may be used to identify oxalacetic ester.—J. T. D.

ORGANIC—QUANTITATIVE.

Tannin Determination; [Filtration of Quebracho and Mangrove Extracts]. K. Schorlemmer. Collegium, 1904, 137—144.

Two litres each of various quebracho and mangrove extracts were prepared as for analysis by the method of the Internat. Assoc. of Leather Trades Chemists, halved int portions A and B, and the times occupied in filtering th various fractions recorded (see table). The chief points o interest were (*a*) the length of time, usually several hours required to filter a quantity of these apparently clear liquid through the "S. and S. No. 605 hard" paper and (*b*) th irregular behaviour, with these materials, of these papers though they were all taken from one and the same packet The 500 c.c. fractions, less 50 c.c. removed to determine the contents, were passed each through a second filter II. A. o II B., as in the method for finding the "correction facto of the filter-paper," and here the time required was usuall a matter of minutes. In the first filtration, substances ar removed which, even after the factor has been applied represent appreciable percentages of insoluble matters (se last col. in table), although, with two exceptions, all th liquors appeared too clear to require filtration. Four different values for insoluble matter were obtained from on and the same extract (Expts. No. 8 and 9), as the result o four trials *viz.*, 8.A., 8.B., 9.A., 9.B. In four instance weighed filter papers were employed and the dried deposits after removal of soluble matter by washing, determined b difference. The weights so obtained bore a definite relatio to the times required to filter, being greater as the latte were longer. The value of applying a correction factor i the analysis of these materials would appear to be smal because (1) filtered and unfiltered liquors behave differentl towards the papers and (2) the papers themselves sho large differences in behaviour. The percentage of tota soluble matter determined by evaporating 50 c.c. fron filtrate (*b*) was in most cases identical (occasionally higher with the result deduced from filtrate (*a*) plus the correctio factor. In the table the figures in brackets are difference (losses) in mgrms. per 50 c.c. from the contents of 50 c.c. o original unfiltered liquor. In other words, the losses i filtrate (*b*) are almost the same as the losses in filtrate (*a* after correction by the plus amount due to the factor, so that equally true results might be obtained more simply by rejecting a larger quantity of filtrate, say 400 c.c., than at present customary, before collecting for evaporation.

—R. L. J.

Table showing the times required to filter (in hours) and refilter (in minutes) Quebracho and Mangrove Liquors.

——		Filter I.					Filter II.		(6)	(7)
		(1) First 250 c.c. Hours.	(2) Next 50 c.c. Filtrate (*a*).		(3) Next 500 c.c. Filtrate (*b*).		(4) First 250 c.c. Mins.	(5) Next 50 c.c. Filtrate *c*. Mins.	Correction Factor ($b - c$). + mgrms.	"Insolubl Matter." Per Cent
			Hours.	Loss in Mgrms.	Hours.	Loss in Mgrms.				
1. Quebracho extract "soluble"........	A	3·5	2·0	5	26·0	2	30	8	3	0·36
	B	0·5	10 mins.	6	7·0	4	40	15	2	0·73
2. Quebracho extract "soluble".......	A	2·25	1·2	4	36·0	4	150	105	2	0·33
	B	2·5	1·7	3	36·5	4	60	40	3	0·0
3. Quebracho liquid extract "soluble"	A	3·5	2·2	12	25·0	7	35	5	5	1·16
	B	3·5	2·5	12	26·0	8	45	10	5	1·16
4. Quebracho extract	A	14·0	5·0	16	26·0*	13	40*	30	3	2·36
	B	13·0	4·2	11	27·5*	14	5	2	0	2·00
5. Quebracho extract "soluble"........	A	8·0	4·0	2	36·0	0	3	1	0	0·27
	B	12 mins.	1 min.	4	15 mins.	2	3	1	0	0·53
6. "R. Catechu," liquid.............	A	3·5	1·5	12	26·0	11	60	5	3	1·72
	B	5·7	1·7	14	29·7	11	30	1	1	2·45
7. "Mimosa D.".....	A	1·7	0·8	7	30·7	6	55	15	1	1·18
	B	2·2	2·0	9	35·5	7	50	20	4	1·00
8. Mangrove extract .	A	7·0	2·5	6	36·5	4	120	60	4	0·36
	B	7·0	2·5	6	40·5	5	90	45	5	0·18
9. Mangrove extract same as No. 8....	A	1·0	0·7	8	13·0	7	40	8	2	1·09
	B	8·0	3·0	12	36·0	8	40	5	1	2·00

* Only part of the required amount filtered in this time.

Glycerin [in Wine]; Determination of —— by the Lime and by the Iodide Method. J. Schuch. Z. landw. Versuchsw. in Oesterr., 1904, **7**, 111. Chem.-Zeit., 1904, **28**, Rep. 158.

The differences, expressed in grams of glycerin per litre of wine, between the results obtained by the lime method and by the iodide method of Zeisel and Fanto, are stated as follows:—For white wines, − 0·35 to + 0·20; for red wines, −0·51 to + 0·77; for sweet wines, − 1·21 to + 1·21. These differences, even in the case of sweet wines, are not sufficiently great to cause the lime method to be replaced, especially as the glycerin obtained by the iodide proce can only be regarded as "crude glycerin." The li method has the advantage of allowing a number of dete minations to be carried on simultaneously, without delayi the other determinations of a wine analysis. To do tl with the iodide method necessitates the use of a numb of expensive pieces of apparatus.—T. H. P.

XXIV.—SCIENTIFIC & TECHNICAL NOTE

Suspensions or Colloids; Flocculation of ——, and Agg tination of Bacteria. H. Bechhold. Z. physik. Che 1904, **48**, 385—423. (See also this J., 1901, 688.)

The author's experiments related to:—(1) The flocculati by various electrolytes of suspensions of mastic, bacte (chiefly typhus bacteria cultivated on bouillon, killed with "formol" and washed in a centrifugal apparatus with distilled water) and agglutinin-bacteria (typhus bacteria treated with the serum of a goat which had been inoculated with typhus bacteria); and (2) the influence of various colloids of the first order (gelatin, serum, gum arabic, &c.) on the action of the electrolytes. The results may be summarised as follows :—Below a certain concentration of the electrolyte and of the suspension, no flocculation takes place even on prolonged contact. Above these limiting concentrations, within certain limits, the rate of flocculation increases with the concentration of the electrolyte and of the suspension. No essential difference can be observed between the flocculation of bacteria, agglutinin-bacteria, and unorganised suspensions or colloids. The flocculation of bacteria and of agglutinin-bacteria, like that of true suspensions by electrolytes, depends upon the valency of the cation, its rate of migration and decomposition-potential, and the ionisation of the electrolyte. The flocculation of bacteria suspensions cannot be effected by mono- and di-valent cations of high decomposition-potential. The flocculation of unorganised suspensions or colloids of the second order (inorganic colloids) can be prevented by colloids of the first order (albumin, gelatin, &c.), but the latter have no influence on the flocculation of agglutinin-bacteria. The irregular action of salts of trivalent cations in effecting flocculation, is ascribed to the envelopment of the suspension by colloidal aluminium hydroxide, ferric hydroxide, &c., produced by hydrolytic dissociation. By treating bacteria with lead nitrate, alcohol, acids, &c., products are obtained which, with regard to their behaviour towards electrolytes, form intermediate steps between bacteria and agglutinin-bacteria. When a bacterial suspension is subjected to the action of an electric current, the bacteria, like all true suspensions, migrate to the anode. Agglutinin-bacteria are agglutinated by the electric current. With regard to flocculation by salts, agglutinin-bacteria behave like unorganised true suspensions, whilst bacteria ehave like unorganised suspensions to which a colloid of he first order has been added.—A. S.

THE SCHUNCK RESEARCH LABORATORY AT MANCHESTER.

The chemical research laboratory, including a library of chnical works and periodicals and a fine collection of emical specimens, relating more particularly to that partment of organic chemistry embracing the colouring atters, which the late Dr. Edward Schunck, F.R.S., queathed to the Owens College, and which has been ansferred from Kersal, Manchester, to the college ground, as formally opened on Friday, July 1st, by Dr. W. H. rkin, Sen., F.R.S. At the same time the extensions of e College laboratories connecting them with the Schunck boratory were declared open. The Vice - Chancellor Dr. Hopkinson) and Prof. H. B. Dixon, F.R.S., spoke of e distinction which Schunck gained by his researches, and the great value which his gift would be to the Manchester niversity.

In his address, Dr. Perkin briefly reviewed Dr. Schunck's rk, especially in connection with vegetable colouring tters. He remarked that, great as were the difficulties h which Dr. Schunck had to contend in his pioneer rk on the constituents of certain plants, the problems ch organic chemistry has still to solve, and especially se which deal with physiological chemistry, will be found offer still greater difficulty. The future progress of siological chemistry may be said to depend largely on acquirement of an accurate knowledge of the nature of ch, albumin, and their decomposition products. When estigating problems dealing with the constitution of ural products, it should always be borne in mind that ure not only builds up its complicated substances from simplest materials, but that all its operations are carried at ordinary temperatures and without the use of erful reagents.

medallion portrait of the late Dr. Schunck, which . Schunck has presented to the University, was unveiled her son, Mr. Charles Schunck, and was formally accepted r. E. J. Broadfield on behalf of the University Court.

New Books.

Radium, and other Radio-Active Elements. A popular account treated experimentally. By Leonard A. Levy and Herbert G. Willis. Percival Marshall and Co., 26-29, Poppin's Court, Fleet Street, London, E.C. 1904. Price 2*s.* 6*d.*

8vo volume, containing introduction, 97 pages of subject-matter, an appendix of eight pages, and a total of 26 illustrations. The leading subjects treated of are as follows :—I. Discovery of Radium ; its Extraction. II. The Radium Emanation. III. and IV. Physical Effects (Electrical and Magnetic). V. Chemical Effects. VI. Actions on Animal Life and Living Tissues. VII. Other Radio-active Elements. Appendix. Experimental Apparatus.

Subject List of Works on Electricity, Magnetism, and Electro-Technics in the Library of the Patent Office. [Pat. Office Library Series, No. 14 ; Bibliogr. Series, No. 11.] Darling and Son, Ltd., His Majesty's Stationery Office, 34-40, Bacon Street, London, E. Patent Office, 25, Southampton Buildings, Chancery Lane, London, W.C. 1904. Price 6*d.*

Die Farben-Photographie [Photographische Bibliothek, Bd. 19]: eine gemeinverständliche Darstellung der verschiedenen Verfahren, nebst Anleitung zu ihrer Ausführung. Von Dr. E. König. Gustav Schmidt's Verlag, Berlin. 1904. Price M. 2.50.

Small 8vo volume with coloured frontispiece, preface, introduction, and 87 pages of subject matter, containing two illustrations. The subjects treated of are the following.—Direct Methods of Colour Photography—1. Becquerel's Process. 2. Lippmann's Process. 3. The Bleaching-out Process. 4. Joly's Method. Indirect Methods of Colour Photography.—Section I.—The Three-Colour Printing, or Subtractive Method of Tricolour Photography. 1. Photographic Apparatus (Camera). 2. Light Filter. 3. Plates and Sensitisers. 4. Exposure and Development. 6. Finishing of Copies. Appendix. Two-Colour Photography. Section II.—The Additive Method of Tricolour Photography by Optical Synthesis. 1. Theoretical. 2. Guide in the Preparation of Partial Pictures. 3. Guide to Preparation of the Chromoscope.

Die Herstellung von Diapositiven [Photographische Bibliothek, Bd. 20], zu Projektionszwecken (Laternbildern), Fenstertransparenten und Stereoskopen. Von P. Hanneke. Gustav Schmidt's Verlag, Berlin. 1904. Price M. 2.50.

Small 8vo volume with preface, introduction, and 126 pages of subject-matter, containing 25 illustrations, and followed by an alphabetical index. The following are the subjects mainly treated of :—I. The Preparation of Diapositives on Chlorobrominated Silver Plates. II. Preparation of Enlarged or Reduced Diapositives. III. Diapositive on Silver bromide-gelatin Plates. IV. Diapositive on Collodion Plates. V. Diapositive on Albumin Plates. VI. Diapositive on Chloride of Silver Plates for Copying out. VII. Diapositive by the Pigment Process. VIII. Stereoscopic Diapositive. IX. Coloured Diapositive. X. Appendix.

Trade Report.

I.—GENERAL.

Canada ; Tariff Changes in ——.

Bd. of Trade J., June 23, 1904.

A memorandum (No. 1,284 B), issued by the Canadian Commissioner of Customs, gives in detail the tariff changes as set forth in the resolutions introduced by the Minister of Finance in the Canadian House of Commons on 7th June.

The resolutions, which are now in force (but which are still under discussion in the Canadian House of Commons), contain the following passages :—

1. Resolved, That it is expedient to amend "The Customs Tariff, 1897," to the following effect :—

Notwithstanding anything contained in Schedule D (which refers to the British preferential tariff), the maximum duty on the under-mentioned articles when imported under the British Preferential Tariff shall be as follows :—

	Rate of Duty.
Table ware of china, porcelain or other clay.....	15 % *ad val.*
Common and colourless window glass...........	7½ % ,,

Item 203 of Schedule A. shall be repealed and the following substituted therefor :—

203.	Plate glass not bevelled, in sheets or panes not exceeding 7 sq. ft. each, n.o.p.	10 % *ad val.*
203*a*.	Plate glass not bevelled, in sheets or panes exceeding 7 sq. ft. each, and not exceeding 25 sq. ft. each, n.o.p.	25 % ,,

Items 22, 151, 170, 171, 172, 173, 175, and 178 of Schedule A. shall be repealed and the following substituted :—

22.	Paraffin wax candles	25 % *ad val.*
151.	Paraffin wax.............................	25 % ,,
170.	Illuminating oils, composed wholly or in part of the products of petroleum, coal, shale, or lignite, costing more than 30 cents. per gall.	20 % ,,
171.	Lubricating oils, composed wholly or in part of petroleum, costing less than 25 cents. per gall.	2½ cents per gall.
172.	Crude petroleum, gas oils (other than benzine and gasoline), above 40° Beaumé gravity, at 60° temperature...............	1¾ cents per gall.
173.	Oils, coal, and kerosine distilled, purified or refined, naphtha and petroleum, and products of petroleum, n.e.s.	2½ cents per gall.
175.	Lubricating oils, n.e.s., and axle grease.....	20 % *ad val.*
178.	Vaseline, and all similar preparations of petroleum for toilet, medicinal, or other purposes	25 % ,,
	Molasses, the produce of any British country entitled to the benefits of the British Preferential Tariff, in the original package in which it was placed at the point of production, and not afterwards subjected to any process of treating or mixing; the package also to be free: Provided, however, that this shall not apply to molasses to be used for the purpose of distillation..............................	Free.

2. *Resolved*, that the following articles now dutiable shall be transferred to the free list :—

Whale oil soap	Free.
Plain, basic photographic paper, baryta coated, for albumenizing or sensitizing	,,
Hydrofluosilicic acid	,,
Glass cut to size for the manufacture of dry plates for photographic purposes, when imported by the manufacturers of such dry plates for use exclusively in the manufacture thereof in their own factories........................	,,
Ferment cultures to be used in butter-making..	,,
Quassia juice	,,
Crude petroleum, fuel and gas oils, 43° Beaumé gravity, or less, at 60° temperature, 0·8233 sp. gr.	,,

II.—FUEL, GAS, AND LIGHT.

CALCIUM CARBIDE INDUSTRY; PROSPECTS OF —— [IN GERMANY].

P. Wangemann. Chem. Ind., 1904, **27**, 318—322.

The consumption of carbide in Germany during 1904 will be, it is estimated, about 20,700 tons, whilst the production will be 13,300 tons, leaving 7,400 tons or about 35·7 per cent. of the total to be imported. In discussing the prospects of the carbide industry, attention is drawn to the new fields opened out for calcium carbide by the introduction of dissolved acetylene (see this J., 1901, 1196; 1903, 288), and of calcium cyanamide prepared from calcium carbide and atmospheric nitrogen (this J., 1903, 794, 809).
—A. S.

III.—TAR PRODUCTS, PETROLEUM, Etc.

PARAFFIN LIQUID AND "PARAFFINUM MOLLE": U.S. CUSTOMS DECISION.

April 26, 1904.

It was held, providing it could be shown that, in "paraffinum molle," ceresin was the component material of chief value, the merchandise was free of duty. The Board of General Appraisers, after thoroughly considering the question of value, decided that the paraffin liquid was composed entirely of petroleum, and, being produced from Russian petroleum, was subject to a countervailing duty equal to that imposed by Russia on imports of the same character from the United States; and, in the case of "paraffinum molle," since the mineral wax or ceresin was present only to the extent of one-fifth, the remaining four-fifths of paraffin liquid were sufficient to render the merchandise subject to the same countervailing duty. (Compare this J., 1903, 930.)—R. W. M.

MINERAL WAX: U.S. CUSTOMS DECISION.

May 17, 1904.

A waxy substance, called ozokerite, containing resins and pitch, was held to be dutiable at 20 per cent. *ad valorem* as a "manufactured article unenumerated."—R. W. M.

IV.—COLOURING MATTERS AND DYESTUFFS.

SULPHIDE DYESTUFFS: U.S. CUSTOMS DECISION.

April 21, 1904.

Sulphaniline Black, Sulphaniline Brown and Sulpho Black T G were decided to be dutiable at 30 per cent. *ad valorem* as "coal tar colors or dyes," under paragraph 15 of the present tariff. The claims of the importers for assessment of duty at 20 per cent. *ad valorem* under the same paragraph as "coal tar preparations," or at 25 per cent. *ad valorem* as "chemical compounds," under paragraph 3, were unsupported by evidence and overruled.—R. W. M.

TETRACHLOROPHTHALIC ACID: U.S. CUSTOMS DECISION.

April 22, 1904.

It was decided that tetrachlorophthalic acid was dutiable at 25 per cent. *ad valorem* as an "acid not otherwise provided for," under paragraph 1 of the present tariff. The claim for assessment of duty at 20 per cent. *ad valorem*, as a "preparation of coal tar" was overruled.—R. W. M.

LOGWOOD BLACK: U.S. CUSTOMS DECISION.

April 22, 1904.

Logwood Black was decided to be dutiable at ⅞ cent per lb. as "logwood extract," under paragraph 22 of the tariff. The assessment of duty at 30 per cent. *ad valorem* as a "colour" was overruled.—R. W. M.

V.—PREPARING, BLEACHING, Etc., TEXTILES, YARNS, AND FIBRES.

BLEACHER'S BLUE: U.S. CUSTOMS DECISION.

Duty was assessed on bleacher's blue at 30 per cent. *ad valorem* as a "coal tar color," under paragraph 15 of the present tariff. On appeal from a decision of the Board of General Appraisers, affirming the above assessment, the United States Circuit Court reversed the decision, and held that bleacher's blue was dutiable at 20 per cent. *ad valorem*, under the same paragraph as a "preparation of coal tar, not a color or dye."—R. W. M.

VII.—ACIDS, ALKALIS, Etc.

BARYTES: U.S. CUSTOMS DECISION.

April 25, 1904.

The Treasury Department holds that barytes separated by crushing and jigging from the accompanying worthless rock is dutiable at 75 cents per ton, as "barytes unmanufactured," and not at 5 dols. 25 cents per ton, as "manufactured barytes."—R. W. M.

MANGANESE BORATE: U.S. CUSTOMS DECISION.

May 9, 1904.

The United States Circuit Court of Appeals at Philadelphia decided that manganese borate used chiefly as a drier for varnish is dutiable at 25 per cent. *ad valorem* as a "chemical compound or salt," under paragraph 3 of the present tariff, and not at 3 or 4 cents per lb., under paragraph 11, according as the contents of anhydrous boric acid is above or below 36 per cent. The Court held that the article is not a borate material, but a product of the borate materials enumerated in paragraph 11.—R. W. M.

BORAX GLASS POWDER: U.S. CUSTOMS DECISION.

April 29, 1904.

Powdered borax glass, which on analysis was shown to contain 66·86 per cent. of anhydrous boric acid, was held to be dutiable at 5 cents per lb. as "borax," under paragraph 11 of the present tariff.—R. W. M.

COPPER ACETATE: U.S. CUSTOMS DECISION.

May 20, 1904.

Copper acetate was held to be dutiable at 25 per cent. *ad valorem* as a "chemical salt" under paragraph 3 of the present tariff. The claim that it was free as "verdigris or subacetate of copper" under paragraph 694 was overruled.
—R. W. M.

X.—METALLURGY.

OUTPUT OF CERTAIN MINERALS AND METALS IN THE WORLD IN 1902.

Bd. of Trade J., June 16, 1904.

The colonial and foreign section of the Mines and Quarries Report for the year 1902 contains a table showing the utput of certain minerals and metals (contained in or btained from ore raised) in the British Empire and in oreign countries during the year 1902. The following is brief summary of the table in question :—

—		United Kingdom.	British Colonies and Possessions.	Foreign Countries.	Total.
oal......	Met. tons	230,739,359	25,264,052	547,153,634	803,157,045
opper ...	,,	490	51,718	519,644	571,852
ine gold..	Kilos.	116	232,391	215,137	447,644
,, silver	,,	4,560	460,060	4,288,831	4,753,451
on	Met. tons	4,470,420	714,227	37,484,831	42,669,478
ead......	,,	17,988	25,124	759,835	802,947
troleum	,,	25	298,701	22,568,134	22,868,860
lt.......	,,	1,924,273	1,275,948	10,078,811	13,279,032
n.......	,,	4,462	51,496	37,483	93,441
nc......	,,	9,275	576	493,397	503,241

INES AND QUARRIES: GENERAL REPORT AND STATISTICS FOR 1903. PART I. DISTRICT STATISTICS. [CD. 2,115.] Price 6½*d*.

This return, which forms the first part of the General port on Mines and Quarries for 1903, contains statistics the number of persons employed, the output of minerals, d of accidents at mines and quarries in the United ngdom arranged according to the inspection districts. e total output of the undermentioned minerals in the ited Kingdom in 1903 as compared with 1902 was as lows :—

—	1902.	1903.
	Tons.	Tons.
1..............................	227,095,042	230,334,469
ys and shale..........................	15,304,136	16,198,021
ore..............................	13,426,217	13,715,645
estone (other than chalk)...........	12,172,851	12,222,971
eous rocks...........................	5,466,964	5,425,538
dstone..............................	5,483,130	5,409,502
lk..................................	4,395,673	4,469,974

MINES OF BRITISH COLUMBIA.

U.S. Cons. Reps., No. 1977, *June* 13, 1904.

From the annual report of the Minister of Mines of British Columbia for 1903, just issued, it appears that the total production of the mines of the Province show a very slight increase over the year previous, being of the value of 17,495,954 dols., compared with 17,486,550 dols. in 1902. Excepting copper and coke, which show an increase, there is a falling off in all products, as shown by the following table :—

Description.		1902.		1903.	
		Quantity.	Value.	Quantity.	Value.
Gold :—			Dolls.		Dolls.
Placer	Ozs.	53,657	1,073,140	53,021	1,060,420
Lode.......	,,	236,491	4,888,269	232,831	4,812,616
Silver........	,,	3,917,917	1,941,328	2,996,204	1,521,472
Copper.......	Lb.	29,636,057	3,446,673	34,359,921	4,547,535
Lead.........	,,	22,536,381	824,832	18,089,283	689,744
Coal	Tons	1,397,394	4,192,182	1,168,194	3,504,582
Coke.........	,,	128,015	640,075	165,543	827,715
Other minerals		..	480,051	..	531,870
Total		..	17,486,550	..	17,495,954

ALLOYS: U.S. CUSTOMS DECISION.

May 20, 1904.

An alloy consisting of iron, manganese, and aluminium, and used for hardening bronze, was held to be dutiable at 8 cents per lb. under paragraph 172 as an "alloy in which aluminium is the component material of chief value." Another alloy, consisting of copper and tin, used to manufacture anti-friction bearings, was decided to be dutiable at 20 per cent. *ad valorem* as a "metal unwrought," under paragraph 183.—R. W. M.

XII.—FATS, FATTY OILS, Etc.

SPERMATINE: U.S. CUSTOMS DECISION.

May 5, 1904.

A waxy substance, which was stated to be obtained from brown coal in central Germany by extraction with benzine (petroleum spirit) and subsequent distillation and refining was held to be free of duty as "mineral wax," under paragraph 695 of the present tariff. The assessment of duty at 20 per cent. *ad valorem* as a "manufactured article unenumerated," was overruled.—R. W. M.

ADEPS LANÆ CUM AQUA: U.S. CUSTOMS DECISION.

This substance was decided to be dutiable at 25 per cent. *ad valorem* as a "medicinal preparation, not alcoholic." The claim for assessment of duty at ½ cent per lb. as "wool grease," was overruled, on the ground that it was not the wool grease of commerce, and on the authority of a decision of the United States Circuit Court of Appeals.—R. W. M.

XIII. C.—INDIA-RUBBER, Etc.

RUBBER; EXPORT TAX ON —— IN BRAZIL.

U.S. Cons. Rep., No. 1977, *June* 13, 1904.

Until lately the State of Amazonas has imposed an export tax on all rubber coming into its jurisdiction from up the Amazon river. This export tax has now been reduced from 20 per cent. of the declared value to 15 per cent., and the owner or purchaser of rubber grown outside of the state of Amazonas is at liberty to ship his rubber from Manaos or Para, as he pleases.

The amount of rubber affected by the new regulation is estimated at not less than 7,000 tons. Of this quantity, it is believed that 5,000 tons will come to Para.

XVI.—SUGAR, STARCH, Etc.

CHARCOAL: U.S. CUSTOMS DECISION.

May 4, 1904.

Charcoal, used for decolorising purposes, was held to be dutiable at 20 per cent. *ad valorem*, as a "manufactured article unenumerated." The assessment of duty at 35 per cent. *ad valorem*, as an "article composed of carbon," was overruled.—R. W. M.

XVII.—BREWING, WINES, SPIRITS, Etc.

Duty-Free Spirit Question in Russia.

Z. Spiritusind., 1904, **27**, 249.

The reported Russian law to the effect that the use of duty-free technical spirit would be given a three years' trial, is confirmed, the matter being now in the hands of the Minister of Finance. The Minister called together in February, at St. Petersburg, a Congress of Distillers who were to make themselves individually conversant with the progress in the use of technical spirit, and express their opinions as to the best method of organisation for the sale of the spirit. The Minister proposed the formation of co-operative associations of distillers for the sale of technical spirit and for promoting the use of such spirit. These associations would be responsible for the observance of the strict regulations drawn up by the Minister for the sale and control of the spirit. The Congress declared themselves generally in agreement with the proposals of the Minister. They considered it desirable that each association of distillers should be limited to a definite radius; that the associations should combine to form unions and that periodic "union congresses" be held; and finally that a permanent board with full powers should be formed in St. Petersburg. The responsibility for the observance of the regulations as to the sale of the spirit could only be undertaken by the associations, if they were granted exclusive rights with regard to the sale of technical spirit. The Congress elected a committee for the defence of the interests of the spirit distillers, and this committee was charged with the drawing up of rules for the new associations to be formed for the sale of technical spirit. They also resolved to petition the Government:—(1) to remit the customs tax on engines, burners, lamps, &c., designed for the use of denatured spirit, provided similar goods are not manufactured in Russia; (2) to reduce the tariff for the transport of denatured spirit; and (3) to discontinue the inspection and control of manufacture in the case of agricultural distilleries and to introduce a scheme of obligatory mutual insurance of such distilleries. The Minister is continuing his efforts to discover a suitable denaturing process. Apart from the prize of 50,000 roubles (see this J., 1903, 1109), the professors of the Kiew Polytechnicum are experimenting with ketones. The Minister of Agriculture is also interesting himself in the use of technical spirit, and in conjunction with the Imperial Russian Technical Society, has resolved to organise in the course of the year an exhibition in St. Petersburg on the lines of the one held in Vienna.

—A. S.

Alcohol Tax in U.S.A.

On May 23, 1904, the United States Circuit Court decided that the local taxes on alcohol in France, known as the *octroi*, or *droit de ville*, which are not collected on merchandise exported, are not part of the dutiable value of merchandise imported into the United States.—R. W. M.

XX.—FINE CHEMICALS, Etc.

Saccharin in Glycerin: U.S. Customs Decision.

May 7, 1904.

A preparation consisting of 20 per cent. of saccharin and 80 per cent. of refined glycerin was decided to be dutiable at 1 dol. 50 c. per lb. and 10 per cent. *ad valorem* as "saccharin" under paragraph 211 of the present tariff, on the ground that the saccharin was the component material of chief value.—R. W. M.

Chrysarobin: U.S. Customs Decision.

June 1, 1904.

It was decided that chrysarobin, extracted from Goa powder, is dutiable at 25 per cent. *ad valorem*, as a "medicinal preparation."—R. W. M.

Opium Powdered: U.S. Customs Decision.

May 6, 1904.

It was decided that powdered opium was dutiable a "opium crude," at 1 dol. per lb. under paragraph 43 of th present tariff. The claims of the importer that it wa dutiable at $\frac{1}{4}$ cent per lb. and 10 per cent. *ad valorem* under paragraph 20 as a "drug, advanced in value o condition," or at 25 per cent. *ad valorem* as a "medicina preparation," under paragraph 68, were overruled.

—R. W. M.

Heroine and Heroine Hydrochloride: U.S. Custom Decision.

April 22, 1904.

Heroine and its hydrochloride were decided not to be tru salts or alkaloids of opium, but new chemical bodies derive from morphine. For this reason the Board of Genera Appraisers reversed the assessment of duty at 1 dol. pe ounce, as "salts or alkaloids of opium," under paragrap 43, and sustained the claim of the importers that bot were dutiable at 25 per cent. *ad valorem*, as "medicina preparations in the preparation of which alcohol is used.

—R. W. M.

Synthetic Oils: U.S. Customs Decision.

June 2, 1904.

Synthetic oils of jasmine, "amber," bergamot, and nerol were held to be free of duty under their respective name as provided for in paragraph 626 of the present tariff.

—R. W. M.

Orange Flower Water: U.S. Customs Decision.

April 20, 1904.

In accordance with a decision of the United State Circuit Court, the Board of General Appraisers held tha orange flower water is dutiable at 25 per cent. *ad valore* as a "medicinal preparation, not alcoholic," unde paragraph 68 of the present tariff.—R. W. M.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," an [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, a asterisk is affixed. The dates given are (i) in the case of Applic tions for Patents, the dates of application, and (ii) in the case Complete Specifications Accepted, those of the Official Journa in which acceptances of the Complete Specifications are advertise

Complete Specifications thus advertised as accepted are open inspection at the Patent Office immediately, and to oppositi within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 13,481. Sulman and Kirkpatrick-Picard. Remov of precipitates from liquids. June 14.

„ 13,638. Dewar. Method of absorbing gases, a the application thereof to the production of hi vacua and the separation of gases. June 16.

„ 13,765. Johnson. Apparatus for separating co slack, ores, minerals, or substances of differe specific gravity. June 17.

„ 13,892. Gayley. Appliances for extracting mo ture from air and feeding such air to bl furnaces or converters.* June 20.

„ 14,042. Parsons. Production of high vac June 21.

„ 14,067 Kaehl. Centrifugal separating apparat [Ger. Appl., July 31, 1903.]* June 21.

„ 14,337. Bigàllet, Olivo, and Maurin. Tuyères melting furnaces or cupolas, and the method charging such furnaces. June 25.

[A.] 14,621. Bonnet. Apparatus for mixing, emulsifying, and homogenising liquids.* [Fr. Appl., July 1, 1903.] June 29.

[C.S.] 17,348 (1903). Holt. Means of softening and filtering water for steam boilers, economisers, bleaching, dyeing, &c., and apparatus therefor. July 6.

„ 18,869 (1903). Gerhardt. Distillation apparatus. June 29.

„ 26,213 (1903). Roney. Furnaces. June 22.

„ 26,471 (1903). Strehlenert. Centrifugal extraction apparatus. July 6.

II.—FUEL, GAS, AND LIGHT.

[A.] 13,316. Everitt. Method of extracting tar and other impurities from crude illuminating, heating, or power gases. June 13.

„ 13,367. Payeus and Neuman. Generators for the manufacture of generator gas, water gas, &c. June 13.

„ 13,377. Roux, Gonin, and Thompson. Purification of coal gas with the resulting bye products. June 13.

„ 13,517. Dunlop and Kynoch, Ltd. Gas-producing plant. June 15.

„ 13,563. Linden. Gas generators. June 15.

„ 13,576. Hartridge. Manufacture of artificial fuel. June 15.

„ 13,647. Woods. Manufacture of incandescent mantles for gas lamps. June 16.

„ 13,822. Whittaker, and C. Whittaker and Co. (1900), Ltd. Manufacture of peat fuel, and apparatus therefor. June 18.

„ 13,877. Hatton. Gas producers. June 20.

„ 14,157. Armstrong. Manufacture of coke, and furnaces, ovens, and apparatus therefor. June 22.

„ 14,196. British Thomson - Houston Co. (General Electric Co.). Electrodes for arc lighting. June 23.

„ 14,219. Höpfner. Manufacture of artificial fuel, and apparatus therefor. June 23.

„ 14,288. Valeriela, Sepulchre, and Moeller. Manufacture of incandescent mantles. June 25.

„ 14,333. Elworthy and Williamson. Manufacture of gas for illuminating, heating, and power purposes. June 25.

, 14,355. Gersabeck. Process for generating air-gas.* June 25.

, 14,383. Poetter. Gas producers.* June 25.

, 14,389. Gerdes. Manufacture of fuel blocks or briquettes. June 25.

, 14,445. Boult (Lomax). Method of purifying illuminating gas.* June 27.

14,500. Carter and Fowler. Method of chemically treating arc-lamp carbons, whereby all wastage is stopped on same while lamp is burning, &c., &c. June 28.

14,563. Warren and Skinner. Apparatus for generating combustible gas from liquid hydrocarbons. June 28.

14,718. Carpenter. Apparatus for use in the gasification of coal or other materials in the production of illuminating and heating gas.* June 30.

[C.] 13,763 (1903). Crossley and Rigby. Regulation of gas producers. June 22.

13,764 (1903). Crossley and Rigby. Gas producers. June 22.

14,014 (1903). Cory. Artificial fuel. June 29.

14,663 (1903). International Oxy-generator Syndicate, Ltd., and Rosenberg. Oxy-hydrogen combustion apparatus. July 6.

[C.S.] 17,103 (1903). Timmis. Means for getting more perfect combustion of fuel in the fire-chambers of boilers, and also for the prevention of smoke and sparks. July 6.

„ 17,215 (1903). Westinghouse (Gow). Method of and apparatus for the manufacture of gas. July 6.

„ 22,451 (1903). Evered and Co. (Weiblen). Incandescent mantles. June 29.

„ 8311 (1904). Kurzwernhart. Siemens regenerative furnaces. June 29.

„ 8325 (1904). Bühlmann. Process of manufacturing incandescent mantles. June 22.

„ 12,231 (1904). McLean and Paterson. Treatment of peat. July 6.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 14,417. Paterson. Process for recovering phenol from carbolic solutions. June 27.

[C.S.] 13,473 (1903). Thompson (Ges. z. Verwertung der Boleg'schen Wasserlöslichen Mineralöle und Kohlenwasserstoffe). Production of lubricants. June 22.

„ 17,973 (1903). Aminaff. Dry distillation of organic substances. June 29.

„ 2102 (1904). Coulson. Method of solidifying tar. June 29.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 13,941. Lake (Oehler). Manufacture of mordant dyes.* June 20.

„ 13,956. Johuson (Badische Anilin und Soda Fabrik). Manufacture of hydroxethylaniline and derivatives thereof. June 20.

„ 14,289. Vidal and Juuius. Reducing nitrosed or nitrated aromatic compounds whereby iron oxides are produced which may be used as oil colours, &c. June 25.

„ 14,506. Heys (Sansone). Production of indigo derivatives and sulphur colours, and their use in printing and dyeing. June 28.

„ 14,566. Lorrain (Bell). Dye-compound.* June 28.

„ 14,634. Newton (F. Bayer and Co.). Manufacture and production of new colour-lakes. June 29.

[C.S.] 14,768 (1903). Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of azo dyestuffs. June 22.

„ 17,792 (1903). Ransford (Cassella and Co.). Manufacture of a new acetdiamidophenolsulphoacid and of colouring matters therefrom. June 22.

„ 18,283 (1903). Imray (Meister, Lucius und Brüning). Manufacture of a tetrazo-phenolsulphonic acid. July 6.

„ 10,678 (1904). Lake (Oehler). Halogenised nitrocompounds. July 6.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 13,302. O'Brien (L'Huillier). Dyeing, and apparatus therefor.* June 13.

„ 13,382. Long and Kay. Cleaning and permanently restoring colour in fabrics. June 14.

„ 13,484. Dolder. Process for the dyeing of cotton and the like in the form of cops, spools, &c., with alizarin red. June 14.

„ 13,485. Thompson (Wickels Metallpapierwerke). Method of producing a silky appearance on cotton and other fabrics. June 14.

[A.] 13,773. De Keukelaere. Process for treating flax, jute, and similar fibres for the purpose of bleaching. June 17.

„ 13,867. Muntadas y Rovira. Process and apparatus for the bleaching of fabric and yarn. [Ger. Appl., June 18, 1903.]* June 18.

„ 13,879. Bailey and Casson. Manufacture of artificial silk threads. June 20.

„ 13,895. Kemp (Morley). Dyeing machine for dyeing raw cotton, loose wool or silk, rags, mungo, yarns of all kinds, and slubbing. June 20.

„ 14,182. Greenwood. Mercerising and lustreing textile fibres and fabrics. June 23.

„ 14,202. Roberts and Mitchell. Extracting or carbonising in all classes of pieces of cloth or yarn made from änimal fibre. June 23.

„ 14,869. McWhirter. *See under* IX.

[C.S.] 13,556 (1903). Reid. Method and apparatus for treating spun fibres with liquids for dyeing, bleaching, and other purposes. June 22.

„ 14,191 (1903). Berger. Apparatus for the treatment of wool slivers. June 29.

„ 14,472 (1903). Burdick and Pervilhac. Process for colouring, decorating, or printing textiles, paper, &c. June 29.

„ 17,616 (1903). Hoyle and Barker. Production of bleached yarn, and appliances therefor. June 22.

„ 9311 (1904). Stöhr. Apparatus for dyeing hanks of yarn. June 29.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 13,565. Castiglioni and Calastretti. Process for reducing sulphates of the alkaline earths and of the alkalies to sulphides, and for reducing metallic oxides to metals. [Italian Appl., June 20, 1903.]* June 15.

„ 13,827. Grossmann. Method of obtaining ferrocyanide and ammonia compounds from crude coal-gas. June 18.

„ 13,875. Levi. Production of alumina and alkali from alkaline silicates of alumina, such as leucite. June 18.

„ 13,955. Johnson (Badische Anilin und Soda Fabrik). Manufacture of reducing agents. June 20.

„ 13,981. Behrens and Behrens. Processes for manufacturing carbonic acid.* June 20.

„ 14,431. Pictet. Apparatus for the separation of oxygen and nitrogen from air. [French Appl., June 27, 1903.]* June 27.

„ 14,464. Lake (Dr. Alb. R. W. Brand and Co.). Recovery of carbonic acid from waste gases. June 27.

„ 14,848. Artigue. Apparatus for the commercial manufacture of oxygen. [French Appl., July 6, 1903.]* July 1.

„ 14,859. Hargreaves. *See under* XI.

[C.S.] 14,213 (1903). Price. Apparatus for the separation of oxygen and nitrogen from air. July 6.

„ 18,594 (1903). Newton (F. Bayer and Co.). Manufacture and production of nitrous anhydride and nitrites. July 6.

„ 20,069 (1903). Davis. Manufacture of alkaline prussiates. June 29.

„ 26,007 (1903). Brothers. Manufacture of crystalline gypsum for filling purposes. June 29.

„ 28,400 (1903). Hunt. *See under* XI.

„ 28,682 (1903). Soc. pour l'Exploitation des Procédés Georges Claude. Process and apparatus for separating gaseous mixtures, applicable for the separation of oxygen and nitrogen from liquid air. June 22.

„ 10,538 (1904). Alsop. Method of generating a gaseous medium from air. June 22.

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[C.S.] 18,255 (1903). Carolan (General Electric Co.). Methods of sealing metal into glass or other vitreous material. June 29.

„ 18,290 (1903). Dansette. Ceramic tiles, plates, &c. June 29.

„ 28,790 (1903). Foureault. Apparatus for manufacturing glass sheets or plates. June 29.

„ 10,649 (1904). Dolley and Belknap. Ornamental glass. June 22.

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„ 14,138. Boult (Buffard). Luting or cemen June 22.

„ 14,183. Conti-Vecchi. Process of and means fo impregnating wood with antiseptic and lik substances or liquids.* June 23.

„ 14,297. Rynd. Preparation of pipeclay. June 2

„ 14,869. McWhirter. Apparatus for heating, steaming, and chemically treating wood and fabrics different kinds, and for drying such article July 2.

[C.S.] 14,366 (1903). Wirtz. Process for obtaining a sul stitute for emery and like substances from sla June 29.

„ 16,412 (1903). Winstanley. Process of and m chines for preparing lime and Portland cemen June 22.

„ 18,064 (1903). Williams. Manufacture of ceme for use in repairing retorts, &c. June 29.

„ 7343 (1904). Neusch (Westdeuts Thomas-phosph Werke). Asphalt composition for floors and like. June 22.

„ 7736 (1904). Spatz. Manufacture of firepro stone or stoneware and mortar. June 29.

„ 10,040 (1904). Devillers. Process for the manufa ture of slabs or sheets imitating marble. July

„ 11,218 (1904). Wulf. Manufacture of a floor cove ing. June 22.

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[A.] 13,328. Pelletier and Semprun. Solder for alu nium or its alloys.* June 13.

„ 13,462. Fris. Treatment of earths containing g or other precious metals or gems. June 14.

„ 13,565. Castiglioni and Calastretti. *See under* V

„ 13,578. Elmore. Process for separating cert constituents of subdivided ores, &c., and ap ratus therefor. June 15.

„ 13,579. Cowper Coles and Co., Ltd., and Cowp Coles. Deposition of metals or metallic co pounds on metals or metallic articles. June 1

„ 13,648. Woods. Utilisation and separation refuse metals. June 16.

„ 13,730. Lewis. Metallic alloys. June 17.

„ 13,744. Flewin. Gold extractor and concentra June 17.

„ 14,213. Simpkin and Ballantine. Manufacture briquettes. June 23.

„ 14,214. Simpkin and Ballantine. Means for phosphorising iron ores and concentrates. June

„ 14,302. Cameron. Process for the production oxydulated iron. June 25.

[C.S.] 13,454 (1903). Huntington and Heberlein. Pro for treating sulphide ores or compounds pre ratory to smelting. June 22.

„ 14,013 (1903). Cory. Treatment of ores. June

[C.S.] 17,445 (1903). Rouse and Cohn. Method of converting into briquettes or lumps, iron sand, whether natural or prepared by reducing iron ore or iron wastes. June 22.

„ 18,763 (1903). Savelsberg, Wannschaff, and Allgem. Elektro-Metallurgische Ges. Extraction of heavy metals by means of chlorine. June 22.

„ 19,366 (1903). Abel (Siemens und Halske Akt. Ges.). Reducing metallic compounds and fusing metals, in particular nickel and iron, in the electric furnace. June 29.

„ 7981 (1904). Mercadier. Manufacture of spongy porous lead and of articles therefrom. June 22.

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[A.] 13,579. Cowper-Coles. *See under* X.

„ 13,759. Borchers and Hupperts. Production of titanium from its oxygen compounds electrolytically. [German Appl., June 18, 1903.]* June 17.

„ 13,952. Imray (Soc. Anon. d'Études Electrochimiques). Apparatus operating with automatic regulation for submitting gases and vapours to the action of the electric arc. June 20.

„ 14,058. Potthoff. Solutions for the electro-deposition of metal.* June 21.

„ 14,059. Potthoff. Apparatus for electro-galvanising.* June 21.

„ 14,128. Leitner. Preliminary treatment for accumulator plates. June 22.

„ 14,147. Cowper-Coles and The Metals Corporation, Ltd. The electrolytic deposition of metals. June 22.

„ 14,504. Hargreaves. Electrolytic cells. June 28.

„ 14,859. Hargreaves. Manufacture of carbon. July 2.

[C.S.] 17,885 (1903). Wood-Smith. Apparatus for ozonising air and other gases. June 22.

„ 19,366 (1903). Abel (Siemens und Halske Akt. Ges.). *See under* X.

„ 28,400 (1903). Hunt. Process for the production of hydroxides and oxides of metals by electrolysis. June 22.

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[A.] 13,451. Zimmermann and Stöhr. Manufacture of a floating soap.* June 14.

„ 13,529. Smith. Treatment and refining of oils and fatty substances. June 15.

„ 13,983. Stockhausen. Compounds of sulphonated oils and fats, and the method of producing same. June 20.

„ 14,482. Wheelwright and Fiske Apparatus for cooking garbage and offal, and removing the oil therefrom.* June 27.

„ 14,483. Wheelwright and Fiske. Apparatus for cooking garbage or offal, and removing the oil therefrom.* June 27.

„ 14,709. Wheelwright and Fiske. Apparatus for removing oil or grease from garbage and offal.* June 30.

, 14,808. Mitchell. Manufacture of soap. July 1.

S.] 15,457 (1903). Macalpine. Appliance for use in refining oils. June 29.

, 4867 (1904). Hearson (Frank and Ziegler). Process for the extraction of fat or wax like substances from hydrous materials. June 22.

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[A.] 13,923. Lekeu and Tonglet. Paint, and the manufacture thereof.* June 20.

„ 14,289. Vidal and Junius. *See under* IV.

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[A.] 14,130. Southworth. Process for treating raw or partly dressed hides. June 22.

„ 14,203. Castet. Process and apparatus for the extraction of tannin at a low temperature and at a low pressure. June 23.

[C.S.] 11,094 (1904). Lewis. Manufacturing soluble albumen from milk. June 22.

XV.—MANURES, ETC.

[A.] 13,361. Mathesius. Process of manufacturing an artificial manure. [German Appl., June 13. 1903.]* June 13.

„ 13,664. Hammerschlag. Manufacture of artificial manures or fertilisers. June 16.

„ 13,842. Meusel. Manufacture of fertilisers and cattle foods.* June 18.

XVI.—SUGAR, STARCH, GUM, ETC.

[A.] 13,833. Stein and Loewenthal. Manufacture of sugar and other food for diabetics. June 18.

„ 14,205. Lichtenstein. Manufacture of caramel or caramel solution. June 23.

[C.S.] 19,499 (1903). Calico Printers' Assoc., Browing, and Barlow. Production of soluble starch or dextrin. June 29.

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[A.] 14,028. Schneible. Art of brewing.* June 21.

„ 14,382. Hunt. Maturing and improving the aroma of raw whiskey and other spirits and also certain wines. June 25.

„ 14,472. Moberts. Manufacture of beer. June 27.

„ 14,827. Hunt. Treatment of whiskey and other spirits. July 1.

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„ 13,715. Hutmaker. Milk foods. June 17.

„ 13,833. Stein and Loewenthal. *See under* XVI.

„ 14,010. Lehman. Process for humanising cows' milk and condensing it to a dry state. June 21.

„ 14,588. Beadle and Stevens. Manufacture of foodstuffs. June 29.

[C.S.] 5102 (1904). von Dalfsen. Production of an article of food from sweet cassava. June 22.

„ 11,094 (1904). Lewis. *See under* XIV.

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[A.] 13,436. Vial. Water clarification. June 14.

„ 13,588. Henderson. Treatment of sewage. June 15.

[A.] 14,003. Schweitzer. Apparatus for treating sewage. June 21.
,, 14,452. Kloeters. Disinfection. June 27.
,, 14,482. Wheelwright and Fiske. *See under* XII.
,, 14,483. Wheelwright and Fiske. *See under* XII.
,, 14,484. Wheelwright and Fiske. Removing liquids from solids, applicable for the treatment of garbage, &c.* June 27.
,, 14,709. Wheelwright and Fiske. *See under* XII.
[C.S.] 18,569 (1903). Fidler. Method of and apparatus for removing sludge, &c. from settling tanks. July 6.
,, 18,570 (1903). Fidler. Settling or precipitating tanks. July 6.
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[A.] 14,447. Hennessen and Spix. Process of manufacturing figured glazed paper.* June 27.
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,, 16,605 (1903). Stearn and Topham. Apparatus for pumping and controlling the passage of liquids or semi-liquids, and more especially of solutions of cellulose, in the manufacture of filaments. July 6.

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,, 14,758 (1903). Bouveault and Blanc. Manufacture of alcohols and alcohol derivatives applicable as perfumes, flavourings, &c., and of primary alcohols generally. June 22.
,, 18,245 (1903). Newton (F. Bayer and Co.). Manufacture of a pharmaceutical compound. June 22.

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[C.S.] 18,370 (1903). Bloxam (Neue Photographische Ges.). Reproduction of pictures or the like by aid of catalysis. June 22.

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[A.] 13,562. Moller. Manufacture of nitro-glycerine. June 15.
,, 14,480. Ceipek. Explosives. June 27.
[C.S.] 14,825 (1903). Lake (Alf. Nobel and Co.). Explosives. July 6.
,, 12,238 (1904). Reine. Means for igniting fuses. July 6.

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G. J. Ward.
J. White.

Hon. Treasurer: S. J. Pentecost.

Hon. Local Secretary:
S. R. Trotman, King's Walk Chambers, Parliament Street, Nottingham.

The following takes office in Sept. next:—*Committee:* J. Goldn

Scottish Section.

Chairman: *T. L. Patterson.*

Vice-Chairman: *D. J. Playfair.*

Committee:

H. Bumby.
D. B. Dott.
Thos. Ewan.
J. Arnold Fleming.
W. Frew.
G. H. Gemmell.
Jas. Hendrick.
Jas. Hope.
H. Ingle.
D. S. Jerdan.
W. G. Johnston.
J. Falconer King.
J. G. F. Lowson.
J. S. Macarthur.
J. McCulloch.
M. A. Parker.

Hon. Secretary and Treasurer:
Thomas Gray, c/o Gourlay and Deas, 180, Hope Street, Glasgow

The following take office in Sept. next:—*Chairman:* R. Thomson. *Vice-Chairman:* J. S. Macarthur. *Committee:* W. Curphey, L. Dobbin, Robt. Hamilton, T. L. Patterson, and D Playfair.

Sydney, N.S.W., Section.

Chairman: A. Liversidge.

Committee:

W. A. Dixon.
J. F. Elliott.
F. B. Guthrie.
L. Meggitt.
J. Morison.
A. A. Ramsay.
J. A. Schofield.
R. Greig Smith.
H. G. Smith.
T. Steel.

Hon. Local Secretary:
T. U. Walton, Colonial Sugar Co., O'Connell Street, Sydney, N.S

Yorkshire Section.

Chairman: *Jas. E. Bedford.*

Vice-Chairman: G. W. Slatter.

Committee:

C. S. Bedford.
E. A. Brotherton.
John W. Cobb.
W. M. Gardner.
A. J. Murphy.
H. R. Procter.
F. W. Richardson
Geo. Ward.
H. A. Watson
Thorp Whitaker
J. B. Wilkinson

Hon. Local Secretary and Treasurer:
T. Fairley, 17, East Parade, Leeds.

The following take office in Sept. next:—*Chairman:* H. Procter. *Committee:* W. Ackroyd, J. E. Bedford, F. Bran
B. A. Burrell, and A. Smithells.

N.B.—The names in *italics* are those of members of Committee who retire from their respective offices at the end of the current sess

Notices.

ANNUAL GENERAL MEETING, NEW YORK, 1904.

The Annual General Meeting will be held in New York City on Thursday, Sept. 8th, and following days. Members who propose to attend the meeting are requested to inform he General Secretary, as soon as possible, by what steamer hey will travel. The principal boats will be met on arrival t New York by a representative of the Reception Committee, who will escort the guests to the Hotel Seville, Iadison Avenue and 29th Street, which will be the ociety's Headquarters in New York. A similar system ill be observed at all the other cities visited by the special rain. A revised programme appeared in the March 31st ssue.

In accordance with the provisions of Rule 18 of the ye-laws, notice is hereby given that those members whose ames are printed in *italics* in the list of Council will retire om their respective offices at the forthcoming Annual leeting.

Mr. Wm. H. Nichols has been nominated to the office of resident under Rule 8; Dr. Edw. Divers, Prof. W. R. aton Hodgkinson, Mr. Max Muspratt, and Mr. T. J. arker have been nominated Vice-Presidents under ule 8; and Sir Wm. Ramsay has been nominated a Vice-resident under Rule 11.

The Hon. Treasurer and Hon. Foreign Secretary have een nominated for re-election to their respective offices.

ST. LOUIS EXHIBITION.

Copies of the Catalogue of the British Chemical Exhibits the St. Louis Exhibition, with descriptive articles by perts, may be obtained by members on application at e office of the Royal Commission, 47, Victoria Street, estminster, price 1*s*. each.

TAX-FREE ALCOHOL.

The following resolution, passed by the Chemical Section the London Chamber of Commerce and approved by e Council of the Chamber, has been endorsed by the uncil of this Society:—"That the Chancellor of the chequer be urged to appoint a departmental committee, luding recognised commercial and scientific representa-es, to examine and report upon the best method of viding untaxed alcohol for manufacturing and other rposes, such as power, heating, and lighting."

COMMUNICATIONS.

Authors of communications read before the Society, or of its Local Sections, are requested to take notice that ler Rule 43 of the Bye laws the Society has the right of ority of publication for three months of all such papers. ringement of this Bye-law renders papers liable to be cted by the Publication Committee, or ordered to be tracted for the Journal, in which case no reprints can urnished to the author.

List of Members Elected

22nd JULY 1904.

deis, R., Aüssig, Austria, Chemical Manufacturer.

l, Prof. Hubert C., Laboratory of Medical Chemistry, University of Minnesota, Minneapolis, Minn., U.S.A., Chemist (State Board of Health).

brough, Col. John, Blanefield, Stirlingshire.

Clarke, A. R., 613–617, Eastern Avenue, Toronto, Canada, Leather Manufacturer.

Danker, Dan. J., 247, Atlantic Avenue, Boston, Mass., U.S.A., Dyestuff and Chemical Manufacturer.

Ermen, Walter F. A., 11, Park Road, Pendleton, Lancashire, Analytical Chemist.

Gyr, Dr. K. H., c/o Messrs. Joseph Fison and Co., Ltd., Ipswich, Analytical Chemist.

Hamilton, E. H., Anaconda Copper Mining Co., Anaconda, Montana, U.S.A., Assistant Superintendent

Holloway, E. G., 447, Belle Plain Avenue, Chicago, Ill., U.S.A., Chemist.

Hooker, A. H., c/o Heath and Milligan Manufacturing Co., 170, Randolph Street, Chicago, Ill., U.S.A., Manufacturing Chemist.

Kaye, Thomas, Westerfield, Perth, Scotland, Analytical Chemist.

Litter, Hans, Farbenchemisches Laboratorium der Kgl. Technischen Hochschule, Dresden, Germany, Chemist.

Liverseege, J. F., Council House, Birmingham, Public Analyst.

McKenna, A. G., 506, Hawkins Avenue, Braddock, Pa., U.S.A., Metallurgical Chemist.

Marschall, Adolf J., Little Falls, N.Y., U.S.A., Chemist.

Mighill, Thos. A., 127, Purchase Street, Boston, Mass., U.S.A., Chemist.

Rostosky, Dr. Leopold, Tiergartenstrasse 28, Dresden Alt, Saxony, Chemist.

Shedden, Frank, 5, Belvidere Road, Walsall, Science Master.

Southerden, Frank, 75, Barry Road, Dulwich, S.E., Teacher of Chemistry.

Wackenreuter, A.G., 134–136, Kinzie Street, Chicago, Ill., U.S.A., Colour Manufacturer.

Wedekind, Rud., Uerdingen a/Rhein, Germany, Manufacturer of Alizarin and Bichromates.

Whittier, Chas. T., 322, Warren Street, Jersey City, N.J., U.S.A., Manager.

Wünsche, Fritz, Reichenbachstrasse 25 p., Dresden-Altst., Germany, Chemist.

Zimmele, H. B., 621, Main Street, Niagara Falls, N.Y., U.S.A., Technical Chemist.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

Adgate, M., l/o Syracuse; Naugatuck, Conn., U.S.A.

Arnott, G. W. Campbell, l/o King Street East; 114, Victoria Street, Toronto, Canada.

Bloxam, W. Popplewell, l/o India; 73, Walpole Road, Boscombe, Hants.

Boyes, Herbert J. S.; Journals to Alameda Barão de Piracicala, Sao Paulo, Brazil.

Cayvan, L. L., l/o Hôtel Normandie; 19, West 17th Street, New York City, U.S.A.

Clapperton, Jas., jun., l/o Glasgow; retain Journals.

Clayton, R. H., l/o Cheetham Hill; Woodleigh, Blackfield Lane, Kersal, Manchester.

Crowther, J.; all communications to South Australian School of Mines, Adelaide, South Australia.

Fawcett, J. H., l/o Italy; c/o Bank of Australasia, 4, Threadneedle Street, E.C.

Filcock, P., l/o Cumberland House; Sunny Bank, Prestbury Road, Macclesfield.

Gibb, Thos., l/o Mount Perry; Wilford, Doraoch Terrace, Brisbane, Queensland.

Granger, Dr. J. Darnell, l/o Acton; 25, All Saints' Street, Nottingham.

Hall, Wm. F. (of Selukwe); retain Journals.

Harvey, C., l/o Manor Park; 17, Alloa Road, Goodmayes, Essex.

Hewitt, A. H. (of Hong Kong); Journals to Springvale, near Gurnard, Isle of Wight.

Hicks, Edwin F., l/o New York; c/o P. Blakiston's Son and Co., 1012, Walnut Street, Philadelphia, Pa., U.S.A.

Jackson, Edw., l/o Grove Avenue; Ravens Cliff, Oxford Road, Moseley, Birmingham.

Jessop, L. V., l/o Victoria Park; Holmlea, Woodville Road, Leytonstone, Essex.

Jones, T. Tolley, l/o Little Collins Street; Australian Explosives and Chemical Co., Ltd., 138, Queen Street, Melbourne, Victoria.

Lindmueller, Chas., l/o Cleveland; c/o United Zinc and Chemical Co., Argentine, Kas., U.S.A.

Marsden, Dr. Fred., l/o Leeds; 4, Swinton Grove, Manchester, S.E.

Mayer, And., jun., l/o Braddock; 104, St. Mark's Avenue, Brooklyn, N.Y., U.S.A.

Meyer, Aug. R.; Journals to c/o United Zinc and Chemical Co., Kansas City, Mo., U.S.A.

Proctor, C.; all communications to 27, London Road, Forest Hill, S.E.

Runting, D. A.; all communications to Moreland Grove, Coburg, Melbourne, Vic., Australia, Analyst.

Scrymgeour, Wm., l/o Kalgoorlie; Fraser's Gold Mine, Southern Cross, West Australia.

Stevens, Dr. Henry P., l/o Ash; Laboratory, 15, Borough, London Bridge, S.E., Analytical and Consulting Chemist.

Sturrock, Capt. G. C.; Journals to Aruvankad, Nilgiris, India.

Warnes, A. R., l/o London; c/o North West Soap Co., Ltd., 63, Garden Reach, Calcutta, India.

Wilson, Gordon; Journals (temporary) to Promontorio, Estacion Chinacates, Durango, Mexico.

MEMBER OMITTED FROM LIST.

1900. Garrigues, W. E., 66, Beaver Street, New York City, U.S.A., Chemical Engineer.

Death.

Allen, Alf. H., Broomfield Road, Sheffield. July 14.

New York Section.

CORRECTION.

ANALYSIS OF COMMERCIAL ACETATE OF LIME.

BY W. M. GROSVENOR, JUN.

(This J., May 31, 1904, 530—535.)

The author desires to state that when he referred to th Distillation Method as having been originated by Freseniu and modified by Stillwell and Gladding, he was unaware tha the method was really first devised by Dr. H. Endemann i 1874 and published in Dr. Waly's "Industrial Record" n 1875. It may also be found in Prof. Chandler's "America Chemist" for 1876.

Obituary.

ALFRED H. ALLEN, F.C.S., F.I.C.

Original Member of the Society of Chemical Industry. Also Member of Publication Committee, and formerly Member of Council.

Alfred Henry Allen, born at Southwark, London, on January 17th, 1846, was the son of George Allen, an eminent architect. He was educated at a private school in Brighton, and subsequently became a student at the College of Chemistry and Agriculture at Kensington, under the late Mr. John Nesbit, and at the Royal College of Chemistry and School of Mines under Hofmann and Tyndall. He studied metallurgy and practised assaying under Percy, and attended geology and mineralogy classes at University College, London, under Morris. He began his professional career as assistant to the late Dr. A. H. Hassall, but resigned that position in order to go to Sheffield as analytical assistant to the late Dr. James Allan. On the death of the latter Allen became the residuary legatee, and, though very young, resolved to continue the practice on his own account. Later on, he was appointed lecturer in chemistry and physics at the Sheffield School of Medicine, then situated in Surrey Street, and also lecturer on chemical and physical science at Wesley College. He was President of the Society of Public Analysts in 1887 and 1888, and was also an original Fellow and a Member of Council of the Institute of Chemistry. He served for four years on the Council of this Society, and, from 1888 up to his death, on its Publication Committee.

In 1873, when the Sale of Food and Drugs Act came into operation, Allen was made public analyst to the Corporation of Sheffield and also to the West Riding of Yorkshire. These appointments, together with similar ones in connection with other boroughs, he held up to the time of his death. Always a conscientious and impartial officer, he prided himself on the fact that no one had ever been unjustly punished through his evidence.

In the revision of the Foods Acts, &c., Allen gave evidence before several Royal Commissions and Departmental Committees. Amongst these may be mentioned the Select Committee on British and Foreign Spirits, the Commission on Arsenical Poisoning, the Departmental Committee on Beer Materials, and the Board of Agriculture Departmental Committee on Milk and Cream. In the last-mentioned case the standard ultimately fixed was that advocated and used by him for many years. When the consideration of butter substitutes resulted in the passing of the Margarine Act, it was at his suggestion that the title "margarine" was adopted. The Danish Government many years ago invited him to inspect the farms and inquire into the whole question of butter production in Denmark. The results of his investigation are embodied in his report to that Government.

During the epidemic of lead poisoning in Sheffield, fifteen years ago, Allen did an enormous amount of special work connected therewith. His theory as to the cause of the action of Sheffield water on the lead service pipes proved to be correct, and his simple method of preventing further mischief, by the addition of chalk to the water of the reservoirs, is in use at the present time.

Always busy with the affairs of his many offices, he yet found time to devote to scientific research, and has left after him a monumental work, which will serve to keep his name in respectful and grateful remembrance. Many important papers were contributed by him to this and other scientific journals, but their contents represent only a fraction of the extensive original work carried out for and published in his great undertaking just referred to, the eight volumes of his treatise on Commercial Organic Analysis, which has long been accepted as a standard work by chemists everywhere. It should never be forgotten that this invaluable treatise, so admirable in its arrangement, so accurate in its facts, and so generally reliable in its statements, is very much more than a handy and useful compilation from the published works of other chemists, containing as it does on every page the evidence of its author's thought and investigation. Having in mind what he accomplished in developing and systematising commercial organic analysis, it will assuredly be felt by many that he might well be styled the Fresenius of that large branch of chemical analysis.

Another example in this direction may be found in his valuable work on the "Chemistry of Urine," published in 1895. It was written in great measure, so its author informed the writer, as the outcome of an earnest study of the dread complaint (diabetes) which was undermining his own health and powers. In the preface to this work he makes pathetic reference to the subject.

Many will remember how much A. H. Allen's genial presence and powers of entertainment were in request at the social gatherings of the Annual General Meetings in the earlier years of the Society, and what a pervading sense of the incompleteness of those social gatherings in later years was caused, when ill-health enforced his absence from them.

Allen's mental characteristics were a wonderful memory, great keenness of intellect, and ability for rapid grasp of intricate questions. His name will ever be honourably identified with most of the legislation for securing pure food and drugs for the people.

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ATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

English.—8*d.* each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3^e).

—PLANT, APPARATUS AND MACHINERY.

odium Hydroxide; Formation of —— from Sodium Carbonate in Boilers fed with Water containing the latter. J. Brand. Z. ges. Brauw., 1904, **27**, 456—458.

well-water containing 23·5 parts of sodium carbonate 100,000 was employed as boiler feed water. At the end 14 days an incrustation appeared on the fittings, consting of 84·8 per cent. of sodium carbonate, 1·6 per cent. sodium hydroxide, 5·48 per cent. of sodium sulphate, d 7·36 per cent. of water. In 45 days the incrustation attained such dimensions that injury to the boiler was feared, and the water was therefore mixed in equal proportions with one containing alkaline earth carbonates (16° of hardness). After another week the water in the boiler was examined, and was found to contain 1,667 parts of solids per 100,000 parts, including 1,176 parts of sodium carbonate, 362 parts (21·7 per cent. of the total) of sodium hydroxide, and 100 of sodium sulphate. The sediment deposited from the slightly turbid sample consisted solely of calcium and magnesium carbonates. The probable explanation of the formation of sodium hydroxide is that under the high temperature and pressure in the boiler, the magnesium carbonate present is converted into hydroxide, which reacts with the sodium carbonate, the double decomposition being continually repeated; or, it may be that, as stated by Küster and Grüters (this J., 1903, 417), the sodium carbonate parts with its carbon dioxide under certain relative conditions of tension and partial pressure.—C. S.

English Patent.

Centrifugal Machines [Separators] and the like. A. J. Boult, London. From the Firm F. Meyer's Sohn, Tangermünde, Prussia. Eng. Pat. 15,862, July 17, 1903.

See Fr. Pat. 334,041 of 1903; this J., 1904, 14.—T. F. B.

United States Patent.

Granular Materials; Apparatus for Washing ——. G. M. Hoffman and J. T. Gibson, New York. U.S. Pat. 762,309, June 14, 1904.

In order to clean filtering material, such as sand, it is forced by suitable means, together with water, into a hopper working in an immersion pit, and provided with air-lift mechanism, and delivered into a second hopper. The second hopper is provided with an immersion pit and air-lift apparatus, has an overflow for the water, and means for adding additional wash-water to the second immersion pit.—L. F. G.

French Patents.

Muffle Furnace; Circulating ——. E. Ufenast. Fr. Pat. 340,045, Jan. 30, 1904.

The furnace is embedded in the ground, and not arched, being covered in at the top with firebricks. Coal is fed through holes in the roof on to grates of firebrick, and the products of combustion are made to circulate through longitudinal and transverse passages, and to play around the central muffle on all sides. The circulation is regulated and effected by suitable screens, and the coal gases are led away by an iron pipe from the top of the furnace.—L. F. G.

Filters; Method of Constructing ——. Berlin-Anhaltische Maschinenbau Akt.-Ges. Fr. Pat. 340,147, Feb. 3, 1904.

See Eng. Pat. 15,948 of 1903; this J., 1904, 600.—W. H. C.

Dryer; Cylindrical —— for the Direct Heating of Substances in a Continuous Current [of Gas]. M. Hecking. Fr. Pat. 340,260, Feb. 8, 1904.

See Eng. Pat. 25,209 of 1902; this J., 1904, 13.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Illuminating Gas; Condensation of ——. H. G. Colman. J. Gas Lighting, 1904, **86**, 760—763.

In this paper attention is chiefly devoted to a consideration of the function of condensers as scrubbers in which the gas is subjected to the washing action of the liquid products separating from it during the process of cooling, and of the best means of carrying out most efficiently the objects of condensation, namely, to cool the gas to atmospheric temperature and at the same time to retain in it as much of the lowest boiling tar constituents as can be permanently carried during distribution, and to effect as complete a removal as possible of naphthalene and all higher boiling substances. In the analogous process of fractional distillation, where the vapours evolved on boiling a mixed liquid are subjected to fractional condensation to remove higher boiling constituents, the principle universally adopted is to allow the products separating in the still-head to flow backwards against the current of ascending vapour, and it is therefore contended that the same process is also the most suitable in condensing illuminating gas. In the latter case, however, the conditions differ in several respects from those existing in fractional distillation. The vapours are there diluted with large volumes of permanent gases, thus lowering the rate at which the solvents act upon the vapours present; water is also continuously condensing, and, as it does not mix with the tar, tends to form a coating over it, and prevents the latter acting upon the gas. Further, owing to the rapid cooling which takes place in the earl stages after the gas leaves the retort, large quantities of th tar separate as a fog, a considerable portion of which i carried forward mechanically with the gas right throug the condensing apparatus, and must be removed as soon a possible, if the above counter-current system is to be full carried out. In order to effect this removal the autho proposes to treat the hot gas as it leaves the hydraulic o foul main, in a modification of the "cyclone dust collector," by means of which these heavy tar particles are removed The apparatus consists of a short, wide cylinder, to th bottom of which is fixed an inverted cone, the tar flowin away from the lowest portion of the latter by means of seal pot or siphon. The gas enters the cylinder at tangent, takes a spiral course through the apparatus, an leaves by means of the outlet main fixed in the centre o the cylinder. Owing to the whirling motion thus set u the heavy solid and liquid particles are driven by centrifugal force to the circumference of the cylinder and cone where they coalesce and flow away through the sipho This apparatus, as erected at the Tottenham Gas Works effects a practically complete removal of the tar-fog fro the hot gas; the quantity of tar thus separated amounted t 2 galls. per ton of coal carbonised, or one-fifth of the tot tar production. When the separator is at work the quantit of tar condensing during the subsequent cooling stages onl amounts to about one-third of a gallon per ton, and is a thi liquid containing a much higher proportion of low-boilin constituents than ordinary coal-tar. The results obtaine so far indicate that when the heavy tar-fog is remove from the hot gas in this manner, the gas after coolin contains a larger quantity of benzene and toluene and les naphthalene than is the case when the centrifugal separato is not employed.—H. G. C.

Formaldehyde; Presence of —— in the Products of Combustion of Ordinary Fuels. A. Trillat. Comptes rend 1904, **138**, 1613—1615.

Air, carefully freed from any trace of formaldehyde, wa passed over burning combustibles in a heated tube, and th products were collected and examined for formaldehyd In all cases (coal, peat, various woods or products of thei distillation, papers, pure cellulose, cork, india-rubbe tobacco) formaldehyde was found, in amounts varying fro 1/10,000 to 1/100,000 of the weight of substance burn Wood and cellulose gave the largest amounts. The benzen hydrocarbons also yielded formaldehyde, in amounts increasing with their complexity. In all cases the material with which the combustible materials are in contact affe the yield of formaldehyde considerably; copper, fo example, favours its production much more than porcelai The existence of formaldehyde in the atmosphere is n doubt attributable to its formation in combustions.

—J. T. D.

Briquettes; Determination of Proportion of Bindin Material in ——. E. J. Constam and R. Rougeo XXIII., page 764.

Gases containing Hydrogen; Fractional Combustion —— by Means of Heated Palladium Wire. Richardt. XXIII., page 764.

English Patents.

Liquid Fuel; Impts. in Furnaces Heated by ——. A Barron, Mexboro'. Eng. Pat. 15,726, July 16, 1903.

The liquid fuel is blown in by compressed air, and to secur greater heat the flame passage is made longer than usu and flared towards the interior.—C. S.

Carburetted Water-Gas; Apparatus far the Manufactur of ——. W. R. Addicks, New York. Eng. Pat. 10,12 May 3, 1904.

See U.S. Pat. 758,882 of 1904; this J., 1904, 602.—T. F. B.

Gas; Manufacture of ——. H. W. Woodall, Wimborn and A. McD. Duckham, Upper Parkstone, Dorset. Eng Pat. 16,497, July 27, 1903.

Coal is distilled continuously in a vertical retort, the lowe open end of which dips into a water sump, from which th

:e is removed continuously by means of a conveyor. e steam produced, passes up through the retort, forming :er-gas, which is either led off along with the coal-gas or wn off separately. The retort is heated most intensely its upper end, by means of combustible gas, the products combustion being led down a flue surrounding the retort, as to maintain the coke at a high enough temperature to ompose the steam. Coal is fed into a little shoot within top of the retort, by means of a rotating gas-tight ding drum, in such a manner that the shoot and the ort are always full of coal. The position of the bottom the shoot determines the top level of the coal in the ort. The gas is drawn off from the top of the retort as ıal.—H. B.

United States Patents.

el; Manufacture of Artificial —— by Distillation. . T. Davis, San Francisco. U.S. Pat. 763,267, June 21, 904.

mixture of crude petroleum and fine carbonaceous terial is agitated and exposed to a continuously inasing degree of heat, so as to distil off the lighter hydrobons and leave the heavier hydrocarbons associated with carbonaceous material. After cooling, the combustible iduum is pressed.—H. B.

Gas Furnace; Regenerative ——. E. Derval, Paris. U.S. Pat. 762,578, June 14, 1904.

e furnace is fitted with inclined retorts, each of which uilt up of curved sections so arranged that each section t an angle to the horizontal less than that of the next oining section above.—H. B.

ıs Producer. L. Wilson, Glasgow. U.S. Pat. 762,568, June 14, 1904.

e combustion chamber of the producer is formed of a ing, the lower half of which has a refractory lining. s is surrounded by an outer lined casing, an annular ce being left between the inner casing and the lining of outer casing. Within the annular space is a duplicate ed pipe for supplying heated air and superheated steam the combustion chamber. Midway up the combustion mber there are provided lateral exit pipes, through ch the hot gases are led into the annular space, and gases are finally drawn off at the top of the said space. —H. B.

Vater-Gas Generator. D. McDonald, Louisville, Ky., U.S.A. U.S. Pat. 763,313, June 21, 1904.

e generator is provided laterally at its upper end with a rt vertical stack, which communicates with the superter and contains two flues communicating with the rior of the generator at two different levels in its er part. By means of a rotatable valve at the top of stack, either of the two flues may be put in connection h the superheater.—H. B.

oke Oven; Electric ——. M. R. Conley, New York. U.S. Pat. 763,368, June 28, 1904.

ctric resistance plates are arranged in pairs in the r wall of the furnace body (which is of non-conducting erial), and on different horizontal planes, in order to n a series of heating zones. The oven is open at the and is closed at the bottom by swing doors which open he full sectional area of the oven.—C. S.

e; Process of Making ——. M. R. Conley, New York. U.S. Pat. 763,369, June 28, 1904.

: coal is introduced into an essentially air-tight oven previous abstract), which is heated by electrical resis es to a temperature higher than that of the ordinary oven.—C. S.

French Patents.

minating Gas; Manufacture of ——. B. Duttenhofer. Fr. Pat. 340,055, Jan. 30, 1904.

the prevention of the formation of tar and "graphite," n is passed into the coal in the retorts from the beginning of the distillation. It is claimed that the hydrogen supplied in the form of steam in this way combines with the carbon to produce hydrocarbons.—H. B.

Combustible Gas from Pulverised Combustibles; Process and Apparatus for the Production of ——. G. Marconnet. Fr. Pat. 340,075, Feb. 1, 1904.

A mixture of air and finely-pulverised combustible is aspirated in regulated quantities by each suction of the motor (or other apparatus to be supplied with the gas) into a shoot similar to that described in Fr. Pat. 337,514 (this J., 1904, 484), wherein the fuel is burned during its downward passage. From an ashbox at the foot of the shoot the gas produced is led off to the motor, a portion of this gas being withdrawn to feed the burners in the combustion shoot. The device for producing the mixture of air and combustible consists of a vertical pipe having a hopper at the top, from which the powdered fuel descends in a continuous stream. The pipe is connected on one side with the combustion shoot, and on the other with an air-supply pipe. At each suction of the motor, the air rushing through the descending stream of fuel carries over a determinate quantity into the shoot in the form of a cloud. The excess of fuel which accumulates at the foot of the vertical pipe is transferred to the hopper from time to time.—H. B.

Briquette Fuel; Process of Manufacturing ——. V. Conti and A. Levy. Fr. Pat. 340,244, Feb. 6, 1904.

The binding material employed to agglomerate the fuel (coal, lignite, wood, peat, spent tan, &c.) is magnesium oxychloride, in the proportion of about 3 per cent. To facilitate the volatilisation of the oxychloride it is mixed with 3 per cent. of its own weight of potassium bichromate, or double that quantity of sodium bichromate or potassium nitrate. The product is compressed and dried in the usual manner.—C. S.

Carbon or Fuel; Artificial ——, and Method of Manufacturing same. J. Auguiot. Fr. Pat. 338,776, May 1, 1903.

The ingredients of the product consist of powdered fuel materials, with a large proportion of petroleum or other mineral oils, the volatility of which is almost entirely nullified by an admixture of sodium oleomargarate, or of white soap in association with asphaltum or pitch. The following approximate proportions are given:—Crude petroleum, 50 parts; sodium oleomargarate, 6; asphaltum, 25; sawdust, 5; coal dust, 30 parts. The first three are incorporated by heating and continued stirring, and the sawdust and coal dust are afterwards stirred-in in succession. —C. S.

Siemens Regenerative Furnaces; Process and Apparatus for Avoiding Loss of Gas in ——. A. Kurzwernhart. Fr. Pat. 340,332, Jan. 25, 1904.

See Eng. Pat. 1890 of 1904; this J., 1904, 434.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Mineral Oil Industry in the Lüneburger Heide. Häpke. Chem.-Zeit., 1904, **28**, 618—619.

The occurrence of mineral oil at Wietze, a village standing on the small river of the same name in the neighbourhood of Celle, Hanover, has been known since the middle of the seventeenth century, but the first borings were not made till the end of the year 1880. The production of mineral oil at Wietze amounted in 1903 to more than 40,000 metric tons, of a value of about 3,200,000 M., whilst that of Ölheim was about 750 tons, of a value of 60,000 M. The oil occurs in two different zones, the upper one extending to a depth of 250 m. and the lower one to a depth of 350 m. The oil from the upper zone is thick, of a dark brown colour, sp. gr. 0·935—0·950, and is usually accompanied by a strong brine containing some magnesium chloride. On distillation it yields:—Benzine, sp. gr. 0·725, 0·5 per cent.; colourless kerosene ("petroleum"), sp. gr. 0·80, 6·0; kerosene with a faint yellowish tinge, sp. gr. 0·84, 6·0; spindle oil, 20·0; machine oil, 44; tar, 10·0 per cent. The tar on redistillation yields 70 per cent. of an oil containing paraffin, and 30 per cent. of coke. After separation of the benzine and kerosene, the machine oils are used almost exclusively as a wagon-grease. The oil from the lower zone is dark green in colour, and has the sp. gr. 0·885. On distillation it yields:—Benzine, sp. gr. 0·701 at 15° C., 1 per cent.: ligroïn, sp. gr. 0·727—0·730, 2—3; naphtha and kerosene ("petroleum"), 28; lubricating oil, 47; residue, 17; and loss, 4—5 per cent.—A. S.

"Naphtha" [Crude Petroleum] and Gas at Berekei (Daghestan); Examination of the ——. K. Charitschkoff. J. russ. phys.-chem. Ges., 1904, **36**, 321—326; Chem. Centr., 1904, **1**, 1627.

The deposit at Berekei has been worked for only a short time. The crude petroleum appears to be of good quality. It is characterised by its high content (36 per cent.) of light fractions ("petroleum"), its low content of middle fractions, and the relatively low viscosity of the residue. The residue has a calorific value of 10,520 calculated by Mendelejeff's formula; it contains no paraffin. The gas which accompanies the petroleum contains, when freed from air, 12·82 per cent. of carbon dioxide, 65·84 per cent. of methane, and 19·92 per cent. of ethane.—A. S.

Aluminium Magnesium Hydrosilicate [Florida Fullers' Earth]; Decolorisation of Oils with ——. Hirzel. XII., page 755.

Thiophene Reaction with Nitrososulphuric Acid. C. Liebermann and B. Pleus. XXIII., page 763.

English Patent.

Saturators for Sulphate of Ammonia. M. Schwab, London. Eng. Pat. 17,585, Aug. 13, 1903.

"The body of the saturator is formed by taking a four-sided piece of lead, and uniting two edges together to form a cylindrical or tubular member," one end of which is beaten into a dome to form the top. "A second sheet of lead is then joined to the two sides of the cylinder so as to form a fender, and a third sheet is joined to the bottom of the fender and body to form the bottom of the saturator. An aperture is formed or cut in the front part of the body facing the fender, making a passage between the fender and the body," "producing an apron or midfeather out of that portion of the body facing the fender." The usual connections and manhole may be formed in the dome. —E. S.

United States Patent.

Fuel; Manufacture of Artificial —— by Distillation. J. T. Davies. U.S. Pat. 763,267, June 21, 1904. II., page 745.

French Patents.

Meta-Cresol; Process for Producing —— from Crude Cresol. Chem. Fabr. Ladenburg G. m. b. H. Fr. Pat. 339,880, Jan. 25, 1904. XX., page 759.

Shale Oil and Similar Substances; Treatment of ——. A. Adiassewich. Fr. Pat. 340,354, Feb. 10, 1904. Under Internat. Conv., Feb. 25, 1903.

See Eng. Pat. 4431 of 1903; this J., 1904, 247.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Natural Dyestuffs still used in Dyeing, and their Valuation. von Cochenhausen. Z. angew. Chem., 1904, **17**, 874—886.

A long paper on the dyeing properties and methods of valuation of the chief natural dyestuffs still used in dyeing-operations.—A. B. S.

Rosanilines; Additive Ammoniacal Compounds of —. J. Schmidlin. Comptes rend., 1904, **138**, 1709—1711.

The mon-acid salts of rosanilines absorb 4 mols. of a
monia gas, producing colourless substances, apparent
similar to those formed when the tri-acid salts (this
1904, 710) absorb a fourth molecule of hydrochloric a
gas. These ammoniacal compounds are entirely additi
and lose all their ammonia *in vacuo*. The author conclud
that the mon-acid rosaniline salts are unsaturated molecul
and that the free affinities are chemically neutral, and
be satisfied by bases or by acids. No doubt the carbon
a neutral element—is the seat of these unsaturated affiniti
which appear to be satisfied by 4 mols. of either HCl or N
—J. T. D.

Azo Dyestuffs derived from 2:2-Dinaphthol. M. E. Poz
Escot. Comptes rend., 1904, **138**, 1618—1619.

The existence of azo-derivatives of β:β-dinaphthol is stro
evidence in favour of the linkage between the two naphth
nuclei being in the 3:3- and not in the 1:1-position, as
been supposed. The azo dyestuffs obtained have no practi
interest, although, in an acid bath, they dye wool a more
less deep red shade.—T. H. P.

Cyanomaclurin. A. G. Perkin. Chem Soc. Proc., 1904, **20**, 170.

Cyanomaclurin (Chem. Soc. Trans., 1895, **67**, 937), wh
exists in jackwood (*Artocarpus integrifolia*) in conjunct
with morin, crystallises from water in the anhydrous fo
and is now shown to be isomeric with the catechi
$C_{15}H_{14}O_6$. On fusion with caustic alkali, cyanomaclu
gives β-resorcylic acid (not cresorcylic acid as previou
suggested) and phloroglucinol, and with pine wood
hydrochloric acid it resembles the catechins in giving
phloroglucinol reaction. With boiling dilute hydrochl
acid, a brown amorphous compound is produced; this
identical in appearance with the so-called fourth anhydr
from Gambier catechin, and has the same percentage co
position. Cyanomaclurin thus appears to represent
catechin in which the catechol nucleus is replaced
resorcinol.

Catechins; Note on the ——. A. G. Perkin. Chem.
Proc., 1904, **20**, 171.

In a previous communication (Trans., 1902, **81**, 1160)
was pointed out that whereas Gambier catechu contain
catechin, $C_{15}H_{14}O_6$ (m. pt. 175°—177°), the pentabenz
derivative of which melts at 151°—153°, yet a catec
$C_{15}H_{14}O_6$, which was isolated from *Acacia catechu* melte
204°—205°, and gave a benzoyl compound melting
181°—183°. It is now found that the acacia catechin gi
an acetyl derivative, $C_{15}H_9O_6(C_2H_3O)_5$, forming colour
needles (m. pt. 158°—160°), and a tetramethyl et
$C_{15}H_{10}O_2(OCH_3)_4$, separating in colourless prisms (m.
152°—153°). The corresponding substances from
Gambier catechin (Kostanecki and Tambor, this J., 1
851) melt at 129°—130° and at 142°—143° respectiv
For acacia catechin the name "*acacatechin*" is proposed

Indigo; Constituent of Java ——. A. G. Perkin. Chem. Soc. Proc., 1904, **20**, 172.

Rawson (this J., 1899, 251) has shown that Java ind
contains a yellow colouring matter. This substa
$C_{15}H_{10}O_6$, forms yellow needles, melts at 276°—277°,
gives an acetyl compound, $C_{15}H_6O_6(C_2H_3O)_4$, which separ
in colourless needles, and melts, when crystallised f
methyl alcohol, first at 116°—120° and subsequentl
181°—182°. The colouring matter is identical w
kampherol (Chem. Soc. Trans., 1902, **81**, 587).

Indigo; Our present Knowledge of the Chemistry of —
W. P. Bloxam. Chem. Soc. Proc., 1904, **20**, 159—16

As the determination of the maximum amount of ind
obtainable at each successive stage of its preparat
("mahai") and of the quantity present in the leaf of
green plant depends on the purity of the indigotin emplo
as a standard, the author has estimated the percentag
nitrogen in the best specimens procurable, and has

und that they contain only about 90 per cent. of indigotin. nce the pure substances could not be prepared by the tion of solvents on cake indigo or the synthetical product. e crude indigo was sublimed under diminished pressure, d in this way a well-crystallised product was readily tained which gave the percentage of nitrogen required indigotin. This pure material, when sulphonated and bjected to analysis by the permanganate method, was und to give values ranging up to 300 per cent. of the ight of substance taken. As this method is used in linary technical analyses of indigo, this result explained extraordinary variations observed in the published ues given for cake indigo and the products obtained ring the successive stages of the manufacture ("mahai"). has also been found that the red substance occurring the cake obtained from plant-indigo, and known as ndirubin" or indigo-red, is not, as stated, a derivative of ligo, as it contains no nitrogen. This material, which y consist of a mixture of compounds, will be further estigated.

English Patents.

ridine Series ; Manufacture of Colouring Matters of the —— [Acridine Dyestuffs]. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 17,768, Aug. 17, 1903.

: U.S. Pat. 746,981 of 1903 ; this J., 1904, 57.—T. F. B.

phide Dyestuffs ; Manufacture of ——. A. Meyenberg nd The Clayton Aniline Co., Manchester. Eng. Pat. 7,805, Aug. 17, 1903.

ITROPHENOL is heated in the presence of excess of lrogen sulphide, or else a stream of hydrogen sulphide assed through a boiling solution of the sodium salt of itrophenol in water. The water is distilled off, and the duct, after drying, is ready for use.—A. B. S.

thracene Series ; Manufacture of New Derivatives of the —— [Anthracene Dyestuffs]. H. E. Newton, London. rom Farbenfabr. vorm. F. Bayer & Co., Elberfeld, Germany. Eng. Pat. 17,965, Aug. 19, 1903.

: Fr. Pat. 334,658 of 1903 ; this J., 1904, 113.—T. F. B.

oxyl or its Homologues ; Manufacture of ——. O. mray, London. From Farbwerke vorm. Meister, Lucius nd Brüning, Höchst-on-the-Maine, Germany. Eng. at. 18,131, Aug. 21, 1903.

Addition, of Aug. 24, 1903, to Fr. Pat. 317,121 of 1901 ; J., 1904, 114.—T. F. B.

United States Patents.

phur Dye [Sulphide Dyestuff] ; Blue ——, and Process of Making same. E. Mathe, Assignor to Farbwerke orm. Meister, Lucius und Brüning, Hoechst-on-the-laine, Germany. U.S. Pat. 763,193, June 21, 1904.

p-hydroxy-*p*-*p*′-diaminodiphenylamine is heated at 100° 20° C. with sodium sulphide and sulphur. The product s cotton from a sodium sulphide bath indigo-blue shades. —E. B.

thracene Dye, and Process of Making same. H. Weltz, ssignor to Badische Anilin und Soda Fabrik, Ludwigsafen-on-Rhine, Germany. U.S. Pat. 763,233, June 21, 904.

E dyestuff in question is obtained by condensing a yhydroxyanthraquinone sulphonic acid with ammonia. lissolves in hot water with a reddish-violet colour.—E. B.

phur Dyes [Sulphide Dyestuffs] ; Process of Making ——. A. F. Poirrier, Assignor to Soc. Anon. des Mat. ol. et Prod. Chim. de St. Denis, Paris. U.S. Pat. 63,320, June 21, 1904.

Addition, of May 19, 1903, to Fr. Pat. 292,400 of 1899 ; J., 1903, 1241.—T. F. B.

Tetrazo Dye; Orange ——, and Process of Making same. K. Jedlicka and A. Schedler, Basle, Assignor to Soc. Chem. Ind., Basle. U.S. Pat. 763,761, June 28, 1904.

See Eng. Pat. 27,630 of 1903 ; this J., 1904, 249.—T. F. B.

French Patents.

Monazo Dyestuffs ; Manufacture of ——. Soc. Anon. des Prod. F. Bayer and Co. Third Addition, dated Nov. 27, 1903, to Fr. Pat. 323,808 of Aug. 18, 1902.

The diazo derivatives of the *o*-aminophenolsulphonic acids or of their derivatives are combined with 1.5-aminonaphthol in acid solution. The resulting dyestuffs dye wool from an acid bath in various shades, ranging from violet to reddish-violet, many of which are converted into very fast blacks by an after-treatment with bichromate. The colours before chroming are usually violet or reddish-violet.

—A. B. S.

Basic Dyestuffs ; Production of New ——. Fabr. Bâloise de Prod. Chim. Fr. Pat. 340,130, Feb. 2, 1904.

The rhodamine bases of either the phthalic or succinic series are heated with halogen derivatives of fatty acids, *e.g.*, chloracetamide, either alone or in the presence of a diluent, as alcohol or glycerin. The dyestuffs can be precipitated from aqueous solution in the usual way by means of common salt.—A. B. S.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Half-Silk Dyeing ; Two-Colour Effects in ——. A. Sander. Färber-Zeit., 1904, **15**, 197.

To increase the affinity of the cotton for the dyestuffs, it is soaked for 10 minutes in a solution of sodium hydrate, 36° Tw., containing 100 c.c. of glycerin per litre, washed, acidified in a solution containing 50 c.c. acetic acid per litre, washed, and dyed. The cotton is dyed with sulphide dyestuffs at about 70° C. with the usual additions ; some casein is added to prevent the colour staining the silk. The material is then washed and the silk dyed with suitable acid or other dyestuffs.—A. B. S.

Dyeing Process ; Study of the Direct —— and of the Felting of Wool. E. Justin-Mueller. Bull. Soc. Ind. Rouen, 1904. Chem.-Zeit., 1904, **28**, Rep. 199—200.

The author regards the textile fibres as bodies of a colloidal nature, and arrives at the following conclusions with regard to their behaviour in the direct dyeing and felting processes. (1) Explanation of the effect of wetting the wool before steaming, in wool printing. Colloidal bodies only take up foreign substances when they are wet, or in the gel condition or one approximating thereto. Thus the wool takes up the dyestuff satisfactorily, only when it is wet; moreover, on steaming, the wet wool swells, and the dyestuff is converted by the moisture and steam into a dissolved condition, whereby its absorption is favoured. (2) In dyeing wool in an acid bath, the acid tends to convert the wool into the gel condition, in which it has much greater absorptive power for dyestuffs. That this is actually the case is readily perceived if in dyeing woollen yarn, the boiling is prolonged, or too much acid is added ; the yarn then becomes felted together, *i.e.*, it approaches the gel condition. (3) *Felting Process :* The wool and hair fibres are converted into the gel condition by the preliminary treatment, or by the acid or alkaline "fulling" ; then, by the mechanical action during the milling, the fibres in the gel condition become felted together. (4) The greater affinity of mercerised cotton for dyestuffs is also due to the tendency of the caustic soda to convert the cotton into the gel condition.

—A. S.

Printing Tissues; Application of the "Three-Colour Process" in Engraving Rollers for ——. M. J. Witwizki. Z. Farben- u. Textil-Chem., 1904, **3**, 237—241.

Much retouching of the negatives, or of the unetched dies, is necessary in order to obtain, along with secondary and tertiary shades of colour, pure primary hues, in printing with rollers (applying respectively red, blue, and yellow colours) engraved from negatives prepared by photographing richly-coloured designs or natural objects through light-filter colour screens (see this J., 1902, 47; 1904, 184, 560, and 604). Otherwise brownish-grey tones result. The solubility of the colour mixtures employed in tissue printing causes the prints produced to be less successful reproductions than those obtained by lithography, in which insoluble pigments are used, the colours in the fairly open parts running into one another in the former case, while in the latter case they retain to a much greater extent the detached stipple-form in which they are applied. In tissue printing the reproduction of objects in their natural colourings is less sought than their presentation in striking combinations of colour. The author agrees with Pietruszewskij (1) that natural objects cannot be properly depicted by means of three colours only; (2) that the results obtained by mixing colours optically are not identical with those obtained by mixing them in the form of pigments.
—E. B.

Dyeing [Mordanting] Process; P. Heermann's Study of the ——. L. Bloch. Bull. Soc. Ind. Mulhouse, 1904, **74**, 159—166.

The author has repeated a number of the quantitative estimations made by Heermann (this J., 1903, 361 and 623, and 1904, 57 and 438) in his study of the influences of (*a*) length of time of immersion, (*b*) temperature and (*c*) concentration of solution, and (*d*) basicity of the mordanting salt, upon the absorption of the hydrates of stannic tin, iron, chromium, and aluminium, by raw and by boiled off silk. Although the results do not exactly accord with Heermann's, the numbers obtained bear the same relations to one another. With regard to the process of mordanting (weighting) silk with stannic hydrate, which is very extensively practised in the silk-manufacturing centres, the author points out that even if it were definitely shown that an economy in tin is realised by the process of successive immersions in dilute baths, as would from Heermann's results appear to be the most advantageous method, there still remains the question whether the economy thus gained is not more than counterbalanced by the greater expense of working which is involved.—E. B.

Antimony Tannate Mordant; Half-Discharge for ——. H. Bourry. Bull. Soc. Ind. Mulhouse, 1904, **74**, 167—169.

To obtain so-called cameo effects upon cotton tissues, these are mordanted with tannic acid and tartar emetic, printed with a mixture of stannous chloride and ammonium sulphocyanide, and over-printed, during the same passage through the printing machine, with caustic soda lye, the stannous chloride mixture acting at the same time as a half-discharge for the mordant and as a resist for the caustic soda discharge. The proportions for the half-discharge mixture recommended by C. Favre and the author are 5·4 litres of starch and gum-tragacanth paste, 4 kilos. of stannous chloride, and 1·5 kilos. of ammonium sulphocyanide. The printed tissues are steamed for a short time, passed through a chalk bath, dyed with basic dyestuffs, washed, soaped, and cleared as usual. Another method for producing somewhat similar effects consists in printing the thickened caustic soda-lye discharge, steaming for 2—4 minutes, and over-printing with a thickened solution of stannous chloride. The tissues are then passed through a chalk bath and dyed, &c. A full discharge is thus obtained in the parts where the caustic soda has been applied, along with a half-discharge in the parts where the stannous salt alone has been printed.—E. B.

Dyestuffs for Wool; New Classes of —— and N
Reactions of Aldehydes. E. Noelting. Bull. Soc. I
Mulhouse, 1901, **74**, 171.

The author considers the reactions recently described l
Prud'homme (this J., 1904, 512) novel and interestin
The latter finds that a blue dyestuff is produced wh
diazotised "Magenta," decolorised with sodium hydr
sulphite, acts upon benzaldehyde. A number of oth
aldehydes tried by the author act similarly, *viz.*, the thr
nitrobenzaldehydes, the three hydroxybenzaldehydes,
tolnylaldehyde, *p*-chlorobenzaldehyde, *o*- and *p*-aminoben
aldehyde, benzaldehyde *o*-sulphonic acid, protocatechu
aldehyde, vanillin, isovanillin, methylvanillin, piperon
and phenylacetaldehyde. All these give blue dyestu
analogous to that obtained from benzaldehyde.—E. B.

Grease Oleines [Wool Oils] Distilled; Detection of Mine
Oil in ——. A. H. Gill and S. N. Mason. XXII
page 763.

English Patents.

Wool-washing Machinery; Impts. in ——. E. Lesena
Courcoing (Nord), France. Eng. Pat. 5201, March 2, 19

The application to a wool-washing machine "comprising
vat," of a mechanism consisting of combs, is claimed,
"tines" of which combs traverse the bottom of the vat a
carry the wool through the water, removing it at length
a carrier-hand, without raising it from the water in
process. The mechanism referred to, is described in det
comprising standards attached to the vat, bearings fit
in these standards and adjustable therein, shafts journal
in the bearings, sprockets carried by the shafts, cha
adapted to travel over the sprockets, and the con
depending from the links of the chains referred to. Gu
arms and blocks on the links, &c., regulate the position a
movement of the combs through the vats.—A. S.

Yarn Bleaching; Appliances for ——. W. H. Hoyle a
T. Barker, Bolton, England. Eng. Pat. 17,616, Aug.
1903.

The cotton is bleached as it comes from one of
"intermediate" machines, such as the "slubbing fram
so that it is only slightly twisted. The cotton is wou
on perforated vulcanite bobbins, which have a slit in
side, and can be slightly expanded by placing them on
slubbing frame bobbins, which have a key or rib which
into the slit. When wound, the vulcanite bobbins
removed from the frame bobbins and placed on tape
metal tubes to support them during the usual bleach
process. When the bleaching is complete, the materia
dried and the vulcanite bobbins replaced on the slubb
frame bobbins in readiness for the next spinning operatio
—A. B. S

Dyeing, Bleaching, and other Purposes; Methods of
Apparatus for Treating Spun Fibres with Liquids
——. W. Reid, Twickenham. Eng. Pat. 13,556, June
1903.

See Fr. Pat. 339,322 of 1904; this J., 1901, 713.—T. F.

French Patents.

Ramie and Analogous Textile Materials; Process
Machinery for Decortage and Degumming of —
J. Bendel. Fr. Pat. 338,752, April 15, 1903.

The strips of raw ramie, after a previous stamping
water, are hung by their middles over a series of horizon
rods fixed in a frame. Each rod full of ramie is cove
with a metallic cover fitted with spikes, which stick
the material and catch any fibres broken off in the proc
The frame is first placed in a soap-bath containing 1 k
of soap per 100 litres of water. After boiling in this
from 10 to 30 minutes, the frame is removed and placed
a washing machine supplied with fine sprays of wa
which remove the bark, &c., loosened by the soap ba
This lasts from one to five minutes. The frame is th
placed in the degumming bath, where the ramie is trea

to 25 minutes at 60° C. with a solution containing ns. of soap and ½ grm. of vanadic acid per 100 litres amie is then removed and allowed to dry slowly in r.—A. B. S.

easing Wool; Machine for ——, with Vats Mounted Inclined Rails. E. Lesenne. Fr. Pat. 340,189, Feb. 8, 4.

Eng. Pat. 5201 of 1904, under Eng. Pats. preceding —T. F. B.

g Threads on Bobbins; Perforated Tube with aphragm for ——. L. Détré. First Addition, dated . 20, 1904, to Fr. Pat. 333,676, July 10, 1903.

ug. Pat. 4596 of 1904; this J., 1904, 487.—T. F. B.

ers; Process for Preserving ——. R. Wolffenstein. Pat. 338,797, May 11, 1903. Under Internat. Conv., rch 7, 1903.

ng. Pat. 11,712 of 1903; this J., 1904, 439.—T. F. B.

Erratum.

Journal, 1904, 659, column 1, line 30 from bottom, Eng. Pat." *insert its number,* "15,108."

II.—ACIDS, ALKALIS, AND SALTS.

uric Acid Chambers; Oblong and Tangential ——. . Meyer. Z. angew. Chem., 1904, **17**, 926—929.

ply to Hartmann and Benker (this J., 1904, 488) criticisms are considered to be faulty, inasmuch as ompare sets of chambers in the two systems working totally different conditions. The Abraham circula- ppealed to so strongly by Hartmann and Benker, no exists; but whether, even in an oblong chamber, it is minant motion of the gases is very doubtful, and the considers the undirected whirls observed in a glass by Porter (and figured in this J., 1903, 476) to ent much more nearly the actual state of things. It sidered that in a tangential chamber, the Abraham tion must be practically non-existent, or there could the distribution of temperatures (wall, top, 63°; , 61°; centre, top, 56° C.) observed by the author. did it exist, the resulting cooling by the air-cooled walls of the chamber would be quite inadequate to the amount of heat required to keep the temperature to the proper optimum, with such intense working as in a modern tangential chamber. The author's con- g tubes are merely a means of getting the best work the system—a substitute, and, in the author's view, vantageous substitute, for more chamber space. The holds that a tangential chamber can be made ely higher than an oblong one; and he thinks the age of height has nothing to do with the Abraham tion, but arises from the fact that the condensed ts of acid have further to fall through the mist in the er, and thus in part aid its condensation, and in part he reaction by change of temperature and by aiding e of the gases and the mist. According to Lunge re two reactions concerned; each of these has its in- ent "temperature-optimum," and hence temperature- s through ranges embracing both of these optima will l the reaction. Height, if the author's view be correct, e of especial value where water-spray is fed into the r; but here also extreme fineness of division of ay is important.—J. T. D.

'ed Chlorides; Behaviour of Typical —— when 'ed in Hydrochloric Acid Gas. F. A. Gooch and . McClenahan. Z. anorg. Chem., 1904, **40**, 24—38.

a hydrated chloride is heated in air, the products may be, according to the temperature and the of the chloride, either the anhydrous chloride and or hydrochloric acid and the oxychloride, oxide, or de of the metal. The authors chose three typical l chlorides, *viz.*, barium chloride, $BaCl_2.2H_2O$, which gives off its water without loss of chlorine; magnesium chloride, $MgCl_2.6H_2O$, which loses part of its chlorine together with the water; and aluminium chloride, $AlCl_3.6H_2O$, which loses the whole of its chlorine in the form of hydrochloric acid together with the water; and examined their behaviour when heated in hydrochloric acid gas. They find that hydrochloric acid has no influence on the dehydration of barium chloride below 100° C. (the temperature at which the chloride is completely dehydrated). It has also practically no influence on the separation of the first 2 mols. of water from magnesium chloride, $MgCl_2.6H_2O$ (at about 100° C.); the further dehydration is, however, retarded between 100° C. and 130° C., but accelerated above 130° C. Hydrolytic dissociation of the magnesium chloride is not very considerable below 200° C. The dehydration of aluminium chloride, $AlCl_3.6H_2O$, is retarded by hydrochloric acid up to 130° C.; above this temperature, just as above 100° C. in air, water and hydrochloric acid are evolved simultaneously. These differences in the behaviour of hydrated chlorides are satisfactorily explained by the constitutional formulæ proposed by Cushman (Amer. Chem. J., **26**, 505), with tetravalent oxygen and trivalent chlorine. According to this view, the mols. of water which are not readily split off occur in the body of the complex molecule, whilst the mols. of water that can be easily removed, occur in the form of side chains.—A. S.

Arsenic Pentachloride; Non-existence of ——. W. R. Smith and J. E. Hora. J. Amer. Chem. Soc., 1904, **26**, 632—635.

Chlorine was passed into arsenic trichloride for varying times, so as to obtain products containing, for every atom of arsenic, from 3 to 9 atoms of chlorine. Since the freezing points of these products decrease quite regularly with increasing chlorine content, it is concluded that the substance obtained by passing chlorine into arsenic trichloride at − 34° C., and stated to be arsenic pentachloride, is merely a solution of chlorine in the trichloride. (See Baskerville and Bennett, J. Amer. Chem. Soc., **24**, 1070.) —T. F. B.

English Patents.

Salt; Manufacture of ——. H. Tee, Liverpool. Eng. Pat. 8117, April 8, 1903.

Impure or discoloured rock salt is melted in covered crucibles, each provided with a horizontal outlet pipe from the bottom, for running off deposited matter, and with another channel a little above the bottom, through which the purified salt may be run. Air, preferably highly heated, is blown through the molten salt for a considerable time, to oxidise the impurities. In some cases, a small proportion of lime, say from 0·1 to 1·0 per cent., is added to assist the separation of the oxidised iron. After settling, the molten clarified salt is run on to cooling floors, and granulated by suitable devices. In a modified process, the salt is melted by gases acting upon its surface, as in a metal reverberatory furnace.—E. S.

Sulphate of a Higher Oxide of Manganese; [Electrolytic] Manufacture of a ——. J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 17,981, Aug. 19, 1903.

To obtain "manganese superoxide sulphate" [sulphate of the peroxide of manganese], a solution of manganous sulphate in sulphuric acid is electrolysed at a temperature of about 60° C., a lead cathode in sulphuric acid being used. The anode may be of lead; but if it be of manganese or ferro-manganese, a salt of manganese need not be dissolved in the acid, which is then taken of greater strength than in the former case. Another process consists in treating with "lead superoxide," a hot sulphuric acid solution of manganous sulphate. Or, to stated proportions of powdered potassium permanganate and of sodium sulphite, sulphuric acid of 70 per cent. is added. The required salt may be obtained in a solid form by adding, separately, powdered manganous sulphate and potassium permanganate to hot sulphuric acid of 55 per cent. On cooling, black manganese superoxide sulphate separates. —E. S.

Saturators for Sulphate of Ammonia. M. Schwab. Eng. Pat. 17,585, Aug. 13, 1903. III., page 746.

Gas; Process and Apparatus for Separating Mixtures of ——, applicable for the Separation of Oxygen and Nitrogen from Liquid Air. Soc. pour l'Exploitation des Procédés Georges Claude, Paris. Eng. Pat. 28,682, Dec. 30, 1903. Under Internat. Conv., Jan. 3, 1903.

See Fr. Pat. 328,245 of 1903; this J., 1903, 950.—T. F. B.

United States Patents.

Nickel Hydroxide; Recovering [from Nickel-Ammonium Chloride] ——. H. A. Frasch, New York. U.S. Pat. 763,053, June 21, 1904.

Nickel-ammonium chloride is subjected to dry distillation in presence of a "dehydrating agent," the ammonia evolved is collected, the residue is dissolved in a suitable liquid, and nickel hydroxide is precipitated. Or the nickel-ammonium chloride is suspended in a solution of calcium chloride, on heating which, a portion of the nickel separates as hydroxide, and the remainder is precipitated from the separated solution by a suitable agent. Ammonia is then recovered from the cleared solution by heating it with calcium hydroxide. —E. S.

Copper, Sulphate of; Method of Making ——. G. Gin. U.S. Pat. 763,478, June 28, 1904.

See Eng. Pat. 5230 of 1903; this J., 1904, 323.—T. F. B.

VIII.—GLASS, POTTERY, ENAMELS.

Porcelains; New Results Obtained in ——. F. Garros. Comptes rend., 1904, **139**, 68—70.

The author describes the properties of "asbestos porcelain," made by firing asbestos. This is particularly suitable for sterilising filters, and the extremities of the author's sterilising bougies which are made from it, while allowing liquid to pass freely, are said to completely retain the finest solid particles, including micro-organisms of all descriptions. A glaze preparation consisting of oxide of tin has been found very suitable for glazing the ends of these surgical bougies, alkaline glazes being too fusible. The degree of porosity of asbestos porcelain can be regulated by the temperature of firing. As this rises, the individual particles of asbestos contract, and the biscuit becomes more and more porous, and at the same time the translucidity increases up to 1400° C. Between this and 1650° C. incipient fusion occurs, with consequent decrease of porosity, but increase of solidity; and above 1650° C. "Asbestos Glass" is formed. Porous plates or cells for accumulators, of asbestos porcelain, exhibit a much lower resistance than other porous vessels; and insulators have been made, standing a firing at 1500°—1600° C., by a mixture of asbestos with an alumino-alkaline paste. The asbestos predominates in the biscuit for these insulators, while the same mixture with excess of the paste forms a most suitable glaze. Such insulators are very strong mechanically, and will bear without leakage very high electrical pressures. Copper can be joined to asbestos porcelain through the medium of the glaze. A new field in ceramics has been opened up, it is stated, by this work, and the author says that, amongst other applications, he has already produced porcelains from magnesia, talc, &c.—J. T. D.

United States Patents.

Glass; Method of Drawing ——. J. A. Chambers, Alleghany, Assignor to Window Glass Machine Co., Pittsburg, Pa. U.S. Pat. 762,879, June 21, 1904.

Hollow glass cylinders are drawn by feeding molten glass into a receptacle, chilling the upper layer of the glass, and then lowering a "bait" into the bath, forming a neck and enlarged cap, after which the cylinder is drawn up. —A. G. L.

Glass Articles; Method of Drawing ——. J. A. Chambe Alleghany, Assignor to Window Glass Machine C Pittsburg, Pa. U.S. Pat. 762,880, June 21, 1904.

The glass articles are shaped by drawing them upwa from a bath of molten glass, and gradually and au matically increasing the speed of the drawing.—A. G. L.

Glass Sheets; Apparatus for Making ——. J. Broeg Greensburg, Pa. U.S. Pat. 763,633, June 28, 1904.

By means of vacuum action, glass from a bath of mol glass is caused to enter a cavity in a sectional head which an initial portion of the article to be cast is form A further portion of glass attached to the initial par withdrawn from the bath, and means are provided severing the drawn glass from the mass pendent thereon —A. G. I

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

Paving Flags from Destructor Slag; Manufacture of — The Engineer, July 8, 1894, page 41.

The Battersea Borough Council have installed a plant for manufacture of pavement flags from the clinker of their re destructor. The slabs are composed of two distinct layer material, an upper and thinner one, $\frac{3}{4}$ in. thick, consistin granite refuse dust and cement, and a thicker one m up of a mixture of three parts of clinker and six of cem The clinker is first ground in a mill and then mixed the cement and water. The mixture is fed into a mo given a facing of granite to add the appearance of st and subjected to a pressure of 500 tons in a special p similar in pattern to the presses used by other munic bodies. The slabs are 3 ft. by 2 ft., 2 ft. 6 ins. by and 2 ft. by 2 ft., by $2\frac{1}{2}$ ins. thick. Four unskilled men, said, can turn out 120 flags in eight hours.—A. G. L.

Gypsum; The Hydration of ——. P. Rohland. Thon Zeit., 1904, **28**, 942—944.

The author's experiments lead him to conclude that substance which, in the condition of a dilute solu increases the tension of solution (Lösungsdruck) of gyp must also accelerate its velocity of hydration.—C. S.

English Patents.

Lime and Portland Cement; Process of and Machine Preparing ——. T. Winstanley, Formby. Eng. 16,412, July 25, 1903.

For the simultaneous slaking and conveying of li number of trays are mounted on an endless conv Lime is placed on these trays, and water is then sprin on the lime, after which the trays are moved forwards to enter, one or more at a time, a chamber in which are exposed to the steam generated by the heat ev during the slaking. Steam may also be admitted outside if necessary. After leaving this chamber, the are moved forwards to a screening apparatus, into w they discharge their contents, the coarser particles b returned to undergo the same operation. The proces hydrating the free lime in Portland cement is the s except that no water is sprinkled on the trays, the ce being hydrated by moist air in the chamber.—A. G. L.

Asphalt Compositions for Floors and the like. F. N London. From Westdeutsche Thomasphosphat-W Berlin, Germany. Eng. Pat. 7343, March 28, 1904.

Powdered slag is added to melted asphalt compos filling materials, such as sand and gravel; and bin agents, such as tar, resinous products and oil, are a the whole is boiled and stirred, and then allowed to when a hard elastic product is obtained. Suitable pr tions are 80 per cent. of slag, 10 per cent. of as composition, and 10 per cent. of binding and filling mate —A. G.

United States Patents.

ble; *Artificial* ——. D. Feldhamer and N. Oelgiesser, New York, N.Y. U.S. Pat. 763,383, June 28, 1904.

artificial marble is composed of a mixture of slaked coal-ashes, zinc-white, chloride of zinc, and chrome- saturated with a solution of tartar and borax. —A. G. L.

nt derived from Ashes, and Method of Making same. W. Marsden, Philadelphia, Pa. U.S. Pat. 763,685, ne 28, 1904.

cement is made by mixing pulverised coal-ashes and to which unburnt coal may also be added, calcining sing the mixture, and powdering the product. —A. G. L.

nt; Composition of Matter for ——. A. L. Ginter, ark, New Jersey. U.S. Pat. 763,746, June 28, 1904.

cement is composed of 500 lb. of "prince metallic," . of japan, 100 lb. of white lead, 3 galls. of varnish, ls. of oil of citronelli, 10 galls. of coal tar, 1 gall. of tha, and 5 galls. of fish-oil. Ground slate may also be l.—A. G. L.

French Patent.

ks and Agglomerates from Waste Moulding-Sand of asswoorks; Manufacture of ——. Blottefière. Fr. Pat.),282, Feb. 9, 1904.

ENT is made from a mixture of 8 parts of chalk, 12 of ay, and 80 of waste glassworks sand, or of 12 parts of ., 20 of fireclay, and 68 of waste sand. The cement is d with an aggregate consisting of quartz, sandstone, ricks, &c., and the mixture subjected in moulds to aulic pressure, varying from 10 or 30 to 350 kilos. per m., according to the use to which the bricks are to it.—A. G. L.

X.—METALLURGY.

ls; Distillation of a Mixture of two ——. H. Moissan l O'Farrelley. Comptes rend., 1904, **138**, 1659—64.

URES of metals were heated in an electric furnace for og times, and the residues were analysed. In the of copper and zinc, and copper and cadmium, the and cadmium were completely expelled after very periods of distillation. In the case of copper and the same ultimate result was reached, though only a longer distillation, during which the percentage of gradually lessened. In the case of copper and tin, mixtures gradually increased in copper-content, some n-content, and some distilled without change of com- ion. (The latter alloy corresponds approximately to l's crystallised alloy, SnCu.) In the case of lead and the lead gradually lessens in amount, pure tin being ately left. A remarkable character of tin is the wide e of temperature through which the liquid metal exists; t it melts at the low temperature of 226° C., its boiling . is above those of copper and lead. The results of experiments show that the laws of ordinary fractional lation apply even in the case of the distillation of ures of metals.—J. T. D.

etals; Passivity of ——. W. J. Müller. Z. phys. Chem., 1904, **48**, 577—584.

view that the passive state of a metal is due to a ctive coating, whether of gas or of oxide, is not in dance with electrochemical theory, which does, how- support Schönbein's view that passivity is caused by teration or "state of molecular stress" in the surface e metal itself. Where a metallic anode dissolves, no sing action occurs at the anode; this phenomenon place only where the metal is passive, or where it ves as a polyvalent ion which, in solution, is con- l into one of lower valency. Passivity, then, according to the author's view, occurs in cases where the metal can form polyvalent ions, but where the potential difference requisite to cause these to enter into solution is so great that before it is reached the positive electrons themselves are torn away and enter the electrolyte, causing evolution of oxygen or oxidising actions at the anode. This represents the passivity of the noble metals, and of chromium, an element of stable passivity, which on dissolving as an anode, does so as hexavalent ions, at once decomposing water to form chromic acid and hydrogen ions. Lead under similar circumstances forms tetravalent ions, which in strong sulphuric acid dissolve to form $Pb^{iv}(SO_4)_2$, but in more dilute acid form lead dioxide, the corresponding plumbic acid being too weak to exist in the solution. The conversion of the passive into the active metal will clearly be favoured by the impact of anions on the passive anode, especially those which when discharged form substances of great activity from a purely chemical standpoint, such as chlorine and bromine; thus in hydrochloric acid, lead and iron readily lose their passivity, whilst the more stable passive chromium retains it. The recent discovery of Ruer that platinum can be dissolved or rendered active by an alternating current, especially if a continuous current be superposed, is entirely in accord with the present theory. In the case of iron, the passive ions are no doubt hexavalent, like those of chromium, as the passive iron behaves like a noble metal, and does not perceptibly dissolve, save where it has the opportunity (with strong alkali hydroxide electrolyte) of combining with hydroxyl ions to form ferric acid.—J. T. D.

Pig Iron and its Constituent Elements. H. L. Williams. Amer. Foundrymen's Assoc., June 1904.

The author discusses the effect of carbon, silicon, sulphur, phosphorus, and manganese upon the physical properties of pig iron and castings. The effect of silicon depends upon the amount of carbon present and the rate of cooling. Increase of silicon tends to soften iron containing a high proportion of combined carbon; more silicon is required in light castings than in heavy ones. Manganese increases the affinity of iron for carbon, and also reduces the proportion of sulphur. Heavy castings should contain 0·80 per cent., but light castings not more than 0·50 per cent. In chilling work, up to 3 per cent. of manganese may be used. Ordinary foundry castings should contain up to 0·50 per cent. of phosphorus, and ornamental work up to 1·25 per cent. Silicon should be added to iron containing an excessive amount of phosphorus. The amount of sulphur in iron should be low, not exceeding 0·09 per cent. in ordinary castings.—A. S.

Sulphur in Pig Iron; Irregular Distribution of ——. J. J. Porter. Amer. Foundrymen's Assoc., June 1904.

In the following table are shown the results of the determination of sulphur in pigs from a number of different foundry irons containing from 1·50 to 4·00 per cent. of silicon, about 1·50 of manganese, 0·40 of phosphorus, and about 4·00 per cent. of total carbon. The samples for analysis were taken at different depths, and the figures show the great importance of the method of sampling, and also that the point at which the percentage of sulphur is highest is not always at the top of the pig, as is generally supposed.

—	Percentage of Sulphur.				
	Pig A.	Pig B.	Pig C.	Pig D.	Pig E.
Hole No. 1 Top	0·115	0·058	0·066	0·165	0·116
„ 2.............	0·125	0·058	0·061	..	..
„ 3.............	..	0·052	0·061	..	..
„ 4.............	..	..	0·084	..	..
„ 5.............	..	..	0·059	..	..
„ 6—Bottom ...	0·040	0·030	0·029	0·175	0·103

The author also observed slight variations in the percentage of sulphur lengthwise of the pigs.—A. S.

Scrap Iron. W. G. Scott. Amer. Foundrymen's Assoc., June 1904.

The author classifies scrap iron as follows:—Light machinery scrap (gray iron); heavy machinery scrap (gray iron); stove plate scrap (gray iron); car wheel a chilled iron (gray iron); cast borings; malleable ir scrap; steel scrap; wrought iron scrap; and mix scrap; and gives general average analyses of the differ kinds.

——	Silicon.	Sulphur.	Phosphorus.	Manganese.	Carbon.	Graphite.
Light machinery scrap	2·00—2·60	0·075—0·095	0·7—0·9	0·2—0·6	3·00—4·25	..
Heavy machinery scrap	1·6—2·2	0·075—0·150	0·4—0·8	0·3—0·9	2·75 4·00	..
Stove plate scrap	2·3—3·3	0 075 0·135	0·45 1·25	0·2 0·7	3·5—4·5	..
Car wheel and chilled iron scrap	0·50 1·75	0·075 0·150	0·30—0·65	0·3—0·9	2·00—3·75	..
Borings:—						
Cast iron	1·5—3·0	0·075 0·165	0·20—1·25	0·2—0·9	2·5—4·5	..
Steel	0·0—0·5	0·015—0·095	0·015—0·180	0·4 1·0	*0·1 1·5	..
Wrought iron	0·00—0·15	0·008—0·045	0·011—0·35	0·00—0·15	0·00—0·10	..
Malleable iron scrap	0·30—1·75	0·035—0·095	0·011—0·22	0·15—0·50	1·85—4·25	..
Steel scrap:—						
Rail	0·04—0·50	0·025 0·125	0·04—0·14	0·18—1·50	*0·20—0·80	..
Castings	0·02—0·50	0·012—0·065	0·02—0·12	0·20—0·80	0·15—0·90	..
Mixed	0·00—0·75	0·005—0·125	0·005—0·25	0·10—1·50	0·10—1·50	..
Wrought iron scrap	0·00—0·15	0·008—0·045	0·011—0·350	0·00—0·10	0·00—0·10	0·00—0 05

* Combined carbon.

—A. S.

Steel; Heat Treatment of ——. W. C. Roberts-Austen and W. Gowland. Engineering, 1904, **77**, 118—122, 138—142, 170—176, 184—189, 202—203, 205—208, 239—243, 289—292; Science Abstracts, 1904, **7**, B, 476—477.

Specimens of commercial rolled round bars of steels containing 0·130, 0·180, 0·254, 0·468, 0·722, 0·871, 0·947, and 1·306 per cent. of carbon, respectively, were tested, after being subjected to the following heat treatments:—(*a*) Annealing for ½ hour at 620, 720°, 800°, 900°, and 1100° C.; (*b*) soaking for 12 hours at 620, 720°, 800°, 900°, and 1200° C.; (c) quenching in water at 720°, 800°, 900°, and 1200° C.; (*d*) quenching in oil at 720° C.; (*e*) quenching in oil at 720°, 870°, and 1000° C., and reheating to 350° C.; and (*f*) quenching in oil at 800° and 900 C., and reheating to 600° C The tensile test pieces were ½ in. and $\frac{7}{16}$ in. diameter, elongation being taken over 2 in.; the "elastic limit" was deduced from autographic stress-strain diagrams. The results are given in a series of tables and of curve-diagrams showing the change of breaking-stress, "elastic limit," elongation, and contraction, with the percentage of carbon. Stress-strain diagrams are given for the annealed specimens and for those quenched in water. After annealing at 620° C., the 0·871 per cent. carbon steel showed a lower "elastic limit" than either the 0·722 or 0·947 per cent. specimens, although it gave the greatest breaking-stress both in this condition and as rolled. In the 0·947 and 1·306 per cent. carbon steels, the breaking-stress was diminished by annealing at 800° C. and to a less extent at 900° C., owing to segregation of cementite. All the high-carbon steels were more or less "burnt" when subjected to annealing and soaking at and above 900° C., probably owing to decomposition of cementite into ferrite and amorphous carbon. The heating-curve of a sample of cementite prepared by Abel's method, showed that two changes occurred at about 1100° C.; the residue, after the heating, contained free carbon. The following conclusions are drawn from the stress-strain diagrams. The amount and regularity of elongation at the yield-point are dependent upon (1) the non-homogeneity of the steel; it is always greater when the steel is made up of two constituents, such as ferrite and pearlite, or pearlite and cementite, than when it contains only a single constituent; (2) the annealing of the bar at a temperature below Ar_1; (3) the amount of ferrite present. Secondly, the amount of elongation which immediately precedes fracture varies with the homogeneous or non-homogeneous character of the steel, as in the first case. With similar thermal treatment, the steels containing most ferrite show greatest elongation. Annealing at 620° C. generally causes an increase of the elongation. The elongation is usually *nil* when the bar is composed of martensite, and always when "burning" has occurred.

—A. S.

Cementation of Carbon Steels and of Special Steels. L. Guillet. Comptes rend., 1904, **138**, 1600—1602.

The potassium carbonate contained in wood charcoal is a factor in cementation effected by this substance; and the diminution in the speed of cementation observed aft some time is due to the exhaustion of the potassium ca bonate by volatilisation. Barium carbonate has a simi influence to potassium carbonate, but does not volatili and the cementing power of a mixture of charcoal a barium carbonate remains constant. It is a matter indifference whether air or nitrogen fills the cementatio box. The speed of cementation, with a given mixtur depends on the composition of the steel. Manganes chromium, tungsten, and molybdenum (elements which ca substitute a portion of the iron in cementite) accelerate th action, as compared with that in the case of a carbon stee while nickel, titanium, silicon, aluminium, and tin (elemen which exist dissolved in the iron) retard it. The surface bars of steel which had been treated in the cementatio box was analysed immediately after cementation, and aft intervals of six and 12 months; the carbon contents we respectively, 1·35, 1·05, and 0·85 per cent. Thus γ-iro dissolves carbon even at the ordinary temperature; and doubt after a sufficient interval of time these bars wou have become homogeneous throughout. (See also this J 1903, 798.)—J. T. D.

Aluminium; Alloys of —— *with Magnesium and wi Antimony.* H. Pécheux. Comptes rend., 1904, **13** 1606—1607.

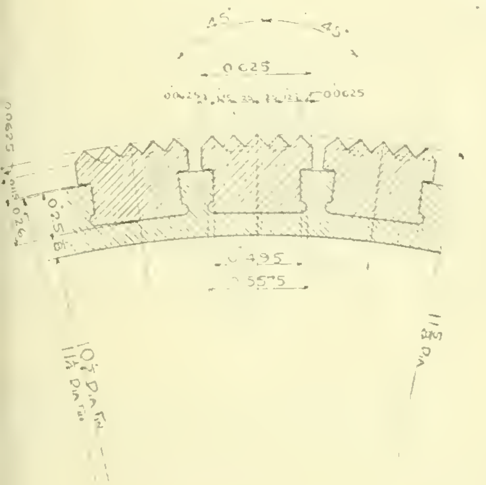
Aluminium-Magnesium.—While the author, operating b fusion in a crucible in presence of air (this J., 1904, 716 could not obtain stable alloys containing less than 65 p cent. of aluminium, Boudouard had formerly obtained n only $MgAl_4$ (81 per cent.) and $MgAl_2$ (70 per cent.), b also MgAl (54 per cent. of aluminium). The last tw however, were obtained by operating in sealed tubes fro which air was excluded.

Aluminium-Antimony.—Aubel has obtained the allo SbAl, melting at 1080° C.; Guillet the alloys SbAl, SbAl $SbAl_4$, and $SbAl_{10}$, which all ultimately fall to powder; an Gautier has studied the curve of melting-points, witho obtaining definite alloys. The author has now obtaine four definite alloys, $SbAl_{30}$, $SbAl_{35}$, $SbAl_{38}$, and $SbAl_{40}$, a melting between 750° and 760° C., and having, respe tively, at 23° C., the densities 2·736, 2·700, 2·662, an 2·592. They all expand on solidifying. They are n brittle, though they file badly, have a coarse-grained vesicul fracture, do not oxidise at the temperature of casting, d not decompose water in the cold, even after filing (SbAl decomposes it at 100° C.), but are attacked by mineral acid and by strong solution of potassium hydroxide.—J. T. D.

Zinc Ore; Magnetic Concentration of —— *in Virgini* C. Q. Payne. Eng. and Mining J., 1904, **77**, 1001—1003.

The material consists of limonite iron ore in conjunctio with hydrated silicate of zinc (calamine) and carbonate zinc (smithsonite). The ground ore is mixed with 8—1 per cent. of coal slack and roasted in a cylindrical rotatin reverberatory furnace. After cooling, the roasted materia is passed over a double cylinder magnetic-separator. Th nders are seamless drawn steel tubes, 16 ins. diameter, about $\frac{1}{16}$ in. thick, each containing a bipolar electronet, the curved face of each pole, 10 ins. wide, being ed close to the wall of the cylinder, along which it pies a certain arc. The upper cylinder is run at a d of 200 revolutions per minute, and produces a clean entrate containing about 48 per cent. of iron. The rial not attracted by the top cylinder passes on to the r one, where it is separated into clean zinc ore, and a in amount of iron "middlings," which are passed igh the separator again.

or the separation of limonite and calamine without ious roasting, a machine is used the design of which is d on the author's discovery that in the separation of feebly etic minerals, such as limonite, garnet, &c., a very rful or dense magnetic field is less effective than one in h the position of the lines of force are so controlled that t differences of magnetic density are established therein.



separating cylinders (see figure) of the machine are of non-magnetic material having a high electrical tance, and are provided, on their surface, with a series ooves, in which are fitted thin, soft steel plates having ed edges. When the cylinder is made to revolve in a etic field, the construction of its surface largely supes Foucault currents, which would cause resistance to otion, whilst the toothed edges of the plates cause the of force to be so divergent that the particles of limonite e attracted and held whilst in the field. The ore, after ; very finely ground, is made to pass through two ssive magnetic fields, arranged vertically. The upper is formed in an air-gap between two stationary electroets, each of which is placed inside a cylinder, the top eing the separating cylinder, and the lower one, of , the feed-cylinder. From the latter, the magnetic les, when brought into the field, are attracted by eparating cylinder, and are conveyed over a division The lower field is somewhat more powerful than pper one, and allows of the separation of very feebly etic ore particles or "middlings." It is established in -gap between two opposing pole-pieces, one of which nected with an external electro-magnet, and the other one contained within the separating cylinder. The ial is fed directly upon the upper part of the sepa- cylinder, and, by means of a non-magnetic guide- connected with the outer pole-piece, is conveyed into ld, which is situated just below the horizontal diameter cylinder.—A. S.

denum in Steel and Steel-making Alloys; Deter-ation of ——. F. Van Dyke Cruser and E. H. Miller. III., page 762.

Calcines; Analysis of ——. J. P. Walker.
XXIII., page 761.

Gold-Mining: Application of Modern Theories of the Flow of Water. H. S. Hele-Shaw. J. Chem. Met. and Min. Soc. of S. Africa, May 1904, 420—426.

By means of ingenious experiments the author sets forth "a great and fundamental truth, *viz.*, that not only does water flow with turbulent motion, which we can expect in a viscous liquid, but" under certain conditions "it can be made to flow with the stream-line motion of a perfect and frictionless liquid." He also shows "that in all the operations of gold-mining, it flows with both these movements, the former in the general mass of liquid, the latter on the surface or skin containing vessel or channel."—J. H. C.

Cyanide Solutions; Determination of Working Constants in ——. G. W. Williams. J. Chem. Met. and Min. Soc. of S. Africa, May 1904. Part II., 412—419. (For Part I. see this J., 1904, 683.)

Methods for determining free cyanides, "protective alkali," carbonates, lime, sulphocyanides, gold, silver, zinc, cyanates, and sulphides are discussed, results of many experiments are detailed, and some improvements are suggested on methods previously described.—J. H. C.

English Patents.

Crucible Furnaces. M. Harvey, Walsall. Eng. Pat. 23,909, Nov. 4, 1903.

A portable furnace containing a crucible is fixed in an outer casing which forms a blast chamber, so that the contents can be poured without removing the crucible. The outer casing is provided with trunnions and is mounted on a carriage. Means are provided for leading the blast into the furnace, for charging the fuel, for tilting the whole, and a spout for pouring.—W. H. C.

Heavy Metals; Process for the Extraction of —— *by Means of Chlorine.* J. Savelsberg, G. Wannschoff, and Allgem. Elektro-Metallurgische Ges., Papenburg-on-the-Ems, Germany. Eng. Pat. 18,763, Aug. 31, 1903.

See U.S. Pat. 741,840 of 1903; this J., 1903, 1247.—T. F. B.

United States Patents.

Ores; Classification of Metallic Constituents of ——. A. E. Cattermole, London. U.S. Pat. 763,259, June 21, 1904.

See Eng. Pat. 18,589 of 1903; this J., 1904, 256.—T. F. B.

Metallic Constituents of Ores from Gangue; Separation of the ——. A. E. Cattermole, London. U.S. Pat. 763,260, June 21, 1904.

See Eng. Pat. 18,589 of 1903; this J., 1904, 256.—T. F. B.

Separation of Minerals; Process of Effecting the ——. G. A. Goyder and E. Laughton, Adelaide, S. Australia. U.S. Pat. 763,749, June 28, 1904.

See Eng. Pat. 16,839 of 1903; this J., 1903, 1133.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Nickel from Zinc; Electrolytic Separation of ——.
Hollard and Bertiaux. XXIII., page 762.

English Patents.

Gaseous Medium from Air; [Electrical] Method of Generating a ——. J. N. Alsop, Owensboro, Ky., U.S.A. Eng. Pat. 10,538, May 7, 1904. Under Internat. Conv., May 29, 1903.

See U.S. Pats. 758,883 and 758,884 of 1904; this J., 1904, 611.—T. F. B.

Separation of Different Liquids from each other, as also for Separating Liquids from Bodies Suspended or Dissolved therein; Process [Electrical Endosmose] and Apparatus for the ——. C. D. Abel, London. From Siemens und Halske, Akt.-Ges., Berlin. Eng. Pat. 14,195, June 25, 1903.

See Fr. Pat. 333,348 of 1903; this J., 1903, 1355.—T. F. B.

Sulphate of a Higher Oxide of Manganese; [Electrolytic] Manufacture of a ——. J. Y. Johnson. From Badische Anilin und Soda Fabrik. Eng. Pat. 17,981, Aug. 19, 1903. VII., page 749.

Hydroxides and Oxides of Metals; Process for the Production of —— by Electrolysis. F. F. Hunt, New York. Eng. Pat. 28,400, Dec. 24, 1903.

See U.S. Pat. 748,609 of 1904; this J., 1904, 119.—T. F. B.

Lead; Manufacture of Spongy or Porous ——, *and of Articles [Electrodes] therefrom.* J. H. Mercadier, Louvres, France. Eng. Pat. 7981, April 6, 1904. Under Internat. Conv., April 7, 1903.

See Fr. Pat. 331,006 of 1903; this J., 1903, 1092.—T. F. B.

United States Patents.

Electrically Extracting Essential Oil; Process and Apparatus for ——. G. D. Burton, Boston, Mass., Assignor to Boston Leather Process Co., Portland, Me. U.S. Pats. 763,151-2, June 21, 1904.

The essential oil is extracted and distilled off by immersing bark, or other vegetable matter in a suitable menstruum through which an electric current is passed to raise the temperature to the desired extent. The apparatus is in the form of a closed still provided with connections for the electric current and with a condenser. The material to be treated, is contained in porous bags and is surrounded by the extracting solution which serves also to conduct the current.—R. S. H.

Treating Sewage; [Electrolytic] Apparatus for ——. W. J. Schweitzer. U.S. Pat. 763,026, June 21, 1904. XVIII. B., page 758.

(*B.*)—ELECTRO-METALLURGY.

Electro-Plating; Composition of Baths for ——. R. Namias. Monit. Scient., 1904, **18**, 487—488.

The following baths are recommended:—

Nickel.—Forty grms. of crystallised nickel sulphate, 25 grms. of ammonium chloride, 10 grms. of boric acid, and 10 grms. of citric acid per litre.

Silver.—The cyanide bath is made up to the formula $AgCN, 2KCN$. As it becomes alkaline in use, a little potassium cyanide and mono-potassium citrate are added from time to time.

Copper.—Solution A:—30 grms. of normal copper acetate, 30 grms. of sodium sulphite, 5 grms. of ammonium carbonate, and 500 c.c. of water. Solution B:—35 grms. of potassium cyanide and 500 c.c. of water. A and B are mixed warm.

Brass.—Fifty grms. of copper acetate, 25 grms. of zinc chloride, 250 grms. of sodium sulphite, 35 grms. of ammonium carbonate, and 100 grms. of potassium cyanide in 3 litres.

Gold.—To gold chloride solution ammonia is added, the precipitate is dissolved in 1 per cent. potassium cyanide, and the solution boiled. One grm. of gold per litre is the minimum.

Platinum.—A solution of potassium chloroplatinate, containing not less than 2 per cent. of the salt.

Iron.—Forty grms. of ferrous sulphate, 100 grms. of ammonium chloride, 100 grms. of ammonium citrate, and 1 litre of water. The citrate prevents anodic deposition of basic salt.—W. A. C.

Steel; "Ageing" of Sheet ——. T. S. Allen. Elec World and Engineer, 1903, **41**, 1048—1049. Scien Abstracts, 1904, **7**, B, 469.

The results of the author's tests on commercial sheet st for armature construction are given in a series of curv It was found that "ageing" takes place in all sheet st subject to a varying temperature, and especially in ste having a high initial hysteresis. Most of the samples w high initial hysteresis examined, "aged" at first, but af periods varying from 20 to 160 days, at a mean temperat of 93° C., the hysteresis showed a tendency to come do to near the initial value. The author concludes from results of the tests that annealing is useless for armat iron.—A. S.

Nickel Cathodes. D. H. Browne. Electrochem. I 1903, **1**, 348—349. Science Abstracts, 1894, **7**, 461—462.

The tendency of electrolytically deposited nickel to cr and curl off the cathode in a shape resembling shavings wood, is attributed to local irregularities in the electrol Artificial circulation of the electrolyte, the employment a uniform current-density throughout the electrolysis, the use of a graphitised cathode of rolled block tin recommended. Good results, so far as the flexibility the deposited nickel is concerned, were obtained un the following conditions:—Electrolyte, 70 grms. of nic chloride and 180 grms. of sodium chloride per litre; t perature, 70° C.; current density, 100—200 ampères sq. m. With regard to the curvature of the deposit, it observed that the curling was always in the direction of anode, and around the longer axis of the cathode. By use of a cathode plate of reversed curvature, it is st that the deposit when stripped from the backing, "spr into a perfect plane surface."—A. S.

Metal Extraction; Electric —— from Ores by Mean Insoluble Electrodes. S. Laszczynski. Elektroch Zeits., 1904, **11**, 54; Chem.-Zeit., 1904, **28**, Rep. 19

In cases in which the anodic oxidation of a cation is t prevented, the author surrounds the insoluble cat with a closely-fitting layer of porous material or fabric. —T. H. 1

Molybdenum; New Carbides of ——. H. Moissan K. Hoffmann. Comptes rend., 1904, **138**, 1558—156

Cast molybdenum, carbon, and excess of metallic alu ium, are heated together in the electric furnace; reaction must not be carried on too long, or the tempera (which is kept down by the volatilisation of the alumin will rise too high. The fusion is treated successively solution of potassium hydroxide, dilute sulphuric acid, concentrated hydrochloric acid, and the graphite separ mechanically. There remains a molybdenum carbid formula MoC; very hard, not decomposing water in cold, or steam at 600° C. It seems analogous to Willi tungsten carbide. Possibly it plays a part in the forma and behaviour of tungsten steels.—J. T. D.

English Patent.

Electro-Deposition of Metals on Aluminium, Alloy Aluminium, and other Metals. F. W. Croucher, F Hants. Eng. Pat. 13,182, June 12, 1903.

In order to ensure the adhesion of the deposited metal aluminium is prepared by treatment with a large numb special solutions intended to clean its surface, *viz.*, w oil soap, hydrochloric acid, potassium cyanide, phosp acid, sulphuric and nitric acids, potassium cyanide, am nium cyanide, ammonium chloride, and cyanide or bichl of mercury, and caustic potash; it is then passed thr suitable "striking" baths before being placed in depositing vat.—R. S. H.

United States Patent.

Aluminium; Process of Electrolytic Manufacture of —. G. Gin, Paris. U.S. Pat. 763,479, June 28, 1904.

See Eng. Pat. 964 of 1903; this J., 1903, 805.—T. F. 1

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

rd ; Crystals obtained in the Belfield Test for ——. I. Kreis and A. Hafner. Z. Untersuch. Nahr.- u. enussm., 1904, **7**, 641—669.

e difference between the form of the crystals deposited n an ethereal solution of lard and from a solution of f fat was attributed by Hehner and Mitchell (Analyst, 328) to the presence of a greater proportion of stearic l in the beef crystals. The authors, however, have not n able to confirm the observations of Hehner and chell as to the gradual formation of needle-shaped stals from lard on recrystallisation, but invariably ained the chisel-shaped crystals. Their lard crystals ted at 45 to 47° C., then solidified as the temperature e, again becoming liquid at 61° C. The crystals from f fat melted at 43° and 58·5° C. After repeated crystaltion from ether the melting points of the crystals ame constant, at the temperatures recorded for the ed glycerides described in the author's former paper s J., 1903, 1136). The synthetical glycerides prepared lescribed before, were identical in every respect with these ural glycerides, and the authors therefore conclude that ir explanation of the difference between lard and mutton beef fat crystals in the Belfield test is that the latter sist of (impure) palmito-distearin, and the former of tadecylo-distearin. Pure heptadecylic acid, $C_{17}H_{34}O_2$, n the lard crystals melted at 55·5° C. It was more ible in 95 per cent. alcohol than either stearic or mitic acid, 100 c.c. dissolving 0·970 to 0·972 grm. at C.—C. A. M.

s ; Decolorisation of —— with Aluminium Magnesium Iydrosilicate [Florida Fullers' Earth]. Hirzel. Chem. Rev. Fett- u. Harz-Ind., 1904, **11**, 116—118, 145—146.

LLERS' earth is found in alluvial deposits of ½ to 4 metres thickness in the interior of Florida. It usually occurs ve a layer of sand, and beneath a layer of ½ metre humus and ½ to 2 metres of plastic clay. When bly dug out it is a moist greenish mass, which has e freed from clay and sand, and dried in thin layers ore it can be sold. During the drying process it loses ut 50 per cent. in weight, and leaves a white friable mass ch still contains from 15 to 18 per cent. of water. ally it is ground in a mill and sorted into different grades sifting. The commercial product is a neutral white or yish or yellowish white powder, which when dry is remely hygroscopic. Its average composition is as ows :—Silica, 56·53 ; alumina, 11·57 ; magnesia, 6·29 ; oxide, 3·32 ; calcium oxide, 3·06 ; water, 17·95 ; and alis, &c., 1·28 per cent. It is usually necessary to ydrate Florida fullers' earth before use. This is best e in a special apparatus from which air is excluded ar as possible, the powder being heated with continual tation at 300° to 500° C., until it assumes a greyish-blue de. This removes both the absorbed water and the mically combined water of hydration. For many pures it is sufficient to expel absorbed water by heating the vder at 120° C., though the product is a much less ective bleaching agent than that roasted at the higher perature. Preliminary experiments should be made h the oils or fats to be bleached, in order to determine most suitable temperature in each case. Thus, light eral oils, such as lamp petroleums and vaseline oil, are apletely decolorised at 12°—17° C., whilst 60° to 80° C. he most suitable temperature for finer vegetable oils, and to 125° C. for solid fats. In the case of the heaviest eral oils, such as cylinder oil, bleaching can only be cted at higher temperatures (140°—150° C.). The ount of earth required also varies with the different oils, e requiring 3 to 5 per cent., others 7 to 10 per cent., ilst others again need as much as 15 to 20 per cent., or re. Hard paraffin, after preliminary treatment with huric acid &c., is completely bleached by means of only to 2 per cent. of the earth. Cocoa nut oil, palm kernel mustard seed oil, and olive oil require 2 to 3 per cent., whilst rape oil arachis oil, cottonseed oil, and linseed oil need a greater proportion—usually 5 to 10 per cent. The earthy flavour left in edible oils after treatment with the fullers' earth can be removed by a short treatment with 10 per cent. of a 10 per cent. solution of sodium chloride, or with 1 to 1½ per cent. of powdered dry sodium bicarbonate. The method of treatment has also great influence on the results. The filtration method is simple and widely employed, but is open to the objections that filtration through a layer of 430 mm. is slow, that only the coarser grades of earth can be used, and that some method of heating the oil or fat during the filtration is necessary. In methods by mixing, the oil, brought to the right temperature, is mechanically mixed for about 20 minutes with the requisite proportion of earth, and then pressed in a filter press. The earth left in either process contains about 80 per cent. of its weight of oil. In the case of linseed or other drying oils the powder can be used in oil paints, whilst in the case of other oils the earth can be extracted with a suitable solvent. The oil thus obtained is of a dark colour, but can be bleached by means of more Florida earth. The residual earth can be regenerated by heating it to 400°—500° C., and the dark grey to black product thus obtained can be used again for bleaching purposes, preferably after the addition of 15 to 20 per cent. of fresh earth.—C. A. M.

Fats ; Decomposition of Potassium Iodide by ——. A. Heffter. XX., page 758.

Grease Oleines [Wool Oils] ; Detection of Mineral Oil in Distilled ——. A. H. Gill and S. N. Mason. XXIII., page 763.

XIII.—PIGMENTS, PAINTS ; RESINS, VARNISHES ; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

UNITED STATES PATENT.

Iron, Preparation of Salts of —— for Use in Oil Colours. R. Vidal, Paris. U.S. Pat. 763,574, June 28, 1904.

SEE Fr. Pat. 333,365 of 1903 ; this J., 1903, 1344.—T. F. B.

(C.)—INDIA-RUBBER, &c.

Kickxia Rubber. M. Zitzow. Gummi-Zeit., 1904, **18**, 793—794.

OF the seven varieties of kickxia rubber at present known only the *K. elastica* Preusz yields a useful latex, and it is also the most widely distributed. On account of its great productive capacity and easy culture, this tree should be selected as the most suitable for West Africa, especially as it would serve a good purpose in shielding cocoa-plantations from sun and wind.—J. K. B.

Crude Rubber ; Examination of ——. G. Fendler. XXIII., page 764.

India Rubber ; Weber's Method for the Direct Determination of ——. P. Alexander. XXIII., page 765.

Sulphur in Golden Antimony Sulphide used for Rubber Manufacture. W. Esch and F. Balla. XXIII., page 761.

XIV.—TANNING ; LEATHER, GLUE, SIZE.

Tannin ; Determination of —— without Hide Powder. H. Wislicenus. XXIII., page 765.

ENGLISH PATENT.

Gelatine and Glue ; Detanning Mineral Tanned Leather, or Leather Waste, or the like for the Manufacture of ——. A. R. Weiss, Hilchenbach, Germany. Eng. Pat. 21,379, Oct. 5, 1903.

SEE U.S. Pat. 738,709 of 1903 ; this J., 1903, 1096.—T. F. B.

United States Patent

Bating or Puering Skins; Process for ——. O. P. Amend, New York. U.S. Pat. 763,347, June 28, 1904.

Hides or skins are treated with a solution of an ammoniacal salt, small quantities of an acid such as hydrochloric acid being added at intervals so as to re-form the salts.
—R. L. J.

XV.—MANURES, Etc.

Sodium Nitrate on the Constitution of the Soil; Effect of the long-continued Use of ——. A. D. Hall. Chem. Soc. Proc., 1904, **20**, 154.

After a review of the results of the mechanical analysis of Rothamsted soils, it was observed that those which had been manured with sodium nitrate every year, gave abnormal results; a further series of fifteen soils was examined drawn from each of the Rothamsted fields where plots with and without sodium nitrate occurred. In general, the use of sodium nitrate has resulted in a lower proportion of "klay" being left in the surface soil. This result was most manifest in the mangel field, where cultivation is frequent, and was not apparent at all in the grass field, where the turf protects the soil from the washing action of the rain. The removal of the finest particles from the surface soil is attributed to deflocculation induced by the use of sodium nitrate and followed by the washing of the finest particles into the subsoil. This hypothesis is confirmed by chemical analysis of the "klays" separated in the mechanical analysis of some of the subsoils, which were found to be richer in fine particles beneath the soils receiving nitrate, and by the condition of the same soils in the field, which showed every evidence of deflocculation.

Soil Acidity; Comparison of Methods for the Determination of ——. F. P. Veitch. XXIII., page 762.

XVI.—SUGAR, STARCH, GUM, Etc.

Diffusion Juice; Cold and Hot Liming of ——. Prangey and de Grobert. Bull. Assoc. Chim. Sucr. et Dist., 1904, **21**, 1241—1247.

An examination of the properties of the principal constituents of the non-sugar portion of beetroot juice, leads to the conclusion that the raw juice should not be heated before carbonating, as, in presence of large additions of lime, there is danger of causing the melassigenic substances which have been rendered insoluble in the scums to re-enter into solution. The only objection to heating the unlimed juice is that the slight acidity (due chiefly to asparagine) may cause inversion, but this may be easily overcome by the addition of a very small quantity of lime to neutralise the acidity. When normal beetroots, which have been gathered only a short time, are being worked, erroneous procedure does not cause serious trouble, but it is quite otherwise if the roots have undergone alteration during storage.—L. J. de W.

Reducing Sugars; Potassium Bromide as Indicator in the Determination of —— with Fehling Solution. P. Berti. XXIII., page 765.

French Patent.

Sugar; Extraction of —— from the Beet and other Plants in one Operation and without producing Molasses. E. Lallemant. Fr. Pat. 339,763, Jan. 21, 1904.

In this process the dried beet or other material, preferably in a coarsely powdered condition, is treated in an extraction apparatus with alcohol of suitable strength, and at as high a temperature as possible without boiling the alcohol. When the latter is sufficiently saturated with sugar, it is removed from the residue and cooled to a low temperature to separate the sugar. The alcohol is then again used for extracting the residual matter, after which it is cooled dow as before. This process is repeated until all the sugar i removed from the material. The sugar thus obtained, either in crystals or as a syrup, is then refined.—T. H. P.

XVII.—BREWING, WINES, SPIRITS, Etc.

Beer; Condition, Viscosity, and "Head" Retention in ——. O. Mohr. Woch. f. Brau., 1904, **21**, 363—368.

Referring to Prior's hypothesis that the retention o carbon dioxide in beer is partly attributable to combinatio with primary phosphates, the author points out that th mean content of phosphoric acid in beer is only 0·07 pe cent. so that not more than 0·03 per cent. of carbon dioxid can enter into such a combination. Equally untenable i his opinion are the assumptions, based on no experimenta evidence whatever, of the formation of an ester by the unio of the carbon dioxide and the alcohol present. The formation of carbonic acid (H_2CO_3) in aqueous solution has lon been recognised. The combination of carbon dioxide wit the proteids of beer, as suggested by Hanke, is equall unsupported by experimental evidence, the gas bein merely held in suspension to an extent determined by th viscosity of the liquid. In examining the influence of th various constituents of beer on the viscosity, he uses th Ostwald viscosimeter, and finds that, with water = 100, on per cent. of absolute alcohol = 104—105, whilst 10 pe cent. = 156—157. The method is simpler than gravit determinations, and can be performed with about 5 c.c. o liquid. By the same method a 1·25 per cent. solution o dextrin gives the viscosity 109—110, and a 5 per cen solution = 142—147·9. Maltose has a far smalle influence on the viscosity, that of a 1·25 per cent. solutio being only 103, and a 5 per cent. solution = 112·5. Glycer gives almost identical results as maltose, whilst the miner salts have a still smaller influence, potassium chlorid even reducing the viscosity below that of water alone (th 7·46 per cent. solution = 93·3). Finally, the influence the proteids diminishes in proportion to the degree of degradation, casein (1 per cent. solution) giving 119·8, pepton 104·2, and asparagine 100·9. Ullik's assumption that th viscosity of beer is affected by (undetermined) substance present in very small amount, seems to be justified, sinc the calculations based on the viscosity of the alcohol an extract present (the latter being calculated as dextrin), giv results below those of the actual determination of the bee Nevertheless, the alcohol, and above all the extract, for the chief factors in governing the viscosity, and, therefor to ensure head retention, it is important to aim at lo attenuation, especially when working with worts of low initi gravity.—C. S.

Beer; Influencing the Retention of "Head" in ——. A. Bau. Woch. f. Brau., 1904, **21**, 382—383.

In addition to the positive causes of "head" retention, *i.e* viscous substances and infinitely minute colloid particle there must be taken into account a negative factor, namel the absence of substances tending to reduce the surfa tension of the beer. Among these head-destroying substances, the chief place is occupied by amyl alcohol an secondary octyl alcohol formed during fermentation, th addition of a drop of which to beer with good "head will cause the latter to dissipate immediately with bris effervescence. Next come the corresponding aldehyd and acids, whereas, contrary to the usual opinion, fa have little influence. It is well known that acetic ac lactic acid, succinic acid, and glycerol are among th by-products of fermentation in beer; but whether th various alcohols, aldehydes, and acids found in spirit an wines are also formed in beer has still to be determinined
—C. S.

Fermenting Liquids; Importance of Determining th Degree of Infection in —— immediately after Samplin P. Lindner. Woch. f. Brau., 1904, **21**, 368—369.

In sending samples of wort or beer through the post f biological examination, the relative character of the organis

y undergo alteration, and, therefore, cease to accurately
resent the original conditions. On this account the
hor recommends brewers to make droplet cultures
hollowed object glasses, since this method will give
cise indications in 15 to 20 hours, and will afford valuable
ormation as to the keeping qualities of a batch of bottled
r, for example.—C. S.

ltose Action ; The Constancy of —— and the Influence
f the Products of Reaction. C. Philoche. Comptes
end., 1904, **138**, 1634—1636.

e author brings forward fresh proofs of the constancy of
action of maltase, which retains its initial activity for
hours, in presence of the products of the transformation.
retardation produced in the action of maltase by the
ition of dextrose is much less than that exerted by
ert sugar on invertase.—T. H. P.

r ; Notes on Claussen's Paper on Sarcina Sickness
—. H. Will and R. Braun. Z. ges. Brauw.,
904, **27**, 462—463. (See this J., 1904, 332.)

the authors' experience a 5 per cent. solution of
nonium fluoride suffices to thoroughly disinfect brewery
nsils. For hose pipes the 0·5 per cent. solution re-
mended by Claussen for the detection of *pediococci*
uld be allowed to act for at least 12, and preferably
24 hours. The antiseptic should not, however, be used
many times or too long, for though it will continue
acious for three to four weeks, it afterwards allows
næ to develop. Contrary to Claussen's experience
have found that sarcina beer, after treatment for half
hour with an equal volume of a 1 per cent. solution
mmonium fluoride, was not freed from infection, develop-
nt taking place in ammoniacal yeast water. Very
k potassium fluoride (0·003—0·007 per cent.) greatly
urs the growth of sarcina, whilst retarding that of
ts and rod bacteria. They cannot agree that ammo-
al yeast water is entirely unsuitable for the detection
sarcina in brewery practice, having often found it
ble for this purpose, though care is necessary in adding
ammonia.—C. S.

rt and Beer Pipes ; Causes and Prevention of
nfection in ——. G. Luff. Z. ges. Brauw., 1904,
7, 453—456, 484—487.

RE is practically no difference in efficiency between the
ous disinfectants used for cleansing metal- and hose-
s, when diluted to the necessary working strength ; con-
ently selection must depend on the cost, possibility of
over again, and action on the pipes, utensils, &c.
nfectants containing hypochlorous acid cannot be used
e. Soda intended for use again must be kept in a
d vessel, whereas the hydrofluosilicic acid preparation
ntanin" can be stored in wooden utensils. Four per
. solutions of this efficient antiseptic have no action
he metallic fittings, varnish, or materials of brewing
sils or pipes. Since the action of disinfectants is in
ase more than temporary, the pipes to be cleansed
ld be treated at least once a week (more often in
ner) for two hours with a 4 per cent. solution of
ntanin," or with some other preparation of suitable
gth.—C. S.

ithin ; Presence of —— in Wine. A. Rosenstiehl.
Monit. Scient., 1904, **18**, 485—487.

RICH and Ortlieb (this J., 1904, 333) found 0·35 grm.
cithin per litre in a Greek wine from Thera : about as
as is contained in milk. In criticising their conclusions,
uthor points out that the lecithin is derived rather
the juice than from the pulp, and that it is not
ciably destroyed by his process of heating the must
fermentation.—W. A. C.

sing Ferment [Anaeroxydase] ; Action of an In-
ct —— on Vanillin and Morphine. E. Bourquelot
L. Marchadier. XXIV., page 766.

Peroxydase Reaction ; Velocity of the ——, &c.
A. Bach and R. Chodat. XXIV., page 766.

Oxido-reducing Enzyme ; Existence and Conditions of an —— in Plants. J. E. Abelous. XXIV., page 766

English Patent.

Filtering Liquids [Wines, Beers, &c.] ; Process and Apparatus for ——. S. H. Johnson and S. H. Johnson and Co., Ltd., Stratford. Eng. Pat. 10,753, May 10, 1904.

A vertical filter-press has the plates arranged around a central tie rod, and has a base plate attached to one end. In the latter are suitable openings for feeding and discharging the liquid. An air- and water-tight cover encloses the press, and is attached to the base plate. A strainer is provided to keep back larger particles of solid matter. The process applied to "fermented beverages and the like" is claimed as well as the apparatus.—W. H. C.

XVIII.—FOODS ; SANITATION ; WATER PURIFICATION, & DISINFECTANTS.

(*A*.)—FOODS.

Butter and Margarine ; Browning and Frothing of —— on Heating. G. Fendler. Chem. Rev. Fett- u. Harz-Ind., 1904, **11**, 122—124.

From the results of experiments (described in detail) the author concludes that the frothing of butter when heated is not due to the presence of soap. Margarine can be made to froth and become brown, like butter, by the addition of 0·2 per cent. of egg yolk or 0·2 per cent. of lecithin. The presence of traces of sugar, such as is introduced with the milk in milk margarine, is also a necessary factor for the browning.—C. A. M.

Cocoanut Oil in Butter ; Determination of ——.
A. Müntz and H. Coudon. XXIII., page 764.

Lard ; Crystals obtained in the Belfield Test for ——.
H. Kreis and A. Hafner. XII., page 755.

Borax [Mineral Spring Water] : Relation of —— to Carbonic Acid. L. Grünhut. XX., page 758.

Alkali Fluorides in Foods ; Detection of ——.
J. Froidevaux. XXIII., page 760.

French Patents.

Milk Powder ; Process for Obtaining ——.
J. R. Hatmaker. Fr. Pat. 339,943, Jan. 27, 1904.

Before evaporating, the acidity of the milk is reduced to "3 degrees" by the addition of a suitable alkali. A preliminary titration is made on a small quantity of the milk in order to ascertain the amount of alkali (*e.g.*, sodium bicarbonate) to be added to the bulk thereof. "Degrees" of acidity is an expression referring to the number of c.c. of N/10 sodium hydroxide solution required per 100 grms. of milk.—W. P. S.

Milk and Lecithin Food Products ; Preparation of ——.
A. Fournier. Fr. Pat. 340,047, Jan. 30, 1904.

The claims are for mixtures of milk, cheese, butter, condensed milk or the like, and lecithin. The latter is added in the form of a concentrated alcoholic or ethereal solution. After thorough incorporation, the alcohol or ether is removed by evaporation, and the mixture sterilised. The lecithin solution and the milk may be separately sterilised before mixing.—W. P. S.

Milk; Process and Apparatus for Producing Purified ——, and Cream and Butter freed from all Objectionable Germs. G. Daseking and H. Paradies. Fr. Pat. 340,145, Feb. 3, 1904.

See Eng. Pat. 12,045 of 1903; this J., 1904, 381.—T. F. B.

Coffee; Process of making an Extract of ——. A. Farago and S. Bartha. Fr. Pat. 340,404, Feb. 12, 1904.

See Eng. Pat. 3465 of 1904; this J., 1904, 452.—T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

Formaldehyde; Atmospheric ——. H. Henriet. Comptes rend., 1904, **139**, 67—68.

The author's determination of the amount of formaldehyde in the air (this J., 1904, 687) from the amount of carbonic acid formed when the air was passed over heated mercuric oxide, led to the figures 2 to 6 grms. per 100 cubic meters of air. Air containing such a proportion, however, would be quite irrespirable; hence the carbon dioxide formed cannot have proceeded from free formaldehyde, but was possibly derived in part from some compound of formaldehyde. Water through which air has been passed in large quantity gives the reaction of formaldehyde; but if the same water be previously treated with sulphuric or acetic acid, formaldehyde is indicated in much larger amount, which shows that some compound of formaldehyde does exist in the air. Delépine has shown that formaldehyde heated with water yields formic acid, carbon dioxide, and methyl alcohol; and as the author has found formic acid and extra carbon dioxide in the atmosphere at times of fog, he suggests that Delépine's reaction may occur in the atmosphere, and that the methyl alcohol and formaldehyde may react to form methylal, from which formaldehyde can be regenerated by the action of acids.—J. T. D.

Formaldehyde; Presence of —— in the Products of Combustion of Fuels. A. Trillat. II., page 744.

United States Patent.

Treating Sewage; [Electrolytic] Apparatus for ——. W. J. Schweitzer, Whiteplains, N.Y. U.S. Pat. 763,026, June 21, 1904.

An electrolysis chamber is used in conjunction with settling tanks for the treatment of sewage which is caused to flow through the system. The grease is subsequently removed, the sediment allowed to settle, and the purified water run off through a filter.—R. S. H.

(*C.*)—DISINFECTANTS.

United States Patent.

Insecticide Compounds. O. D. Goodell, Baltimore. U.S. Pat. 763,481, June 28, 1904.

The following substances mixed together compose this insecticide:—Barium sulphide (the chief constituent), barium silicate, potassium silicate, potassium oxide, and barium oxide, together with iron sulphide, silex, and carbon, if desired.—R. L. J.

XIX.—PAPER, PASTEBOARD, Etc.

United States Patent.

Viscose: Process of Purifying ——. C. F. Cross, London, Assignor to D. C. Spruance, Philadelphia. U.S. Pat. 763,266, June 21, 1904.

See Eng. Pat. 21,030 of 1903; this J., 1903, 1363.—T. F. B.

French Patent.

Celluloid; Artificial ——. J. Schmerber. Fr. Pat. 340,266, Feb. 8, 1904.

Methylacetanilide is claimed as a partial or complete substitute for camphor in the manufacture of celluloid. 40 parts of the two substances mixed or 30—35 parts of methylacetanilide only, dissolved in the usual proportion of alcohol are equal in effect to 50 parts of camphor per 100 of nitro-cellulose.—R. L. J.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Borax; Relation of —— to Carbonic Acid [Minera Spring Water]. L. Grunhut. Z. phys. Chem., 190 **48**, 569—576.

In aqueous solution, borax dissociates completely int sodium metaborate and free boric acid. This view, firs enunciated by Schweizer in 1856, is confirmed by th results of modern research, especially by Shelton's recen determinations of the change of electric conductivity of solution of borax as sodium hydroxide is slowly added to i If carbon dioxide be led into an aqueous solution of borax however, the sodium metaborate is decomposed, a corresponding amount of free boric acid is formed, and the whol of the sodium is converted into bicarbonate. If, in presenc of carbon dioxide, a large excess of boric acid be added, certain, though very slight, formation of sodium metaborat occurs, as shown by the slight decrease in electric condu tivity. From this it would seem that the small amount boric acid which occurs in the waters of some miner springs must exist, at least in the presence of free carbo dioxide, as free acid, H_3BO_3.—J. T. D.

Basic Mercury Salts. A. J. Cox. Z. anorg. Chem., 1904, **40**, 146—181.

The authors have applied the phase rule to the examinatio of the hydrolysis of mercury salts and find that mercur chromate, mercuric and mercurous nitrates, and mercur and mercurous sulphates are converted first into basic sal and then into the oxide; mercuric fluoride is convert directly into the oxide.

Mercuric Chromate.—Only one basic salt exists, dark red powder of the composition, $3HgO.CrO_3$, and th is not stable when the acid-concentration of the solution less than 0·00026 N at 50° C. The other so-called bas mercuric chromates are merely mixtures either of t normal and basic salts or of the basic salt and mercur oxide. The normal chromate is stable only when the aci concentration of the solution is as high as 1·41 N 50° C.).

Mercuric Nitrate.—One basic salt, a heavy white powd of the composition, $3HgO.N_2O_5$, exists. The minimu acid-concentration at which the normal and basic sal respectively, are stable at 25° C. are 18·72 N and 0·159

Mercuric Sulphate.—The basic salt has the compositio $3HgO.SO_3$, and forms a heavy, bright lemon-yell powder, much less soluble than the normal salt. T minimum acid-concentrations at which the compounds a stable at 25° C. are: normal salt, 6·87 N; basic sa 0·0013 N.

Mercuric Fluoride.—This salt is converted directly i mercuric oxide by the action of water, no basic salt bei formed. It is stable when the acid-concentration of t solution is 1·14 N at 25° C.

Mercurous Nitrate.—Two basic salts were isolated, on white powder having the composition, $5Hg_2O.3N_2$ $2H_2O$, and the other a yellowish-green powder, proba $3Hg_2O.N_2O_5.2H_2O$. It is probable that other basic sa also exist. The minimum acid-concentrations at which t compounds are stable at 25° C. are: normal salt, 2·95 basic salt, $5Hg_2O.3N_2O_5.2H_2O$, about 0·293 N; basic s $3Hg_2O.N_2O_5.2H_2O$, 0·0017 N.

Mercurous Sulphate.—Only one basic salt, $2Hg_2O.S$ H_2O exists, and this is stable when the acid-concentrat of the solution is 0·00056 N at 25° C. The normal salt stable when the acid-concentration is 0·0042 N at 25° C. —A. S

Potassium Iodide; Decomposition of ——, by Fats. Heffter. Schweiz. Woch. Chem. Pharm., 1904, **42**, 3 Chem.-Zeit., 1904, **28**, Rep. 188.

Potassium iodide ointment, prepared with lard and wat becomes coloured sooner or later, small quantities of iod being liberated. The substance causing this decomposit is found to be the hydrogen peroxide contained in water made use of; the action is accelerated in prese trace of free fatty acids. The fats are said to be "auto-:idisable substances," which take up oxygen from the :, yielding peroxide compounds, the latter then oxidising e water to hydrogen peroxide.—T. H. P.

Iorphine Reaction ; New ——. C. Reichard. XXIII., page 763.

\ux Vomica ; Extract of ——. K. Papl. Apoth.-Zeit., 1904, **19**, 325 ; Pharm. J., 1904, **73**, 10.

XPERIMENTS to determine the best conditions for the eparation of extract of nux vomica led to the following sults, the most satisfactory extract being that obtained by rcolating with dilute alcohol at between 20° and 30° C.

Extraction with 70 per cent. Alcohol.

Temperature.	Yield of Extract.	No. of c.c. of N/100 Acid required by Alkaloids in 0·66 grm. of Extract.
° C.	Per Cent.	
0	8·368	30·7
10	8·404	30·5
15	8·612	30·9
20	8·766	32·6
25	8·766	32·7
30	8·954	31·4
40	8·666	29·9
50	8·602	30·4
60	8·078	29·8

Extraction at 25°—30° C.

trength of Alcohol.	Yield of Extract.	No. of c.c. of N/100 Acid required by Alkaloids in 1 grm. of Extract.
Per Cent.	Per Cent.	
40	9·358	38·6
50	9·286	44·4
60	9·668	47·5
70	8·864	..
80	8·162	46·7
90	6·398	42·3
99	5·474	35·6

The extracts obtained with 40 and 50 per cent. alcohol ere friable ; in the others the proportion of fat increased ith the strength of the alcohol used. Previous removal of e fat by means of petroleum spirit did not give satis-ctory results, the yield and strength of the extract both ing diminished.—A. S.

'anillin and Morphine ; Action of an indirect Oxidising Ferment [Anaeroxydase] on ——. E. Bourquelot and L. Marchadier. XXIV., page 766.

'anilla containing Heliotropin. Göller. Pharm. Centralh., 1904, 192. Chem. and Druggist, 1904, **65**, 13.

HE author finds that the vanillon or pompona (the fruit of *anilla pompona*), and the fruit of *V. planifolia* contain liotropin as well as vanillin. These varieties of vanilla nnot be used as spices, but are employed to a considerable tent in perfumery.—A. S.

hodinol, the Characteristic Alcohol of Oil of Roses ; Complete Synthesis of ——. L. Bouveault and Gourmand. Comptes rend., 1904, **138**, 1699—1701.

OUVEAULT and Barbier (this J., 1896, 373) first identified odinol, and showed it to be characteristic of the oils rose and of *Pelargonium odoratissimum.* Tiemann and hmidt suggested that it was an optical isomeride of tronellol, but Bouveault showed that the isomerism must chemical, and no doubt due to a difference in the sition of the double linkings, rhodinol being—

$$(CH_3)_2C:CH.CH_2.CH_2.CH(CH_3).CH_2.CH_2OH ;$$

hilst citronellol is—

$$CH_2:C(CH_3).CH_2.CH_2.CH_2.CH(CH_3).CH_2.CH_2OH.$$

The authors have now, by treating ethyl geraniate with sodium, according to Bouveault and Blanc's method of converting esters into alcohols (this J., 1903, 888), obtained from it rhodinol ; and as the constitution of ethyl geraniate has been established by complete synthesis to be—

$$(CH_3)_2 : C : CH.CH_2.CH_2.C(CH_3) : CH.CO_2.C_2H_5,$$

the constitution of rhodinol must be that above given. Similar treatment of ethyl rhodinate, prepared from synthetic geranic acid by Tiemann's method, gave racemic rhodinol, agreeing with rhodinol from oils of rose or of pelargonium in all its characters save optical rotation. The natural and the synthetic rhodinol yield identical pyruvates, colourless oily substances of peculiar odour, boiling at 143° C. at 10 mm., and giving identical crystallised semicarbazones when treated with semicarbazide.—J. T. D.

Robinin ; Study of the Glucoside ——. N. Waliaschko. J. russ. phys.-chem. Ges., 1904, **36**, 421—438 ; Chem. Centr., 1904, **1**, 1609—1610.

THE robinin was prepared by boiling fresh acacia blossoms with water, or extracting the dried flowers with ether. It has the composition, $C_{33}H_{40}O_{19}.7\frac{1}{2}H_2O$; 7 mols. of water are easily split off, but the last $\frac{1}{2}$ mol. is evolved only at 110° C. On hydrolysis with mineral acids it yields almost quantitatively a yellow dyestuff, *robigenin*, $C_{15}H_{10}O_6.H_2O$, 2 mols. of rhamnose, and 1 mol. of galactose. Robigenin loses its water of crystallisation at 130° C. and melts at 270° C. ; it belongs to the flavone group of dyestuffs. —A. S.

Phenocoll ; Detection of —— *in cases of Poisoning.* A. Archetti. XXIII., page 763.

Carbon ; Determination of ——, *by Sodium Peroxide and Barium Chloride in Explosive Compounds and Organic Bodies burning with difficulty* [*Alkaloids, &c.*]. F. von Konek. XXIII., page 763.

Chloroform ; Influence of Moist Alcohol and Ethyl Chloride on the Boiling Point of ——. J. Wade and H. Finnemore. Chem Soc. Proc., 1904, **20**, 163.

CHLOROFORM, when made from alcohol, contains a small quantity of ethyl chloride, the absence of which from chloroform made from acetone detracts from its efficiency as an anæsthetic. The ethyl chloride depresses the boiling point of the chloroform ; it was partially isolated by fractionation through a Young's evaporator column, and was identified by conversion into silver propionate. Incidentally, the authors have isolated binary mixtures of chloroform and alcohol, and chloroform and water, and a ternary mixture of chloroform, alcohol, and water, all of minimum boiling point. The first binary mixture boils at 59·4° 760 mm., has a sp. gr. 1·1125 at 15°/15°, and contains 7 per cent. of alcohol. The second binary mixture boils at 56·1°/mm., and contains about 1 per cent. of water. The ternary mixture boils at 55·5° 760 mm., and contains 4 per cent. of alcohol and about 3·5 per cent. of water. The water in both these mixtures separates at once from the distillate.

Electrically Extracting Essential Oil ; Process and Apparatus for ——. G. D. Barton, Assignor to Boston Leather Process Co. U.S. Pats. 763,151 and 763,152, June 21, 1904. XI. A., page 754.

FRENCH PATENT.

Meta-cresol ; Process for Producing —— *from Crude Cresol.* Chem. Fabr. Ladenburg, G. m. b. H. Fr. Pat. 339,880, Jan. 25, 1904.

THE process is based on the fact that the normal calcium salt of *m*-cresol is much less soluble in water or cresol than is the corresponding salt of *p*-cresol. Crude cresol may be saturated with calcium hydroxide, the mass which separates filtered off, and decomposed with acids, relatively pure *m*-cresol being obtained ; if less calcium hydroxide be used (*e.g.*, an amount equal to that of the cresol employed) the resulting crystalline mass is freed from the mother liquor by washing with benzene, and is finally decomposed by means of acid.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

Carbon; Determination of —— by Sodium Peroxide and Barium Chloride in Explosive Compounds and Organic Bodies burning with difficulty. F. von Konek. XXIII., page 763.

United States Patents.

Explosive Compound. C. M. Hall, Niagara Falls, U.S.A. U.S. Pat. 763,666, June 28, 1904.

The explosive consists of silicon in an oxidisable condition and an oxidising agent.—G. W. McD.

Explosive Compound. C. M. Hall, Niagara Falls, U.S.A. U.S. Pat. 763,665, June 28, 1904.

The explosive consists of a finely powdered brittle alloy containing aluminium, iron, and silicon mixed with ammonium nitrate.—G. W. McD.

Explosive. W. Kirssanoff, Russia, Assignor to Société en Actions "Promethée." Directeur Metchislaw Fiedler, Moscow, Russia. U.S. Pat. 763,675, June 28, 1904.

The explosive consists of potassium chlorate (70 per cent.), potassium permanganate (20 per cent.), turpentine (9 per cent.), and carbolic acid (1 per cent.).—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUALITATIVE.

Alkali Fluorides; Detection of —— in Foods. J. Froidevaux. J. Pharm. Chim., 1904, **20** 11.

About 30 grms. of the finely chopped material are cautiously incinerated in a platinum capsule with 1 or 2 c.c. of 50 per cent. sodium carbonate solution, until all the organic matter has been destroyed. The residue is powdered, boiled with 5 or 6 c.c. of distilled water for a few minutes in the same capsule and filtered; the filtrate is treated with excess of pure hydrochloric acid and a few drops of helianthin. Saturated solution of ammonium acetate is then poured into the mixture until the appearance of a yellow colour. One or 2 c.c. of calcium chloride are added; in the presence of fluorides a turbidity, or a precipitate will be formed. Under these conditions the free hydrochloric acid is completely saturated while acetic acid is liberated, which prevents the ultimate precipitation of the phosphates by the calcium chloride, and favours the precipitation of calcium fluoride.

The nature of the precipitate may be verified by heating the cloudy liquid, collecting, washing, and drying the precipitate and introducing it with sand and sulphuric acid into Sanglé Ferrière's apparatus. The reaction is sufficiently delicate to detect an admixture 0·05 per cent. of an alkali fluoride with meat or meat products.—J. O. B.

INORGANIC—QUANTITATIVE.

Sulphuric Acid; Determination of ——, especially in presence of Iron. G. Lunge. Zeits. angew. Chem., 1904, **17**, 949—953.

Silberberger (this J., 1903, 1149, and 1904, 358) has contended, in favour of his method of precipitation by means of alcoholic solution of strontium chloride, that the author's method of determining sulphur in pyrites does not give accurate results, inasmuch as:—(1) in precipitating the ferric hydroxide, basic ferric sulphates are formed, from which the sulphuric acid cannot be washed out; (2) the barium sulphate precipitate contains barium chloride; (3) the filtrate contains barium sulphate, which is not absolutely insoluble in water or in the salt solutions concerned. The author claims that almost universal experience is against statement (1), and quotes the work of 22 of his students, new to the method, and working solely from printed directions, 12 of whom succeeded completely in washing out the sulphur, while only three had serious errors (0·15 to 0·27 per cent.) from this cause. Experiments were instituted to test Silberberger's method on potassium sulphate and on pyrites (the author holds that Silberberger should not have used sulphuric acid without neutralising, for his test determinations, and that his determination of its strength by alkalimetric titration of 10 c.c. measured by a pipette is not exact enough). In the experiments with potassium sulphate the filtrations were exceedingly tedious, requiring several hours, and the filtrates were never quite clear, though the error from this cause was only 0·02—0·03 per cent. The strontium sulphate was free from chloride, and the concentrated filtrate gave no further indication of strontium sulphate. Similar experiments in presence of ferric chloride showed the same peculiarities in the filtration, and the wet precipitate was always buff-coloured, while many hours of ignition (during which it gained weight) were necessary to bring it to constant weight. The ignited precipitates varied in colour, but all contained 0·23—0·35 per cent. of their weight of Fe_2O_3. Parallel experiments by Lunge's method, exactly as described in the "Alkali-maker's Pocket Book," gave, it is stated, rapid filtrations, clear filtrates, and precipitates constant after the first ignition, the whole operation requiring one-third to one-fourth of the time required for Silberberger's method. The results were 50·01, 49·63, 49·57 per cent., and the precipitates contained 0·43, 0·27, 0·42 per cent. of their weight of Fe_2O_3. The results by Lunge's method were 49·82, 49·87 per cent., with corrections under head 1, of 0·0; under head 2, of − 0·01, − 0·04; under head 3, of + 0·06, + 0·07 per cent.

The author's conclusions are that his method gives results of satisfactory accuracy without any correction, and that the known errors are very small and in opposite directions, while no error should arise from the retention of sulphur by the ferric hydroxide; but that Silberberger's method, said to be very troublesome, and costly from the amount of alcohol needed, though it gives satisfactory results when iron is absent, cannot be used for pyrites, as the results may differ by 0·5 per cent., from the retention of iron by the precipitate and the difficulty of attaining constant weight on ignition.—J. T. D.

Palladium; Separation of —— from other Metals, by means of Hydrazine. P. Jannasch and L. Rostosky. Ber., 1904, **37**, 2441—2461.

Group 1. From Aluminium, Chromium, Uranium, Molybdenum, and Tungsten.—To the mixture, containing just enough hydrochloric acid to preserve a clear solution (and, in the case of tungsten, 2 grms. of tartaric acid), diluted to 300 c.c., and heated to boiling, add 30 c.c., also boiling, of a solution of hydrazine sulphate saturated in the cold. Heat on the water-bath for a few minutes till the precipitate collects together, filter through asbestos in a hard glass tube, wash dry at 110°—120° C., reduce any palladious oxide by ignition in hydrogen, and weigh. In the filtrate, aluminium, chromium, or uranium, is determined by precipitation with ammonia, molybdenum by addition of ammonia and ammonium sulphide followed by hydrochloric acid, and conversion of the sulphide into trioxide by heating in air or oxygen, tungsten by adding to the filtrate 20 c.c. of concentrated hydrochloric acid, evaporating to small bulk, diluting, filtering off the separated tungstic acid and washing with water containing hydrochloric acid, evaporating the filtrate to dryness, completely charring the tartaric acid, extracting thoroughly with ammonia, precipitating the ammoniacal solution with quinoline, and igniting this and the former precipitate of tungstic acid together. In none of these cases does the excess of hydrazine salt interfere.

Group 2. From the Alkaline Earth Metals.—The process is similar to the above, except that (unless for dilute solutions of calcium) hydrazine hydrochloride must be used. The excess of hydrazine salt exerts no influence on the determination of barium or strontium as sulphate, or of calcium as oxalate.

Group 3. From Manganese, Nickel, Cobalt, Cadmium, and Copper (also Zinc and Iron, see this J., 1904, 729).—These netals form difficultly soluble metal hydrazine sulphates, vhich it was thought would interfere with the process by recipitating with the palladium ; but the separation from nanganese or cadmium is effected exactly as above, and rom nickel or cobalt by dilution to 400 c.c., before precipiation, instead of 300. Manganese is precipitated in the ltrate by hydrogen peroxide, nickel or cobalt by sodium ydroxide and hydrogen peroxide, cadmium by hydrogen ulphide. In no case does the excess of hydrazine salt nterfere. In the case of copper, though this metal alone s not precipitated by hydrazine salts, yet it always came own with the precipitated palladium, reduced, no doubt, y the catalytically formed hydrogen. The authors hope effect a separation by working in the cold, but have not et perfected the method.

Group 4. From Antimony, Arsenic, and Tin.—In the case f antimony, 6 grms. of citric acid are added to the solution, hich is diluted to 150 c.c., and precipitated as usual ; the eating on the water-bath, after precipitation is limited to ve minutes, and the filtrate returned if necessary upon the lter till clear. The antimony is precipitated and weighed s sulphide. Arsenic must be converted from the arsenious the arsenic condition, then the precipitation with hydrazine, an be carried out as in the case of aluminium. The arsenic an be determined in the concentrated filtrate as magnesium mmonium arsenate, without removing the excess of ydrazine. In the case of tin, the solution is evaporated to ryness, taken up with 10 c.c. of concentrated hydrochloric cid, diluted to 140 c.c., and precipitated hot with a solution f 1 grm. of hydrazine hydrochloride in 20 c.c. of water. recipitation does not occur for some minutes, and the recipitate can only be filtered after 1—2 hours on the ater-bath, even then requiring several passages through e same filter before the filtrate is clear. This precipitate practically pure metallic palladium. The tin is precipiated as sulphide.

Group 5. From Mercury, Lead, Bismuth, Silver, Platium, and Gold. – In none of these cases could a separation effected.—J. T. D.

alladium ; Determination of —— and its Separation from other Metals by means of Acetylene. H. Erdmann and O. Makowka. Ber., 1904, **37**, [11], 2694—2697.

he authors publish a preliminary note, pointing out that e separation by means of hydrazine proposed by Jannasch, eltges, and Rostosky (this J., 1904, 729, and preceding ostract) is not suitable for palladium. To separate alladium and copper, the present authors proceed as llows :—The palladium is precipitated from hydrochloric cid solution (about 1 c.c. of hydrochloric acid of sp. gr. ·05 to 30—60 c c. of solution) by passing in acetylene for minutes. The light brown precipitate is filtered, washed, ut whilst still moist into a porcelain crucible, and ignited ter the addition of a little ammonium nitrate. After eating for a few minutes in a current of hydrogen it is eighed. To the filtrate, ammonia, and 1 c.c. of a 10 per nt. solution of hydroxylamine chloride are added, and etylene passed for five minutes. The precipitate is tered off, washed, and ignited after evaporation with lute nitric acid. The palladium thus separated is free om copper, and the copper is free from palladium.
—L. F. G.

rsenic ; The Electrolytic Determination of Minute Quantities of ——. H. J. S. Sand and J. E. Hackford. Chem. Soc. Proc., 1904, **20**, 123.

high supertension of the cathode is requisite for the duction of arsenic acid to metallic arsenic, the reaction ing most readily effected in the presence of metals having is property, such as lead or zinc, and probably also ercury. The production of arsenic trihydride from senites is accomplished more readily by platinum cathodes an by those of copper, which have a much higher pertension. The authors recommend the use of lead ectrodes for the determination of minute quantities of senic, as their application causes a simplification of evious methods. Errors which may arise in the electrolytic methods owing to the presence of foreign metals can be rectified by the addition of lead acetate or zinc sulphate to the electrolyte except when the foreign metal is mercury. When lead and zinc cathodes are used, the smallest amount of arsenic which can be detected in alkaline solutions of arsenates and arsenites is about 30 times as great as in acid solution, but cathodes of platinum (which has a low supertension) are quite unsuitable.

Potassium Permanganate ; Standardisation of —— by the Electrolytic and Iodine Methods. F. Dupré. Zeits. angew. Chem., 1904, **17**, 815—817.

Potassium permanganate solutions which had been kept for at least a month, that is, until they no longer changed in strength, were examined by (*a*) Treadwell's electrolytic method (Z. anal. Chem., **2**, 68) and (*b*) Volhard's iodine method (Annalen, **198**, 333 and 318 ; Z. anal. Chem., **20**, 274). Results are given showing that the electrolytic method is quite trustworthy.—R. L. J.

Calcines ; Analysis of ——. J. P. Walker. Eng. and Mining J., 1904, **77**, 922.

For the analysis of the calcines, obtained by roasting in the McDougal furnace, fine concentrates having a composition corresponding to the formula $Cu_2S.6FeS_2$, the following determinations were made, the figures being those obtained in an actual analysis :—Total copper, 12·0 ; copper soluble in 20 per cent. sulphuric acid, 6·8 ; silica, 23·6 ; total iron, 35·0 ; iron present as ferrous oxide, 15·0 ; alumina, 7·6 ; total sulphur, 9·7 ; sulphur soluble in water, 0·4 per cent. Copper oxide was proved to be absent, therefore the copper soluble in sulphuric acid is taken to be that present as cuprous oxide. The ferrous oxide was determined by boiling 4·5 grms. of the sample for 15 minutes with 0·2 per cent. sulphuric acid in a flask fitted with a valve, filtering and titrating with permanganate, a correction being made for the ferrous iron produced by the action of the cuprous oxide, according to the equation : $Cu_2O + Fe_2(SO_4)_3 + H_2SO_4 = 2CuSO_4 + 2FeSO_4 + H_2O$. The actual composition of the sample under notice was then deduced as follows :—Silica, 23·6 ; alumina, 7·6 ; sulphur trioxide (from sulphur soluble in water), 1·0 ; cuprous oxide (from copper soluble in 20 per cent. sulphuric acid), 7·7 ; cuprous sulphide (from total copper less that in the form of cuprous oxide), 6·5 ; ferrous oxide, 20·6 ; pyrites, FeS_2 (from total sulphur less that present as cuprous sulphide and sulphur trioxide), 15·0 ; ferric oxide (from total iron less that present as ferrous oxide and pyrites), 17·0 ; total, 99·0 per cent.—A. S.

Sulphur in Golden Antimony Sulphide used for Rubber Manufacture ; Determination of ——. W. Esch and F. Balla. Chem.-Zeit., 1904, **28**, 595—596.

Two portions of golden antimony sulphide, weighing exactly 10 grms., were extracted in a Soxhlet apparatus, one with carbon bisulphide, the other with acetone. On evaporating the solvent and weighing the sulphur, 1·04 grms. and 1·05 grms. of extracted sulphur were found, corresponding to 10·4 and 10·5 per cent. The acetone extract was found to contain some golden antimony sulphide which had passed through the filter paper. On attempting similarly to determine the loss in weight of two samples on extracting with carbon bisulphide and acetone, drying and weighing the residue, the dried antimony sulphide was found to retain acetone. C. O. Weber has stated that antimony pentasulphide is decomposed into sulphur and antimony trisulphide on boiling with carbon bisulphide. This was shown to be erroneous by adding a weighed quantity of sulphur to antimony sulphide that had been extracted for one hour with carbon bisulphide, and extracting for four hours with carbon bisulphide. A quantity of sulphur exactly equal to that added was extricated. The carbon bisulphide used had been twice distilled over lead oxide, lead dust, and mercury. Ordinary impure carbon bisulphide slightly decomposes golden antimony sulphide, causing a loss of about 0·27 per cent. Benzene is not so suitable a solvent as carbon bisulphide.—L. F. G.

Nickel from Zinc; Electrolytic Separation of ——. Hollard and Bertiaux. Comptes rend., 1904, **138**, 1605.

The authors have already shown that the electrolytic separation of these two metals, impracticable by the ordinary methods because of the similar values of their polarisation-tensions, becomes possible by the employment of a soluble anode or by the addition of a reducing substance to the bath. They now find that zinc ammonium nitrite is a complex salt, does not yield zinc ions in solution, and hence is not an electrolyte; and they accordingly separate zinc from nickel as follows:—To the solution of the sulphates add successively 5 grms. of magnesium sulphate, 25 c.c. of ammonia (sp. gr., 0·924), dilute sulphuric acid to acidity, 12·5 grms. of ammonium nitrate, and 25 c.c. of saturated solution of sulphur dioxide. Boil till all sulphur dioxide is expelled, dilute with water, add 25 c.c. of the ammonia solution, make up to 300 c.c., and electrolyse at 85° C. with a current of 1 ampère. The results of analyses quoted are accurate.—J. T. D.

Molybdenum in Steel and Steel-making Alloys; Determination of ——. F. Van Dyke Cruser and E. H. Miller. J. Amer. Chem. Soc., 1904, **26**, 675—695.

The authors find that in the separation of molybdenum from iron by precipitating the latter as hydroxide, sodium hydroxide is more efficient than ammonia, but with both reagents the results are too high, owing to the formation of a ferric molybdate, which is slightly soluble in excess of alkali. Moreover, vanadium, uranium, and tungsten, if present, are not separated from molybdenum by this method. Molybdenum can be completely precipitated in presence of iron from an acid solution by hydrogen sulphide under pressure. The precipitate carries down mechanically a little iron, which must subsequently be removed by means of ammonia. Any chromium, vanadium, and uranium present remain in solution, and tungsten also, if 3—4 grms. of tartaric acid be added. It is pointed out that, contrary to what is stated in most text-books, tungsten trioxide is quite soluble in acids. The following method of working is recommended:—

Molybdenum Steel.—About 1 grm. of drillings is dissolved in 80 c.c. of "silicon mixture" (500 c.c. of concentrated nitric acid, 150 c.c. of concentrated sulphuric acid, and 1,500 c.c. of water), the mixture evaporated till fumes of sulphur trioxide appear, cooled, and the salts dissolved by adding 50 c.c. of hot water, and boiling. The solution is introduced into a pressure-bottle, 6 c.c. of concentrated sulphuric acid added, the whole diluted to about 200 c.c., and a very rapid stream of hydrogen sulphide passed through. The bottle is then closed, heated on the water-bath for 1—2 hours, allowed to cool, the contents filtered through a Gooch crucible with the aid of the pump, and the precipitate washed with dilute (1:50) sulphuric acid saturated with hydrogen sulphide. The asbestos and precipitate are removed from the crucible, treated with 10 c.c. of concentrated hydrochloric acid, 5 c.c. of concentrated nitric acid, and 10 c.c. of concentrated sulphuric acid, and the mixture evaporated till copious fumes of sulphur trioxide are evolved, air being meanwhile blown through the solution. The solution is then allowed to cool, 50 c.c. of water and excess of ammonia are added, and the asbestos and any precipitated ferric hydroxide are filtered off and washed with hot water. The filtrate is acidified, passed through a "reductor" containing unamalgamated zinc, and the molybdenum determined by titration with potassium permanganate solution, the conditions prescribed by Miller and Frank (this J., 1903, 1149) being observed. When tungsten is present it separates, partially, as tungsten oxide, when the acid solution first obtained is evaporated. It may be recognised by dissolving the deposit in ammonia, making strongly acid with hydrochloric acid, and adding a saturated hydrochloric acid solution of stannous chloride, followed by ammonium thiocyanate. A deep green colour indicates the presence of tungsten. If tungsten be present, the acid solution, after being evaporated as before, is cooled, treated with 50 c.c. of water and 5 grms. of tartaric acid, heated to boiling, and filtered into the pressure-bottle. The residue is washed with hot water, then again treated with the "silico mixture" and tartaric acid as before, the solution filtere into the pressure-bottle, and the method described abov followed.

Ferromolybdenum.—4—5 grms. are dissolved in 180–200 c.c. of "silicon mixture," the solution allowed to coo diluted to 1 litre, and 50 or 100 c.c. treated as in the case o molybdenum steel.

Molybdenum Metal.—2—3 grms. are dissolved in "silico mixture," concentrated hydrochloric acid added, the mixtur heated for some time, diluted with water, and filtered into litre flask. The filter is burnt, moistened with nitric acid i a platinum crucible, using as low a heat as possible, and th residue fused with potassium pyrosulphate. The melt i dissolved in hot water, the solution added to that in the litr flask, the whole made up to the mark, and 50 c.c treated a in the case of molybdenum steel.—A. S.

Soil Acidity; Comparison of Methods for the Determina tion of ——. F. P. Veitch. J. Amer. Chem. Soc., 1904 **26**, 637—661.

The two methods examined were the sodium chlorid method of Hopkins, Pettit, and Knox, and the author' lime-water method. The first method consists in shakin 100 grms. of soil with 250 c.c. of 5 per cent. sodium chlorid solution for three hours, filtering and titrating 125 c.c. o the boiled filtrate with standard alkali solution, usin phenolphthaleïn as indicator. The amount of alkali use multiplied by 4, is that required to neutralise 100 grms. o the soil. In the second method, three equal portions of th soil (each containing as many grms. as the standard lim water contains mgrms. per c.c.) are mixed with 50 c.c. o distilled water and varying amounts of standard lime wate and evaporated to dryness at 100° C. The residues ar allowed to stand for 12 hours with 100 c.c. of water, an 50 c.c. of each solution is evaporated down, after addition o a few drops of phenolphthaleïn, to a volume of 5 c.c., or unt a pink colour is produced. This process is repeated o fresh portions of soil, the differences in the amounts of lim water used being gradually diminished until the leas quantity of lime water which gives a pink colouration i found; this quantity is taken as the acidity equivalent o the soil. It is found that, as the soils tested contain mor organic matter, so the results obtained by the two method become more divergent, the former method showing th lower acidity. Soils containing little organic matter ma give higher acidity values by the former method, but it i concluded that this method will not generally indicate th necessity for sufficient lime dressing, hence, the secon method is more desirable as giving a true indication o the amount of lime required to render the soil slightl alkaline.—T. F. B.

Arsenic; Separation of —— *by Distillation in Hydroge Chloride.* G. T. Morgan. Chem. Soc. Proc., 1904, **20** 167.

A modification of Piloty and Stock's apparatus (Ber. 1897, **30**, 1649) was described in which the mixed sulphide of arsenic and antimony were distilled in a current o hydrogen chloride, so that the vapours did not come int contact with organic matter until after passing through cooled aqueous solution of hydrogen sulphide. In dealin with a mixture containing arsenic in the two states of oxidation, the distillation was first carried out in hydroge chloride, when the arsenious sulphide precipitated in th receiver represented the tervalent arsenic. On repeatin the distillation of the residual liquid in a current o hydrogen chloride mixed with hydrogen sulphide a secon precipitation of arsenious sulphide was obtained, this bein derived from the arsenic originally present in the quin quivalent condition.

Carbon; Determination of —— *by Oxidation with Chromi Acid.* G. T. Morgan. Chem. Soc. Proc., 1904, **20** 167.

Phosphoric acid was substituted for sulphuric or hydrochloric acid in the gravimetric estimation of carbon dioxide in native carbonates, and when these substances containe nic matter, chromic acid was subsequently added to contents of the distilling flask and the operation ated, the second increase in weight of the tared absorp- tube being due to the oxidation of the organic carbon. mixture of chromic and phosphoric acids was also used timating the total carbon in cast iron and ferroman- se, the employment of a non-volatile acid instead of uric acid obviating the risk of carrying over acid s into the weighed absorption tube.

ORGANIC—QUALITATIVE.

phene Reaction with Nitroso-sulphuric Acid. C. bermann and B. Pleus. Ber., 1904, **37**, 2461—2464.

ALBE found that certain benzenes from coke-ovens, n showed thiophene with the isatin reaction, did not any indication of it with Liebermann's reagent, and ned that this was caused by the presence of some rto unknown substance which affected the reaction. authors have carefully examined these benzenes, and that the explanation lies in the fact that they contain little thiophene, and that the isatin reaction is much delicate than that with nitrososulphuric acid. They find, contrary to the statement of Bauer, that the henin reaction is given by pure sulphuric acid, free nitrous or nitric compounds.—J. T. D.

se Oleines [Wool Oils]; Detection of Mineral Oil in stilled ——. A. H. Gill and S. N. Mason. J. Amer. em. Soc., 1904, **26**, 665–671.

authors sought to find methods of detecting adultera- of distilled grease oleines with cheaper mineral oils. find: (1) the bromine values, especially the bromine- ion values (this J., 1900, 176) of the hydrocarbons pure oleines, are much higher than those of mineral (2) the grease oleine hydrocarbons give a rotation of ·18° in the Laurent polariscope, whilst minerals oils nactive or give only a slight rotation (1°—2°); (3) the es of refraction of mineral oils are lower than those of istilled grease hydrocarbons. The following were some e results obtained :—

ture of Oil.	Bromine-addition Value.	Bromine-substitution Value.	Optical Rotation.	Specific Gravity.	Refractive Index at 20° C.
e A ……	28·8	14·2	17 58	0·896	1·4967
es B ……	25·1	14·8	17 36	0·902	1·4991
C ……	21·5	16·8	15 13	0·895	1·4948
e of doubtful ity, D.	3·8	9·0	2 56	..	1·4921
te e." Min-	5·3	5·9	1 6	0·853	1·4735
e ral." eral- oils.	4·4	6·7	1 17	0·859	1·4750
re of 50 per . of A. and er cent. of ite rose."	9·0	12·85	9 47	..	1·4850

—A. S.

ohols; Purification and Identification of ——. . Bouveault. Comptes rend., 1904, **138**, 984—985.

dentification of liquids is always difficult and uncer- a mixture of isomers may be confounded with a te substance. This difficulty is felt in a high degree lcohols, most of which are liquid, and only separable one another by methods of fractionation. The various ds proposed for converting alcohols into other com- ts for identification are of very limited application: ne author now extends the limits by making use of yruvic esters. These, if primary or secondary, can ntly be prepared by simply heating together the l and pyruvic acid for some time, and then distilling; h some unsaturated alcohols (geraniol for example) composed by this process. Tertiary alcohols seem be decomposed by pyruvic acid, and yield alkylene carbons (a useful method of preparing the latter). The pyruvates all react energetically with semi-carbazide, and the semi-carbazones produced are stable well crystallised substances, each with its characteristic constants. By their means the alcohols can be identified (and, if necessary, purified). Treatment with alcoholic potassium hydroxide regenerates the alcohol.—J. T. D.

Morphine Reaction; New ——. C. Reichard. Pharm.-Zeit., 1904, **49**, 523. Chem.-Zeit., 1904, **28**, Rep. 195.

If to a mixture of formaldoxime sulphate and sulphuric acid, a trace of morphine or a morphine salt be added, an intense bluish violet colour is produced on warming. Atropine also gives a reaction with formaldoxime and sulphuric acid, a dark brown colour being produced, which however is destroyed on the addition of a few drops of water. A greater quantity of water is required to destroy the colour produced with morphine.—A. S.

Phenocoll; Detection of —— in Cases of Poisoning. A. Archetti. Chem.-Zeit., 1904, **28**, 597—598.

Phenocoll or aminoaceto-*p*-phenetidine—

$$C_2H_5O.C_6H_4.NH.(COCH_2.NH_2)$$

is a white powder of m. pt. 105·5° C., soluble in alcohol, soluble with difficulty in water, benzene, and chloroform. The aqueous solution gives a reddish-yellow precipitate with bromine water. It is soluble in concentrated sulphuric acid on warming, on adding potassium chromate a brown coloration, changing to green, is produced. On evaporating a little phenocoll with a few drops of caustic potash solution, neutralising with hydrochloric acid, and adding ferric chloride, a deep violet colour is produced. The reaction takes place in accordance with the following equation—

$$C_2H_5O.C_6H_4.NH(CO.CH_2NH_2) + KOH + H_2O = HO.C_6H_4.NH_2 + NH_2.CH_2.COOK + C_2H_5OH.$$

On shaking an aqueous solution of phenocoll hydrochloride with ether, no phenocoll can be extracted. On adding caustic alkali, it readily passes into the ethereal extract. In the body, phenocoll is decomposed into *p*-aminophenol and glycin, in accordance with the above equation.—L. F. G.

Lard; Crystals obtained in the Belfield Test for ——. H. Kreis and A. Hafner. XII., page 755.

ORGANIC—QUANTITATIVE.

Carbon; Determination of —— by Sodium Peroxide and Barium Chloride in Explosive Compounds and Organic Bodies burning with difficulty [Alkaloids, &c.]. F. von Konek. Zeits. angew. Chem., 1904, **17**, 888—891.

A solution of crystallised barium chloride (101·67 grms. per litre) is made use of, each c.c. being equivalent to 0·005 grm. of carbon in the form of barium carbonate. 0·5 grm. of the finely divided substance (in case of bodies not easily combustible 0·25 grm.) is intimately mixed with a weighed quantity of sodium peroxide (10—12 grms.) in a crucible and ignited. The mass when cool is dissolved and made up to 500 c.c. with water free from carbon dioxide. 100 c.c. or 200 c.c. of this solution (equivalent to 0.10 grm. of the organic body) are transferred to a 250 c.c. flask, and 20—25 c.c. of the barium chloride solution added and well agitated. The precipitated barium carbonate is filtered off through a dry filter and in 100 c.c. of the filtrate, the excess of barium chloride is estimated as sulphate, the difference being the barium chloride required to precipitate the carbonate formed during the reaction. The absence of sodium carbonate in the peroxide should be determined by a blank experiment. Alkaloids and picric acid were analysed as above with satisfactory results.—G. W. McD.

Phosphorus and Nitrogen; Determination of —— in Organic Bodies by means of Sodium Peroxide. F. von Konek. Zeits. angew. Chem., 1904, **17**, 886—888.

The material is ground in an agate mortar sifted through the finest gauze, and 0·5 grm. mixed with 10—15 grms. of sodium peroxide in a nickel crucible. The latter is placed in water in a basin and ignited in the usual manner. The melt is then dissolved out, filtered, acidified with hydrochloric acid, heated to drive off carbon dioxide, rendered alkaline with ammonia and precipitated with magnesia mixture. For the determination of nitrogen the same procedure is followed, but the aqueous extract containing the sodium nitrate is reduced in Devarda's apparatus by an aluminium-copper couple and estimated as usual.

—G. W. McD.

Briquettes; Determination of Proportion of Binding Material in ——. E. J. Constam and R. Rougeot. Zeits. angew. Chem., 1904, **17**, 845—848.

Samples of various pitches used in briquette manufacture were examined with the results enumerated in the following table.

Samples.	Softening Point.	Melting Point.	Coke.	Ash.	Soluble in Carbon Bisulphide.
	° C.	° C.	Per Cent.	Per Cent.	Per Cent.
German (23) ..	37—62·5	44—69	25—50	0·04—2·5	60—91
English (6) ...	43—55	52—61	40—50	0·12—0·8	66—79
Dutch (3)	45—52	52—59	50—53	0·15—0·19	63—64
Swiss (1)	53	61	35	0·27	67·8

For the determination of the carbon bisulphide extract, 1—2 grms. of the finely-divided pitch are mixed with about 10 times the amount of ignited sand and extracted for 72 hours in a Soxhlet apparatus, the extract being finally dried *in vacuo* for 4—5 days over phosphorus pentoxide. The plastic condition and the binding power of a pitch are in proportion to its solubility in carbon bisulphide. The carbon bisulphide extract of all the samples of pitch examined gave a mean of 76·3 per cent. and as in general about 7 per cent. of pitch is used in briquette manufacture the authors select 5·34 per cent. carbon bisulphide extract from a briquette as showing sufficiency of binding material, a conclusion confirmed by transport and compression tests. For the estimation of the carbon bisulphide extract from a briquette 10 grms. of the finely-divided material are extracted under similar conditions as described above except that no sand is required.—G. W. McD.

Gases containing Hydrogen; Fractional Combustion of —— by means of Heated Palladium Wire. F. Richardt. J. f. Gasbeleucht., 1904, **47**, 566—570 and 590—595.

The author has studied the behaviour of hydrogen, methane, ethane, and ethylene respectively, when mixed with air and passed over palladium wire. At temperatures up to 450° C., methane is found not to be attacked; above that temperature, even below a visible red heat, an appreciable proportion of the gas undergoes combustion, if it remains long enough in contact with the palladium; but if the current is led quickly over the palladium, practically none of the methane is burned even at 600°—650°. The delay in ignition thus indicated, finds its explanation in the observation of Mallard and Le Chatelier that explosive mixtures of methane and oxygen, when raised to the ignition temperature, do not explode at once, the retardation in the ignition amounting, at 600°—700° C., to about 10 seconds, but diminishing with rise of temperature, until at 1000° it is imperceptible. Any hydrogen present with the methane is burned completely at 450° C., even if the contact with the palladium wire be short. The presence of hydrogen does not affect the combustion of the methane, excepting that the retardation in the ignition disappears, on account of the rise of temperature caused by the combustion of the hydrogen. Ethane behaves on the whole in the same way as methane: these two gases cannot be separated by practical combustion. Ethylene begins to burn even at 300°, but cannot be fractionated from methane or ethane, as the ignition temperature of these two gases would be overstepped. In the determination of hydrogen by Bunte's method (which consists in passing the gas, mixed with air, through a heated capillary tube containing palladium wire, and noting the contraction in the volume of tl gas), the temperature has to be carefully regulated. I as is commonly recommended, the palladium is heat just to visible redness, a sensible amount of the methai is burned. If, however, the tube is heated just until tl alkali of the glass colours the Bunsen flame, and the g is led quickly through the tube, no methane is burne whilst the hydrogen disappears completely. One passa of the gas is sufficient; but it may safely be led ov again if desired, at even a higher temperature, since the absence of hydrogen the retardation in the igniti protects the methane from attack.—H. B.

Cocoanut Oil in Butter; Determination of ——. . Müntz and H. Coudon. Monit. Scient., 1904, 1 530—541.

The method proposed consists in determining the amou of insoluble volatile fatty acids yielded by the sample ai also the ratio which these bear to the soluble volatile fat acids. 10 grms. of the filtered fat are saponified in a fla by adding 5 c.c. of warm concentrated potassium hydroxi solution. The latter is of such strength that it forms saturated solution at 20° C. (about 120 grms. of potassiu hydroxide to 100 c.c. of water). The mixture of fat ai alkali is well mixed and kept at a temperature of 80° for 20 minutes, after which 200 c.c. of water are added ai the soap completely dissolved by shaking the contents of tl flask. Thirty c.c. of phosphoric acid solution (sp. gr. 1·1 are then introduced and the mixture freed from carb dioxide by subjecting it to a reduced pressure at a lo temperature. The flask is now connected to a condens by means of a spiral fractionating tube, the total leng of the latter being 1 metre, and the distillation proceed with. A few pieces of pumice or pipe-clay must be add to prevent bumping. Two hundred c.c. of distillate a collected and the distillation should take about an hour ai a half. The distillate is allowed to stand overnight, ai is then passed through a moistened filter, the receiver bei rinsed out with 5 c.c. of water. One hundred c.c. standardised lime-water are then added directly to tl filtrate and the neutralisation completed by running further quantities of the lime-water from a burette, usi phenolphthalein as indicator. The volume of lime-wat used is then calculated into butyric acid.

The insoluble volatile fatty acids obtained by the di tillation are dissolved from the condenser, receiver, ai filter with alcohol, and the solution titrated with tl standardised lime-water, the volume of the latter used bei calculated into butyric acid.

Pure butters when examined according to the abo method, yielded from 4·79 to 6·01 per cent. of solub volatile fatty acids (as butyric) and from 0·50 to 0·87 p cent. of insoluble volatile acids, whilst various samples cocoanut oil gave from 1·15 to 1·27 per cent. of solub volatile acids and 3·01 to 3·63 per cent. of the insolub volatile acids. The authors also calculate the ratio soluble to insoluble acids according to the formula—

$$\frac{\text{insoluble volatile acids}}{\text{soluble volatile acids}} \times 100$$

This gives a value varying from 9·1 to 15·6 in the ca of butter, whilst for cocoanut oil it lies between 250·3 ai 282·3. A sample of margarine yielded 0·04 per cent. soluble volatile acids and 0·16 per cent. of insoluble volati acids. (See also this J., 1904, 387.)—W. P. S.

Crude Rubber; Examination of ——. G. Fendler. Be d. d. Pharm. Ges., 1904, **14**, 208; Pharm. J., 190 **73**, 10.

The rubber cut into fine shreds is dried in a desiccator ov sulphuric acid. Two grms. of the dried rubber are di solved in petroleum spirit (in about 24 hours), the solutio made up to 100 c.c., and, after a short time, filtered throug a tared filter consisting of a tube containing a layer glass wool 1—2 cm. high. Fifty c.c. of the filtrate ai collected, and the residue is washed, dried, and weighe The 50 c.c. of filtrate are shaken with 70 c.c. of absolu alcohol, the precipitated caoutchouc washed by kneadin with a small amount of alcohol, dried, and weighe e solutions and washings are evaporated and the residual in weighed. The following results have been obtained this method.

—	Caoutchouc.	Resin.	Insoluble (Impurities).
	Per Cent.	Per Cent.	Per Cent.
ber from *Castilloa elastica*	89·25	10·25	0·90
" " "	84·85	14·30	0·80
um rubber	90·55	7·10	2·35
ber from *Manihot Glaziovii*	70·80	4·90	28·45
ber from *Hevea* sp.	80·00	2·30	18·20
horbiaceous rubber	90·80	4·45	3·25

—A. S.

ia Rubber ; Weber's Method for the direct Determination of ——. Paul Alexander. Gummi-Zeit., 1904, **18**, 89—791. See Weber, this J., 1903, 1211.

e author found it necessary to deviate from Weber's ructions a little in order to get satisfactory results. e to two grms. of the sample previously extracted with tone and alcoholic caustic soda, are placed in the decomtion flask with only just sufficient alcohol-free chloron to cover the bottom of the gas-inlet tube. Nitrogen oxide from 50 grms. of lead nitrate is then passed ugh in a rapid stream. After standing some hours, the roform is removed by immersing the flask in lukewarm er whilst drawing a current of dry air through the flask. he dry reaction product is dissolved in acetone and the tion filtered. The solution is then evaporated to a ll volume (not more than 20 c.c.), and poured into c.c. of 10 per cent. ammonium chloride solution and wed to stand over night in order to allow oily products to solidify. The further treatment is precisely rding to Weber's method. Benzene cannot be substil for chloroform as the tendency is much greater for addition product to settle in an oily condition. The or found it essential to use twice as much lead nitrate commended by Weber, also that it is important to keep olume of the acetone solution as low as possible before pouring into the ammonium chloride solution, otherwise difficulty is encountered in obtaining a solid product.

—J. K. B.

Tannin ; Determination of —— *without Hide Powder.* H. Wislicenus. Z. angew. Chem., 1904, **17**, 801—810.

The author describes the physical properties and chemical behaviour towards tanning agents, of a highly porous aluminium oxide and hydroxide, which show by their attraction for the tanning agents a certain analogy to the action of raw hide, and the use of these materials is thus suggested in the analysis of tan stuffs. The metallic compounds resulting from the use of the two substances are called tannal or tannalith.

Preparation.—Aluminium powder (100 grms.) is shaken in a capacious beaker with a 5 per cent. solution of caustic soda, the liquor being decanted off in a short time, fresh caustic soda added, and drained off, and the residue well washed by decantation. To the last washing water a small quantity of mercuric chloride is added, the white powdery hydroxide is drained and dried with alcohol and ether. The mass is then passed through a fine sieve (0·5 mm. mesh) to remove oxide and metal if any, which can be afterwards worked up as before. Alternatively, the aluminium may be at once treated with ethereal solution of mercuric chloride, then, with the calculated amount of water, and dried with alcohol and ether. The oxide is produced by heating the hydroxide in a flat porcelain dish.

Mode of Using.—2·5—3 grms. of the hydroxide or 2—2·5 grms. of the oxide are gradually added to 100 c.c. of the liquor to be analysed, well shaken, and left to stand for a few hours. The clear liquor may be tested with an iron salt to ascertain that absorption is complete. Fifty c.c. of the clear liquor are drawn off and evaporated to determine non tannins and by subtraction from the contents of 50 c.c. of original liquor the tannins are calculated. Further, if a known weight of oxide be employed, the tannalith may be dried and weighed and the increase in weight noted ; or the tannalith may be ignited and the loss observed, as checks on the estimation of tannin by difference.

Some of the analytical results compared with hide-powder determinations are shown in the following table, the quantities being grms. per 100 c.c.

Liquor.		Hide Powder.		Aluminium Hydroxide.		Aluminium Oxide.		Original Total Soluble.
		(*a.*)	(*b.*)	(*a.*)	(*b.*)	(*a.*)	(*b.*)	
		Grms.	Grms.	Grms.	Grms.	Grms.	Grms.	Grms.
1 Tannic acid "	Tannin	0·1288	0·1301	0·1285	0·1285	0·1297	0·1294	0·1321
	Non-tannin	0·0034	0·0018	0·0037	0·0034	0·0025	0·0025	
2 allic acid ..	Tannin	0·0339	0·0358	0·1306	0·1314	0·1298	0·1312	0·1369
	Non-tannin	0·1026	0·1015	0·0059	0·0059	0·0067	0·0061	
3 ine bark ...	Tannin	0·0983	0·0946	0·1119	0·1107	0·1083	0·1075	0·1871
	Non-tannin	0·0803	0·0937	0·0757	0·0770	0·0793	0·0812	
4 ak bark	Tannin	0·3984	..	..	..	0·3947	..	..
	Non-tannin	0·2144	..	..	..	0·1965	..	..
5, hestnut extract	Tannin	0·5000	.	..	.	0·5001	..	..
	Non-tannin	0·1000	..	..	..	0·1042	..	..

e advantages claimed for the method are the certain simple preparation of the material and its regular y, its complete absorptive power, small quantity sary, capability of being washed free from nonis and of being weighed, its similarity in action le-powder, and, in addition, the fact that no special atus is required.—R. L. J.

zing Sugars ; Potassium Bromide as Indicator in the termination of —— *with Fehling's Solution.* P. Berti. l. Assoc. Chim. Sucr. et Dist., 1904, **21**, 1234—1236.

o small crystals of potassium bromide be placed on a lain plate, and, whilst moistening one with a drop of the other be moistened with a drop of a solution oper sulphate of 0·005 per cent. strength, and then h crystal be touched with a drop of concentrated sulphuric acid, the first will be observed to turn y, due to the formation of free bromine, whilst the second acquires a violet tint, due to the formation of anhydrous copper bromide. Potassium bromide may thus be used to indicate the final limit of the reaction with Fehling's solution applied, *e.g.*, in determining the reducing sugars in molasses. A drop of solution is placed on two superposed pieces of filter paper resting on a porcelain plate. A crystal of potassium bromide is then placed on the moistened spot on the plate and a drop of sulphuric acid added. The violet coloration ensues as long as copper is present. The results are within the limits of commercial work.—L. J. de W.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Zinc Blende ; Luminescent ——. A. S. Eakle and W. J. Sharwood. Eng. and Mining J., 1904, **77**, 1000.

The authors report on the occurrence of luminescent zinc blende in Mariposa county, California, Eureka county,

Nevada, and also in Colorado, Arizona, and Montana. The Mariposa ore has either a flaky or schistose structure, and ranges in colour from a light to a dark grey. It consists mainly of a granular mixture of white barite (barium sulphate) and brown sphalerite (zinc blende), the latter being the luminescent constituent. The ore also contains tetrahedrite and galena, and about 17 dols. of gold and 4 oz. of silver per ton. When the ore is scratched with a knife-blade (or even with the finger-nail), a bright line of light follows the point of the blade. The appearance is that of a series of momentary sparks, which are plainly perceptible in daylight. The ore is not radio active.
—A. S.

Vanillin and Morphine; Action of an indirect Oxidising Ferment [Anaeroxydase] on ——. E. Bourquelot and L. Marchadier. J. Pharm. Chim., 1904, **20**, 5—10.

It is found that the indirect oxidising ferments [anaeroxydases], such as are found in an infusion of oatmeal, react on vanillin and morphine, in the presence of hydrogen peroxide, precisely like the direct oxidising ferments or oxydases, forming dehydrodivanillin in the first case, and oxymorphine in the second. The action is quite independent of any decomposition of the hydrogen peroxide; if manganese dioxide be employed as the decomposing agent, the oxidisable body undergoes no modification, which demonstrates that the so-called "nascent" oxygen plays no part in the reaction. It appears that the oxygen given off under the action of anaeroxydases, is, at any rate partially, in a different molecular state at the time of its generation, to that formed by the action of manganese dioxide.

Oxydases and anaeroxydases have several properties in common which show that their functions are closely related. Thus the presence of a relatively high percentage of alcohol, even up to 50 per cent., does not hinder the action of either. Traces of hydrocyanic acid are sufficient to arrest their activity, and both ferments are much more resistant to heat than hydrolysing ferments. Bourquelot has advanced the theory that true oxidising ferments may be a special form of ozonides (in fact, peroxides), which, after having parted with their available oxygen to oxidisable bodies, absorb it again from the air and thus act as carriers of oxygen. For the continuous decomposition of the regenerated ozonide, the intervention of an anaeroxydase is necessary. A direct oxydase would therefore appear to be a mixture of such an ozonide and an anaeroxydase. The fact that direct oxydases almost invariably act on hydrogen peroxide is thus explained. This hypothesis has recently been advanced, although somewhat differently, by Chodat and Bach [*Biochem. Centralblatt*, 1903, **1**, 417]. See following abstracts. According to them, there are three classes of oxidising bodies, oxygenases (albuminoids which fix molecular oxygen forming peroxides); peroxydases, (indirect oxydases); and catalases (bodies which decompose hydrogen peroxide without themselves forming oxidation products). They therefore apply the term peroxydases, originated by Linossier, to the anaeroxydases, on the ground that the denomination is more in conformity with the nomenclature generally accepted for the soluble ferments.

The word peroxydase would indicate a ferment acting on peroxides and oxidising them, which is absurd, since it reduces them; while oxygenase would mean a body acting on oxygen and oxidising it. Anticipating this anomaly, Bourquelot has chosen, almost a year prior to Linossier, the terms "direct oxidising" and "indirect oxidising" ferments for these two groups, names which are self explanatory. As to the "catalases," since these are not agents of oxidation, they have no place in the category of the oxydases.—J. O. B.

IX. Peroxydase Reaction; Velocity of the ——*; Function of Peroxides in the Chemistry of Living Cells.* A. Bach and R. Chodat. Ber., 1904, **37**, 2434—2440. (See also this J., 1902, 1561; 1903, 384, 887; 1904, 210, 505.)

The authors show that the velocity of the action of peroxydase follows the law of mass action, in so far as the reaction is not disturbed by the products formed. Peroxydase must be regarded as an enzyme, and differs in onl one way from other enzymes: it becomes rapidly and com pletely used up in carrying out oxidation in presence c hydrogen peroxide, whilst other enzymes are more or les completely regenerated during their action, and are henc able to act on a relatively large quantity of material. Thi regeneration is, however, not a characteristic property c the enzymes, which are all more or less limited in the action.—T. H. P.

Oxido-reducing Enzyme; Existence and Conditions c Action of an —— *in Plants.* J. E. Abelous. Compte rend., 1904, **138**, 1619—1620.

The juice of the potato contains an enzyme which, lik one present in the animal organism, energetically reduce nitrates, but which is incapable of oxidising salicylic alde hyde, except in presence of an oxidising agent, such a potassium chlorate; the latter then undergoes partial re duction. This difference in mode of action between th oxido-reducing enzyme of the animal organism and that c the vegetable organism, is due to the oxydases present in th latter, which oxidise the substance reduced by the form enzyme. When the plant cells are not ruptured and whe air is excluded, so as to prevent the action of the oxydase potato juice is able to oxidise salicylic aldehyde.—T. H. P

Oxalates; Decomposition of —— *by Heat.* Alex. Sco Chem. Soc. Proc., 1904, **20**, 156.

In spite of the simple formulæ given to the oxalates, the decomposition by heat is by no means as simple as usual stated. Ordinary precipitated calcium oxalate turns gr on ignition, and this change, which is due to the separati of small quantities of carbon, occurs even with the pur calcium oxalate. This salt gives very little carbon dioxi and carbon, but always a little of each, decomposing pra tically in accordance with the equation usually give $CaC_2O_4 = CaCO_3 + CO$. Sodium and barium oxala decompose in accordance with the following equations: $7Na_2C_2O_4 = 7Na_2CO_3 + 3CO + 2CO_2 + 2C$; $8BaC_2O_4$ $8BaCO_3 + 6CO + CO_2 + C$. Magnesium oxalate giv exactly equal volumes of carbon dioxide and monoxide a no carbon, $MgC_2O_4 = MgO + CO + CO_2$, but almost all t other oxalates tested gave notable quantities of carb dioxide and carbon.

Butea Frondosa; Colouring Matter of the Flowers of —— A. G. Perkin. Chem. Soc. Proc., 1904, **20**, 169.

In a former communication (J. J. Hummel and A. Perkin, this J., 1903, 693), it was considered probable tl butein from *Butea frondosa* exists in a colourless, as well in a yellow form. These modifications are, howev distinct substances. The colourless compound now term butin, $C_{15}H_{12}O_5$, crystallising from alcohol in colourle needles and from dilute alcohol in pale yellow needles w $\frac{1}{2}H_2O$, melts at 224°—226°, whilst butein, $C_{15}H_{12}O_5$, orang yellow needles (m. pt. 213 —215°), crystallises from dil alcohol with $1H_2O$. It is obtained in small quant together with butin from the plant, and can be prepar from butin by the action of hot dilute caustic alkali alcoholic potassium acetate. On fusion with alkali, but gives the same decomposition products as butin, and methylation the same two trimethyl ethers, (*a*) m. 156 —158 , and (*b*) m. pt. 119°—121°. When digested w boiling dilute alcoholic sulphuric acid, butein is partia reconverted into butin, and by digesting the trimeth compound (m. pt. 119 —121°), which is really butin met ether, with alcoholic potash and water it passes into butein methyl ether (*a*) (m. pt. 156°—158). Again digesting butein methyl ether with alcoholic sulphuric a butin methyl ether is obtained. Butein has the constitut of a tetrahydroxybenzylideneacetophenone (chalkon whilst butin is shown to have that of the correspond flavanone compound (this J., 1904, 367).

New Books.

Calculations used in Cane-Sugar Factories. A Practical System of Chemical Control for Louisiana Sugar Houses and other Cane-producing Countries. By Irving H. Morse, B.S. First Edition. John Wiley and Sons, New York. 1904. Chapman and Hall, Ltd., London. Price 6*s*. 6*d*.

Small 8vo volume, containing preface and 75 pages of ubject-matter, principally tables. The subjects treated of re mainly as follows:—I. Analysis of Products, with Tables. II. Extraction, Saturation, Inversion, &c.; III. Laboratory Records. IV. Tables. Solids, and Purity corresponding to each degree. Polarisation of Commercial ugar, &c. V. Factors used in Calculating Available Sugar. Factors for Refinery Products. Beet-Sugar Factories and Factories Manufacturing 96° Sugar or "YC" Sugar. VI. The most Profitable Sugar to Manufacture, &c. VII. The Available Sugar in a Ton of Cane. Yellow clarified," Second and Third. "96 Test," Second and Third. "Rendimiento" or Sugar Extraction or Cuban Factories.

Die Elektrochemische Industrie Deutschlands. Von P. Ferchland, Ph.D. Wilhelm Knapp's Verlag, Halle-a.-S. 1904. Price M. 2·50.

vo volume, containing 64 pages of subject-matter, with our illustrations, and an alphabetical index. The subjects reated of are:—I. Origin, Aims and Limits of Electro-Chemical Industry in Germany. II. Production of Power or Electrochemical purposes in Germany. III. Alkali nd Chlorine (Bromine). IV. Electric Bleaching. V. Hydrogen, Oxygen, and Ozone. VI. Calcium Carbide and Phosphorus. VII. Sodium, Magnesium, and Aluminium. VIII. Zinc. IX. Copper, Nickel. X. Noble Metals. XI. Other Inorganic Chemical Processes. XII. Organic Electro-Chemistry. XIII. Power required for Substances prepared lectrolytically.

Die Elektrochemische Reduktion der Nitroderivative organischer Verbindungen in experimentaller und theoretischer Beziehung. Von Joh. Möller. Wilhelm Knapp's Verlag, Halle-a.-S. 1904. Price M. 4.

vo volume, containing 113 pages of subject-matter and he alphabetical index of subjects and authors. This work devoted to a description of all the experimental and heoretical results so far obtained in the reduction of the itro-derivatives of organic compounds.

he Occurrence of Aluminium in Vegetable Products, Animal Products, and Natural Waters. By C. F. Langworthy, Ph.D., and Peter T. Austen, Ph.D. First Edition. John Wiley and Sons, New York. 1904. Price 8*s*. 6*d*. net. Chapman and Hall, London.

vo volume, containing 132 pages of subject-matter and he alphabetical index. The subject treated of is classified s follows:—I. Aluminium in Vegetable Products. II. In nimal Products. III. In Natural Waters. IV. In Miscellaneous Materials. The work takes the form of a assified and complete bibliography of the subject.

nalytical Chemistry. By F. P. Treadwell, Ph.D., Professor of Analytical Chemistry in the Zürich Polytechnikum. Translated from the Second German Edition by William T. Hall, S.B. Volume II.—Quantitative Analysis. John Wiley and Sons, New York. 1904. Price 17*s*. net. Chapman and Hall, Ltd.

vo volume, containing prefaces, 645 pages of subject-atter, with 96 illustrations, and including numerous tables, d a set of logarithmic tables, followed by the alphabetical dex. After the introduction with the usual descriptions f general methods of procedure, and of apparatus used, the ork is divided into Parts I., II., and III., devoted as llows:—I. The Gravimetric Determination of the Metals d of the Metalloids. Part II. Volumetric Analysis—(A) Oxidation and Reduction Methods; (B) Precipitation ethods. Part III. Gas Analysis.

A Systematic Handbook of Volumetric Analysis, or the Quantitative Estimation of Chemical Substances by Measure, applied to Liquids, Solids, and Gases. Adapted to the Requirements of Pure Chemical Research, Pathological Chemistry, Pharmacy, Metallurgy, Manufacturing Chemistry, Photography, &c., and for the Valuation of Substances used in Commerce, Agriculture, and the Arts. By Francis Sutton, F.I.C. Ninth Edition, revised and enlarged. J. and A. Churchill, 7, Great Marlborough Street, London. 1904. Price 20*s*. net.

This volume, 8vo size, contains 607 pages of subject-matter, with 121 illustrations, and the alphabetical index. It is subdivided as follows:—Part I. Devoted to General Principles, gives Descriptions of the Chemical Balance, and General Apparatus and Methods. II. Alkalimetry. III. Analysis by Oxidation or Reduction. IV. Analysis by Precipitation. V. Application of Foregoing Principles of Analysis to Special Substances. VI. Special Applications of the Volumetric System to the Analysis of Urine, Potable Waters, Sewage, &c. VII. Volumetric Analysis of Gases and Construction of Apparatus.

Report on Air Tests in Humid Cotton Weaving Sheds. By Frank Scudder, F.I.C. [Home Office.] Eyre and Spottiswoode, East Harding Street, Fleet Street, London, E.C.; 32, Abingdon Street, Westminster, S.W.; Oliver and Boyd, Edinburgh; and E. Ponsonby, 116, Grafton Street, Dublin. 1904. Price 3*d*.

This report refers to the question of ventilation of humid cotton cloth factories, in pursuance of an inquiry into the Cotton Cloth Factories Act, 1889, commenced in 1896, when the Secretary of State appointed a Departmental Committee of which Sir Henry Roscoe, F.R.S., was chairman. On Feb. 2, 1898, it was ordered that ventilation should be such that the carbon dioxide in the air of such factories should not exceed nine volumes per 10,000 of air. The report states that "in the great majority of cases the proportion of carbon dioxide was far below" the limited quantity mentioned. The method of determination and apparatus employed Mr. Scudder describes. The method used was that of Pettenkofer with baryta water and oxalic acid.

Trade Report.

I.—GENERAL.

International Exhibition, Saint Louis, 1904. Dept. C., Liberal Arts. Catalogue of British Exhibits, Classified under Group 23. Chemical and Pharmaceutical Arts. Issued by the Royal Commission. William Clowes and Sons, Ltd., Duke Street, Stamford Street, S.E., and Great Windmill Street, W., London. 1904. Price 1*s*. net.

Sub-Committee for Group 23 (Chemical and Pharmaceutical Arts), Dr. Boverton Redwood, F.R.S.E., *Chairman*, A. Gordon Salamon, Esq., Thomas Tyrer, Esq., Charles Wightman, Esq., Edmund H. Lloyd, *Secretary*.

This catalogue of the British exhibits in Group 23 contains an introductory note of nine pages, a plan of the exhibits, a list of the exhibitors arranged in alphabetical order, with references to the plan and to the pages in the catalogue, a series of descriptive accounts of some of the principal branches of the industry represented by the exhibits (pages 11—137), and a detailed list of exhibitors and exhibits (pages 138—180).

In the introductory note it is stated that arrangements were made with Mr. G. R. Dunell to obtain information by means of interviews with leading exhibitors and technologists in Great Britain, and that the particulars so furnished have, with the assistance of Mr. Walter F. Reid, Chairman of the London Section of the Society of Chemical Industry, been embodied in the descriptive accounts already mentioned.

Exhibits of Special Scientific Interest.

Low Temperature Research Exhibit.—Complete plant in operation, as employed by Prof. Sir James Dewar, F.R.S., at the Royal Institution, London, in producing liquid and solid hydrogen. (Constructed for the Royal Commission by Messrs. Lennox, Benton, and Reynolds, Ltd.) *Scientific Lectures and Demonstrations* in connection with this exhibit will be given by Mr. J. E. Petavel.

Wellcome Chemical Research Laboratories; Wellcome Physiological Research Laboratories.—Specimens of essential oils, substances isolated from chaulmugra seeds, chaulmugric acid derivatives, alkaloids, extracts, morphine derivatives, phenylic salts of dibasic acids, and certain inorganic salts, &c.

Baly, E. C. C.—Photographs of spectra.

Collie, Prof. J. Norman, Ph.D., F.R.S.—Specimens of dimethylpyrone, and some derivatives, also of oxonium compounds.

Glasgow and West of Scotland Technical College (Prof. G. G. Henderson, M.A., D.Sc.).—Specimens illustrative of research work.

Hartley, Prof. W. N., F.R.S., Royal College of Science for Ireland, Dublin.—Photographs and substances recently prepared for research purposes.

Lister Institute of Preventive Medicine (Dr. Allan Macfadyen and Mr. Sydney Rowland).—Diagrammatic section and photographs of the disintegrator used in investigations on intracellular toxines.

Lovibond, Joseph W.—"Tintometer" and sets of equivalent colour standards, &c.

Newlands, B. E. R.—Collection of 11 ancient bronze or bell metal mortars. Photographs, by Miss M. A. Newlands, of old prints.

The Owens College (Prof. H. B. Dixon, M.A., F.R.S.).—Exhibits illustrating the discoveries of Sir H. E. Roscoe, F.R.S., and the late Prof. C. Schorlemmer, F.R.S.; the late Dr. E. Schunck, F.R.S.; the late R. S. Dale and Prof. C. Schorlemmer; the late Sir Edw. Frankland, F.R.S.; and Prof. H. B. Dixon, F.R.S.

Ramsay, Prof. Sir Wm., F.R.S.—Vacuum tubes containing helium, neon, argon, krypton, and xenon (Ramsay and Travers).

Reynolds, Prof. J. Emerson, F.R.S.—Specimens illustrative of research work at Trinity College, Dublin.

Royal College of Science, London (Prof. W. A. Tilden, F.R.S.).—Specimens illustrative of research work by staff and students.

Society of Apothecaries of London (Wm. Chattaway).—Antiquities relating to pharmacy.

Travers, Prof. Morris W., F.R.S.—Diagram of hydrogen liquefier.

The names of the firms who take part in the British Exhibit are given below under the respective branches of Chemical Industry and Pharmacy:—

Alkali Industry:

- *Alkali.*—Brunner, Mond and Co., Ltd.; Castner-Kellner Alkali Co., Ltd.; Chance and Hunt, Ltd.; J. Crosfield and Sons, Ltd.; United Alkali Co., Ltd.
- *Sulphuric Acid.*—F. W. Berk and Co., Ltd.; W. Pearce and Sons, Ltd.; Spencer, Chapman and Messel, Limited.
- *Nitric Acid.*—F. W. Berk and Co., Ltd.; Alfred White and Sons.

Alum.—R. and J. Garroway; Peter Spence and Sons, Ltd.

Brimstone.—Albright and Wilson, Ltd.; The Anglo-Sicilian Sulphur Co., Ltd.; A. Boake, Roberts and Co., Ltd.; Chance and Hunt, Ltd.; J. M. Collett and Co.; The Gas Light and Coke Co.; F. C. Hills and Co.; F. Kendall and Son, Ltd.; W. Pearce and Sons, Ltd.; United Alkali Co., Ltd.

Coal Tar Products.—J. B. Aitken; Brooke, Simpson and Spiller, Ltd.; The Gas Light and Coke Co.; Levinstein, Ltd.; Read Holliday and Son, Ltd.; The South Metropolitan Gas Co.; Stone and Tinson.

Cyanides and Prussiates.—The British Cyanides C Ltd.; The Cassel Gold Extracting Co., Ltd.; T Castner-Kellner Alkali Co., Ltd.; The Gas Light a Coke Co.; Swan and Kendall; The United Alkali C Ltd.

Electro-Chemistry.—The Castner-Kellner Alkali C Ltd.; The United Alkali Co., Ltd.

Explosives.—Nobel's Explosive Co., Ltd.; Jas. Pain a Sons.

Nickel.—Specimens illustrating the Mond Nickel Carbo Process; The Mond Nickel Co., Ltd.

Oils, Fats, Waxes, Soap, and Candles:

- *Mineral Oils.*—Assam Oil Co., Ltd.; Burmah Oil C Ltd.; Joseph Crosfield and Sons, Ltd.; Eva Sons, Lescher and Webb, Ltd.; J. C. and J. Fie Ltd.; Price's Patent Candle Co., Ltd.
- *Apparatus.*—Baird and Tatlock, London, Ltd.; W. Fraser and Co.; John J. Griffin and Sons, Lt Joseph W. Lovibond; Townson and Mercer.
- *Soap Manufacture.*—Edward Cook and Co., Ltd Joseph Crosfield and Sons, Ltd.; Evans, So Lescher and Webb, Ltd.; J. C. and J. Field, Lt Price's Patent Candle Co., Ltd.; Sharon Chemi Co., Ltd; United Alkali Co., Ltd.
- *Candle Industry.*—Assam Oil Co., Ltd.; Burmah Co., Ltd.; J. C. and J. Field, Ltd.; Price's Pate Candle Co., Ltd.
- *Ethereal Oils.*—Allen and Sons, Ltd., Staffor Burroughs, Wellcome and Co.; Evans, Sons, Lesch and Webb, Ltd.; T. Morson and Son.

Pharmacy, Chemistry and Pharmaceutical Apparat Antiquities relating to Pharmacy.—Albright a Wilson, Ltd.; Allen and Hanburys, Ltd.; Allen a Sons, Ltd., Stafford; John Austen; Baird and Ta lock (London), Ltd.; Battley and Watts; A. Boak Roberts and Co., Ltd.; The Bone Phosphate a Chemical Co., Ltd.; Burroughs, Wellcome and C J. M. Collett and Co.; Corbyn, Stacey and Co., Ltd Daniel Davison; Doulton and Co., Ltd.; Ellima Sons and Co.; Evans, Sons, Lescher and Webb, Ltd W. H. Francis; John J. Griffin and Sons, Ltd.; Hemin way and Co.; Hopkin and Williams, Ltd.; Howar and Sons, Ltd.; Jeyes' Sanitary Compounds Co., Ltd Kemball, Bishop and Co., Ltd.; F. Kendall and So Ltd.; John Bennet Lawes and Co., Ltd.; Joseph Lovibond; Wm. Martindale; McDougal Bros.; M and Baker, Ltd.; Morris, Little and Sons, Ltd T. Morson and Son; B. E. R. Newlands; Newto Chambers and Co., Ltd.; Parkin, Ness and Co The Society of Apothecaries of London; John a E. Sturge; Townson and Mercer; Thomas Tyrer a Co., Ltd.; United Alkali Co., Ltd.; Wm. Warre Alfred White and Sons.

Pigments and Paints.—Lewis Berger and Sons, Ltd Walter Carson and Sons; The Gas Light and Co Company; Hemingway and Co. and Hemingway' London Purple Co., Ltd.; May and Baker, Ltd The Sharon Chemical Co., Ltd.; Thomas Tyrer a Co., Ltd.; Wood and Bedford.

Power Gas.—Model of Mond's Patent Gas-produc Plant, with ammonia recovery apparatus. Dr. Ludw Mond, F.R.S.

Franco-German Tariff and Trade Relations.

U.S. Cons. Reps., No. 1984, *June* 21, 1904.

A committee appointed by the Parliament of France investigate the tariff and trade relations of France wi some of the great nations of the world as affected by t new arrangements entered into or to be negotiated since t end of the treaties which expired December 31, 1903, h just made a voluminous report, of which the following is extract:—

The report of the commission begins by a short review the industrial and agricultural condition of Germany. Th lowing are the figures of production for the past three ars :—

Description.	1899—1900.	1900 · 1901.	1901-2.
	Tons.	Tons.	Tons,
neat............	3,847,447	3,841,465	2,498,851
e..............	8,675,792	8,550,659	8,162,660
rley...........	2,988,876	3,002,182	3,221,102
ts.............	6,882,687	7,031,930	7,050,153
tatoes.........	38,486,202	40,585,317	48,687,261
y..............	25,909,781	23,767,700	22,370,047

The large crop of potatoes was stimulated by the growth the output of alcohol, which, in Germany, is generally rived from potatoes. The exports of alcohol from rmany are constantly increasing, and the consumption alcohol for varnish, chemical products, lighting, heat, and wer is very great.

The beet crop alone has increased in France during the t 10 years. It passed from 479,500 acres to 837,500 es, an increase due to the sugar laws of 1884 and 1897 ablishing the export bounty. As those laws are repealed day this acreage is likely to diminish. It will be very ficult to find a compensation in the increase in the sumption of alcohol in industry.

The commission here enters upon an elaborate review of mineral wealth of Germany, comparing the output of n, potassium, zinc, lead, salt, lignites, copper, and coal the past six years. The concluding sentence is that growth in the mining industry in Germany can only be npared to that of the United States.

Following this is a tabulated statement of the iron and el industry of the United States, Great Britain, Germany, ince, Russia, and Spain, in the order given, the consion again being that the progress of Germany in that ustry is only comparable with the United States.

he report states that Germany wages a very sharp npetition against French chemical products—above all, e products for the laboratory. In that branch the Gerns have almost monopolised the commerce of the world, nks to the exceedingly well-equipped mills and to their vity. They have also succeeded in materially reducing first cost of production. In Germany, 1,950,000 cb m. ,816,200 cb. ft.) of wood were turned into paper in 1897. many consumes annually 750,000 tons of paper and ls. This immense consumption is due to the activity of ting and lithography in that country.

he report enters into a careful examination of the mercial conditions existing between France and Germany, ng the text of the treaties, and then gives the new oms laws of Germany, from which the following are n :—

ubricating oils are charged a duty of 12·50 francs 12 dols.) per 100 kilos. (220 lb.) by the new German f. Stearin, which was formerly free of duty, is now able at 12.50 francs (2.412 dols.) per 100 kilos. ; candles 28.15 francs (5.433 dols.) per 100 kilos. The duty on same articles coming into France are but 8 and 16 francs 44 dols. and 3.088 dols) respectively. Soaps are ged with a duty of from 6.75 to 12.50 francs (1.302 to 2.412 dols.). France formerly exported 1,500,000 s' (289,500 dols.) worth of soap and perfumery into aany. It is thought that this business will be lost r the new tariff.

rmany's exports of aniline and similar products ased from 52,000,000 marks (12,376,000 dols.) in to 81,345,000 marks (19,360,110 dols.) in 1901.

ance imported chemical products from Germany in representing a value of 22,700,000 francs (4,381,100); in 1901, a value of 21,501,000 francs (4,149,693); and in 1902, a value of 21,618,000 francs (4,172,274).

the new German tariff sulphuric, nitric, hydrochloric, , and other acids are free of duty ; but oxalic acid is cted by a duty per 100 kilos. of 10 francs (1.93 dols.) ; acid, 15 francs (2.895 dols.) ; and tartaric acid, ncs (1.93 dols.).

following the example of France, Germany has found essary to protect soda salts by a high duty ; caustic soda, 4.37 francs (84.3 cents) ; sodium carbonate, 1.87 francs (35 cents). The duty on alum and aluminium sulphate is 3.75 francs (72.3 cents).

Aniline colours are exempt, which is very natural, as Germany possesses all the markets.

Varnish, lacquers, and mastics are placed at greatly increased duties—37.50 francs (7.237 dols.) for alcohol varnish.

In short, for secondary chemical products a heavy protective duty has been imposed—6.75 francs (1.286 dols.) ; for gelatin in leaves, 37.50 francs (7.237 dols.). Casein has a protection of 12.50 francs (2.412 dols.), while as paste it has no duty at the French frontier.

Drawbacks in the United States of America.

Foreign Office Annual Series, No. 3185, *June* 1904.

Although the United States tariff is strongly protective, a drawback of 99 per cent. of the duties paid on imported articles is allowed when they are used in the manufacture of other articles in the United States which are subsequently exported. This applies to the tin plate trade. Large quantities of British tin plates are imported, and on being made up in America into cases, are filled with American oils, canned goods, &c., and on exportation 99 per cent. of the duty paid is refunded as a drawback. This drawback affects a large number of articles other than tin plates. The law will be found in the Act of July 24, 1897, which has been recently published in the Parliamentary Paper, Commercial No. 2 (1904).

Chemical Exports from Germany.

Foreign Office Annual Series, No. 3196, *June* 1904.

A large firm manufacturing fine chemicals reports that, though demand was active in 1903, prices were almost unremunerative by reason of fresh competition at home and abroad. Foreign countries are endeavouring ever more vigorously to emancipate themselves altogether from German products, and with much success. The United States, especially under protection of its tariff, is rapidly and successfully developing the manufacture of fine chemicals, so that the export from Germany to America can now be effected only with great difficulty. The firm adds that exports to Canada have been made impossible by the differential duty in favour of the United Kingdom.

III.—TAR PRODUCTS, PETROLEUM, Etc.

Petroleum in California in 1903.

Foreign Office Annual Series, No. 3185, *June* 1904.

The output of oil in California amounted to 20,000,000 barrels* in 1903, as against 13,000,000 barrels in 1902. Deducting that which will be either refined or exported, the balance available for steam purposes will be large enough to disturb the coal market. The price of oil has decreased during the past year, and the railway companies have bought up large oil properties. The older wells—especially in South California—are giving out, and the greatest caution as to oil properties offered for sale should be exercised. The Standard Oil Co. purchased 9,000,000 barrels from the Peerless Oil Co., at 20 c. a barrel at the wells, and engage to purchase 5,000 barrels daily for five years as from Jan. 1, 1903. This is held to prove that the Standard Oil Co. are convinced that the attempts to refine crude Californian oils have succeeded. In fact, they are being refined locally with very good results, but are not of a high grade, and are mixed with fine Eastern oil. The use of oil fuel is extending in every direction.

Petroleum Production of Russia.

Bd. of Trade J., July 7, 1904.

The production of naphtha wells in the peninsula of Apcheron in 1903 was 595,000,000 pouds,* as compared with 637,000,000 pouds in 1902, and 675,000,000 pouds in 1901. The decrease in 1903 is due to the fact that, owing

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* 1 barrel = 33·5 galls. ; 1 poud = 36·112 lb.

to the low market price of petroleum, several of the more important wells were not worked during the earlier part of the year; there was also a diminution in the output of some of the other wells. Moreover, work was severely hampered by labour disputes during the month of July. Some of the wells are giving signs of exhaustion, but on the other hand, new sources of production have been discovered in the district of Bibi-Eibat.

In 1903, 80,000,000 pouds of naphtha were exported from Batoum, showing an increase of 8 per cent. on 1902. Of this, 61,000,000 pouds were petroleum properly so-called. 27,000,000 pouds were sent to the East, the remainder to Europe.

IV.—COLOURING MATTERS AND DYESTUFFS.

Dyestuffs: U.S. Customs Decisions.

June 1904.

Pyrol Black R.O., Sulphur Black T.G., and Sulphaniline Black were decided to be dutiable at 30 per cent. *ad val.* as "coal tar dyes," under par. 15 of the tariff.
—R. W. M.

X.—METALLURGY.

Zinc Ore Exports from Carthagena, Spain.

Foreign Office Annual Series, No. 3188, *June* 1904.

In his report for 1903, the British Vice-Consul at Carthagena gives the following figures showing the shipments of zinc ore from that port to the countries named during the past year:—

	Tons.
United Kingdom	4,150
Belgium	82,050
Germany	1,050
France	1,000
Total	88,250

The above total shows an increase of 22,580 tons over the preceding year. The United Kingdom has taken more by 893 tons, Belgium by 21,427 tons, Germany by 900 tons, and France by the full shipment of 1,000 tons. Of the above quantity 7,900 tons were calamine, the remainder being blende, usually found in the mines which are worked for lead, and, not unfrequently, the lead ore gives out and "degenerates," as the miners say, into blende.

Iron Industry of the Transvaal.

Bd. of Trade J., July 7, 1904.

The *Rhodesia Herald* states that the first blast-furnace in South Africa has recently been erected near Pretoria, on the line of the railway; it is situated in the centre of iron deposits and close to coal supplies. The furnace, which will have a weekly capacity of 500 tons of pig-iron, is to be followed by rolling-mills and a steel-converting plant. In addition to iron ore and coal, there is plenty of limestone in the neighbourhood. The ore is of the hematite and magnetite variety, and runs 58 to 62 per cent. of metallic iron. A survey above ground and cross-cutting indicate that there are some 62,000,000 tons of iron in sight. There is also manganese ore in Africa.

Mineral Output of Western Australia.

Government Gazette of Western Australia, April 8, 1904.

	1902.		1903.	
	Quantity.	Value.	Quantity.	Value.
	Tons.	£	Tons.	£
Black tin	620	39,788	817	55,890
Copper ore	2,262	8,090	20,526	56,541
Ironstone	4,800	2,040	220	81
Coal	140,884	856,188	133,427	69,128
Limestone	5,080	1,340	1,280	178

Arsenic in Spain.

Chem. and Druggist, July 2, 1904.

A company has been formed to develop deposits arsenical pyrites situated in the province of Orense, Spa The ore carries some gold and from 25 to 40 per cent arsenious acid. It is proposed to treat the pyrites cyanidation for the recovery of the gold, and the resid will then be used for the production of arsenic. A numl of concessions have been granted recently in the sa locality for similar undertakings.

XII.—FATS, FATTY OILS, Etc.

Castor Oil Production in New Zealand.

Queensland Agric. J. Pharm. J., July 9, 1904.

The castor oil plant (*Ricinus communis*) is a native of warm countries. It is very hardy and will thrive on alm any soil and in any situation, attaining a great height one season after sowing the seed. The plant prefers soils. The seed should be sown in rows, 6 ft. apart 4 ft. in the rows. Before sowing, the seed should be stee in hot water for 24 hours. After the plants are ab ground, the cultivation is the same as for corn, cotton, tobacco.

When the seed-pods are ripe, they suddenly burst o and scatter the seeds in all directions. Special arran ments must, therefore, be made for harvesting th When the pods are seen to be turning brown, the spi which bear them are cut off and taken to a clean-sw piece of hard ground which may be enclosed with galvani iron. Here they remain, being turned occasionally until pods have emptied themselves. The husks are then moved by winnowing, and the beans swept up and bagg They must on no account be allowed to get wet. T work is so light that it can be done by young children.

The yield of beans varies between 20 and 30 bushels acre. The oil is extracted by means of a hydraulic screw, or a lever press. What is known as "cold-dra castor oil" is that obtained by mere pressure. The f thing to do is to remove the external hull. This is effec by passing the beans through two revolving rollers, se such a way as merely to crack the hull, which is then rid of by winnowing. The decorticated seeds are then into coarse hempen bags about 2 ft. in diameter. Betw each layer of bags there is placed a steel plate, and at 20 or 30 bags, each holding about 40 lb. of seeds, are pla on top of each other in the press. The pressure must applied gradually, and the oil running from the first p is the best. As the pressure is increased up to the power of the press a second quality is produced. The p after this is taken out, mixed with hot water, and ag pressed to obtain the third quality. Another method is place the beans in a stone roller mill. This consists of large round stones connected by a spindle, which revolved by horse-power in a hollow round stone, in wh the beans are placed. These stone mills hold about 2 c and this quantity is crushed every half-hour. The o poured into filtering bags, and the pure oil runs from shelves on which the bags are placed through tubes vessels placed to receive it. The average yield of o 40 per cent.

Finishing Soap: U.S. Customs Decision.

June 16 *and* 18, 1904.

Several varieties of soap known as finishing soap, sisting in one case of beef tallow and alkali, assessed duty as "alizarin assistant not made from castor oil," a per cent. *ad val.* under par. 32 of the tariff; in ano case assessed for duty as "alizarin assistant containing than 50 per cent. of castor oil," at 15 cents per gallon; in a third case, consisting of resin and alkali, assessed duty at the same rate—none of the above having sulphonated—were decided to be dutiable at 20 per c *ad val.* under par. 72 of the tariff, as "soaps not speci provided for."—R. W. M.

SOAP STOCK: U.S. CUSTOMS DECISION.

June 21, 1904.

A mixture of oils consisting of castor oil, 77·50 per cent.; live oil, 12·72 per cent.; and oleic acid, 9·78 per cent., nd intended for use in manufacturing, was held to be utiable according to the component material of chief value nder section 7 and par. 33 as "castor oil" at 35 cents per allon. Although the article was suitable for use in soap aking, its common and exclusive use for this purpose was ot shown with sufficient conclusiveness to entitle it to free ntry under par. 568 as "soap stock." The Board also held hat oleic acid is not a distilled, essential, expressed, or endered oil; hence the above mixture is not covered by ar. 3, which provides for combinations of the foregoing

—R. W. M.

XIII. A.—PIGMENTS, PAINTS, Etc.

OCHRE SHIPMENTS FROM CARTHAGENA.

Foreign Office Annual Series, No. 3188, *June* 1904.

As regards ochre, the Vice-Consul states that only 343 ns were shipped, all to the United Kingdom. Buyers are fficult to please, good ochre is difficult to get, and profits e not good enough to animate shippers in making special forts to increase quantities.

MARKING INK; MANUFACTURE OF —— IN MEXICO.

Bd. of Trade J., July 14, 1904.

According to a despatch from the Italian Minister at exico, reproduced in the *Bolletino Ufficiale del Ministero Agricoltura*, a large quantity of marking ink of the best ality is now being manufactured at Jalapa, in the state of ra Cruz. This ink is extracted from the pulp of the *cleloahnitl* tree. During the month of April, about 2,300 es were exported to Germany.

The tree from which the ink is manufactured is found in eat abundance throughout the districts of Jalapa, Vinios, xpoco, and Huaxtlau; it is therefore confidently expected it the new industry will be greatly developed.

XIII. B.—RESINS, VARNISHES, Etc.

RUBY VARNISH: U.S. CUSTOMS DECISION.

June 10, 1904.

A varnish tinted red for photographic purposes was held be properly assessed for duty as "varnish" at 35 per t. *ad val.* under par. 53 of the Tariff Act, and not to be iable either at 25 per cent. *ad val.* as a chemical comınd under par. 3, or at 20 per cent. *ad val.* under section ıs a "manufactured article unenumerated." The Board ther held that the assessment of duty at 1·35 dols. gallon and 35 per cent. *ad val.*, as "spirit varnish," was oneous, as the article contains no ethyl alcohol.

—R. W. M.

XIII. C.—INDIA-RUBBER, Etc.

NDIA-RUBBER CULTIVATION IN GERMAN COLONIES.

Foreign Office Annual Series, No. 3186 *June* 1904.

Much attention has been given of late in Germany to the essity of improving the existing condition of india-rubber ivation in German African colonies, where the same has developed as it was hoped, and in some of the colonies production has in fact been diminishing. Those proug most india-rubber at present are Cameroon and East ca, but the exportation of both together did not exceed ,000*l.* in value in 1902.

XVI.—SUGAR, STARCH, Etc.

CHOOL IN CONNECTION WITH THE SUGAR, STARCH, AND ALCOHOL INDUSTRIES IN ITALY.

Bd. of Trade J., July 7, 1904.

Consul-General at Florence reports that, in ust next, a school will be opened, attached to the University of Ferrara, in connection with the sugar, starch, and alcohol industries.

The teaching will include Technical Chemistry, Technical Mechanics, Seed Selection and Technical Agriculture, Zymotechnics, Legal Matters and Accounts, and Chemical and Industrial Analyses.

GUMS IN ABYSSINIA.

Bd. of Trade J., June 30, 1904.

Abyssinian gums in general are white and highly esteemed. They are abundant and receive but little commercial attention. The best regions are those of from 4,900 to 5,900 ft. altitude, although in the lower plains there is quite sufficient to invite exploitation. All these gums are exported by way of Aden, and are probably never recognised at the ports of arrival as of Abyssinian origin. The export at present amounts to about 1,930*l.* annually. This export could be easily augmented to five times the present amount.

XVII.—BREWING, WINES, SPIRITS, Etc.

INTERNATIONAL SPIRIT INDUSTRY EXHIBITION, VIENNA.

Chem.-Zeit., 1904, **28**, 477—478.

Cooking Apparatus.—The experiments made with various types of cooking apparatus fed with spirit show that whilst the older forms required 13 minutes to boil 1 litre of water and consumed 38 grms. of spirit, the newer types do the same in nine minutes with 32 grms. and the regulator stoves in eight minutes with 27 grms. The quantity of spirit consumed per hour in the three kinds is 175, 210, and 200 grms. respectively.

Lamps. — The exhibits comprise incandescence spirit lamps up to 1,000 Hefner candle-power. Tests of some of them, under the auspices of the Ministry of Commerce, gave the following results, 90 per cent. spirit being used:—

Lamp.	Candle Power.	Time Needed for Heating Burner.	Consumption per 10-Candle Hour.
		Min.	Grms.
Incandescence lamp with by-pass flame	42·5	1·5	24
Incandescence lamp with heat conductor	34·0	2·0	29
Street spirit lamp	70·0	9·5	12
Petroleum lamp with 16-line circular burner	9·5	..	43

Motors and Automobiles.—The exhibits are considered to demonstrate the suitability of spirit for power purposes, and the competition with petrol resolves itself into the question of relative cost. The fixed motors are fed with unmixed motor spirit, carburetted spirit being used for automobiles.

Denaturing.—A portion of the spirit was denatured with a preparation prescribed by the Royal Austrian Agricultural Experimental Station [composition not given], the remainder being mixed to furnish motor spirit.—C. S.

METHYLATION: RECTIFYING AND COMPOUNDING.

Pharm. J., July 9, 1904.

In the House of Commons, on July 5, the Chancellor of the Exchequer said that the total quantity of spirits distilled in England during the year ended March 31, 1904, was 11,694,831 proof gallons. The quantity of home-made spirits used for methylation during the same period was 4,398,002 proof gallons. He had no means of knowing the quantities used for rectifying and compounding. 33,300 proof gallons of British spirits were despatched to Customs warehouses at Leith from English distilleries during the 12 months ended June 30, 1904. The materials commonly used in the distillation of English spirit were malt, unmalted grain, molasses, sugar, glucose, and rice.

Tax-free Spirit.

Times, July 21, 1904.

In committee on the Finance Bill, on July 20, Mr. Scott-Montagu moved a new clause providing that alcohol which had been suitably denatured and rendered unpotable and was required for motive power, lighting, heating, and manufacturing purposes should be sold without payment of any duty or tax, and that absolute alcohol should also be exempt from duty when employed in manufacturing operations where it could be proved to the Commissioners that denaturing agents would prevent its use. He also asked that a committee should be appointed to investigate the subject.

The Chancellor of the Exchequer said that he could not accept the clause as it stood on the paper, but he would accept the suggestion to have a committee appointed to look into the matter. He was aware that a great deal of importance was attached to the question, and he agreed that the public should have an opportunity of explaining what it was they wanted as well as an opportunity of learning the facilities which the law provided. He could not undertake to deal with a point of legislation in the Finance Bill.

Mr. Bryce asked whether alcohol for motive power would be the only question inquired into by the committee, or whether the inquiry would be extended to the exemption of alcohol for use in various trades.

The Chancellor of the Exchequer: I intended the committee to cover both subjects.

Mr. Gibson Bowles warned the right hon. gentleman against agreeing too readily to these exemptions of alcohol. Exemption of one man meant an increased burden on another. The committee might disclose grievances, of course, but the right hon. gentleman should not be led away to propose in his next Budget anything in the interest of the motor industries or any other industries. He did not agree with the proposal that spirits which were not drunk should be exempt any more than spirits that were drunk.

The clause was withdrawn.

Spirit in Poland.

Chem. and Druggist, July 16, 1904.

The failure of the potato crop in Poland last year proved disastrous for the spirit distilleries, and large quantities of maize had to be imported from Bessarabia and the Caucasus to replace potatoes. The prices paid by the monopoly for spirit in 1903 were from 55 to 71 copecks per vedro (average 6*d*. per gallon), which was higher than usual. According to the law of 1903, permission was granted for the use of denatured spirit free of Excise for industrial and technical purposes; but little advantage was taken of it on account of the shortness of spirit and the low price paid by the monopoly (4*d*. per gallon) for spirit to be denatured, which did not encourage distillers to sell spirit to the monopoly for that purpose. Denatured spirit was sold by the monopoly only at Warsaw at 6*d*. per gallon. The consumption of denatured spirit was small, as special permission to use it has to be obtained from the Ministry in each case, even for a single lamp. According to the Law of June 12, 1900, which was in force till the end of 1903, Poland was allowed to produce 22,500,000 galls. of spirit a year; but a new law, which came into force in January 1904, does not now in any way restrict the production of spirit in Poland. The annual requirements of the monopoly have been fixed by the Ministry at 18,191,355 galls. for the period 1903–7, the monopoly taking this quantity at a fixed rate.

Spirituous Tinctures in Cape Colony.

Pharm. J., June 18, 1904.

On and after July 1, 1904, a duty of 15*s*. per proof gallon will be levied on spirituous tincture imported into Cape Colony. Tinctures made in the Colony will only pay a duty of 6*s*. The duty affects British manufacturers very seriously, and the matter is under consideration by the London Chamber of Commerce.

XVIII. B.—SANITATION.

Nitrous Fumes and Arseniuretted Hydrogen.

Chem. Tr. J., July 9, 1904.

The annual report of the Prussian factory inspect gives particulars concerning the 1,293 chemical factor which were visited, special attention being paid to accide and dangers incidental to chemical manufactures. Meati is made of several cases of poisoning by nitrous fume in some instances the workmen appeared to recover fr the effects, but were subsequently seized with internal pa and died. Arseniuretted hydrogen was the cause of t deaths in another instance. The particularly deadly natu of this gas is not sufficiently realised. It is very liable be present in hydrogen generated from zinc or iron, a may be formed from arsenic contained either in the a or the metal. Very minute quantities are sufficient to kil man. Wherever hydrogen is used, either for lead burni or for reducing purposes, or for filling balloons, this dang should not be lost sight of. Several explosions took pl in explosive factories during 1903.

Chloroform as a Remedy for the Injurious Effec of Inhaling Nitrous Fumes.

Chem. Ind., 1904, **27**, 379.

Chloroform has been found an excellent remedy for ill effects of "gassing" with nitrous fumes. In ma cases, after apparent entire recovery, workpeople and oth are seized with cramps or spasms and die. The direct of the Rheinisch-Westfälischen Explosives Compan Troisdorf, have issued an instruction in their works t any person who has inhaled nitrous fumes must h administered to him every 10 minutes a glass of water i which 3 to 5 drops of chloroform have been added from dropping-tube until recovery. The largest quantity chloroform that may be thus administered per day 1·5 grm.; 3 drops of chloroform are considered as weighi 0·045 grm., and 5 drops 0·078 grm. This prescription to be strictly observed, and the amounts by no me exceeded. Chloroform being somewhat unstable wh exposed to light, it must be kept in bottles of colou glass.

XX.—FINE CHEMICALS, Etc.

Cascara Sagrada, or Chittim Bark, in Oregon

Foreign Office Annual Series, No. 3207, *July* 1904.

The bark of the cascara sagrada, or chittim tree, has recent years assumed a growing importance as an article commerce, and appears to be produced principally in t district. The article is being largely used in medicine, during the past year about 500 tons were shipped to United Kingdom and Continent. The production stimulated by high prices to such an extent that there danger of all the trees being destroyed. In May average price paid was 2*d*. per lb., but under demand reached 6*d*. in August, and as much as 10*d*. was paid September. The peeling season is from May to Aug. The tree grows in wet ground, is of rapid growth, but rar attains a size over 1 ft. in diameter. One was repor last year as 2 ft. 3 ins., but the sizes preferred for peel are from 4 ins. and upwards. In peeling, the tree is girdled about 5 ft. from the ground and the bark remo down to the base. It is then cut down, and the b removed from the rest of the trunk and larger branch The bark is then dried in the sun for four or five d chopped up, and packed in sacks for shipment. production last year was about 1,000 tons. From pre appearances there will be an over-production in 1904, not more than 2*d*. is offered for the dried bark.

"Oil of Lemon" Extraction in California.

Foreign Office Annual Series, No. 3185, *June* 1904.

California lemon growers are most anxious to obtai machine for extracting "oil of lemon," the present pro being unsatisfactory.

Acetin: U.S. Customs Decision.

June 17, 1904.

Merchandise invoiced as "Essigsäure," which on analysis as shown to contain 75 per cent. of mixed acetins, was eld to be dutiable at 25 per cent. *ad val.* as a "chemical ompound" under par. 3 of the tariff, and not as "acetic id" under par. 1.—R. W. M.

Amyl Acetate: U.S. Customs Decision.

June 16, 1904.

Chemically pure amyl acetate was decided to be dutiable 2 dols. per lb. as a "fruit ether" under par. 21 of the Tariff ct.—R. W. M.

Ichthyol: U.S. Customs Decision.

June 10, 1904.

Ichthyol ammonium sulphonate, generally known in armacy as ichthyol, was held by the Board to be free of ty as "ichthyol" provided for in par. 626. Duty had been sessed at 25 per cent. *ad val.*, under par. 3, as a "chemical mpound," or under par. 68 as a "medicinal preparation," the ground that the ichthyol provided for in par. 626, hich covers various oils, was the oil of ichthyol, and not e sulphonated ammonium salt (see J., 1903, 833). The ard held that the term "ichthyol," as used in the law, vers the sulphonated ammonium salt, and overruled the sessment of duty.—R. W. M.

Patent List.

.B.—In these lists, [A.] means "Application for Patent," and S.] "Complete Specification Accepted."

here a Complete Specification accompanies an Application, an erisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of plete Specifications Accepted, those of the Official Journals hich acceptances of the Complete Specifications are advertised. omplete Specifications thus advertised as accepted are open to pection at the Patent Office immediately, and to opposition hin two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

A.] 15,010. Reavell. Cooling towers for reducing temperature of condensing water and other liquids. July 5.

,, 15,129. Burdh. Cooling, heating, and similar apparatus. July 6.

,, 15,775. Martin. Filtering apparatus for the extraction of liquid from finely crushed minerals or the like. July 15.

,, 15,776. Ogle and the Cyanide Vacuum Filter Co. Apparatus for the separation of liquids from solids, particularly applicable to the extraction of metals from their ores. July 15.

,, 15,780. Withers (Bruyère). Distillation apparatus. July 15.

S.] 16,419 (1903). Junkers. Apparatus for heating liquids. July 20.

, 16,472 (1903). Leetham. Apparatus for treating finely divided materials, such as flour, with a gaseous agent. July 13.

, 22,094 (1903). Thompson (Blaisdell). Apparatus for discharging or filling vats and like receptacles. July 20.

[C.S.] 22,095 (1903). Thompson (Blaisdell). Distributing apparatus especially applicable for filling vats or the like. July 20.

,, 13,186 (1904). Neel. Desiccation of liquids. July 20.

II.—FUEL, GAS, AND LIGHT.

[A.] 14,947. Bayles. Fuel. [U.S. Appl., July 2, 1903.]* July 4.

,, 14,952. Baer and Co. Catalytic gas igniters. [Fr. Appl., July 18, 1903.]* July 4.

,, 14,971. Steins. Process and apparatus for the manufacture of generator gas.* July 4.

,, 15,088. Dixon. Gas washing, cooling, and heating towers. July 6.

,, 15,089. Dixon. Gas producers. July 6.

,, 15,269. Kermode. Burners for liquid fuel. July 8.

,, 15,270. Kermode. Apparatus for burning liquid fuel. July 8.

,, 15,271. Kermode. Apparatus for burning liquid fuel. July 8.

,, 15,800. Robins. *See under* XVIII. B.

,, 15,810. Robt. Dempster and Sons, and Radcliffe. Calciners and destructors. July 16.

,, 15,821. Mason. Apparatus for manufacturing producer- and water-gas. July 16.

,, 15,846. Spencer. Gas regenerative furnaces. July 16.

,, 15,862. Wilson. Furnaces for burning coal dust or like pulverulent fuel. July 16.

[C.S.] 23,659 (1903). Thompson (Best). Furnaces for burning liquid hydrocarbons. July 20.

,, 23,660 (1903). Thompson (Best). Apparatus for burning liquid hydrocarbons in furnaces and fire boxes. July 20.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[C.S.] 23,659 (1903). Thompson (Best). *See under* II.

,, 23,660 (1903). Thompson (Best). *See under* II.

,, 7481 (1904). Kuess. Process for solidifying petroleum and other mineral oils for their application as fuel and for lighting purposes. July 13. (Date applied for, Nov. 6, 1903.)

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 14,970. Imray (Meister, Lucius und Brüning). Manufacture of new dyestuffs of the anthracene series. July 4.

,, 14,972. Imray (Meister, Lucius und Brüning). Manufacture of yellow mordant dyestuffs. July 4.

,, 15,025. Shillito (J. R. Geigy). Manufacture or production of ortho-oxy-azo colouring matters. July 5.

,, 15,223. Imray (Basle Chem. Works). Manufacture of indoxyl, its homologues, and their derivatives. July 7.

,, 15,418. Shillito (J. R. Geigy). Manufacture of α-nitro-1-diazo-2-oxynaphthalene-sulphonic acid, or sulphonic acid of the nitro-naphthalene-1.2-diazoxide. July 11.

[A.] 15,624. Abel (Act.-Ges. f. Anilin-fabrikation). Manufacture of 1.8-arylnaphthylaminesulphonic acids. July 13.

[C.S.] 18,246 (1903). Newton (F. Bayer and Co.). Manufacture and production of pyrimidine derivatives. July 20.

„ 18,924 (1903). Read Holliday and Sons, Ltd., Turner, Dean, and Turner. Production or manufacture of colouring matters. July 13.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 15,080. Mather. Kiers for treating textile fabrics and the like. July 6.

„ 15,276. Sello. Method of producing dust-free consistent surgical dressing material.* July 8.

„ 15,297. Drewsen. Process of manufacturing products from cornstalks, sugar cane, and analogous pithy stalks.* July 8.

„ 15,331. Roberts and Crossley. Method and means employed for carbonising fibres. July 9.

„ 15,395. Venter. Process for bleaching textile fabrics.* July 9.

„ 15,615. Payne and Masterson. System of spirit dyeing. July 13.

„ 15,721. Ward and Kenworthy. Apparatus for dyeing, bleaching, and otherwise treating yarn, warp, and fibrous materials with liquid. July 15.

„ 15,729. Roberts and Crossley. Method of and means for removing vegetable impurities from woollen rags, wool, and other animal fibres. July 15.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

[A.] 15,424. Armitage, Jowett, and Sowry. Method of and apparatus for varnishing or otherwise coating paper or other materials. July 11.

[C.S.] 9487 (1904). Boult (Fabr. F. Schwartz and Co.). Wall paper. July 20.

„ 10,798 (1904). Tittel. Process and apparatus for the production of paper coated on one side with coloured material. July 20.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 14,966. Schilling and Kremer. *See under* XVIII. B.

„ 15,138. Gutensohn. *See under* X.

[C.S.] 15,212 (1903). Hiebling. Manufacture of soda and caustic potash, chlorine, and hydrochloric acid by electrolysis of aqueous solutions. July 20.

„ 19,267 (1903). Bergmann. Method of producing di-calcium phosphate. July 13.

„ 12,797 (1904). Leduc and Griffiths. *See under* X.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 15,662. Neuss. Method of producing different colours on pearl heads of solid glass-headed pins. July 14.

„ 15,866. Arbogast. Method of manufacturing glassware. [U.S. Appl., July 16, 1903.]* July 16.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 15,057. Muller. Manufacture of new pulverulen product for coating masonry or brickwork c furnaces, retorts, and the like. [Fr. Appl July 8, 1903.]* July 5.

„ 15,142. Muller. Process for the manufacture bricks and products with a facing of carborundu or other material. [Fr. Appl., July 13, 1903.] July 6.

„ 15,176. Steenbock. Manufacture of vitreo cement.* July 7.

„ 15,181. Steenbock. Manufacture of materi designed for the production of cement.* July

„ 15,549. Broadbent. Burning of pipes, chimn pots, and other like earthenware goods in kil or ovens. July 12.

„ 15,795. Rieter-Bodmer. Manufacture of artifici stone pipes, tiles, plates, vessels, and the lik and apparatus therefor. July 15.

[C.S.] 218 (1904). Forell. Process for manufacturi cement from slag. July 13.

„ 8859 (1904). Windholz. Process of making grinding, polishing, or smoothing substance, one refractory to heat. July 13.

„ 12,518 (1904). Watson Material or compositi to be used for damp courses, for covering roo surface of bridges, and the like, for insulatiou electrical conductors, and other purposes of a li kind. July 13.

X.—METALLURGY.

[A.] 14,980. Lébédeff. Process for smelting sulphurat copper ores and the simultaneous concentrati of the matte. July 4.

„ 14,985. Cie. du Réacteur Métallurgique. Manuf ture of steel, and treatment of copper, nick and like matts. [Fr. Appl., Aug. 6, 1903. July 4.

„ 15,138. Gutensohn. Recovering desired metal a oxides from acid solutions containing the sa July 6.

„ 15,141. Sir W. G. Armstrong, Whitworth, & Ltd., and Ferry. Manufacture of steel and ot forgings. July 6.

„ 15,220. Hadfield. Manufacture or treatment armour plates and other articles of steel. July

„ 15,347. Griesbach. Apparatus for utilising wa tin plate, scrap, and the like. July 9.

„ 15,577. Nicholas. Recovery of metals from o &c. July 13.

„ 15,592. Phillips and Pickering. Cyanide proc of gold extraction. July 13.

„ 15,727. Twynam. Recovery of zinc from z cuttings and galvanised waste. July 15.

„ 15,776. Ogle and the Cyanide Vacuum Filter *See under* I.

„ 15,792. Wrinkle and Wrinkle. Smelting furnac July 15.

[C.S.] 12,797 (1904). Leduc and Griffiths. Process the enriching of calcareous ores. July 13.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 15,294. Betts. Process of electro-depositing antimony. July 8.

„ 15,298. Betts. Process for treating metal mixtures produced as a by-product in electrolytic metal-refining operations. July 8.

„ 15,308. Betts. Process of making lead dithionate.* July 8.

C.S.] 15,212 (1903). Hiebling. *See under* VII.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

A.] 15,235. Wheelwright and Fiske. Process of cooking garbage and offal, and removing the oil or melted grease therefrom.* July 7.

.S.] 19,163 (1903). Defavrie. Composition for the manufacture of phonographic cylinders and for other purposes. July 13.

„ 2081 (1904). Töllner. Process for manufacture of substitute for cod-liver oil. July 13.

„ 10,536 (1904). Haase. Candles. July 13.

„ 13,171 (1904). Hunter. *See under* XX.

I.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

.] 15,725. Adam. Carbon recovery plant for the manufacture of lamp-black and such like. July 15.

„ 15,754. Dunnett. Preparation for preventing incrustation of and preserving the hulls of sea-going ships. July 15.

(*B.*)—Resins, Varnishes.

S.] 12,647 (1904). Krämer. *See under* XVII.

, 12,663 (1904). Melville, Rees, and Rees. Substitute for oilcloth or linoleum. July 20.

(*C.*)—India-Rubber.

.] 15,436. Kittel. Process for regenerating vulcanised rubber waste.* July 11.

IV.—TANNING, LEATHER, GLUE, SIZE, Etc.

.] 15,449. Bossuet. Substitute for whalebone. [Fr. Appl., Dec. 16, 1903.]* July 11.

15,629. Piesbergen. Artificial leather substitute and its method of manufacture.* July 13.

S.] 11,249 (1904). Amidon. Apparatus for treating hides, skins, and sides of leather. July 13.

XV.—MANURES, Etc.

] 15,709. Boutan. Manufacture of manures. [Fr. Appl., Aug. 13, 1903.] July 14.

XVII.—BREWING, WINES, SPIRITS, Etc.

] 15,370. Boult (Pabst Brewing Co.). Pasteurising apparatus.* July 9.

[A.] 15,615. Payne and Masterson. *See under* V.

„ 15,780. Withers (Bruyère). *See under* I.

[C.S.] 23,327 (1903). Blaxter, Blaxter, and Chaloner. Apparatus for the production of non-deposit beer and the like, and for clarifying liquids and carbonating the same. July 13.

„ 12,647 (1904). Krämer. Apparatus for varnishing, pitching, or similarly treating casks, vats, or the like. July 13

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—Foods.

[A.] 15,020. Eichmann. Processes of preserving milk and cream. July 5.

„ 15,135. Priest. Manufacture of custard powder. July 6.

„ 15,370. Boult (Pabst Brewing Co.). *See under* XVII.

„ 15,440. Imray (Maragliano). Manufacture of meat powder or meal, and process therefor. July 11.

„ 15,505. Petersson. Method of and apparatus for sterilising milk, cream, &c. July 12.

„ 15,605. Harris. Refrigerating and preserving meats, butter, milk, and other matter subject to decay. July 13.

[C.S.] 15,319 (1903). Sandison. Treatment of fish, fish refuse, and the like. July 20.

„ 16,472 (1903). Leetham. *See under* I.

„ 18,428 (1903). Boult (Rücker and Pickée). Preservatives and the method of applying them to foodstuffs and the like. July 13.

„ 19,760 (1903). Cleghorn. Process of preserving meat, fowl, fish, &c. July 20.

„ 10,758 (1904). Dunne. Means for preserving food, &c. July 20.

(*B.*)—Sanitation; Water Purification.

[A.] 14,929. Adams. Sewage filters. July 4.

„ 14,966. Schilling and Kremer. Process for extraction of ammonia from sewage waters and the like.* July 4.

„ 15,235. Wheelwright and Fiske. *See under* XII.

„ 15,276. Sello. *See under* V.

„ 15,800. Robins. Method and means for treating smoke, steam, sewer gas, impure air, and other fumes for the prevention or mitigation of a nuisance. July 15.

„ 15,829. Middleton. Filter and contact beds for the bacterial treatment of sewage. July 16.

[C.S.] 8865 (1904). Bamberger, Böck, and Wanz. Process of and apparatus for regenerating breathed-out air for respiration purposes. July 20.

„ 12,232 (1904). McLean and Patterson. Treatment of sewage. July 13.

(*C.*)—Disinfectants.

[C.S.] 8415 (1904). Lake (F. Stearns and Co.). Antiseptic compounds, and processes for manufacturing them. July 13.

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[A.] 15,435. Gardner (Weiler-ter-Meer). Process for producing substances resembling celluloid. July 11.

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[A.] 14,955. Gärtner. Polychlorals, and manufacture of same. July 4.

,, 15,784. Boult (F. Fritzsche and Co.). Manufacture of protocatechuic aldehyde.* July 15.

[C.S.] 13,171 (1904). Hunter. Machine for extracting oil from the rind of limes and other citrus fruits. July 20.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 15,053. Cocking and Kynoch, Ltd. Smokele powders and their manufacture. July 5.

[C.S.] 19,438 (1903). Lundholm. Explosives. July 20

,, 20,216 (1903). Bielefeldt. Explosives or blastin compositions. July 20.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[A.] 15 706. Thompson (Ver. Maschinenfabrik Augsbu und Maschinenbaugesellschaft Nürnberg A.-G Method for the continuous determination of t hydrogen contents of gaseous mixtures, a apparatus therefor.* July 14.

* * *

Printed and Published by Eyre and Spottiswoode, East Harding Street, London, E.C., for the Society of Chemical Industry.—P 2

JOURNAL OF THE
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Notices.

ANNUAL GENERAL MEETING, NEW YORK, 1904.

The Annual General Meeting will be held in New York City on Thursday, Sept. 8th, and following days. Members who propose to attend the meeting are requested to inform the General Secretary, as soon as possible, by what steamer they will travel. The principal boats will be met on arrival at New York by a representative of the Reception Committee, who will escort the guests to the Hotel Seville, Madison Avenue and 29th Street, which will be the Society's Headquarters in New York. A similar system will be observed at all the other cities visited by the special train. A revised programme appeared in the March 31st issue.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Mr. Wm. H. Nichols has been nominated to the office of President under Rule 8: Dr. Edw. Divers, Prof. W. R. Eaton Hodgkinson, Mr. Max Muspratt, and Mr. T. J. Parker have been nominated Vice-Presidents under Rule 8; and Sir Wm. Ramsay has been nominated a Vice-President under Rule 11.

Mr. Oscar Guttmann, Prof. W. R. Lang, Dr. Boverton Redwood, and Mr. Walter F. Reid, have been nominated under Rule 18 to fill four vacancies among the Ordinary Members of Council. No ballot will be required.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

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London Section.

Meeting held on June 6th, 1904.

ERRATA.

THE LOSS OF NITRE IN THE CHAMBER PROCESS.

BY J. K. H. INGLIS.

(This J., June 30th, 1904, 643—645.)

Discussion.

On p. 645, col. 1, for author's reply, read as follows:

Mr. Inglis, in reply, said that the amount of nitrous g found in the bulbs corresponded to 50 per cent. of the loss of nitre. But if pure nitric oxide were condensed bulb at the temperature of liquid air, and the bulb evacuated by means of a mercury pump, it was found the nitric oxide had an appreciable vapour pressure at temperature, therefore the whole of the nitric oxide in flue gases could not be condensed, and some of it woul lost. Hence the total amount accounted for was at greater than 50 per cent. of the whole loss. It was possible to state whether the main loss was as nitric or nitrogen peroxide, for the latter seemed to interact sulphur dioxide in the bulb, and nitric oxide would be product of this reaction.

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—PLANT, APPARATUS, AND MACHINERY.

English Patents.

sks, Boxes, and other Receptacles; Impermeable Coatings or Linings for ——. J. Wetter, London. From the firm of Hugo Blank, Berlin Eng. Pat. 16,490, July 27, 1903.

E cask, &c. is coated with a solution of casein, albuse, or glue or gelatin products in water, ammonia, or er suitable solvent, and the layer, after drying, treated h formaldehyde. Or, formaldehyde may be mixed with coating solution before use.—C. A. M.

istillation Apparatus. A. Gerhardt, Kassel, Germany. Eng. Pat. 18,869, Sept. 1, 1903.

Fr. Pat. 335,034 of 1903; this J., 1904, 111.—T. F. B.

United States Patents.

Drying Materials; Method of ——. L. Gathmann, Washington. U.S. Pat. 763,387, June 28, 1904.

t is caused to pass downwards through the chamber taining the material to be dried, and is there heated so o cause it to take up the vapour to be expelled. The urated air is then passed to a lower level, where it is 'ed, and the vapour condensed. The same air is then o passed through the drying space, being used conously.—W. H. C.

rying Substances; Method of ——. L. Gathmann, Washington. U.S. Pat. 763,388, June 28, 1904.

process is similar to that of the foregoing U.S. Pat. 387, with the exception that the condensation takes e in a separate vessel, connected by pipes to the ng chamber.—W. H. C.

ing Kiln. J. F. Haurahan, Ottawa. U.S. Pat. 764,583, July 12, 1904.

Eng. Pat. 4602 of 1904; this J., 1904, 537.—T. F. B.

porating Apparatus; Piled Vacuum ——. T. Suzuki, Sunamura, Japan. U.S. Pat. 764,393, July 5, 1904.

Eng. Pat. 3165 of 1904; this J., 1904, 483.—T. F. B.

Aerating Liquids; Apparatus for ——. F. G. Hampson, London. U.S. Pat. 764,461, July 5, 1904.

See Eng. Pats. 11,612 and 16,353 of 1901; this J., 1902, 984 and 1191.—T. F. B.

French Patents.

Filtering Liquids; Process for ——. G. Stade, Germany. Fr. Pat. 340,322, Feb. 10, 1904.

The flow of the liquid on to the filtering medium (which is preferably sand) is so arranged that the stream of liquid is broken up, and does not disturb the surface of the sand. —W. H. C.

Vacuum; Apparatus for Supplying a —— *by the Circulation of a Liquid.* C. W. Stanton. Fr. Pat. 310,885, March 2, 1904. Under Internat. Conv., Dec. 17, 1903.

See Eng. Pat. 5791 of 1904; this J., 1904, 538.—T F. B.

II.—FUEL, GAS, AND LIGHT.

Coal Analysis; A Frequent Cause of Error in ——. J. Alix and Bay. XXIII., page 800.

Spirit; Production of Cheap —— *for Technical Purposes.* Delbrück. XVII., page 796.

English Patents.

Tar [*for Briquettes, &c.*]; *Method of Solidifying* ——. S. G. Coulson. Eng. Pat. 2102, Jan. 28, 1904. III., page 780.

Gas Producers; Regulation of [*Suction*] ——. W. J. Crossley and T. Rigby, Manchester. Eng. Pat. 13,763, June 20, 1903.

The patentees state that the difficulty experienced in making good gas, in a suction producer which is subject to a varying demand for gas, may be largely overcome if the proportion of steam to air is reduced while the demand is low, and raised to the maximum at full load. The cooling of the fire by an excess of steam is thus avoided. To effect the required automatic regulation of the proportions, one part of the air supply to the producer (the primary supply) is led directly to the fire-grate through an inlet of such an area as to be always working practically at its fullest, even at low loads. The secondary air supply is passed through a chamber in which it mixes with steam, and thence to the fire-grate, where it mixes with the primary air supply. Any variations in the suction applied to the producer affect mainly the secondary supply, as the primary is almost constant, and hence an increase in the rate of suction causes a corresponding increase in the ratio of steam to air (see following abstract).—H. B.

Gas Producers [Suction]. W. J. Crossley and T. Rigby, Manchester. Eng. Pat. 13,764, June 20, 1903.

To prevent the adhesion of clinker to the refractory lining of the producer (which is of the up-draught type), the fire-grate is fixed in the centre of an air-tight bottom plate, a few inches below the foot of the refractory lining. Annular box-castings are arranged concentrically in the space between the foot of the lining and the bottom plate, and act as superheaters for the air and steam passing through on their way to the under side of the fire-grate. A steam-generating device is provided on the top of the producer, surrounding the fuel hopper and depending into the combustion chamber. The secondary air supply is drawn through this chamber, and passes, mixed with steam, down to the superheaters mentioned above. The primary air supply enters directly below the fire-grate. The action of the primary and secondary air supplies is that described in the preceding abstract.—H. B.

Gas Producers [for Bituminous Fuel]. J. Fielding, Gloucester. Eng. Pat. 15,966, July 26, 1903.

The producer, which carries a feed hopper above and rests upon a water-sealed foundation as usual, is provided a little above its middle height with an annular conical grate, through which the air (or air and steam) supply enters in a substantially horizontal direction, suitable ducts being arranged near the base of the producer for leading off the gas generated. By this arrangement the air, or air and steam, is brought into the combustion chamber below the level of the raw fuel, directly into the incandescent zone, and is then deflected downwards so as to pass through the whole body of incandescent fuel.—H. B.

Gas; Method of and Apparatus for the Manufacture of ——. G. Westinghouse, London. From A. M. Gow, Edgewood Park, Pa., U.S.A. Eng. Pat. 17,215, Aug. 7, 1903.

See U.S. Pats. 742,411 and 742,412 of 1903; this J., 1903, 1287.—T. F. B.

Water-Gas, Producer-Gas, and the like; Process and Apparatus for the Production of ——. P. Schmidt, Hanover. Eng. Pat. 24,935, Nov. 16, 1903.

See Fr. Pat. 338,626 of 1903; this J., 1904, 653.—T. F. B.

Alkaline Prussiates; Manufacture of ——. G. E. Davis. Eng. Pat. 20,069, Sept. 17, 1903. VII., page 787.

United States Patents.

Gas-Producer. P. J. Buckley, Waukesha. U.S. Pat. 763,460, June 28, 1904.

Air circulates through chambers in the walls of the producer and is then led through a closed feeding-hopper, containing the raw fuel, after which it is passed into the combustion chamber of the producer. The discharge valve of the hopper is carried by the air-inlet pipe, which extends vertically down the centre of the hopper and is connected at its upper end to branch pipes entering telescopically the pipes which lead the hot air from the chambers in the walls of the producer.—H. B.

Gas; Process of Making ——. D. Turk, Riesa, Germany, Assignor to F. J. Maly, Aussig, Austria-Hungary. U.S. Pat. 764,320, July 5, 1904.

See Eng. Pat. 23,662 of 1900; this J., 1901, 1197.—T. F. B.

Carbon [Graphite]; Separating —— from Pulveris Carbonaceous Materials. J. D. Darling, Philadelphi U.S. Pat. 763,859, June 28, 1904.

Powdered carbonaceous material, such as graphitic or mixed with oil, is mechanically agitated under a body water divided horizontally by an obstruction (on which th mixture rests) impervious to the commingled oil an carbon, but pervious to the water and gangue. A flow water enters above the obstruction, below which it has i outflow, thus maintaining a downward current of wat through the "foraminate partition."—E. S.

French Patents.

Fuel; Artificial or Compound ——. International Fuel Co. Fr. Pat. 340,779, Feb. 19, 1904.

See Eng. Pat. 3781 of 1904; this J., 1904, 601.—T. F. B.

Furnace for Burning Tan and similar Fuel. D. M. Myer Fr. Pat. 340,849, March 1, 1904. Under Internat Conv., March 2, 1903.

See Eng. Pat. 5015 of 1904; this J., 1904, 653.—T. F. B.

Coke; Apparatus for Electrically Separating —— fro Cinders, &c. H. Lelarge. Fr. Pat. 340,898, March 1904.

See Eng. Pat. 5799 of 1904; this J., 1904, 653.—T. F. B

[Acetylene] Gas Generator with Warm Chamber. F. Fescourt and C. Maurin. Fr. Pat. 340,227, Feb. 6, 190

The generator, in which gas is produced by the action water on carbide of calcium or the like, is characterised the arrangement, above the bell in which the gas liberated, of a "warm chamber" through which the gas led before leaving the apparatus, "in order to be dried the heat developed by the decomposition of the substanc producing the gas."—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM AND MINERAL WAXES.

English Patents.

Distillation of Organic Substances; Dry ——. H. Aminoff, Domnarfvet, Sweden. Eng. Pat. 17,9 Aug. 19, 1903.

See U.S. Pat. 748,457 of 1903; this J., 1904, 113.—T. F.

Tar [for Briquettes, &c.]: Method of Solidifying — S. G. Coulson, Sheffield. Eng. Pat. 2102, Jan. 28, 1904

Tar is mixed, at 140° to 150° F., with one-tenth to or eighth of its weight of concentrated sulphuric acid, t addition of acid being performed so that the temperatu does not rise above 250° F. The mixture is then allow to cool in suitable moulds, when it is intended for use a binding material for fuel, road-making materials, &c. —T. F. B.

United States Patent.

Wood; Process of Destructive Distillation of ——. G Gilmer, New Orleans, Assignor to Illinois Investme Co., West Virginia. U.S. Pat. 762,303, June 14, 190

Wood is distilled in a retort slightly inclined to the ho zontal, by applying heat to the upper portion only of the bo of wood, the application of heat being so controlled a cause the heated zone to pass gradually downwards throu the wood. The vapours evolved are drawn off from t bottom of the lower end of the retort in several fraction —T. F. B

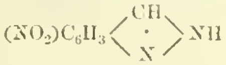
IV.—COLOURING MATTERS AND DYESTUFFS.

Trialkylated Amidines ; Preparation of ——. J. v. Braun. Ber., 1904, **37**, 2678—2685.

THE author has investigated the action of phosphorus pentachloride on dialkylated acid amides of the benzene and naphthalene series, and finds that in a suitable organic olvent, such as chloroform, these substances react smoothly nd readily to form aminochlorides, according to the equa- ion $R_1.CO.NR_2 + PCl_5 = R_1.CCl_2.NR_2 + POCl_3$. The roducts are extremely stable in absence of air. With water hey re-form the original acid amides with violent evolution f hydrochloric acid. By precipitating the aminochlorides rom chloroform solution with light petroleum spirit, ashing out the phosphorus oxychloride with more petro- eum spirit, and then acting on them with primary amines n chloroform solution, amidines are readily and rapidly ormed. In this way it is possible to form amidines ontaining groups which could not hitherto be introduced nto the molecule.—E. F.

ndazoles from Nitrated Orthomethylated Amines ; Forma- tion of ——. E. Noelting. Ber., 1904, **37**, 2556—2597.

HEN a diazotised nitro-derivative of *o*-toluidine is decom- osed by boiling its solutions or by letting its neutral aqueous olution or solution in acetic acid stand, the two main roducts of the reaction are the corresponding phenol and dazole. Thus the diazo compound from *o*-nitro-*o*-toluidine, $_5H_3(CH_3)(NH_2)(NO_2)$[1.2.3], yields *o*-nitro-*o*-cresol, and nitro-indazole—



$$(NO_2)C_6H_3\left\langle\begin{matrix}CH\\ \cdot\\ N\end{matrix}\right\rangle NH$$

he proportions of these two substances which are formed ry greatly, both with the constitution of the original azo compound and with the conditions under which the action takes place, it being often possible to obtain the e or the other product quantitatively. The author has stematically investigated the proportions of cresol and dazole formed from the diazo compounds of 22 mono- d dinitrated *o*-toluidines and homologues on boiling th mineral acids, with dilute acetic acid, and in neutral ueous solution, and also on standing in glacial acetic d solution at the ordinary temperature, and has tabulated e results. The following general conclusions were rived at :—

(a) *o-Nitramines.* — On boiling with mineral acids, 80— 0 per cent. of indazole is formed. An additional methyl oup in *o*-position to the methyl group which takes part the ring-formation exerts a favourable, a methyl group *p*-position to the amino group an unfavourable effect. heating with dilute acetic acid, or letting stand with cial acetic acid, the yields of indazole are, in general, aller.

(b) *m-Nitramines.* — On warming the diazo solutions th dilute mineral acids, cresols are mainly formed, ethylated derivatives yielding cresols only. Theoretical lds of cresol are formed in all cases by dropping the zo liquid into boiling dilute mineral acid. On boiling th glacial acetic acid, about 80 per cent. of indazole is med. Even *p*-methylated derivatives give similar yields indazole on adding the cold solution of the diazo com- und in glacial acetic acid to boiling glacial acetic acid. acial acetic acid solutions of the diazo compounds give nost quantitative yields of indazole on standing. Methylated derivatives yield large amounts of by-products en treated in this way.

(c) *p-Nitramines.*—These yield phenols quantitatively boiling the diazo solutions with mineral acid. Indazoles obtained in yields of 80 per cent. on letting the glacial tic acid solutions stand in the cold.

(d) *Dinitramines.*—Satisfactory yields of indazole are tained on boiling mineral acid solutions of the diazo npounds, 80 per cent. yields on dropping them into dilute boiling sulphuric acid. *p*-Methyl groups exert a very unfavourable effect on the indazole formation. The diazo solutions are very unstable even in the cold, forming reddish-brown by-products.

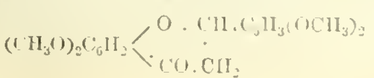
In general, by-products are formed in this reaction, especially in the case of the *p*-methylated compounds and on boiling in acetic acid solution. These consist of nitro derivatives of toluene-azo-indazoles and of oxyazo compounds, together with nitrogenous substances of unknown constitution which are very insoluble. Nitro-indazoles are white to yellow substances which can be sublimed, and are either non-volatile or scarcely volatile in a current of steam. They are usually easily soluble in alcohol, in glacial acetic acid, and in acetone. They have weakly basic and rather more strongly marked acid properties. The imino hydrogen can be replaced by alkyl and by acidyl groups. Nitro-indazoles do not react with diazo compounds. They can be readily reduced in acid solution to amino-indazoles which are strong bases, which condense with dimethyl-*p*-aminobenzaldehyde to form strong yellow dyestuffs and can be readily diazotised in acid solution. The diazo compounds react with amines and phenols to form dyestuffs which have a weak affinity for unmordanted cotton. Amino-indazoles also react with diazo compounds to form dyestuffs which show a weak affinity for unmordanted cotton.—E. F.

Diphenyl- and Triphenylmethane Dyestuffs ; Basic ——*II.* J. v. Braun. *p-Diaminodiphenylmethane ; Derivatives of* ——. J. v. Braun and E. Kayser. Ber., 1904, **37**, 2670—2678. (See also this J., 1904, 318.)

NEITHER auramine base nor Michler's ketone could be smoothly converted into the corresponding cyanomethylated compounds by means of cyanogen bromide. On the other hand, the authors were able to obtain *p*-dicyanodimethyldiaminodiphenylmethane, $[(CH_3)(CN).N.C_6H_4]_2:CH_2$, in good yields by the action of cyanogen bromide on *p*-tetramethyldiaminodiphenylmethane. The product, a white crystalline substance, can be easily oxidised to the corresponding ketone, $[(CH_3)(CN).N.C_6H_4]_2:CO$, but the preparation of the corresponding auramine, $[CH_3(CN).N.C_6H_4]_2:NH$, in a pure state, which was the ultimate object of the authors, was found to be extremely difficult. *s*-Dimethyldicyanodiaminobenzophenone reacts readily with hydroxylamine to form the corresponding oxime, but does not react with tertiary aromatic bases in presence of phosphorus oxychloride, nor was it found possible to form dimethyldicyanodiaminotriphenyl carbinol from it by Grignard's reaction with magnesium bromobenzene. By the action of mineral acids dicyanodimethyldiaminodiphenylmethane is converted into *s*-dimethyldiaminodiphenylmethane, $[CH_3.NH.C_6H_4]_2:CH_2$, a substance already described in Ger. Pat. 68,011, according to which it is formed by the action of formaldehyde on methylaniline. With benzylbromide it forms *s*-dimethyldibenzyldiaminodiphenylmethane, the solutions of which in organic solvents and in aqueous acids are pale blue in colour. This latter is a well-defined crystalline substance, very different in properties to the product described under the same name in Ger. Pat. 68,665. On treatment with mineral acids *s*-dimethyldicyanodiaminobenzophenone can be converted into *s*-dimethyldiaminobenzophenone, $[CH_3.NH.C_6H_4]_2CO$. The solutions of this substance in organic solvents and in aqueous acids have an intense yellow colour. With cyanogen bromide the original dicyano compound is re-formed. The substance also forms a pale yellow nitroso compound, $[(CH_3)(NO)N.C_6H_4]_2:CO$ and a colourless, crystalline dibenzoyl compound $[(C_6H_5CO)(CH_3)N.C_6H_4]_2:CO$ which does not agree in properties with the product obtained by Nathanson and Müller by the action of benzoyl chloride on Michler's ketone (this J., 1889, 978).—E. F.

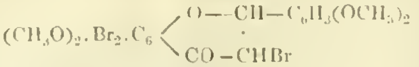
Luteolin ; A Second Synthesis of ——. S. Fainberg and St. v. Kostanecki. Ber., 1904, **37**, 2625—2627.

1.3.3′.4′-TETRAMETHOXYFLAVANONE—



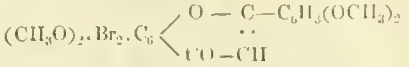
$$(CH_3O)_2C_6H_2\left\langle\begin{matrix}O\ .\ CH.C_6H_3(OCH_3)_2\\ \cdot\\ CO.CH_2\end{matrix}\right.$$

is converted by the action of bromine into 2.4.α-tribromotetramethoxyflavanone—



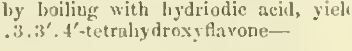
$$(CH_3O)_2.Br_2.C_6\left\langle\begin{matrix} O-CH-C_6H_3(OCH_3)_2 \\ \cdot \\ CO-CHBr \end{matrix}\right.$$

On treatment with alcoholic potassium hydroxide this forms 2.4-dibromo-1.3.3′.4′-tetramethoxyflavone—



$$(CH_3O)_2.Br_2.C_6\left\langle\begin{matrix} O-C-C_6H_3(OCH_3)_2 \\ \cdot\cdot \\ CO-CH \end{matrix}\right.$$

which on saponification and simultaneous elimination of bromine, by boiling with hydriodic acid, yields luteolin, which is 1.3.3′.4′-tetrahydroxyflavone—



$$C_6H_2(OH)_2\left\langle\begin{matrix} O-C-C_6H_3(OH)_2 \\ \cdot\cdot \\ CO-CH \end{matrix}\right.$$

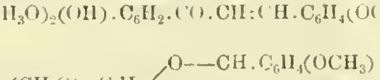
—E. F.

3.4.2′-*Trihydroxyflavonol.* S. S. Cohen and St. v. Kostanecki. Ber., 1904, 37, 2627—2631.

By the action of gallacetophenonedimethyl ether on salicylaldehydemethyl ether, 2′-hydroxy-3′.4′.2-trimethoxychalkone is formed, either alone or mixed with 3.4.2′-trimethoxyflavanone, according to the equations—

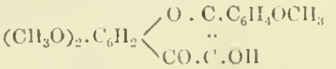
$$C_6H_2(OCH_3)_2(OH)(COCH_3)[1.2.3.4] + C_6H_4(OCH_3)(CHO) = (CH_3O)_2(OH).C_6H_2.CO.CH:CH.C_6H_4(OCH_3) + H_2O$$

or—



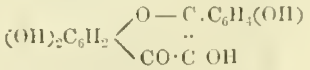
$$(CH_3O)_2.C_6H_2\left\langle\begin{matrix} O-CH.C_6H_4(OCH_3) \\ \cdot \\ CO.CH_2 \end{matrix}\right. + H_2O$$

The first of these products, the chalkone, is converted into the second by boiling with dilute mineral acids. 3.4.2′-Trimethoxyflavanone is converted by amyl nitrite and hydrochloric acid into the isonitroso compound, which on boiling with a mixture of acetic and dilute sulphuric acids, is converted into 3.4.2′-trimethoxyflavonol—



$$(CH_3O)_2.C_6H_2\left\langle\begin{matrix} O.C.C_6H_4OCH_3 \\ \cdot\cdot \\ CO.C.OH \end{matrix}\right.$$

The latter is demethylated by boiling with hydriodic acid, forming 3.4.2′-trihydroxyflavonol—



$$(OH)_2C_6H_2\left\langle\begin{matrix} O-C.C_6H_4(OH) \\ \cdot\cdot \\ CO\cdot C\ OH \end{matrix}\right.$$

This compound dyes in intense orange-yellow shades on alumina, and brown to black on iron mordant. Almost exactly the same dyeings are obtained with 3.4.3′-trihydroxyflavonol, described in the next abstract.—E. F.

3.4.3′-*Trihydroxyflavonol.* St. v. Kostanecki and O. Schleifenbaum. Ber., 1904, 37, 2631—2633.

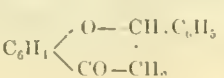
2′-Hydroxy-3′.4′.3-trimethoxychalkone—

$$(CH_3O)_2(OH).C_6H_2.CO.CH:CH.C_6H_4(OCH_3)$$

was obtained by the action of gallacetophenonedimethyl ether on *m*-methoxybenzaldehyde. This was converted, by the methods described in the last abstract, successively into the corresponding flavanone, an isonitroso derivative of the same, 3.4.3′-trimethoxyflavonol, and finally into 3.4.3′-trihydroxyflavanol, which closely resembles the corresponding 3.4.2′ compound in properties.—E. F.

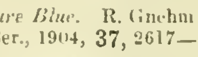
Flavanone and Flavone: Synthesis of ——. St. v. Kostanecki and W. Szabrański. Ber., 1904, 37, 2634—2635.

o-Methoxyacetophenone was demethylated by heating with hydrochloric acid, forming *o*-hydroxyacetophenone. This yields 2′-hydroxychalkone with benzaldehyde according to the equation $C_6H_4(OH)(COCH_3) + C_6H_5.CHO = C_6H_4(OH).CO.CH:CH.C_6H_5 + H_2O$. On boiling with dilute hydrochloric acid in alcoholic solution this forms flavanone—



$$C_6H_4\left\langle\begin{matrix} O-CH.C_6H_5 \\ \cdot \\ CO-CH_2 \end{matrix}\right.$$

a substance of pleasant, faintly aromatic odour, crystalli ing in colourless needles, and soluble in concentrat sulphuric acid to a pale yellow, and in alcoholic sodiu hydroxide to an orange-yellow solution With bromine yields α-bromoflavanone, which is converted by alcohol potassium hydroxide solution into pure flavone—

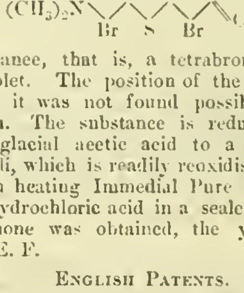


$$C_6H_4\left\langle\begin{matrix} O.C.C_6H_5 \\ \cdot\cdot \\ CO.CH \end{matrix}\right.$$

—E. F.

Immedial Pure Blue. R. Gnehm and F. Kaufler. Ber., 1904, 37, 2617—2623.

Immedial Pure Blue, obtained by melting *p*-dimethylamin *p*-hydroxydiphenylamine with sulphur and sodium sulphi according to Ger. Pat. 134,947, was purified by means the hydrochloride of the leuco compound, which w isolated, oxidised in alkaline aqueous suspension in current of air, and finally freed from unchanged dipheny amine derivative and from Methylene Violet by washi with dilute acid. The purified dyestuff was heated wi potassium bromate and aqueous hydrobromic acid in sealed glass tube to 115°—125° C. From the products this reaction, nitrobenzene extracts 30—50 per cent. of finely crystalline reddish-violet product, which is ve insoluble in most other ordinary solvents. The analys and molecular weight determination agree with the empiric formula $C_{14}H_8ON_2SBr_4$. A determination of the meth groups attached to nitrogen agreed with the presence of dimethylamino group. The substance does not chan colour on boiling with acetic anhydride, and is insolul in alkali, and therefore does not appear to contain fr amino- or hydroxy groups, and one must assume that t sulphur takes part in the ring-formation. These co siderations lead the author to the formula—



for this substance, that is, a tetrabromo derivative Methylene Violet. The position of the bromine atoms uncertain, and it was not found possible to complet eliminate them. The substance is reduced by stann chloride and glacial acetic acid to a leuco compou soluble in alkali, which is readily reoxidised to the origi substance. On heating Immedial Pure Blue with sodi chlorate and hydrochloric acid in a sealed tube to 130° tetrachloroquinone was obtained, the yield being ab 20 per cent.—E. F.

English Patents.

Azo Dyestuffs; Manufacture of [Black] ——. G. Ellis, London. From Chem. Fab. vorm. Sandoz, Ba Eng. Pat. 14,768, July 2, 1903.

Black azo dyestuffs, suitable for use in wool dyeing, obtained by combining in alkaline solution diazotised am and aminoazo compounds of the benzene and naphthal series and their sulphonic acids with 1.8-aminonaphth 3.6-disulphonic acid, diazotising the resulting compou and combining with amino and hydroxy derivatives naphthalene and their sulphonic acids. For examp 2.6.8-naphthylaminedisulphonic acid is diazotised coupled with α-naphthylamine, the product is diazoti and combined with 1.8-aminonaphthol-3.6-disulpho acid, and the compound thus formed is in turn diazoti and combined with α-naphthylamine. The dyestuff fir obtained dyes wool in blue-black shades, which are tur to deep black by subsequent treatment with potassi bichromate.—E. B.

Acetdiamidophenolsulpho Acid [Azo Dyestuffs]; N ——, and Colouring Matters therefrom. R. B. Ransfo Upper Norwood. From L. Cassella and Co., Frankf on-Maine. Eng. Pat. 17,792, Aug. 17, 1903.

Nitroaminophenolsulphonic acid (OH : NO_2 : NH_2 : S 1:2:6:4) is acetylated and reduced. The ace diaminophenolsulphonic acid thus obtained gives, w diazotised and combined with phenols and amines, yestuffs of great technical value. Those produced from a umber of naphthol- and aminonaphtholsulphonic acids, pplied in an acid bath and after-treated on the fibre with otassium bichromate, dye wool in shades ranging from iolet to black; thus, for example, the dyestuff prepared om 1.8.4-aminonaphtholsulphonic acid dyes wool a violet, hich changes to a blue-black colour on chroming, the yeing produced being, it is stated, exceedingly level and ist to washing, milling, and light. (Compare this J., 1904, .)—E. B.

United States Patent.

itramines [Nitro Compound]; Process of Reacting on —— with Formaldehyde and a Product thereof. B. Homolka and J. Erber. Assignors to Farbwerke vorm. Meister, Lucius und Brüning, Höchst a/M. U.S. Pat. 763,756, June 28, 1904.

ALTS of primary aromatic nitramines are acted upon in queous solution by formaldehyde. The compound thus oduced from *p*-nitro-*o*-toluidine ($CH_3:NH_2:NO_2=1:2:4$), m. pt. 107° C., is a yellow crystalline substance, melting 230° C., insoluble in water, almost insoluble in most the usual organic solvents, but soluble in hot, glacial etic acid.—E. B.

French Patents.

Anthracene Dyestuffs. Cie. Paris. Coul. d'Aniline. Fr. Pat. 338,756, April 16, 1903.

IE halogen derivatives of 1.5- and 1.8-aminoanthra-inonesulphonic acids (see Fr. Pat. 334,576; this J., 04, 57) are condensed with primary aromatic amines, e resulting products being sulphonated. A dyestuff which es unmordanted wool in pure blue shades is thus obtained brominating the 1.8-isomeride, condensing with *p*-luidine, and sulphonating. (See U.S. Pats. 748, 375, 4, and 768; this J., 1904, 113 and 368.)—E. B.

lphide Dyestuffs derived from the Indophenol, $HO.C_6H_4.N:C_6H_4:O$, and its Homologues; Blue ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 338,761, April 18, 1903.

Fr. Pat. 303,524, reference is made to a dyestuff which formed by the action of sodium sulphide (4 parts) and phur (1 part) upon the "simplest" indophenol, of formula $HO.C_6H_4.N:C_6H_4:O$, and which is therein cribed as being of no value. Later (Fr. Pat. 315,669; s J., 1902, 543), it was discovered that, in the case the sulphide dyestuffs derived from the indophenols erally, better yields are obtained when the proportion sulphur employed in the reaction (in aqueous solution 100° C.) is increased so as to be sufficient for the possible mation with the sodium sulphide of sodium pentasulphide. s now found that not the yield only, but the nature of product also is influenced by such increase, which is ecially noticeable with the indophenol of the formula en above and its homologues. A valuable dyestuff is, example, produced by heating together in aqueous tion at 110°—115° C. for 24 hours a mixture of the ium compound of the "simplest" indophenol (30 kilos.) n sulphur (80 kilos.) and crystallised sodium sulphide 0 kilos.). The product dyes from a sodium sulphide h unmordanted cotton in deep greenish-blue shades, ch are converted by oxidising agents into indigo-blue des of great fastness.—E. B.

sazo Dyestuffs [Azo Dyestuffs]. Badische Anilin und Soda Fabrik. Fr. Pat. 338,782, May 4, 1903.

-DIHYDROXYNAPHTHALENE is coupled with two molecular portions of the same diazo-salt or of dissimilar diazo s The products dye wool in shades ranging from red lue. The dyestuff prepared from two molecular propor- s of *o*-diazophenolsulphonic acid dyes a violet shade, h becomes black on chroming.—E. B.

nothioalphyl Derivatives and Azo Sulphide Dyestuffs rived therefrom; Production of New ——. [Azo Dyestuffs.] Soc. pour l'Ind. Chim. à Bâle. First Addition, ated Jan. 19, 1904, to Fr. Pat. 337,329, Nov. 5, 1903.

EN the dinitrothioalphyl compounds mentioned in the cipal patent (this J., 1904, 486) are completely reduced, diamino compounds are produced, which, on being diazotised and combined with amines or phenols, &c., or coupled with diazo compounds, give rise to new dyestuffs which possess the property of dyeing unmordanted cotton. A series of mononitrothioalphyl compounds has also been prepared by substituting the corresponding mononitro compounds for the dinitro intermediate compounds previously named (*loc. cit.*). New dyestuffs result when the mono-amino compounds derived from these are diazotised and coupled with amines and phenols, &c., or are themselves coupled with diazo compounds. In place of the aminothio-alphyl compounds, amino-alphyldisulphides and the corresponding xanthates can also be employed.—E. B.

Azo Dyestuffs; Electrolytic Method for Preparing ——. C. F. Boehringer und Soehne. Fr. Pat. 340,447, Feb. 15, 1904.

SEE U.S. Pat. 761,310 of 1904: this J., 1904, 712.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Natural and Artificial Silks; Differentiation of ——. A. Herzog. Z. Farben- u. Textil-Chem., 1904, **3**, 259—260.

IF an artificial silk fibre be dyed, and then, after suitable mounting, be examined under a microscope fitted with a Nicol's prism, it shows dichroïc effects when moved into different positions with regard to the plane of vibration of the light passing through the Nicol. In the case of natural silks there is either no dichroïc effect or else it is quite inappreciable. It is of interest to note that these optical effects persist through all the changes from cellulose to artificial silk.—A. B. S.

Weighted Silk; Action of Hydrofluosilicic Acid on ——. R. Gnehm. Z. Farben- u. Textil-Chem., 1904, **3**, 258—259.

THE extraction of a sample of black weighted silk with hydrofluosilicic acid gave results which varied enormously according to the conditions of treatment. Such small changes as, *e.g.*, drying the silk between two acid treatments, had quite an important influence on the results. The usual weighting material (tin-phosphate-silicate) appears to be acted on quite differently from one containing alum. The amount of the weighting material extracted by the acid varied, in the different experiments, from 20 to 65 per cent. (see also this J., 1903, 969).—A. B. S.

Cotton from North-Eastern Rhodesia and British Central Africa. Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, **2**, 90 and 87).

FOUR samples of cotton grown near Mirongo Station, in the Senga country, have been examined. (1) *Mironjo-Senga:* A cotton of creamy colour, with a faint reddish tinge, having a soft, silky staple, 1·2—1·4 ins. long. Value, 7⅝*d.*—8*d.* per lb. (2) *Katumbi-Senga:* Cotton of good creamy colour, with weak and irregular staple, 1·3—1·5 ins. long. Value, 7⅜*d.*—7½*d.* per lb. (3) *Mironjo-Egyptian:* Soft, silky cotton of pale reddish-brown colour, with a rather irregular staple, 1·3—1·5 ins. long. Value, 8½*d.* per lb. (4) *Katumbi-Egyptian:* Cotton similar to (3), but rather paler in colour. The staple was "neppy," less silky than that of (3), and had a length of 1·3—1·5 ins. Value, 8¼*d.* per lb.

Two samples from British Central Africa were also examined, one from Zomba and the other from North-Eastern Rhodesia. The Zomba specimen was somewhat harsh and of a yellowish colour, with occasional buff-coloured stains where the cotton was "perished"; it contained fragments of broken seeds together with a few whole seeds, and had a staple 24—32 mm. in length. The cotton, free from seeds, and properly cleaned, would be worth about 5*d.* per lb. on the spot. The Rhodesian specimen consisted of wild cotton, which had not been ginned; it was fairly silky, of white to yellowish colour, with occasional buff-coloured stains, and had a staple of 23—33 mm. If properly prepared, it would be worth 4½*d.* per lb. on the spot. The seed freed from cotton would be worth about 4*l.* 5*s.* per ton.—A. S.

Cotton (Gossypium Barbadense) from South Australia. Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, 2, 89.

The sample, which had been gathered from plants several years old, the cultivation of which had been neglected, had a length of staple of 1·2—1·5 ins. The cotton was silky, but irregular, and inferior to American "Sea Island" cotton. It is estimated as worth about 7½*d.* per lb.—A. S.

Hemp, Sisal (Agave Rigida, var. Sisalana), from South Australia. Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, 2, 88.

The specimen examined consisted of white, fairly strong fibre, with a staple of average length, 40 ins. It is valued at 35*l.*—38*l.* per ton on the London market. The results of the chemical examination of the sample, together with those obtained with specimens of Sisal hemp from other British Colonies, are given in the following table :—

Source of Fibre.	Moisture.	Ash.	Cellulose.
	Per Cent.	Per Cent.	Per Cent.
South Australia............	8·8	0·7	79·1
Bahamas	12·8	4·4	75·9
Trinidad....................	11·6	1·0	77·2
New South Wales	9·8	1·6	77·7
India (Saharanpur).........	9·1	0·8	82·4

—A. S.

Fibre of Furcræa Gigantea from British Central Africa. Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, 2, 84.

Furcræa gigantea, the plant from which Mauritius hemp is derived, has been found to grow well in British Central Africa. The specimen of the fibre examined was fairly white in colour, and had a staple about 40 ins. in length. In the following table the results of the chemical examination of the fibre are given, together with those obtained with specimens of the same fibre from S. India, Grenada, and Victoria :—

——	B.C.A. Specimen.	S. Indian Specimen.	Grenada Specimen.	Victoria Specimen.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Moisture	8·7	9·8	10·2	11·6
Ash	1·4	..	2·4	2·8
Loss on (*a*) hydrolysis..............	10·0	12·4	14·9	13·0
Loss on (*b*) hydrolysis	14·5	14·5	22·0	23·5
Loss on acid purification	1·7	1·7	3·8	5·6
Loss on mercerisation..............	8·7	11·4	16·0	16·2
Gain on nitration ...	38·1	40·7	34·0	34·0
Cellulose............	75·8	77·7	77·8	72·2
Length of ultimate fibre in mm.	2—5 (aver. 3·5)	2—5	1—5	1—3

The specimen examined closely resembles that from Southern India, and is distinctly superior to those from Grenada and Victoria. It is estimated as worth from 26*l.* to 30*l.* per ton.—A. S.

Hemp, Mauritius (Furcræa Gigantea), from South Australia. Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, 2, 89.

The specimen consisted of a very long fibre (staple, 5 ft.), but of poor colour, roughly prepared and weak. It is said to be worth 28*l.* to 30*l.* per ton. It contained 8· per cent. of moisture, 1·4 per cent. of ash, and 74·5 per cent. of cellulose.—A. S.

Hemp, Bowstring (Sansevieria Zeylanica), from South Australia. Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, 2, 88—89.

The sample consisted of a soft, fine fibre, somewhat deficient in strength, and with an average length of 38 ins. It is estimated as worth from 33*l.* to 35*l.* per ton. analysis, the sample gave the following results, the fig obtained with specimens of the fibre from other sour being also given for the purpose of comparison :—

Source of Fibre.	Moisture.	Ash.	Cellul
	Per Cent.	Per Cent.	Per Ce
South Australia............	8·1	0·4	80·9
Assam.......................	9·4	0·7	75·6
Grenada	9·5	1·4	72·7
Straits Settlements	9·9	0·7	75·9

—A.

English Patents.

Viscose; Manufacture or Treatment of Threads or I ments from ——. C. H. Stearn, London, and C. Topham, Kew. Eng. Pat. 16,604, July 28, 1903.

Threads of viscose, after passing through the bath ammonium salt solution, and before spinning, are tre with a solution of an iron salt or other salt which prod an insoluble sulphide with alkali sulphide (*e.g.*, a 10 cent. solution of ferrous sulphate). This removal of am nium sulphide and polysulphide prevents the fibres f adhering together when spun and becoming stiff.—T. F.

Colouring, Decorating, or Printing Textile and o Fabrics, Paper, and other Materials; Process for — C. L. Burdick, London, and H. Pervilhac, Villeurba France. Eng. Pat. 14,472, June 29, 1903.

See Fr. Pat. 334,667 of 1903; this J., 1904, 185.—T. F.

United States Patents.

Dyeing, &c.; Apparatus for ——. J. Schmitt, Danjou Belfort, France. U.S. Pat. 764,825, July 12, 1904.

See Eng. Pat. 6591 of 1901; this J., 1901, 713.—T. F.

Dyeing; Apparatus for ——. O. Venter, Chem Germany. U.S. Pat. 764,966, July 12, 1904.

See Eng. Pat. 23,055 of 1901; this J., 1902, 310.—T. F.

VII.—ACIDS, ALKALIS, AND SALTS.

Alkali, &c. Works; Fortieth Annual Report on —— the Chief Inspector. Feb. 17, 1904.

The Alkali, &c. Works Bill of 1903, to amend and solidate previous Acts, was read a first time in the ses of 1903. It was proposed in this Bill to include, thoug a very limited manner, certain smelting or metallurg works within its scope; but in the Bill of 1904, rece introduced, the clauses relating to these have been w drawn, as, if included, it became evident that opposi causing delay would be made. But amendments of cer clauses of the 1903 measure are included, which have agreed upon with the trades affected.

Alkali and wet copper works, these being the lon under inspection, have given "little ground for complai in the past year. Complaints of damage done conti to be received from Widnes in 1903, but in this dis there are metallurgical works not within the jurisdictio the Alkali Acts, with which works the responsibility n be shared.

In alkali waste works, attention continues to be direc to the acid discharges from the chimneys to which, "a combustion to sulphurous acid in special coal-fired furna the residual mixture of fine sulphur, sulphuretted hydro and sulphurous acid is draughted." The chief inspecto first suggested the use of a spray of alkaline magma (bonated spent waste) thrown up to meet the residual ga but such waste proved to be too crystalline to be a g absorber, and to be apt to clog the passages. An exp mental plant was set up by Mr. Murphey, co-opera with Dr. Affleck, in which a constant flow of milk of wa rendered alkaline either by (1) milk of lime; or (2) carbonated spent waste (discharged from the Cha rbonators), ran down two boiler fire-flues set up on end, tandem, in which sloping shelves were fixed, extending half the diameter of the flue. In order to interpret tionally the results obtained, Mr. Linder undertook a boratory investigation "to determine the conditions most vourable for the complete absorption of hydrogen sulphide nd sulphur dioxide by 'waste' slurry, either alone or in onjunction with added lime." The questions to be answered ere: (1) Nature of the interaction of hydrogen sulphide nd sulphur dioxide in presence of varying amounts of alcium hydroxide. (2) Nature of the interaction of hydro- en sulphide and sulphur dioxide in presence of tank waste spended in water. In respect to (1), calcium sulphide ave no reaction with calcium sulphite in presence f excess of lime. Calcium hydrosulphide and calcium isulphite yielded mainly calcium thiosulphate. Calcium lphide and hydrosulphide with calcium bisulphite, in resence of free sulphurous acid, gave calcium thio- lphate, free sulphur, and sulphur in other forms, but the eacting proportions are always S as H_2S : S as SO_2 : : 44 : 56. t appears, therefore, that if loss of sulphur as thiosulphate r free sulphur is to be avoided, the presence of free lphurous acid or bisulphite should be excluded. In spect to (2), the action of hydrogen sulphide and sulphur ioxide upon "waste slurry" at 60° F., the experiments hich were made with (*a*) hydrogen sulphide alone; (*b*) lphur dioxide alone; and (*c*) hydrogen sulphide and lphur dioxide together, lead to the following conclu- ions:—"(*a*) The free base in solution as hydrate or arbonate reacts with the added hydrogen sulphide and lphur dioxide to form soluble hydrosulphide or insoluble lphite respectively. (*b*) The sulphurous acid reacts with in- luble calcium sulphide—(i.) Local, $2H_2SO_3 + CaS = H_2S +$ a$(SO_3H)_2$; (ii.) General, $H_2SO_3 + CaS = H_2S + CaSO_3$.) The sulphuretted hydrogen added, and that liberated by eactions (*b*) reacts with insoluble calcium sulphide, $H_2S +$ aS $= Ca(SH)_2$. (*d*) Calcium bisulphite and calcium hydro- lphide react locally to form thiosulphate, $2Ca(SO_3H)_2 +$ a$(SH)_2 = 3CaS_2O_3 + 3H_2O$. Applying these equations calculate the theoretical yield of hydrosulphide, figures e obtained which agree well with experiment." Details the results obtained are given in two tables.

At wet copper works, more difficulty is experienced than alkali works generally, in keeping the hydrochloric id gas evolved within due limits, partly because it has t proved convenient to construct the furnaces on the us-pressure principle, as usually the case. Dr. Affleck ports that by a plan of burning a certain proportion "pyrites smalls" in a special furnace apart, at certain tervals, and mingling the gases with those derived om the other furnaces, in which the mixture of burnt pper ore with salt is calcined, all excess of chlorine in these ses is reduced, obviating the difficulty in absorption which herwise arises. It is stated that at a factory in which one imney draws from 20 or more furnaces, the adoption this method has rendered air dilution, as formerly actised, unnecessary, in order to keep within the require- nts of the Act.

The works in which sulphuric acid is made by the amber process have given no grounds for complaint in spect to escape of acid gases in the past year. Of the ntact process, two examples, on different systems, are now erating in England, and a factory also exists in Scotland. ese English works have been the occasion of some uble, due to defects of design and construction. The ef inspector recommends, for the reduction of the escape acid, when its recovery is not desired, a limestone er, fed with water, such as has been successfully em- yed in the Venetian red manufacture. In respect to the tch factory (using the contact process), the chief inspector rets that not much progress has been made in reducing escape of acid gases; but trials are being made of a design, from which better results are expected. The tom inlet to vitriol chambers, of which Mr. Porter showed lass model before the Society of Chemical Industry at nchester, in April 1903, (this J., 1903, 477), has been pted at several works, and an experimental trial of the hod at one works has shown a yield of acid in the ire plant "7·0 per cent. higher with the bottom inlet he chamber, than with the old flues, and there was also found to be a saving of nitre just on 1·0 per cent." Other advantages accruing from the adoption of the method are also mentioned.

Many firms have to purify their sulphuric acid from arsenic by means of hydrogen sulphide, and at present the sulphide mud is consigned to the nearest tip; but it is hoped that some method of utilising it may be found. An analysis by Mr. Fryer shows that the mud contains, besides its main constituents (arsenious sulphide and free sulphur), sulphuric acid and water, appreciable proportions of antimonious, lead, bismuth, and copper sulphides, besides calcium and ferrous sulphates.

In the concentration and rectification of sulphuric acid, "the overheat pan has not yet been replaced" by a method "yielding more satisfactory results in lessened escape of acid gases." The Kessler system has received further extension, though not unattended by complaints on the starting of new plant; but improved results are expected. The advantages arising from the exclusion, as far as possible, of air and permanent gases from the vapour to be condensed, previously pointed out by the chief inspector, are increasingly recognised. The best results are obtained where platinum stills with platinum covers are used, next to which in efficiency comes the Faure-Kessler combined platinum and lead apparatus. In making acidimetric estimations, the chief inspector emphasises the precautions necessary to be observed. In using phenolphthalein and methyl orange as indicators, it is to be noted that the former gives an erroneous result unless it is titrated at a boiling heat, owing to the action of carbonic acid; and it is pointed out that 1 cb. ft. of air at 60° F. contains carbon dioxide equivalent to 0·59 grain of sulphuric anhydride. When an alkaline absorbent of residual acid gases is used, the conditions are favourable for retention of the carbon dioxide. In exits of chambers using pyrites, or the gases of sulphate of ammonia saturators, or spent oxide from gas works, as the source of sulphur, the proportion of carbon dioxide is increased for reasons that are explained. The chief inspector writes, "as regards the critical comparison of various absorbents, it is absolutely essential that concurrent aspirations should be made, if it is desired to draw any conclusion with certainty as to the efficiency of any particular absorbent. Conditions vary, from time to time, with such rapidity in the chamber process that only in this way is it possible to proceed to obtain results of permanent value." The manufacture of chemical manures has been conducted in increased volume in the past year. Dr. Affleck's method of testing the acid gases escaping from the final exit flues in the manufactures described in the preceding report (see this J., 1903, 863) has been adopted generally, accuracy being thereby secured. The following table shows the amount of manure materials, in tons, imported during the years indicated:—

—	1903.	1902.	1901.
Guano	28,000	9,000	13,000
Mineral phosphates	392,714	365,000	354,910
Nitrate of soda	115,000	105,000	107,600

The exports of sulphate of ammonia were 162,300 tons in 1903, as compared with a home consumption of 71,700, inclusive, for all purposes. For 1902, the corresponding figures were 162,750 tons and 63,750 tons respectively. Mond producer-gas plants, fitted for the recovery of ammonia, have been introduced for the first time in Scotland, and in 1904 a further increase in them is looked for, as well as further extension of coke-oven plants with recovery of residuals. The tendency for gasworks to work up their own residual products is on the increase. The chief inspector directs attention to certain sources of loss of ammonia in the saturators, one of which is the construction of saturators with too steep an angle in the bottom from back to front, so that after the sulphate formed has been fished out, the ammonia-distributing pipe tends to become unsealed; losses also occur through gradual enlargement of the holes in the pipe.

Amount of Sulphate of Ammonia produced in the United Kingdom.

——	1903.	1902.	1901.
Gas works	149,489	150,055	142,703
Iron works	19,119	18,801	16,353
Shale works	37,353	36,931	40,011
Coke-oven works	17,438	15,352	12,255
Producer-gas and carbonising works (bone and coal)	10,265	8,177	5,891
Total	233,664	229,316	217,213

Mr. Linder, at the request of the Chief Inspector, gives "Analyses of Ammoniacal Liquors from various Sources, and Review of the Methods employed in Determining the various Sulphur Compounds," in which he details the methods adopted for the determination of ammonia, free and fixed; carbonic acid; chloride; sulphur, under (*a*) as sulphate; (*b*) as thiocyanate (sulphocyanide); (*c*) as sulphide, sulphite, and thiosulphate; (*d*) total sulphur; (*e*) sulphur as polysulphide. Under the heading "Estimation of Sulphate in Ammoniacal Liquors," three methods are described, consisting in: (1) differentiation of sulphite and thiosulphate by oxidation with a current of air; (2) precipitation of the sulphite by baryta water; (3) polysulphide method, for which the results are given in tabular form. Other headings are: Estimation of Total Sulphur in Ammoniacal Liquors; Distribution of Sulphur in Ammoniacal Liquors; and Estimation of Cyanide in Ammoniacal Liquors.

The total output of rock salt, white salt, and salt contained in brine used for making alkali by the ammonia-soda process, was, in 1902, 1,893,881 tons, the output for the preceding year having been 1,783,056 tons. Most of the increase was due to the works in Cheshire and Stafford. In cement works, there is continued extension of methods depending on the continuous feed of materials and discharge of calcined cement by the use of rotary cylindrical kilns. Difficulties in reference to the occurrence of black smoke have not been wholly overcome. All the works of the Associated Portland Cement Manufacturers, 1900, Ltd., have been provided with cylinders of compressed oxygen, with mouthpieces, for use in cases of poisoning by kiln gases. It has been suggested to other owners and managers of cement works to adopt similar precautions. The production of arsenic has fallen from 3,361 tons in 1901 to 2,131 tons in 1902. No fault is found with the works. A new Venetian red work has been established in South Wales.

In respect to the conduct of tar works, the Home Office has issued draft rules calling attention to the risks to workmen who are engaged in carrying on the various operations of the process, in harmony with the chief inspector's previous warnings, as to isolation of stills during the process of chipping out and cleaning. In "Studies on the Claus Kiln Reaction," the substance of much of the paper by the chief inspector and Mr. Linder, published in this Journal for March, 1903, 457—465, is reproduced, with the results of experiments made since that date. The examples given in the 39th Report of the theoretical maximum heat of reaction were confined to the Scotch works, but have now been extended to the English works. According to the hypothesis examined, the maximum arrived at lies between 946° and 1033° F. There is evidence that at the top of the Claus kiln, owing to the intensity of chemical reaction in this space, temperature is very high, causing much injury to the wrought-iron top. It is anticipated that Dr. Affleck will continue experiments at an experimental Claus kiln to further elucidate this point. The chief inspector gives, in an appendix to the above-mentioned "Studies," detailed calculations showing that the governing factor for conditions for the reversing action, $3S + 2H_2O = 2H_2S + SO_2$ (the other reaction being $H_2S + O = H_2O + S$), is the large amount of heat required to vaporise the sulphur.

The Claus kiln reaction studies are grouped under the following heads:—(A.) The Heat reactions, theoretically considered, of different Gaseous Mixtures, with tabular matter. (B.) Experiments with Manganese Oxides as Contact Material in place of Ferric Oxide, in respect to which it is stated that "while, in the Claus kiln, ferric oxide is converted into iron bisulphide, manganite of manganese and manganite of calcium are converted into manganous and calcium sulphates. The stage of manganese sulphide appears to be of very temporary duration; no trace of this could be found. The manganous sulphate is in the form of monohydrate." (C.) Determination of the "Efficiency" of the Claus Kiln and Chambers, with remarks upon the measurement of gaseous volumes, and methods applicable to exit gases. Under this heading, several tables of results are given, partly derived from experiments (by Mr. Linder) with the Leicester Corporation, and South Metropolitan Gas Company's Claus plant, supplemented by tests from other works. (D.) Ammonia in Recovered Sulphur from Claus kilns attached to Gas Liquor Processes. Under this heading the results of experiments on the reaction of steam upon hydrocyanic acid at from 500°—600° C. are given. (E.) Appendix, giving thermal calculations and discussions with numerous experiments, and calculations relating to the air supply in treating saturator gases; and on the volume of reacting mixture entering, to that of the exit gases. Mr. Sutton (Eastern and South Eastern Counties District) writes: "The presence of considerable quantities of ammonia salts in the recovered sulphur from the Claus process ha frequently been observed. These were generally attributed to ammonia having passed by the saturators; but during a recent investigation of the working efficiency of certai contact material used in a Claus kiln and the reaction taking place therein, it was found that cyanogen compound passing forward to the kiln with the saturator gases were converted into ammonia compounds. This interesting reaction is receiving further investigation." Combustion o foul saturator gases in a special furnace, with subsequen neutralisation of the resulting sulphurous acid, has received further extension in several works; whereas their passage to the hydraulic or crude gas main of coal-carbonising plant is less adopted. The practice of passing such gase to the retort or boiler fire flues is still in use, but is considered to be legitimate only at the smallest works.

A curious statement is made respecting the heaps of alkal waste about the Netham Chemical Works, at Bristol. Of these, for years no blade of grass or weed grew; but now the narrow-leaved wall mustard (*Diplotaxis tenuifolia*) i "fast spreading its verdure over these arid heaps of chemica refuse." The plant occurs in the south, south-west, an east of England, but in other parts is rare or absent. I bears pale yellow flowers with an almond-like fragranc It is suggested that, on æsthetic grounds, it might b worth while to encourage the growth of this plant on othe such unsightly heaps besides those of Bristol. There wa one prosecution in the year covered by the Report, f infractions of the provisions of the Act of 1881 in th manufacture of chemical manure. The Report contai 183 pages, of which 13 pages are devoted to Scotland.

—E. S.

Electrolysis of Alkali Chlorides by the "Bell Process"
G. Adolph. Z. Elektrochem., 1904, **9**, 449—450.

The author claims priority for the experimental found tions of a theoretical explanation of the continuous functio of this process, as recently dealt with by O. Steiner (th J., 1904, 545); he considers that the experiments of t latter confirm, rather than contradict, his previous work.

—R. S. H.

Potassium Metabisulphite and Sodium Bisulphite; Alter tion of —— when Exposed to Air. A. and L. Lumi and A. Seyewetz. XXI., page 799.

Cyanogen and Cyanides: Slow Oxidation of —— by Fr Oxygen. Berthelot. Comptes rend., 1904, **139**, 169 177.

Alkali cyanides, cyanogen, and hydrocyanic acid, aqueous and alcoholic solutions, all absorb free oxyg slowly; the absorption is accelerated by sunlight and al by rise in temperature. The absorption is most marked the case of potassium cyanide, and most feeble with hyd cyanic acid. When the absorption is carried out ov ercury, small quantities of the metal are dissolved; when e oxidation of potassium cyanide was performed in coholic solution, over mercury, and in presence of otassium hydroxide, no solution of the mercury was found occur.—T. F. B.

English Patents.

itrous Anhydride and Nitrites; Manufacture of ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer & Co., Elberfeld, Germany. Eng. Pat. 18,591, Aug. 28, 1903.

E Fr. Pat. 335,229 of 1903; this J., 1904, 186.—T. F. B.

icalcium Phosphate; Method of Producing ——. E. Bergmann, Ohlau, Germany. Eng. Pat. 19,267, Sept. 7, 1903.

E Fr. Pat. 335,798 of 1903; this J., 1904, 253.—T. F. B.

lkaline Prussiates; Manufacture of ——. G. E. Davis, Knutsford, Cheshire. Eng. Pat. 20,069, Sept. 17, 1903.

the process for the manufacture of alkali prussiates from al gas scrubbings described in Eng. Pat. 26,566 of 1902 his J., 1903, 1243), it is found to be necessary to use an xcess of sodium carbonate over that needed to form sodium russiate and to displace ammonia in the mixture of liquids d solids coming from the scrubber, and this excess ecomes concentrated in the mother liquor remaining after e crystallisation. The present invention consists in adding me to the mother liquor, and using the caustic filtered lution for introduction to the still for the conversion of e sodium-ferrous-ferrocyanide into sodium prussiate, as escribed in the cited patent.—E. S.

ypsum; Manufacture of Crystalline ——, applicable for Filling Purposes. W. Brothers, Prestwich, Lancashire. Eng. Pat. 26,007, Nov. 28, 1903.

E Fr. Pat. 333,858 of 1903; this J., 1904, 20.—T. F. B.

itrogen and Oxygen; Apparatus for the Separation of —— from Atmospheric Air. J. Price, London. Eng. Pat. 14,213, June 27, 1903.

HE process consists in the known process for the use of rium oxide or the like; but in such manner as to be ntinuously carried out. The apparatus includes the mbination with a suitably heated retort, of means for ceiving air and for discharging separated gases; of a rtition carried by a spindle mounted on bearings in the tort, capable of being turned in either direction to tablish or cut off communication between the oxygen d nitrogen chambers defined by the partition; and trays contain the absorbing material, arranged in connection th the spindle, and to be moved out of one chamber into e other simultaneously with the movement of the partition. another form of apparatus, also giving a continuous ocess of separation, means are provided for moving the eptacles containing the absorbing medium from one amber to another, to effect peroxidation and deoxidation. —E. S.

United States Patents.

trous Anhydride and Nitrites; Process of Making. H. von Kéler, Leverkusen, Germany, Assignor to Farbenfabriken of Elberfeld Co., New York. U.S. Pat. 763,491, June 28, 1904.

MIXTURE of ammonia with air or oxygen in excess is ssed over an oxide of a heavy metal (iron oxide for tance), or over a mixture of such oxides, kept at a mperature between 650° and 750° C. to obtain nitrous ydride. When it is desired to form a nitrite, the effluent es, containing "nitrous anhydride," are brought into tact with an alkali hydroxide or carbonate.—E. S.

drocyanic Acid; Process of Making ——. W. Feld, Hönningen-on-the-Rhine, Germany. U.S. Pat. 764,443, uly 5, 1904.

s addition, of Aug. 30, 1902, to Fr. Pat. 315,837 of 01; this J., 1903, 571.—T. F. B.

Ammonium, Nitrate of; Process of Producing ——. E. Naumann, Cologne, Germany. U.S. Pat. 764,251, July 5, 1904.

See Fr. Pat. 339,733 of 1904; this J., 1904, 714.—T. F. B.

Copper Sulphate; Process of Making ——. G. Gin, Paris. U.S. Pat. 765,000, July 12, 1904.

See Eng. Pat. 5230 of 1903; this J., 1904, 323.—T. F. B.

Acid of Proof Composition. F. A. Pank. U.S. Pat. 763,421, 1904. IX., page 788.

French Patents.

Phosphoric Acid; Producing ——, by Means of Aluminum Phosphate and other Substances. Brandon Frères. Fr. Pat. 340,272, Feb. 9, 1904.

Aluminium phosphate (especially the natural phosphate), which may be mixed with coal dust, is heated in a suitable retort, connected to condensing apparatus and an exhausting pump, to a temperature not exceeding 800° C. It is stated that on maintaining a vacuum (say from 6 to 50 mm. of mercury) in the retort by use of the pump, the heated phosphate gives off fumes which condense in water, mainly to metaphosphoric acid, mixed with small proportions of orthophosphoric, hypophosphoric, and hypophosphorous acids. The vapours not absorbed by water are passed through alkaline solutions.—E. S.

Oxygen; Simplified Preparation of ——. G. F. Jaubert. Fr. Pat. 340,388, Feb. 12, 1904.

The process is one of preparing oxygen by the action of water on alkali peroxides, &c. The peroxides are contained in hermetically soldered tin boxes, preferably in packets or pieces separated from one another by suitable bands or metal strips. A box thus charged is provided with an opening in its upper side, closed by a screw stopper, and another, but perforated stopper, is provided, adjusted to the same thread, having a rubber tube attached, connecting it to a reservoir. A pin hole is made in the under side of the box, which, fitted to the discharge tube, is completely immersed in water. As the water slowly enters, oxygen is formed and is collected. Compare Fr. Pat. 325,627 of 1902, and Add. to the same, this J. 1903, 743 and 1348, and Fr. Pat. 336,062 of 1903; this J., 1904, 323. —E. S.

VIII.—GLASS, POTTERY, ENAMELS.

Ceramic Body; New ——. M. Buchner. Z. angew. Chem., 1904, **17**, 985—988.

It is found that the artificial corundum, obtained as a by-product of the Goldschmidt aluminothermal process (this J., 1898, 1151), is capable of imparting to kaolin, clay, and other ceramic bodies (for stoneware in particular), the property of resisting extreme fluctuations of temperature, owing to the fact that it almost entirely eliminates the element of contraction in these bodies. Sherds containing corundum as an ingredient may be heated to whiteness in the oxyhydrogen blowpipe flame and immediately plunged into water without fracture. They also possess a high tensile strength (*e.g.*, 61·2 kilos. per sq. cm.), with a total extensibility of 0·0149 (permanent 0·0019, elastic 0·012) per cent. With ordinary stoneware of corresponding quality, these values are about 44 kilos., and 0·0097 (permanent 0·0002, elastic 0·0095) per cent. respectively. The crushing strength of the corundum ware is 1725 to 2685 kilos. per sq. cm., as compared with 800—1300 kilos. in the case of ordinary stoneware. The ware is acid-proof, and can be made up in the form of porous diaphragms for electrolytic purposes; whilst the absence of shrinkage is considered to specially fit it for these uses.—C. S.

French Patent.

Glass; Process for Working ——. H. J. Hays. Fr. Pat. 340,920, March 3, 1904.

See Eng. Pat. 4501 of 1904; this J., 1904, 546.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

English Patents.

Fireproofing Compounds [*for Wood*] *and the Art of Making the same.* J. L. Ferrell, Philadelphia, U.S.A. Eng. Pat. 18,090, Aug. 21, 1903.

See Fr. Pat. 335,054 of 1903; this J., 1904, 116.—T. F. B.

Fireproofing Compounds [*for Wood*] *and the Art of Making the same.* J. L. Ferrell, Philadelphia, U.S.A. Eng. Pat. 18,092, Aug. 21, 1903.

See Fr. Pat. 335,055 of 1903; this J., 1904, 116.—T. F. B.

Cement from Slag; Process for Manufacturing ——. C. von. Forell, Hamburg. Eng. Pat. 218, Jan. 4, 1904.

See Fr. Pat. 339,316 of 1904; this J., 1904, 663.—T. F. B.

United States Patents.

Acid-Proof Composition. F. A. Pank, Butte, Mont., U.S.A. U.S. Pat. 763,421, June 28, 1904.

A mixture of linseed oil, india-rubber, rosin, beeswax, silica, red lead, and gypsum, specified proportions of which are these:—1 gall. of linseed oil; 8 oz. of india-rubber; 4 oz. of rosin; 10 oz. of beeswax; 3 lb. of silica; 2 lb. of red lead; and 3 lb. of gypsum.—C. A. M.

Cement; Process of Manufacturing ——. G. Geissler and G. Geissler, jun., Gratz, Austria-Hungary. U.S. Pat. 764,453, July 5, 1904.

See Eng. Pat. 9835 of 1903; this J., 1903, 868.—T. F. B.

French Patents.

Bricks; Process for Covering —— *with a Protective Coating to prevent Efflorescence and Blackening.* M. Perkiewicz. Second Addition, dated Feb. 10, 1904, to Fr. Pat. 330,655, March 27, 1903.

See Eng. Pat. 3760 of 1904; this J., 1904, 662.—T. F. B.

Refractory Products; Process for Making Extremely ——. J. Bach. Addition, dated Feb. 12, 1904, to Fr. Pat. 336,518, Nov. 10, 1903.

See Eng. Pat. 4478 of 1904; this J., 1904, 607.—T. F. B.

Lithographic Stones; Manufacture of Plates suitable for Use as Substitutes for ——. G. Bower and W. Gauntlett. Fr. Pat. 340,445, Feb. 15, 1904. Under Internat. Conv., March 17, 1903.

See Eng. Pat. 6155 of 1903; this J., 1904, 325.—T. F. B.

Adhesive Substance [*Cement*]; *Process of Making an* ——. L. Weiss. Fr. Pat. 340,754, Feb. 27, 1904.

See Eng. Pat. 4939 of 1904; this J., 1904, 607.—T. F. B.

X.—METALLURGY.

Metals; Hard and Soft States in ——. G. T. Beilby. Electro-Chem. and Metall., 1904, **3**, 806—819.

The author brings forward a new theory of the hardening of metals by plastic flow based on the results of a study of the microstructure of metal and other surfaces (this J., 1903, 1107,* 1108), and, in particular, the discovery of surface flow during the polishing of crystalline solids (this J., 1901, 922; 1903, 1166). According to the theory metals occur ordinarily in two distinct phases: the hardened or amorphous (A), and the annealed or crystalline (C) phase. The A phase is transformed into the C phase by the agency of heat, the C phase is transformed into the A phase by mechanically produced flow. In the transformations $A \rightleftarrows C$ there are two intermediate mobile phases, M and M′, so that the transformations may be written $A \rightarrow M' \rightarrow C$ and $C \rightarrow M \rightarrow A$. Evidence in favour of the theory is furnished by:—(1) The distinct mechanical properties of the two phases A and C. (2) The microstructure of these and the indications which it supplies of the existence of the mobile phases M′ and M. (3) The optical properties, (4) the electrical properties, and (5) th thermochemical properties of the phases A and C.

Mechanical Properties—When silver is rolled, hammered or wire-drawn, its hardness and tenacity are raised to very high point. For instance, the tensile strength of sol silver may, in this way, be raised from under 10 tons t over 20 tons per square inch. A strip of silver made quit hard and springy by hammering will, after heating t 260° C., become so soft that it may be pressed perfectl flat on a smooth surface by the slightest pressure from th finger.

Microstructure.—Annealed silver, if in a sufficientl massive form, always shows a crystalline microstructur consisting of skeletons or grains built up of lamellæ similarly oriented units. The microstructure of hardene silver is vitreous-looking on the surface, and finely granul immediately below the surface. By careful treatment wit a solvent, the glassy surface and the granular portio immediately below can be completely removed, disclosir the crystalline grains or skeletons of the C phase mo or less deformed or broken up. The vitreous layer wi granules thickly distributed throughout its mass, alwa appears at surfaces of flow, the granules probably bei produced by the breaking down of the lamellæ and th setting free of the units of which they are built up. Th persistence of the units of the C phase in the granules m be due to their being encased in an envelope of the hardene A phase.

Optical Properties.—Hardened silver, even in i moderately attenuated forms, such as beaten leaves an deposited films, is highly reflecting and only slight translucent. By heating to 250°—300° C., the leaf or fil becomes transparent and loses much of its reflecti quality, but opacity and reflecting power are restored "flowing" or burnishing the annealed leaf or film.

Electrical Properties.—Silver wire in the annealed sta has an electrical conductivity 8—10 times higher than th of the same wire in the hardened state. A thermo-juncti consisting of a hardened and an annealed silver wire h an E.M.F. of 0·17 micro-volt for 1° C. of difference betwe the hot and cold junctions. At 260° C. the E.M.F. fa to zero, as the hardened wire then passes into the s condition. Copper, iron, platinum, and magnesium show a measurable E.M.F. between the two states.

Thermochemical Properties.—In etching polished hardened silver, the solvent acts first on the harden phase, leaving the crystalline phase exposed, whereas the hardened metal were merely a slightly compacted fo of the annealed, the latter more open form would be mo readily attacked and dissolved.

The author discusses the application of his theory to t deformation of the crystalline structure of metals by ov strain as observed by Ewing and Rosenhain (this J., 18 834; 1900, 1115), the increase in the tensile strength a metal produced by drawing it through a die, the hardeni of iron by thermal treatment and the mechanical action gases in this respect (see this J., 1901, 1212), and t breaking down of the tenacity and elasticity of met under frequent repetitions or reversals of stress. The gr inferiority of a wire which has been hardened by stretchi as regards tenacity to one which has been harden by drawing through a die, is due to a difference in t structural disposition of the two phases in the harden metal. In the stretched wire the surface layer duri stretching must be alternately made and broken ma times, and is finally left rough and open. In drawi on the other hand, the flow of the surface as the wir leaving the die, ensures that it is strong and unbroken.

Spathic Iron Ore; Calcination of ——. C. Lacoisne. Bull. Soc. d'Encourag., 1904, **106**, 360.

The spathic ores of Western Hungary and Austrian Sile contain 35 per cent. of iron or less, and are usually calcu so as to lessen the cost of transport. The furnaces, li with ordinary brick and cased in sheet iron, hold ab 60 tons, and calcine about 15 tons per 24 hours. Altern layers of ore (3½ tons) and coke (210 kilos.) are charg and a tube of 25 mm. diameter passes down the centr the furnace, through lateral holes in which fine jets of wa ler pressure are injected horizontally into the furnace. e reaction of this upon the hot coke, and the subsequent nbustion of the hydrogen and carbon monoxide pro- ed, favour the calcination, so that a saving of half fuel (from 12 to 6 per cent.) formerly used has been ected.—J. T. D.

Tool-Steels ; Rapid ——. H. le Chatelier. Bull. Soc. d'Encourag., 1904, **106**, 334—347.

E author gives the following analyses of rapid tool els :—

o.	Carbon.	Silicon.	Manganese.	Tungsten.	Chromium.
1	0·71	0·20	0·30	12·0	3·0
2	0·43	0·22	0·17	15·5	4·5
3	0·45	0·16	0·02	13·0	1·6
4	0·45	0·60	0·18	9·5	2·05
5	0·60	0·40	0·30	13·5	8·0
6	0·20	0·25	0·18	7·0	2·1
7	0·65	0·60	0·12	0·4	3·6

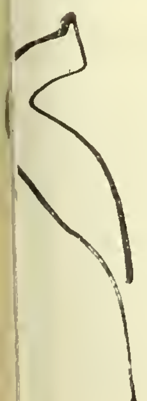
e may take the average or typical composition to be :— rbon 0·5, silicon 0·2, manganese 0·2, tungsten 12, romium 3·0, molybdenum 1, iron 83 ; but very probably s will be modified in the future, and may revert to the gher carbon and lower tungsten and chromium of the ginal rapid steels. The points of chief importance in nsidering the progress made or to be made in rapid steels e as follows :—1. *Net price:* This is high, say 6 frs. r kilo., due to the high prices of vanadium (110), molyb- num (17), and tungsten (7 frs. per kilo.). 2. *Hardness:* is seems to decrease with the carbon, for these steels n be scratched more easily than high carbon tool steels. *Fragility:* Rapid steels are more brittle than carbon steels ; to minimise the inconvenience of this, tools have been made of ordinary steel, with a piece of rapid steel welded on by the oxyacetylene flame to form the cutting edge. Probably careful determinations of the temperature of heating and of the cooling bath would enable a less brittle rapid steel to be produced. An over-heated carbon steel segregates and becomes heterogeneous, and no doubt a rapid steel does the same ; and this heterogeneity probably causes brittleness. 4. *Resistance to Tempering:* The temperature of softening is above 500—600° C., but an hour at 700° C. softens the hardest steel completely. The higher this temperature can be kept the better ; for though the average temperature of the tool at work may not reach 500° C., yet the outer portions may be at a much higher temperature. It is to be remembered that the temperature of recalescence is about 700° C., so that as the softening temperature approaches 700° C. there comes a point where softening is impossible. The tempering temperature depends both on the composition of the steel and the initial temperature of heating. A bar with its lower end dipping into water, and heated to fusion at its upper end, then plunged into a zinc-aluminium alloy at 550° C., showed four zones (illustrated in the paper by micro-photographs) indicating, at the bottom, the soft steel unaltered ; above, slight softening of the hardened metal on remaining in the bath ; above this, perfect temper, homogeneity, with no sign of softening, and at the top hard and brittle steel, heterogeneous in structure. 5. *Cracks:* These form one of the troubles of tempering. They arise from sudden changes of volume, and the liability to them is greatest with high carbon and with a low percentage of tungsten. They have two distinct causes :—*a.* The state of the metal which is stable at a high temperature is not preserved during the sudden cooling, for the non-magnetic metal becomes magnetic. This change is accompanied by change of volume, producing cracks ; and this effect is the greater, the colder and more brittle the metal is when the change occurs. For this reason the use of metallic baths is advantageous, provided the temperature is not high enough to allow any softening to take place. It is probably to avoid cracks, too, that the carbon has been gradually lessened and the tungsen increased in rapid steels. *b.* Rapid steels as distinguished from steels in general exhibit another cause of cracks, the same which produces them in glass. A drop of water on the hot steel, for instance, will cause them, hence the recommendation that tools of rapid steel should be sharpened either dry or in a liberal stream of water. In an appendix the author gives the following diagrams showing the points of transformation of the seven steels, the analyses of which are given above, determined by Roberts - Austen's method, using the modified apparatus of M. Saladin, and adds for comparison a similar curve obtained from an ordinary steel with 0·9 per cent. of carbon (see first figure in preceding group). The ordinates measure temperatures, the abscissæ differences of temperature between a piece of nickel and the steel under experiment.—J. T. D.

C = 0 9

6

5.

2.



4.

3.

1.

7.

Rapid Steels ; Contribution to the Theory of ——. F. Osmond. Bull. Soc. d'Encourag., 1904, **106**, 348—352.

The specific characters of rapid steels are as follows :—1. The critical points are lowered during the cooling, when the temperature of the previous heating is raised ; and if that temperature is above a certain minimum and the metal is cooled through a sufficient range, it remains self-hardened. 2. Rise of the temperature of heating may cause coalescence of the points Ar 3. 2, and Ar 1, or separation of the multiple point Ar 3. 2. 1. 3. Prolonged heating at a low temperature is equivalent, as far as the position and form of the critical points are concerned, to a shorter heating at a higher temperature. 4. The hardness acquired is more stable during tempering than in the case of carbon steels. The explanation of these characters is found in the following considerations:—1. Suppose a hypereutectoid carbon steel, heated to the point Ac 3. 2. 1, and suppose the homogeneous redistribution of the carbon above the critical point to be instantaneous. The α-iron changes to γ-iron, the carbide of the perlite dissolves and the perlite becomes austenite. If now cooled, the independent cementite plays no part, the content of active carbon is that of the eutectoid—constant and the final state depends on the rate of cooling. Besides the independent cementite, we have, if this rate be infinitely slow, ferrite in grains and extra-granular cementite; complete physico-chemical and structural equilibrium. If ordinary, perlite; physico-chemical equilibrium complete, structural incomplete. If accelerated, sorbite; less complete physico-chemical equilibrium, structural quite incomplete. If rapid, troostite, and if very rapid, martensite; the physico chemical equilibrium more incomplete at each stage. If the heating be continued above Ac 3.2.1, the independent cementite gradually dissolves, and the dissolved carbon increases till a temperature is reached depending on the total carbon: and if the subsequent cooling be rapid enough to impede the segregation of the independent cementite, the final state will depend on the amount of carbon originally dissolved, and as the rapidity of cooling increases we shall have successively—troostite and cementite; martensite and cementite; martensite and austenite. In the austenite, transformation has not begun, and the iron is in the γ-state. 2. Suppose a rapid steel similarly treated. The effect of the chromium and tungsten is to impede the segregation of the cementite, so that, as a first approximation, and within limits, we can neglect the variations in the rate of cooling. Thus, even during slow cooling, the transformation points are lowered further, the greater is the excess of carbon-content at the beginning over that of the eutectoid; and the carbon-content itself depends, directly on the temperature of heating, and indirectly on the chemical composition. By varying the temperature of heating, and thus the content of dissolved carbon, then, we can have as final state, any one of the series, perlite, sorbite, troostite, martensite, austenite, or mixtures of them among themselves and with the cementite in excess. 3. In rapid steels, the hypothesis of the immediate redistribution of the carbon above the critical point does not represent the facts. Its solution is slow, as is the segregation on cooling: they are two sides of one character. Moreover, the cementite is often spherolitic, in separated nuclei, which further retards the solution of the carbon. Thus, unless the heating be very prolonged or the temperature very high, the carbon distribution is not homogeneous, but there are maxima around the cementite nuclei and minima between them. On cooling, each portion behaves independently, and hence a doubling of the recalescence, and a heterogeneous final product, containing always at least two constituents. Usually, recalescence will be single if the temperature has been just above Ac 3.2.1 (for the independent cementite has hardly begun to diffuse) or if it has been very much higher (for the redistributed carbon is homogeneous), and it will be double for intermediate temperatures. 4. If the temperature be raised above the highest temperature spoken of in 3, recalescence may again be double; for partial fusion may separate the metal into two constituents of different carbon-content, which remain distinct during cooling. 5. Chromium, tungsten, &c., lower the eutectoid carbon-content, so that rapid steels are usually hypereutectoid. In the contrary case (or with the hypereutectoid if the cementite be spherolitic) there may be on cooling a point Ar 3.2, independent of Ar. 1. 6. The elevation of the temperature of softening in rapid steels is not yet definitely explained: it seems to be another result of the difficulty of segregation of the carbide. Possibly the austenite is transformed into martensite, and thus we get hardening instead of the softening that occurs in carbon steels. 7. There is n separate theory of rapid steels; the general theory o carbon steels is applicable, if we bear in mind that th solution of carbon during heating and segregation durin cooling are rendered difficult by the presence of chromiur and tungsten, so that we get, without hardening, all th series of effects which characterise hardening in carbo steels.—J. T. D.

Electrical Resistance of Hardened Carbon Steels; Effe of Reheating on ——. Grenet. Bull. Soc. d'Encourag 1904, **106**, 353—357.

Bars of steel (carbon 1·29, manganese 0·07, silicon 0·1 phosphorus 0·006, sulphur, traces) of different sizes an shapes were hardened by heating to varied temperature and then cooling in dilute sulphuric acid. Their electric resistance was determined in this state, and after r heating to varied temperatures for 10 minutes. Moderatel energetic hardening exerts no influence on the electri resistance (nor, as Charpy has shown, on the dilatation of steels, though it acts energetically on their mechanic properties. Reheating, up to 700° C., acts continuously o the mechanical properties of these steels. Very energet hardening acts on the electric resistance and on th dilatation of these steels, but reheating to 400° C. destroy this effect completely, while it continues to act more an more strongly up to 700° C. on their mechanical propertie Thus, increase of mechanical resistivity and of electric resistivity, though produced by the same means, do n seem to be due to the same modification of the steel. Col hammering acts on the mechanical properties of stee similarly to moderate hardening, but it has no effect on th electric resistance.—J. T. D.

Nickel Steels; Effect of Heat Treatment on ——. Grene Bull. Soc. d'Encourg., 1901, **106**, 358—359.

Two samples were examined, containing carbon 0·3. manganese 0·36 and 0·34, nickel 26·9 and 29·0 per cen respectively, and traces of silicon, phosphorus, and sulphu Their temperatures of dilatometric transformation were, heating 510°—540° and 495°—535° C. respectively, and, cooling below 0° C. Forged and reheated at 925° C., bot samples showed the ordinary microscopic characters of no transformed metal. Forged, reheated at 925° C., cooled 80° C., and reheated at 550° C., they showed that, after th cooling, part of the metal had been transformed: they we now magnetic; but after reheating they again became no magnetic, though their microscopic aspect was the san as that of the cooled specimens. Possibly the coolin separates the elements, not of a eutectic, but of a supe saturated solution, and when the transformation-temperatu is passed on reheating, only a small proportion of the elements recombine. On heating to 800° the metal recove the aspect it had before transformation. The steels, heat to 550° C., after having undergone transformation wi change of volume at a low temperature, exhibit an increa of tensile strength at the elastic limit, an increase maximum tensile strength, and a diminution of elongatio as compared with the metals before cooling and reheatin J. T. D.

Iron and Steel; New Process for the Protection of — from Corrosion. S. Cowper-Coles. Electro-Chem. a Metall., 1904, **3**, 828—836.

The iron or steel freed from scale or oxide is placed in closed air-tight iron receptacle coated on the inside wi plumbago and charged with zinc dust. The whole is th heated to 500°—600° F. for a few hours, and allowed cool. In order to avoid the formation of too much zi oxide, the air is exhausted from the receptacle before th heating, or about 3 per cent. of carbon in a very fine sta of division is added to the zinc dust. The thickness of th coating depends on the temperature and the duration heating. The process ("Sherardising") can also be applie to the coating of iron with copper, aluminium and antimon and of aluminium and copper with zinc. Copper and alloys when subjected to the process are case-hardened, a can indeed be rendered so hard on the surface as to tu the edge of a steel tool. Various advantages are claime for the process over the ordinary method of hot galvanisin —A. S.

Platinum in Wollastonite, found in Sumatra. L. Hundeshagen. Inst. Min. & Met., July 21, 1904.

ıe author describes a deposit of wollastonite associated th garnet (*grossularite*), bornite, gold, and platinum ıich occurs in old schists near the Singeuggoe River, ıich have been penetrated by granite and subsequently erlaid by augite-diorite and by volcanic rocks. He nsiders that the present ore-deposit was originally "a yer or big lens" of limestone included within the schists, d that the alteration into wollastonite and garnet has en effected by the intrusion of "apophyses of granite," e introduction of copper, gold, platinum, &c., having been bsequently effected by hot springs. The absence of rpentine and of magnesian compounds generally is reırked upon by the author. A sample of slightly composed wollastonite gave 6 grms. of platinum with grms. of gold and 2 grms. of silver per 1,000 kilos. ains of gold and platinum are found in the river sands low the ore-deposit.—J. H. C.

Platinum and its Deterioration; Some Notes on ——. W. Campbell. Electrochem. Ind., 1904, **2**, 259—261.

ıe chief causes of the deterioration of platinum seem to its volatility at high temperatures and the fact that ating above 1,000° C. for any length of time causes ttleness. This brittleness may be due to crystallisation, the formation of compounds, or to the absorption and olution of gases. The author considers the matter parularly as it affects the use of this metal in resistance ermometers and thermo-couples. The greatest alteration caused by heating in a reducing atmosphere in presence siliceous material.—R. S. H.

Lead and Tin; Behaviour of Alloys of —— towards cids. O. Sackur. Z. Elektrochem, 1904, **10**, 522—529.

determining the equilibrium established when lead-tin oys are acted on by acidified solutions of lead salts and tin salts, it is shown (1) that, above 10 per cent., lead present in the free state, and below 10 per cent. in solid lution; (2) that tin forms solid solutions up to 3 per nt.; and (3) that no chemical compound is formed by metals. Further, a series of alloys was exposed to the vcat action of dilute acetic acid of various strengths, itated by a constant supply of air. The lead is directly solved, whilst the tin goes into solution secondarily precipitating an equivalent quantity of lead from the viously formed salt; a coating of pure lead is thus left the alloy, and from this point onward the sum of lead l tin dissolved is approximately independent of the comsition of the alloy. The greater the air supply the more tal goes into solution, but only when the alloy contains ove 30 per cent. of lead. Lactic acid dissolves comparaly more tin than acetic acid of the same strength.
—W. A. C.

tal Substitution. A. J. J. Vandevelde and C. E. Vasteels. Bull. Acad. roy. Belg., 1904, 331—360. Chem. Centr., 1904, **1**, 1629.

e influence of temperature and concentration on the rate ubstitution of copper in aqueous alcoholic sulphate solu- by zinc was determined. The experiments were made emperatures of 24°—25°, 17°—18°, and 7°—8° C., with eous alcoholic solutions containing equal amounts of per sulphate but varying proportions of water and alcohol. general, increase of temperature caused an increase in rate of substitution. The initial velocity of reaction is atest in pure aqueous solutions, and, in aqueous alcoholic itions, decreases as the proportion of alcohol increases. er some hours, the maximum rate of substitution occurs aqueous solutions at low temperatures, but in aqueous holic solutions, containing increasing proportions of hol, at higher temperatures. The reaction is a double , being chiefly a simple substitution, with separation of per, in the first stage, and formation of an insoluble c zinc sulphate in the second. Low temperature and hol retard the metal substitution, but favour the formn of basic salts. The precipitate which separates is mixture of metallic copper with the basic sulphates $ZnO.ZnSO_4$ and $2ZnO.ZnSO_4$. Metallic zinc does not cause separation of basic sulphate from a solution of pure zinc sulphate. (See also this J., 1903, 368, 626.)—A. S.

Blast-Furnace Charges; A Graphic Method for the Computation of ——. C. O. Bannister. Inst. Min. and Met., July 21, 1904.

The method proposed by the author is somewhat similar to that devised by H. C. Jenkins (J. Iron and Steel Inst., 1891, 151), but it merely requires a sheet of squared paper, no slide-rule being necessary. The author gives a diagram in illustration of his method. (See also this J., 1892, 821.)
—J. H. C.

Sulphur in Iron; Rapid Method for the Determination of Total —— by Evolution. S. S. Knight. XXIII., page 800.

English Patents.

Iron Sand, whether Natural, or Prepared by Reducing Iron Ore or Iron Wastes; Converting —— into Briquettes. T. Rouse and H. Cohn, London. Eng. Pat. 17,445, Aug. 11, 1903.

Iron sand concentrates, powdered iron ore, blue-billy, or the like, are agglomerated into blocks by means of a solution of water-glass, and the blocks are hardened in a chamber through which hot air and steam are passed, so that the atmosphere of the chamber may be kept hot and moist without condensation of water. Compare Eng. Pat. 21,880 of 1902, and 15,188 of 1903; this J., 1903, 1090, and 1904, 664.—E. S.

Sulphide Ores or Compounds: Treating —— preparatory to Smelting. T. Huntington and F. Heberlein, London. Eng. Pat. 13,454, June 16, 1903.

The sulphide ores are roasted in a suitable furnace "until the proportion of sulphur is reduced to a suitable degree," and are then quickly cooled by the aid of water. The cooled ore is then placed upon a layer of hot ore or fuel in a receptacle through which a current of air is passed, whereby the oxidation is completed, and the mass is fitted for transference to a blast furnace for reduction of the metal. Compare Eng. Pats. 8064 of 1896, and 3795 of 1897; this J., 1897, 543 and 683.—E. S.

Ores [Zinc Sulphide or Complex]; Treatment of ——. C. Cory, Swansea. Eng. Pat. 14,013, June 23, 1903.

Zinc sulphide ores are mixed with coal and with a small proportion of sago (say from ½ to 2 per cent. of the mixture), and the powdered mixture is subjected to the action of live steam, hot enough to rupture the starch cells of the sago. The plastic mass is then made into briquettes, which are heated in retorts lined with carborundum, to obtain zinc by distillation. The briquetting with the aid of sago, used as described, of sulphide and complex ores generally, is also claimed.—E. S.

United States Patents.

Sulphides from Ores; Apparatus for Use in certain Processes for Extracting ——. G. D Delprat, Assignor to Broken Hill Proprietary Co., both of Australia. U.S. Pat. 763,662, June 28, 1904.

The invention relates to apparatus for use in the process of floating concentrates from ores to the surface of a body of liquid. A pan having an inclined bottom is provided with an adjustable distributing plate at its upper end, having its lower edge close to the bottom of the pan. There is a discharge for the concentrates at the upper part of the pan, over a sump at the lower end of the inclined bottom; a vertical baffle-plate extends from the beginning of the discharge to near the lower edge of the bottom, separating the sump from the pan, and maintaining a submerged entrance to the sump for the tailings from the pan. Means for feeding ore and acid solution, and for heating the pan, are provided. See also Eng. Pat. 27,132 of 1903; this J., 1904, 610.—E. S.

Smelting and Reducing Metals; Process of ——. C. Diesler, Coblentz, Germany. U.S. Pat. 764,041, July 5, 1904.

See Eng. Pat. 920 of 1901; this J., 1902, 261.—T. F. B.

Ore Separator: Magnetic ——. F. J. King, Croydon, Surrey. U.S. Pat. 765,013, July 12, 1904.

See Eng. Pat. 5209 of 1902; this J., 1902, 1399.—T. F. B.

French Patent.

Ores; Treatment of ——. [*Vacuum Filter for Solutions of Metals.*] The Rapid Cyanide Treatment, Limited. Fr. Pat. 340,238. Feb. 6, 1904.

The crushed ores are placed, with the dissolving solution, in a closed rotating, horizontal cylinder, with filtering material arranged within its sides and ends upon a grill of wooden supports, in such manner that the vacuous spaces communicate with a cased aperture centrally placed at one end of the cylinder, from which the filtered liquid flows down a vertical pipe connected to a pump, by means of which a partial vacuum is formed on the discharge side of the filtering material. The solvent solution is supplied to the cylinder through a pipe in connection with a forcing pump and an ozonising apparatus, so that air or ozonised air may be introduced. By means of the pump, pressure, say not exceeding 1 kilo. per sq. cm., may be put upon the contents of the cylinder on the supply side of the filtering material. After the solvent solution and washings have been forced through the filtering material, leaving the layers of pulp practically dry, the revolution of the cylinder is suspended, so that the dried pulp may fall by gravity on the simultaneous cessation of the out-draught and establishment of equilibrium between the opposite sides of the filtering material. The cylinder has removable doors on its sides for charging and discharging.—E. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Aluminium Anodes; Dimensions of Films on ——. W. R. Mott. Electrochem. Ind., 1904, **2**, 268—271.

In studying the formation of anode films on aluminium electrodes in phosphate solutions, the author finds that the thickness of the film is approximately a linear function of the voltage. Various methods were used for measuring the thickness. From the gain in weight of the anode, as also from the coulombs required for the formation, the calculation can be made. By the interference colours of the film an accurate and easy method of measurement is available, whilst by actually separating the film from the metal the thickness can be directly measured. The approximate thickness with different voltage is given as:—1 volt, 0·000001 cm.; 20, 0·00002; 80, 0·00008; and 320 volts, 0·0003 cm.—R. S. H.

Hydrosulphites [Hyposulphites] of Sodium and Calcium; Electrolytic Preparation of ——. A. R. Frank. Elektrochem., 1904, **9**, 450—452.

The author describes his work on this subject, and in particular replies to the criticism of Elbs and Becker (this J., 1901, 611). The statement that a saturated solution of calcium bisulphite contains only 9·3 grms. per litre, is said to be quite incorrect; solutions containing up to 90 grms. are in everyday use, and with such concentrated solutions the solid calcium hydrosulphite can be electrolytically prepared with a good yield.—R. S. H.

English Patents.

Ozonising Air and other Gases; Apparatus for ——. R. F. Wood-Smith, London. Eng. Pat. 17,885, Aug. 18, 1903.

The invention relates to improvements in ozonising apparatus of the Andreoli type. A plate of sheet metal, such as aluminium, is provided on one or both of its face with a number of projecting points, formed by stampin holes alternately from opposite sides of the plate. Spacin pieces separate the points from two dielectric plates o *micanite*, arranged one on each side of the aluminium plat and metal plates are fixed against the outer surfaces of th *micanite*.—B. N.

(*B.*)—ELECTRO-METALLURGY.

Refining Gold Alloys; Electrolytic Process of ——. E. Wohlwill. Electrochem. Ind., 1904, **2**, 261—264.

The author extends his previous article (this J., 1901, 717 by considering the factors which limit the more gener application of the electrolytic process. On account of th low temperature and current density employed, the Phila delphia results do not give satisfactory data. If th temperature be raised from 50°—55° C. to 65°—70° C gold containing up to 15 per cent. of silver can be dealt wit advantageously by this method. Moreover, the intere charges are considerably reduced, since it is possible t recover from 80 to 82 per cent. of the anode gold in 2 hours, when the current density is increased to the prop extent.—R. S. H.

Electrolysis with well-stirred Electrolytes. H. Sand. Z. Elektrochem., 1904, **9**, 452—454.

Referring to the recent publication of Amberg (this J 1904, 667), the author draws attention to his work on th electrolysis of an acid solution of copper sulphate (this J 1901, 725). From this it appears that the current densit is only limited by the rapidity of rotation of the electrode, an that consequently the condition of the metal deposit is n directly dependent on the current density. The effect stirring is to diminish the alterations of concentration in th immediate neighbourhood of the cathode, which alone a capable of exerting a very great influence on the nature the deposit.—R. S. H.

English Patent.

Metallic Compounds; Reducing of ——, *and Fusing Metals, in particular of Nickel and Iron, in the Electr Furnace.* C. D. Abel, London. From Siemens an Halske Akt.-Ges., Berlin. Eng. Pat. 19,366, Sept. 1903.

In the reduction of metallic compounds (particularly o nickel protoxide) and in the fusing of metals, such as nick and iron, in the electric furnace, the lower carbon electrod is covered, before the process begins, with a layer of sla such as of magnesia, with an addition of fluorspar, co ducting to electricity, and such as may remain "in a toug or solidified form at the reducing or smelting temperature," —E. S.

United States Patent.

Vanadium and its Alloys: Process of Manufactur ——. G. Gin, Paris. U.S. Pat. 765,001, July 1 1904.

See Fr. Pat. 340,413 of 1904; following these.—T. F. B.

French Patent.

Vanadium and its Alloys; [Electrolytic] Manufacture of ——. G. Gin. Fr. Pat. 340,413, Feb. 13, 1904.

The process consists in electrolysing a bath of fuse calcium fluoride, in which the cathode is a block of stee and the anode is an agglomerated mixture of carbon with vanadium oxide. The bath is fed with a certain quantit of fluoride of iron or of other metal, an alloy of whic with vanadium it is desired to obtain. The decompositio of such a fluoride assists the process, and supplies th fluorine which continuously regenerates the electrolyte the expense of the anode, and plays the part of the mediu of transmission of the vanadium from the anode to th cathode. (See this J., 1903, 1248).—E. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

en Oil; Nature and Commercial Uses of ——. Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, **2**, 117—120.

Ben" or "Behen" oil is obtained from the seeds of *oringa pterygosperma* and *M. aptera*. A sample of pods d seeds of *M. pterygosperma* from Northern Nigeria elded, on extraction with ether, 38 per cent. of a pale llow, almost odourless oil, having a bland, agreeable te. By filtration at 17°—18° C. the oil was separated o a liquid and a solid portion, which gave the following ults on analysis:—

—	Liquid Portion.	Solid Portion.
ecific gravity at 15° C.	0·914	...
d value	15·3	...
e fatty acids (as oleic cid) Per cent.	7·7	...
onification value	189·2	194·4
ine value	70·7	68·3

other sample of ben oil, from Jamaica, was separated filtration at 17° C. into 60 per cent. of a pale yellow and 40 per cent. of a nearly white, solid fat. On lysis the following results were obtained:—

—	Liquid Portion.	Solid Portion.
ific gravity	0·9124 at 15° C.	*0·8650 at 100° C.
l value	8·7	7·2
e fatty acids (as oleic id) Per cent.	4·4	3·6
onification value	196·3	193·6
ne value	70·1	65·2

* Compared with water at 15° C.

en oil could be produced at a sufficiently cheap rate, ould be likely to find a market as an edible oil, whilst liquid portion might be of use as a lubricant for fine hinery. (See also Lewkowitsch, this J., 1904, 25).
—A. S.

English Patents.

; Appliance [and Process] for Use in Refining ——. Macalpine, London. Eng. Pat. 15,457, July 13, 1904.

upright cylindrical vessel, the bottom of which is al in shape, and provided with a draw-off cock and rated false bottom, is partially filled with granular rial, such as coke, &c. Pipes for introducing com- ed air, and the solution with which the oil is to be ed, enter the vessel below the false bottom, on which ranular material rests. The refining reagent is run the vessel and allowed to saturate the granular rial, the excess being run off. The crude oil is then luced, and agitated with the granular material by ing compressed air through the mass.—T. F. B.

or Wax-like Substances from Hydrous Materials; traction of ——. T. A. Hearson, London; F. Frank l M. Ziegler, Berlin. Eng. Pat. 4867, Feb. 27, 1904.

aw material is extracted without preliminary drying neans of vapours of benzene, carbon bisulphide, ne, alcohol, chloroform, or carbon tetrachloride, and ixed solvent and water vapours are subsequently con- d in a receiver, where separation takes place through ation.—C. A. M.

cants; Production of ——. W. P. Thompson, ndon and Liverpool. From Ges. z. Verwerthung der eg'schen Wasserlöslichen Mineralöle u. Kohlenwas- stoffe, G. m. b. H., Berlin. Eng. Pat. 13,473, June 16, 3.

ral oils soluble in water (this J., 1904, 655) are ed by ozone or compressed air at 70°—105° C., and mixed with a small proportion of ceresin or paraffin (previously treated with 1—2 per cent. of alkali solution) and also with water, soap solution, or gelatin solution according to requirements.—C. A. M.

French Patent.

Soap containing Alcohol. A. Wolff. Fr. Pat. 340,247, Feb. 8, 1904.

The claim is for a soap containing, *e.g.*, 15 parts of anhydrous cocoanut oil soap, 5 parts of water, and 80 parts of alcohol, with or without the addition of perfumes or disinfectants.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*B.*)—RESINS, VARNISHES.

Kauri Resin; Supposed —— *from Queensland.* Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, **2**, 91—92.

The sample consisted of a single rounded block, weighing about 3 lb., composed of a bright yellow transparent resin with a number of dark streaks and opaque patches scattered throughout its mass. The resin had a pleasant aromatic odour, was completely soluble in alcohol and ether, slightly soluble in benzene, and very slightly so in chloroform. Sp. gr., 1·0543; acid value, 136·6; ash, 0·13 per cent. The essential constituents of the resin are the same as those of the resin of *Callitris verrucosa*, *viz.*, pimaric and callitrolic acids (see this J., 1901, 1222), and it may therefore be regarded as a sandarac derived from a species of *Callitris*. Commercial sandaracs occur in characteristic, elongated, light yellow tears, the most valuable variety (60*s.*—70*s.* per cwt.) being African sandarac obtained from *Callitris quadrivalvis*. The Queensland resin, owing to its unusual form, would probably be worth only 25*s.* to 30*s.* per cwt., instead of the 35*s.* per cwt. obtained for the ordinary tear form of Australian sandarac.—A. S.

Tacamahac Resin, Commercial; Constitution of ——. A. Tschirch and O. Saal. XX., page 798.

(*C.*)—INDIA-RUBBER, &c.

Rubber from British Central Africa. Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, **2**, 83.

A sample of rubber as collected and offered for sale by the natives of British Central Africa, and stated to be obtained from the vines of the indigenous Landolphias, was examined. The rubber was not sticky and exhibited good elasticity and tenacity. It gave the following results on analysis:—Moisture, 1·3—1·5; caoutchouc, 87·5—89·7; resin, 4·7—4·8; dirt, 4·2—6·3; ash (included in dirt), 0·6—0·8 per cent. The sample may be regarded as good, clean ball rubber. It was valued at 3*s.* 2*d.*—3*s.* 3*d.* per lb. on the London market.—A. S.

"Mpai" Rubber from Amatongaland, Natal. Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, **2**, 94—95.

The specimen rubber was obtained from the "Mpai" or "Mfubu" tree, probably a species of Ficus. It consisted of a light-brown, flat, elongated cake. The material had a somewhat fibrous structure, resembling that of gutta-percha; it exhibited very little elasticity, but considerable tenacity. In warm water it softened a little without becoming sticky and could then be readily drawn out. The specimen contained:—Moisture, 28·4; resin, 49·9; caoutchouc, 19·6; dirt, 2·1; ash (included in dirt), 0·79 per cent. It is worth about 10½*d.* or 11*d.* per lb.—A. S.

Rubber of Landolphia Kirkii from Amatongaland, Natal. Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, **2**, 95—96.

Two capsules of rubber from the "Ibuugu" vine, *Landolphia Kirkii*, have been examined. The rubber was light pinkish-brown externally, but deep reddish-brown within; it was not sticky, and exhibited very good elasticity and tenacity. On chemical examination the samples furnished the following results:—

—	Sample A.	Sample B.
	Per Cent.	Per Cent.
Moisture	7·7	9·1
Caoutchouc	80·1	75·7
Resin	6·9	10·3
Dirt	5·3	4·9
Ash (included in dirt	0·31	0·37

The rubber thus appears to be of good quality and would be worth about 4*s.* per lb. in the London market as compared with 4*s.* 8*d.* per lb. for fine Para rubber.—A. S.

Caoutchouc Molecule; Decomposition of the —— with Formation of a Cyclic Hydrocarbon. R. Ditmar. Monatsh. f. Chem., 1904, **25**, 464—474.

The author has examined further the amorphous yellow product obtained by the action of concentrated nitric acid on crude Para caoutchouc (see this J., 1902, 626, 1404). 50 grms. of crude Para rubber in very small pieces were exhausted with acetone for the removal of resin, fat, and oils, and the residue was extracted successively with 4·4 per cent. caustic potash solution and distilled water, and dried *in vacuo* over sulphuric acid, till of constant weight. The caoutchouc so obtained is soluble in the usual solvents and also in melted paraffin, hot benzaldehyde, and quinoline. The crude rubber also is soluble in the two latter solvents. From a warm quinoline solution the caoutchouc separates on cooling, and also on treatment with ether, in the form of elastic structureless pellicles, which can be kneaded together and remain plastic for a long time. The best results on nitration were obtained with red fuming nitric acid. The nitro product is soluble in glacial acetic acid, acetone, and quinoline, but is reprecipitated from solution by ether. The alkali salts of the product are soluble in water. From the results of reduction, acetylating, and other experiments, the author concludes that the nitro product is the 5.6-dinitro-2.3-dihydro- or 3.6-dinitro-2.5-dihydrocumic acid, $C_3H_7.C_6H_4(NO_2)_2.COOH$.—A. S.

Caoutchouc and its Distillation Products; Chemistry of ——. R. Ditmar. Ber., 1904, **37**, 2430—2434.

The author considers that the product obtained by Wallach (Annalen, **238**, 87) by the action of fuming nitric acid on the sesquiterpene, $C_{15}H_{24}$, isolated from cubeb, patchouli, galban, cade, and sabine oils, is identical with the dinitro compound (5.6-dinitro-2.3-dihydro- or 3.6-dinitro-2.5-dihydrocumic acid) formed by the action of nitric acid on rubber (this J., 1902, 626; Ber., 1902, **35**, 1948, 3265; also preceding abstract). From the behaviour to nitric acid of the products of the destructive distillation of caoutchouc, the author concludes that this nitric acid reaction is a general one for sesqui-, di-, and polyterpenes. 0·5 kilo. of crude Para rubber was destructively distilled, and the crude oil obtained, the so-called "cautchoucine" fractionated, the following portions being collected:—(1) 35°—70° C., isoprene fraction, colourless, very mobile liquid; (2) 70°—150° C., slightly yellowish, mobile liquid; (3) 150°—200° C., dipentene fraction, brownish, mobile liquid; (4) 200°—300° C., hevene fraction, dark brown, mobile liquid; and (5) above 300° C., di- and polyterpene fraction, very dark brown, oily liquid. It was found on treating the fractions with nitric acid, that the course of reaction was different with the concentrated and with the fuming acid, but the final products were the same with both reagents. Fractions (1) to (4) gave resins; fraction (5) gave a solution which when poured into water yielded a large amount of the dinitro compound. From the resins yielded by (3) and (4), 0·1 and 0·8 grm., respectively, of the dinitro compound were isolated.

—A. S.

XIV.—TANNING; LEATHER, GLUE, SIZE.

(Divi-Divi) Pods of Cæsalpinia Coriaria from Indi Bull. Imp. Inst. (Suppl. to Board of Trade J.), 190 2, 92—93.

The sample (No. 18,545) consisted principally of husl
with a few small unbroken fruits containing one or tv
minute black seeds. It resembled in appearance the div
divi of commerce. In the following table are given tl
results of the chemical examination of the present sampl
two samples of Indian divi-divi previously examined, and
specimen received from Queensland in 1898:—

—	Indian Samples.			Queensla Sampl
	No. 18,545. Per Cent.	No. 8026. Per Cent.	No. 8028. Per Cent.	Per Ce
Tannin (calculated on material dried at 105° C.)	15·4	19·7	32·8	51·4
Total soluble matter	68·5	65·9	46·0	68·3
Moisture	13·3	12·8	13·1	15·9
Ash (calcium carbonate, with a little ferric oxide and silica).	2·6	3·1	3·3	2·2

The present specimen is thus of much better quality th
either of the previous Indian samples, and would probal
sell readily at 8*l.* 10*s.* to 11*l.* per ton.—A. S.

Bleaching of Leather. B. Kohnstein. Der Gerber, 19 30, 189—190.

Methods for bleaching leather may be divided into (
natural and (*b*) chemical processes. The former compi
the action of direct sunlight, only applicable to oil-leathe
and freezing, which gives a very soft leather. When
organic acids are used, it is advisable to dry out and tl
bleach, as such acids, if allowed to penetrate right thro
the hides, are difficult to remove by washing. Oxalic ac
sulphuric acid, and sulphurous acid vapour are used, a
lead acetate solution (9 kilos. in 320 litres of water), witl
subsequent bath of sulphuric acid (3½ kilos. in 320 litre
water). Potassium permanganate with sulphuric acid, a
hydrogen peroxide, have proved too costly; but the use
barium or sodium peroxide is established in America. T
last is employed as follows:—1 kilo. of sulphuric a
(66° B.) is poured into 400 litres of cold water, 1·75 ki.
of sodium peroxide are gradually added, and fin
ammonia until the liquor is faintly alkaline to litn
A bleaching effect is secured by mixing white or blu
white solid materials, such as talc, china-clay, or "baryte
with the fat-liquor.—R. L. J.

[Spueing] on Upper Leather: Formation of White Pat ——. W. Eitner. Der Gerber, 1904, **30**, 173—174

Museum specimens of chrome-leather containing 5 per ce
of grease (soap and moëllon and neatsfoot oil), which
been left in contact with vegetable-tanned leather (hors
containing 17 per cent. of grease, showed clearly-defi
white patches at the points of contact. These proved to
stearin crystals, which had penetrated right through
chrome-leather, and showed on both sides. No evide
could be obtained as to whether these had passed from
one leather to the other in a state of solution, *i.e.*, dissol
in the more fluid components of the grease used on
vegetable-tanned leather, or whether they had pa
directly through the membrane represented by the chro
leather as crystalloid substances are known to do.
author cites the appearance of magnesium sulphate on
surface of boots, arising from the loading material in
canvas linings, and considers, as a practical result,
stearine should be avoided in the fat-liquoring of chro
leather and the greasing of lightly tanned calf, whilst its
is indicated for heavily tanned or hot-stuffed chrome go

—R. L.

English Patent.

ides, Skins, and Sides of Leather ; Apparatus for Treating [Bleaching] ——. E. C. Amidon, Corry, Pa., U.S.A. Eng. Pat. 11,249, May 16, 1904. Under Internat. Conv., Jan. 28, 1904.

U.S. Pat. 759,844 of 1904 ; this J., 1904, 671.—T. F. B.

XVI.—SUGAR, STARCH, GUM, Etc.

English Patent.

rch and Dextrine : Method of and Apparatus for the Production of Soluble ——. Calico Printers' Assoc., Ltd., Manchester, and W. Browning and J. J. Barlow, Accrington. Eng. Pat. 19,499, Sept. 10, 1903.

Fr. Pat. 336,903 of 1903 ; this J., 1904, 419. –T. F. B.

French Patents.

rch : Process and Apparatus for the Continuous Extraction of ——. W. H. Uhland. Fr. Pat. 338,792, Nov. 11, 1903. (See this J., 1903, 642).

starch milk is directed downwards, the velocity of the rent being slowly and gradually retarded, the movement the deposited starch being accelerated as the lower part reached, while the water is drawn off laterally. The er part of the apparatus is cylindrical or polygonal, the er conical ; the supply pipe rests entirely submerged in ylinder to allow of the escape of entrained air, while a es of baffles directs the water laterally to the overflow, rate of escape being regulated by cocks. There is a cial arrangement for drawing off the separated starch, sisting of a cock of large diameter and wide aperture, capable of being closed or regulated instantly so as to off the starch at the exact speed found most suitable.
—L. J. de W.

roodextrin ; Process of Manufacturing —— by Treatent of Peat. G. Reynaud. Fr. Pat. 340,719, Feb. 25, 904.

U.S. Pat. 761,542 of 1904 ; this J., 1904, 721.—T.F.B.

VII.—BREWING, WINES, SPIRITS, Etc.

uminoïd - Content of Barley : Simple Method for easuring the ——, by Pappenheim's Triacid Solution. Lindner. Woch. f. Brau., 1904, 21, 397—398.

PENHEIM'S triacid solution (see U. Pepper, Woch. f. ., 1903, 20, [29]), which in the form of the base ins the colouring matter of Unna's Methylene Blue Eosine, has been suggested as a means of obtaining some of the proportion of albuminoids present in barley and od preparations. The author has examined, by means is dyestuff, three specimens of barley containing 8, , and 16·1 per cent. of albuminoids, determined by lahl's method. It was found that the principal seat of lbuminoids, which are coloured red by the above dyelies in the layers of cells situate immediately below the one layers and especially in the neighbourhood of the al furrow. Although there is a considerable difference pearance between the cross sections of the barley conig 8 per cent. and of that containing 16·1 per cent. of inoids, yet no conclusion can be drawn therefrom rning the whole corn. The author therefore adopted rocedure made use of by Weissbein in the examinaf food preparations ; 0·2 grm. of the finely-powdered was placed in a small tube, together with 10 c.c. ter and 6 drops of the dyestuff solution. The tube vell shaken up several times, and at the end of five es was centrifugalised in a hand machine. In two es the meal was found to be collected at the pointed f the tube, and the coloured liquid was poured off. nove excess of the dyestuff, the meal was stirred up c.c. of water, the volume of which was then made up ut 10 c.c. ; this liquid was then separated by centrifug. The appearance of the residue varies considerably, barleys poorest in albuminoids appearing blue to green, the others being sprinkled with red. In order to compare different barleys better, the residual meal was stirred up with 1 c.c. of water and quickly poured out on to a stiff card and spread out so as just to cover a circle " 10 cm." in diameter, any liquid being then removed by means of filter paper. When dry the various preparations may be compared with one another and with a permanent preparation. Working thus it is easy to analyse four barleys in this way in 20 minutes, and so discover whether they are rich or poor in albuminoids.—T. H. P.

Malt with Short Acrospire and the Beer yielded by it. R. Holzhauser. Woch. f. Brau., 1904, 21, 403—404.

In the preparation of malt with short acrospire growth, which the author recommends for beers of the Pilsener type, it is important not to steep for too great a period. Using the aëration method of steeping, a total of 26 hours under water and 26 hours dry is sufficient. The author gives the details of his method of flooring, by which he obtains an acrospire of $\frac{1}{2}$ to $\frac{2}{3}$ of the length of the corn and with moderately short, stout rootlets. No heating takes place during the flooring, the highest temperature attained being 61°—63° F. Low temperatures are so easily maintained that it is possible to steep 6—10 per cent. more barley for the same floor area than when the old method is used. The green malt is thoroughly dried on the upper floor of the kiln, and is then dried off at an average temperature of 194° F., which is maintained for $3\frac{1}{2}$ hours. The malt prepared in this way is mealy, has a somewhat aromatic flavour, and seldom contains steely-ended corns. The yield of malt is very high, often reaching 80 per cent., and the colour of the laboratory wort corresponds with 0·25 c.c. of N/10 iodine solution. The mashing method used by the author is a rapid process, the temperatures being 149°, 158°, and 167° F. Saccharification takes place quickly and both the first and second worts are perfectly clear. The average extract obtained is 72·5—73 per cent. calculated by Windisch's tables. The first half-dozen brews carried out by this method deposited large quantities of albuminoid matter on fermentation and the beers cleared slowly, although perfectly, in the lager cellar ; with subsequent worts, however, a normal behaviour was obtained. The course of the primary and after fermentations shows that the wort yielded by malt with short acrospire growth contains considerably more malto-dextrins and dextrin than wort prepared by the same mashing process from malt with greater acrospire development. The final beer is pure yellow in colour, has a full malty flavour and a pleasant bitter taste, and retains its head extremely well. During a severe winter it showed no inclination to become turbid, and can be kept for five weeks without forming any deposit.
—T. H. P.

Pale, High-Dried Malt : Preparation of ——. F. Soding. Woch. f. Brau., 1904, 21, 438—439.

In the kilning of pale malt at high temperatures, it is important that the malt should be well dried on the upper floor of the kiln before it is passed down to the lower floor. The temperature must be kept down until the combes can be readily rubbed off between the hands. Any cooling of the malt on the upper hearth, such as may take place in wet weather, must be avoided, as it is always accompanied by increase in the colour. The author therefore passes the air through a layer of dry malt combes spread on a small wire floor, all moisture being in this way removed from the air. High-dried pale malt must not be stored warm, as it speedily deteriorates ; it is therefore advisable to spread it out immediately after unloading, the small amount of moisture absorbed having no prejudicial effect on the wort. Beer prepared from malt kilned in this way has a full taste and pleasant aroma not met with in ordinary pale beers.—T. H. P.

Yeast ; Use of —— instead of Kräusen. G. Henne. Woch. f. Brau., 1904, 21, 427.

The advantages of adding yeast to beer after the primary fermentation instead of "kräusening" are greater brilliancy,

better keeping quality, and retention of head, and the absence of any raw unripe taste. The addition of the yeast, the great disadvantage of which is the time taken up, especially in large breweries, is carried out as follows: About a bucketful of beer is taken from the cask, mixed intimately with healthy, thick, pasty yeast, and returned to the cask through a funnel. As vigorous frothing takes place, it is necessary to wait a little while in order to fill the cask completely, and when this is done the cask is tightly bunged again. About 2 litres of the pasty yeats should be taken to 20 hectolitres of beer (*i.e.*, 0·1 per cent. by vol.). Mixing the yeast with boiled and cooled water before adding to the beer is not recommended, as the cooling of the water occupies considerable time. In the case of a beer which had become turbid and had assumed a very unpleasant flavour and smell, the author added about 4 litres of extremely vigorous pasty yeast to each cask. After being kept tightly bunged for 12—14 days, the beer became "water-white" and regained its normal pleasant flavour. This result is brought about by the agglomeration of the bacteria by the glutinous cell membrane of the yeast.
—T. H. P.

Bacterial Infection in the Brewery: Detecting ——. Falk, Hausmann, and Luff. Z. ges. Brauw., 1904, **27**, 524—528.

In the detection of bacterial infection in wort, beer, &c., by the pure yeast fermentation method first recommended by Prior, it is found that the yeast sediment deposited after 9—10 days rarely exhibits traces of bacteria, these (especially sarcina and lactic bacilli) not developing until the samples have been forced at 25° C. for 8—10 days in small sterilised flasks. Sporagenic yeasts, however, may be detected in the original sediments. Two cases of infected breweries have been successfully dealt with by this method.
—C. S.

Beer; Action of —— *on Metals.* H. Seyffert. Woch. f. Brau., 1904, **21**, 398—400.

Cold brewery wort, left for some time in contact with sheet-iron, dissolves some of the latter, which can be readily detected in the liquid. When such wort is fermented, a considerable proportion or, in some cases, all of the iron is removed and passes into the yeast. The presence of iron in the beer injures the head-retaining properties. Also, beer in which iron, copper, or tin is immersed, becomes turbid, the action being especially rapid with the first two metals; with lead, no turbidity is obtained. With practice, the author's palate became very sensitive to iron in beer, so that he was able to detect quantities of this metal too small to be recognised by direct chemical tests. These small proportions of iron give to the beer a certain dryness and thinness of taste. The author's experiments show that beer should never be allowed to come into contact with an iron surface, and that contact with bright copper or brass should be as limited as possible. Tinned iron, which is so frequently used in beer filters, racking apparatus, &c., is especially dangerous, and should never be employed. Only well-tinned copper and brass are allowable, and these must be previously treated for some time (at least 24 hours) with beer residues, so that the white surface of the tin becomes slightly yellowish. Such apparatus should never be vigorously brushed or treated with alkalis, otherwise the thin protective coating may be removed. In general, thorough washing, first with cold, and then with hot water is sufficient. But when the wire gauze of the filter becomes stopped up, and it is necessary to clean it thoroughly with brushes and alkali or acid, it should be subsequently soaked in beer residues before being used again. The whole of the tin present in the beer may be readily precipitated in the following manner: 1 litre or more of the beer is rendered faintly alkaline with sodium carbonate, and heated to 60° C., by which means a flocculent precipitate, which readily settles, is formed. The clear supernatant beer is siphoned off and the residue filtered, dried, and ignited, the ash thus obtained being tested for tin. It is probable that the precipitate formed consists of a compound containing tin, phosphoric acid, and protein.—T. H. P.

Spirit; Production of Cheap —— *for Technical Purpose* M. Delbrück. Z. Spiritusind., 1904, **27**, 301.

Although 1 litre of petroleum furnishes 10,000 units c heat on combustion against 6,000 units yielded by 1 litr of alcohol, it is still possible for the latter to compete wit the former for incandescent lighting purposes, provide that the price of alcohol is to that of petroleum in the pr portion of 3 : 2. In countries where petroleum is des this ratio is more nearly reached than in Germany, but, the same time, the fiscal regulations of the latter countr are of great assistance. With regard to the manufactu of cheap spirit, a decrease in the cost of production considered likely by the author. Cheaper raw material the use of the beetroot and its by-products, and th cultivation of new varieties of potatoes, will diminish th price of the alcohol, as will also the protection of the ra materials from decomposition, caused by enzymes and th like. It will be found cheaper to dry potatoes instead storing them in their natural state, the cost of drying w more than compensating for the loss which occurs on lon keeping. The introduction of the "amylo" process fro Japan has considerably cheapened the production alcohol. This process gives practically a theoretical yie of alcohol combined with a great saving of malt, the latt being only used in sufficient quantity to liquefy the mas Saccharification is brought about by inoculating the mas with the fungus *Amylomyces Rouxii.* The production, b patent apparatus, of alcohol of high percentage direct fro the mash is of great importance. This strong alcohol less contaminated by storage in wooden barrels than weaker spirit, and is consequently preferable for technic uses.—W. P. S.

Arsenic; Electrolytic Methods for the Detection and D termination of Minute Quantities of —— *in Beer, Ma Foodstuffs, &c.* W. Thomson. XXIII., page 799.

IX. Peroxydase Reaction; Velocity of ——. A. Bach and R. Chodat. XXIV., page 802.

English Patent.

Casks, Boxes, and other Receptacles; Impermeable Co ings or Linings for ——. J. Wetter. Eng. Pat. 16,4 1903. I., page 779.

United States Patent.

Brewing Kettle, Hop-Jack Tank, and Cooker; Combi ——. C. F. Hettinger, Boston, Mass. U.S. Pat. 763,6 June 28, 1904.

The claims are for the combination with a vessel adapted be used as a cooker, brewing-kettle, and "hop-jack tan an agitator therein, means for heating the same, of a "cle out" in the bottom thereof and located at its lowest p and of a telescopic hop strainer removably attached to directly over the clean-out, and means for remova attaching the hop-strainer from the outside of the vesse, outlet, and a valve on the clean-out to lead the content the kettle to either a mash-tub or through a second strai into a beer-cooler.—L. J. de W.

French Patent.

Alcohol Vapour; Apparatus for Preventing Loss of — *in Alcohol or Brandy Distilleries.* J. Szabo Szathmary. Fr. Pat. 340,581, Feb. 20, 1904.

See Eng. Pat. 4011 of 1904; this J., 1904, 452.—T. F.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Margarine; Characteristic Values of ——. E. Ru and V. H. Kirkham. XXIII., page 801.

uit Juices ; Use of Preservatives in ——. G. Heinzelmann. Z. Spiritusind., 1904, **27**, 299.

IE use of salicylic acid for preserving fruit juices has actically ceased in Germany, as the result of regulations sed on the medical opinion that this acid is injurious to alth, even in the small quantities employed for preserving rposes. Hydrofluoric acid having recently been detected fruit juices, the author points out that there is a preservae on the market bearing the name "Frut," which nsists of an aqueous solution of hydrofluoric acid. This sold in special prepared flasks, and a powder is also ppiied at the same time, consisting of calcium carbonate. ie latter is to be added to the fruit juices before they are ought into use, in order to precipitate the hydrofluoric acid calcium fluoride. As it is quite likely that in some cases sufficient calcium carbonate may be added, leaving excess hydrofluoric acid in the juice, the use of this preservative very objectionable. The most suitable preservative is cohol, provided that a declaration of its presence be made. —W. P. S.

rsenic ; Electrolytic Methods for the Detection and Determination of Minute Quantities of —— in Beer, Malt, Foodstuffs, &c. W. Thomson. XXIII., page 799.

English Patent.

luble Albumin [Casein] from Milk ; Manufacture of ——. C. Lewis, Toronto. Eng. Pat. 11,094, May 13, 1904.

SUFFICIENT quantity of alcohol is added to skimmed lk to cause precipitation of the casein and albumin. The ter are then separated, ground, and dried at a temperature ow 149° F. to form the product claimed.—W. P. S.

United States Patent.

aporating Liquids ; Apparatus for ——. M. Ekenberg, Assignor to Martin Ekenberg's Aktiebolag, Stockholm. J.S. Pat. 764,995, July 12, 1904.

e Eng. Pat. 10,124 of 1903 ; this J., 1903, 878.—T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

English Patent.

cose ; Manufacture or Treatment of Threads or Filaents from ——. C. H. Stearn and C. F. Topham. Eng. 'at. 16,604, July 28, 1903. V., page 784.

United States Patent.

'ulose ; Process of Converting Wood ——. M. F. wen and G. H. Tomlinson, Chicago. U.S. Pat. 763,472, ane 28, 1904.

LLULOSE is converted into fermentable sugar by heating . closed vessel with sulphurous acid gas to 120°—160° C., l the conversion is effected. The gaseous product ved from heating a solution of sulphurous acid is passed ntil the vessel contains about 3 per cent. of sulphur ide and about 60—70 per cent. of water on the weight he sawdust, and the mixture is heated by a separate ication of heat or by introducing steam to supply the and water required to bring about the conversion, so the pressure may be at least greater than three ospheres without increasing the temperature above C.—L. J. de W.

French Patent.

Paper ; Safety —— [and Ink]. J. Rowan. Fr. Pat. 340,837, Feb. 29, 1904.

Eng. Pat. 3909 of 1904 ; this J., 1904, 453.—T. F. B.

X.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

ine Glycerophosphates. P. Carré. Bull. Soc. Chim., 1904, **31**, 803—805.

c quinine glycerophosphate is obtained by mixing 1 mol. of lycerophosphoric acid (this J., 1904, 35 and 1128) 2 mols. of the base, in alcoholic solution ; if absolute alcohol be the solvent the resulting salt is anhydrous ; if 80 per cent. alcohol be used it contains 4 mols. of water of crystallisation. In either case it is precipitated from the alcoholic solution with ether. Dried at normal temperatures the hydrated salt has the formula—

$$CH_2OH.CHOH.CH_2.O.PO(O.C_{20}H_{24}N_2O_2)_2 + 4H_2O.$$

It is readily rendered anhydrous at 100° C., and then has the m. pt. 148·5° C. The hydrated salt begins to melt at 147° C.

Neutral quinine glycerophosphate is prepared as above, but with 1 mol. of acid and of base. It also forms anhydrous or hydrated crystals, according to the solvent used. The hydrated salt has the formula—

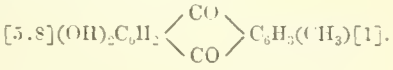
$$CH_2OH.CHOH.CH_2.O.PO(OH)_2C_{20}H_{24}N_2O_2 + 2H_2O.$$

It becomes anhydrous at 100° C., and melts at 151°—152° C. Both salts occur in fine acicular crystals. The basic salt is soluble in alcohol, insoluble in ether, sparingly soluble in water ; in the hydrated state it is insoluble in acetone, but it becomes soluble therein when anhydrous. The neutral salt is more soluble in alcohol and in water than the above ; in other respects its behaviour to solvents is the same. Since the hydrated salts are insoluble in acetone, they may be obtained in fine crystals by adding that body to the alcoholic solutions.—J. O. B.

Chrysophanic Acid and Emodin ; Constitution of ——. H. A. D. Jowett and C. E. Potter. Chem. Soc. Trans., 1903, **83**, 1327—1334.

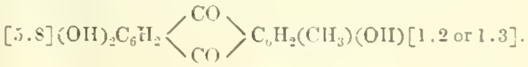
CHRYSOPHANIC acid and emodin are known to be respectively the di- and tri-hydroxy derivatives of a methylanthraquinone, but the position of the substituting groups has not yet been satisfactorily determined. Attempts to synthesise the compounds failed, but the results obtained enable the authors to propose, with a considerable degree of certainty, the following formulæ for them :—

Chrysophanic acid,



$$[5.8](OH)_2C_6H_2\left\langle\begin{matrix}CO\\CO\end{matrix}\right\rangle C_6H_3(CH_3)[1].$$

Emodin—



$$[5.8](OH)_2C_6H_2\left\langle\begin{matrix}CO\\CO\end{matrix}\right\rangle C_6H_2(CH_3)(OH)[1.2 \text{ or } 1.3].$$

—A. S.

Quercitol ; A Lævo-rotatory Modification of ——. F. B. Power and F. Tutin. Chem. Soc. Trans., 1904, **85**, 624—629.

BY extraction with alcohol, the authors isolated from the leaves of *Gymnema sylvestre* (Br.), a colourless crystalline compound, $C_6H_7(OH)_5.H_2O$, m. pt. 174° C. ; $[\alpha]_D = -73·9°$. The compound is thus a hydrated lævo-rotatory quercitol. It loses its water of crystallisation at 110° C. Like *d*-quercitol it yields malonic acid on oxidation with permanganate, and a diketotrihydroxyhexahydrobenzene when oxidised with sodium hypobromite.—A. S.

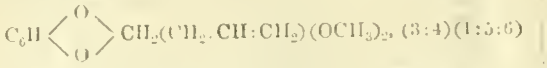
Oil of Turpentine ; Action of Salicylic Acid on ——. E. Tardy. J. Pharm. Chim., 1904, **20**, [2], 57—58.

HAVING set aside for some years the viscous liquid esters obtained by the action of salicylic acid on oil of turpentine and subsequent fractionation, it was recently found that these had crystallised to a fine crop of bornyl salicylate, m. pt. 44°—45° C., $\alpha_D - 34° 20'$. The oily liquid originally obtained was therefore mainly bornyl salicylate, prevented from rapid crystallisation by the presence of adherent impurities. Attention was directed to these abandoned experiments by the recent publication of a patent for the preparation of borneol, isoborneol, and camphor from oil of turpentine by the action of salicylic acid, and the subsequent saponification of the esters thus formed.—J. O. B.

Dill- and Parsley-Apiols ; Constitution of ——. H. Thoms. Archiv der Pharm., 1904, **242**, [5], 344—347.

THE behaviour of the ethylated phenol in the case of dill-apiol shows that the ethoxy group must be in the para-position ; while in the formation of a quinone from the ethylated product an ethyl and a methyl group are split off.

The two methoxyl groups are therefore present in juxtaposition, and dill-apiol is a (1) allyl- (5.6) dimethoxy-(3.4) methylenedioxybenzene—



$C_6H\langle O_2 \rangle CH_2(CH_2.CH:CH_2)(OCH_3)_2$, (3:4)(1:5:6)

Parsley apiol, on the other hand, has been shown by the author to be (1) allyl (2.5) dimethoxy (3.4) methylene dioxybenzene (this J., 1903, **22**, 1255).—J. O. B.

Matico Leaves; [*Essential*] *Oil of* ——. H. Thoms. Archiv der Pharm., 1904, **242**, 328—344.

The oil employed had the sp. gr. 1·1343. Fractionated in an atmosphere of carbon dioxide, it gave 1·9 per cent. at 270° C.; 17·1 per cent. at 270°—282° C.; 46·0 per cent. at 282°—286° C.; 20·1 per cent. at 286°—288° C.; and 11·9 per cent. of resinoid residue. These fractions were refractionated under reduced pressure, and the following constituents isolated. A hydrocarbon boiling at 121°—130° C. under 13 mm. pressure, solidifying at −18° C. A trace of an unidentified phenol ester, which gives a bromo derivative, m. pt. 123°—124° C. A considerable amount of dill-apiol; a small quantity of parsley-apiol. No matico camphor or asarone, such as was found in commercial matico oil 20 years ago, could be isolated. Nor could the matico ether, $C_{11}H_{18}O_4$, of Fromm and Emster be isolated as a distinct body. This supposed constituent was probably a mixture of the two apiols. Similarly, the so-called maticoic acid obtained by those authors by oxidation with permanganate, is a mixture of dill-apiolic acid, m. pt. 151° C., and parsley-apiolic acid, m. pt. 175° C. No proof of the splitting off of carbon and oxygen atoms, by means of bromine, as stated by Fromm and Emster, could be established. Doubtless these investigators were dealing with a mixture of bromo-bodies containing tribromo-apiol, which, however, they failed to isolate. The author finds that the bromo derivatives of the lower boiling fractions of matico oil have relatively higher melting points, contain more bromine, and possess a lower methoxyl content. The richer in apiol the fractions, the lower are the melting points of its bromo derivatives. The ratio of methoxyl contained in them is in inverse proportion to the amount of bromine.
—J. O. B.

Tacamahac Resin, Commercial; *Constitution of* ——. A. Tschirch and O. Saal. Archiv der Pharm., 1904, **242**, [5], 395—400.

The resin [a fragrant oleo-resin of undetermined botanical source, allied in properties to elemi] was insoluble in water, soluble in most organic solvents, including light petroleum spirit and carbon bisulphide. Its alcoholic solution has an acid reaction. The resin, purified from foreign matter by solution in ether, melts at 85°—87° C. It contains 3 per cent. of gum; 0·5 per cent. of tacamahinic acid, $C_{43}H_{77}O_2$, amorphous, melting at 95° C., removed by shaking out the ethereal solution with 1 per cent. ammonium carbonate solution; 0·5 per cent of tacamaholic acid, $C_{15}H_{25}O_2$, m. pt. 104°—106° C., removed by dilute sodium carbonate solution; 3 per cent. of essential oil with a camphoraceous and turpentine odour, the greater part distilling between 170° and 175° C., the rest between 175° and 210° C.; 50 per cent. of α-takoresene and 30 per cent. of β-takoresene: the former, $C_{21}H_{35}O$, insoluble in alcohol, sp. gr. 0·892, m. pt. 93°—95° C.; the latter, $C_{15}H_{25}O$, soluble in that solvent; m. pt. about 82° C.; with traces of bitter principle and 10 per cent. of foreign impurities.—J. O. B.

Digitalin; *Detection of* ——. C. Binz.
XXIII., page 800.

English Patents.

Pharmaceutical Compound [*Trichlorisopropyl Alcohol*]; *Manufacture of* ——. H. E. Newton. From the Farbenfabriken vorm. F. Bayer and Co., Elberfeld. Eng. Pat. 18,245, Aug. 24, 1903.

Methyl bromide or other halogen methyl compound is mixed with dry alcohol-free ether and allowed to act upon magnesium filings. Dry chloral in dry alcohol-free ether is added, when a halogen magnesium compound of trichlor isopropyl alcohol is formed, $CCl_3.CH(OMg.halogen).C$l When this latter is decomposed by ice-water, trichloroisopropyl alcohol is liberated, melting at 48°—49° C. aft recrystallisation.—F. S.

Alcohols and Alcohol Derivatives applicable as or in t Manufacture of Perfumes, Flavourings, or the like, a of Primary Alcohols generally; *Manufacture of* —. L. Bouveault and G. Blanc, Paris. Eng. Pat. 14,7 July 2, 1903.

The preparation of the following new alcohols is claimed Methyl-3-nonanol-1; dimethyl-3:7-octene-6-ol-1; unde lene-10-ol-1; oleic alcohol; hexahydrobenzyl alcoh campholene alcohol; campholic alcohol; paramethox phenyl-2-ethanol; 2:2-dimethylbutanediol-1:4; 2:2 methylpentanediol-1.5; 2-methylhexanediol-1:6; octa diol-1:8; decanediol-1:10. Also derivatives of the n alcohols, *viz.*, butyrate, valerate of nonyl and of dodec oxide, acetate, and butyrate of campholene alcohol; bu rate and valerate of phenylethyl; formate, acetate, butyra and valerate of phenylpropyl; acetate of paramethoxyphen ethyl; oxide of methyloctyl. These alcohols are manuf tured by reducing the corresponding acid ester with sodi in absolute alcohol. The alcohol and ester must be f from all traces of moisture to secure the best yield.—F. S

Oxybenzaldehydes and Oxybenzoic Acids; *Manufact of* ——, *and Intermediate Products of the said Ma facture*. J. Y. Johnson, London. From The Badis Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. E Pat. 17,347, Aug. 10, 1903.

Aromatic sulphonic acid esters of cresols, obtained by action of an aromatic sulphonic chloride on a dilute alka solution of a cresol, are oxidised to the correspondi sulphonic esters of hydroxybenzaldehyde and hydro benzoic acid by means of manganese dioxide and sulph acid. 500 parts of the benzenesulphonic acid ester o-cresol are mixed, at 100° C., with 300 parts of mangan dioxide and 800 parts of 70—80 per cent. sulphuric ac the mixture is agitated for four or five hours at the s temperature, and diluted with about 900 parts of water allowed to stand in a warm place. The oily product wh separates is mixed with cold, dilute caustic soda solut filtered, and acidified, when the benzene sulphonic acid e of salicylic acid separates. "The reaction product rem ing undissolved" is mixed with bisulphite solution, and aldehyde-bisulphite compound decomposed by means alkali, the benzenesulphonic ester of salicylic aldeh being obtained. These esters are easily saponified to corresponding hydroxy acids and hydroxy aldehydes.
—T. F. B

Pinene Hydrochloride; *Purification of* ——. F. Lie (Chem. Fabr. Uerdingen, Lienau, and Co.) and Naschold, Uerdingen-on-Rhine, Germany. Eng. I 14,189, June 25, 1903.

See Fr. Pat. 328,009 of 1902 and addition thereto; J., 1903, 1101, and 1904, 336.—T. F. B.

United States Patents.

Isoionone; *Homologues of* ——, *and Process of Ma same*. R. Schmidt, Assignor to Haarmann and Rei Chem. Fabr. zu Holzminden, G. m. b. H., Holzmin Germany. U.S. Pat. 762,765, June 14, 1904.

Isomers of cyclic homoionones are obtained by treatin mixture of cyclocitral (or its isomers) and "homolog ketones" with condensing agents; the resulting compou possess the odour of violets and orris (See Ger. Pat. 116, of 1898; this J., 1901, 150).—T. F. B.

Saponin, and Process of Making same. R. Kob Rostock, Assignor to Firm of E. Merck, Darmst. U.S. Pat. 763,003, June 21, 1904.

Guaiacum extract containing saponin is treated with l acetate, thereby precipitating the lead salt of the saponin; the neutral saponin is precipitated as its lead r treating the filtrate with lead subacetate; neutral ponin is obtained from its lead salt, by treatment with lphuretted hydrogen, in the form of a powder soluble alcohol, but insoluble in ether, and precipitated from its queous or alcoholic solution on addition of ammonium lphate.—T. F. B.

Extracts; Process of Increasing the Solubility of ——. J. Maggi, Paris. U.S. Pat. 764,483, July 5, 1904.

ee Fr. Pat. 330,691 of 1903: this J., 1903, 1078.—T. F. B.

French Patent.

lucinium Hydroxide; Process for Obtaining Pure ——. G. van Oordt. Fr. Pat. 340,027, Jan. 29, 1904.

r digesting a mixture of the hydroxides of glucinium, uminium, and iron, with water, dilute ammonia, &c., or ith insufficient alkali hydroxide solution to dissolve the droxides, the glucinium hydroxide is rendered very soluble in acids and dilute alkalis; if the iron be then moved by means of acid, and the alumina by long ating with just sufficient alkali hydroxide, fairly pure ucinium hydroxide is obtained; this can be further eed from traces of iron and aluminium hydroxides by ssolving in acetic acid, evaporating the solution to dryness, eating with glacial acetic acid, again evaporating to yness, and extracting the iron and aluminium acetates by eans of water, and then extracting the pure glucinium etate by means of chloroform.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

lver; Influence of the Character of Developers on the Size of Grain of Reduced ——. A. and L. Lumière and A. Seyewetz. Brit. J. Phot., 1904, **51**, 630—631.

e size of the grain of reduced silver, as produced by the rious developers in common use, is practically invariable, l temperature (between 5° and 35° C.) and concentration the developer would appear to be without influence also; y protracted development tends to cause a diminution the size of the grain, whilst excess of alkali or alkali omide produces a very slight enlargement of the grain. ehle developers, such as *p*-phenylenediamine or *o*-amino-enol, when used with sodium sulphite, produce a deposit nilar to that obtained with collodion emulsions, and of a ch finer grain than that given by the other developers; addition of alkali carbonate, however, the size of the in increases until the "normal" composition of developer eached, when the size and appearance of the grain are nost identical with those produced by other developers. —T. F. B.

tassium Metabisulphite and Sodium Bisulphite; Alteraion of —— *when exposed to Air.* A. and L. Lumière nd A. Seyewetz. Brit. J. Phot., 1904, **51**, 645—646.

lid potassium metabisulphite is not appreciably altered exposure to air, even at a temperature of 100° C. In tion, gradual oxidation occurs, the rate of decompoon being greater the more dilute the solution; the tions are much more stable than those of sodium phite of the same strength (see this J., 1904, 488), a 1 per t. solution of the latter being totally oxidised after one k, whilst a 1 per cent. solution of potassium metalphite is only oxidised to the extent of about 22 per t. after three weeks; in the more concentrated solutions difference is less marked, though very apparent. stallised sodium bisulphite deteriorates rather rapidly exposure to air, the decomposition being more rapid in ist air. In solution, the salt behaves very similarly potassium metabisulphite. On the whole, however, ydrous or normal sodium sulphite seems most suitable photographic use, since the use of metabisulphite essitates the addition of measured quantities of alkali at time of development.—T. F. B.

English Patent.

Pictures or the like by Aid of Catalysis; Reproduction of ——. A. G. Bloxam, London. From the Neue Photographische Gesellschaft, Berlin. Eng. Pat. 18,370, Aug. 25, 1903.

The present invention consists in substituting a stable catalyst for the silver in negatives. For this purpose the negative is treated with either (1) a solution of manganic hydroxide in tartaric acid, afterwards rendered alkaline with sodium hydroxide; (2) a solution of potassium permanganate mixed with an excess of sodium tartrate; (3) a solution of potassium permanganate and tartaric acid rendered alkaline with sodium hydroxide; or (4) a saturated solution of sodium tartrate in which is dissolved a mixture of potassium permanganate and manganous sulphate. The negative or picture is then washed for a short time and brought into a solution of potassium ferricyanide and sodium hydroxide. The negative thus obtained is well suited for catalytic multiplication by means of hydrogen peroxide. After long use its activity may be restored by means of ammonia vapour.—W. P. S.

French Patent.

Photographic Papers; Process for the Preparation of ——. I. Hoffsümmer. Addition, dated Feb. 3, 1904, to Fr. Pat. 336,873, Nov. 21, 1903.

See Eng. Pat. 3855 of 1904; this J., 1904, 622.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

English Patent.

Explosives. H. H. Lake, London. From Dynamit-Act.-Ges., vorm. A. Nobel and Co., Hamburg. Eng. Pat. 14,825, July 3, 1903.

See Fr. Pat. 333,443 of 1903; this J., 1903, 1367.—T. F. B.

United States Patent.

Nitrating Fibrous Matter; Process of ——. J. Selwig, Brunswick. U.S. Pat. 764,776, July 12, 1904.

See Fr. Pat. 327,802 of 1902; this J., 1903, 963.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUANTITATIVE.

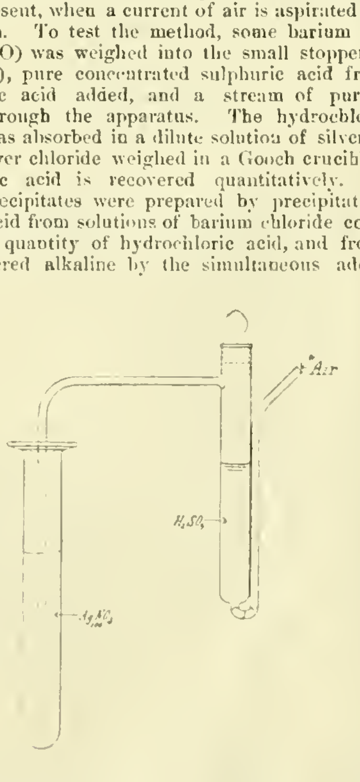
Arsenic; Electrolytic Methods for the Detection and Determination of Minute Quantities of —— *in Beer, Malt, Foodstuffs, &c.* W. Thomson. Memoirs and Proc. Manchester Lit. and Phil. Soc., 1904, **48**, Part III.

The apparatus designed by the committee appointed by the Commissioners of Inland Revenue for the electrolytic detection and determination of arsenic does not, in the author's hands, produce a mirror when less than $\frac{1}{300}$ grain of arsenic per gallon is present, using 50 c.c. of the solution. With a cathode composed of granulated zinc, connected with the battery by a platinum wire, much better results were obtained, but, when working with 0·001 gr. per gall. the mirror produced was not so intense as that obtained with the Marsh-Berzelius method. The form of apparatus ultimately adopted, and which gave mirrors of equal intensity to those obtained with the Marsh-Berzelius apparatus, consists of a porous pot, 3 ins. high by $1\frac{1}{2}$ in. diameter, surrounded, as in the "Committee's" apparatus, by a band of platinum foil, which serves as anode. A glass stopper is ground into the top of the porous pot, and is provided with two openings; through one of these, the narrowed end of a zinc rod projects, and is connected with the negative pole of the battery; the other opening serves both for introducing the liquid to be tested and as an exit for the hydrogen. The whole apparatus is placed in a glass beaker, about $\frac{1}{5}$ in. more in diameter than the external diameter of the porous pot, thus necessitating the use of only a small amount of sulphuric acid. In other respects, the apparatus is similar to that devised by the "Committee."

It is found that a current of 3 ampères is preferable to one of 5 ampères, as the mirrors obtained with the former are less spread out over the tube, and therefore easier to compare. Experiments showed that all the arsenic was collected in the form of a mirror 40 minutes after the introduction of the liquid, and that, with this form of apparatus, arsenic as well as arsenious compounds were completely reduced without addition of metabisulphite. A series of experiments showed that the addition of amyl alcohol to prevent frothing (as recommended by the Committee) resulted in the formation of smaller deposits of arsenic than when no amyl alcohol was used; in fact, an experiment with as much arsenic as is permissible in beer (50 c.c. of a solution containing $\frac{1}{200}$ gr. of arsenious oxide per gallon) no mirror was produced when amyl alcohol was added. Glucose was also found to have a marked influence in preventing the formation of mirrors. It is concluded that, in using 25 c.c. of beer, as recommended, and destroying organic matter, a very faint mirror is produced from beer containing 0·01 gr. per gallon, but when beer is used direct with amyl alcohol, no mirror is produced, and therefore the direct method fails to detect an amount of arsenic considerably greater than that which the committee regard as sufficient to condemn the sample.
—T. F. B.

Barium Sulphate; Chlorine in precipitated ——. G. A. Hulett and L. H. Duschalk. Z. anorg. Chem., 1904, **40**, [2], 196—217.

The "occlusion" of barium chloride by precipitated barium sulphate, and its non-removal by calcining, extracting with acids, and washing with water, has so far been quantitatively investigated only by Richards and Parker (Amer. Acad. Sci., **31**, (1896), 67), the determination of the amount of chlorine present being very difficult. The authors make use of the fact that barium sulphate is completely soluble in concentrated sulphuric acid, and loses any chlorine present, when a current of air is aspirated through the solution. To test the method, some barium chloride ($BaCl_2.2H_2O$) was weighed into the small stoppered tube (see figure), pure concentrated sulphuric acid free from hydrochloric acid added, and a stream of purified air bubbled through the apparatus. The hydrochloric acid liberated was absorbed in a dilute solution of silver nitrate, and the silver chloride weighed in a Gooch crucible. The hydrochloric acid is recovered quantitatively. Barium sulphate precipitates were prepared by precipitation with sulphuric acid from solutions of barium chloride containing a constant quantity of hydrochloric acid, and from solutions rendered alkaline by the simultaneous addition of barium hydroxide solution. The chlorine present in the precipitates was determined, and found to be 0·27—0·64 per cent. in the case of the hydrochloric acid solution, and 0·158 per cent. in the case of the alkaline solution, 0·096 per cent. of this latter being volatile. Barium sulphate precipitated from barium hydroxide solution with sulphuric



acid does not "occlude" chlorine after shaking for 20 d
with a solution of barium chloride. On heating preci
tated barium sulphate between 300° and 650° C. it lo
water and volatile chlorine. Between 650° and 900° C.
residue consists of barium sulphate and barium chlori
On further heating between 900° and 1100° C. it again lo
in weight, and the residue shows an alkaline reaction.
the determinations were carried out in platinum or J
glass vessels, the barium sulphate in the wash waters
recovered, and all weighings reduced to vacuum.
authors consider the "occlusion" of chlorine in the p
cipitates to be due to the presence of HSO_4' and $BaCl^{\cdot}$ i
in the solution, causing the precipitation of BaCl.HS
They confirmed this by precipitating barium platinocyani
$BaPt(CN)_4$, solution with magnesium sulphate soluti
when the theoretical quantity of barium sulphate
obtained. They recommend the calcining of barium s
phate precipitates at 700° C. and subsequent determinat
of the barium chloride present.—L. F. G.

Sulphur in Iron; Rapid Method for the Determination
Total —— *by Evolution*. S. S. Knight. Amer. Che
J., 1904, **32**, 84—85.

Two grms. of the sample of iron, mixed with 1 grm.
pure iron-dust, are placed in a porcelain crucible
covered with a layer of 1 grm. of iron dust. The wh
is covered with a disc of filter paper, the crucible lid
put in place, and the contents roasted strongly for
minutes by means of a blow-pipe flame. When nea
cool, the mass is decomposed by hydrochloric acid, and
evolved gases passed through a standard solution of c
mium chloride, which is subsequently titrated with stand
iodine solution. The results obtained by this meth
(which occupies less than half an hour) agree closely w
those obtained by slower methods, which have been pro
to be accurate.—T. F. B.

ORGANIC—QUALITATIVE.

Digitalin; Detection of ——. C. Binz. Arch. inter
de Pharmacod., 1904, **12**, 337. Biochem. Centra
1904, **2**, 701.

Grandeau's test (purple coloration with concentr
sulphuric acid and bromine water) did not give the cha
teristic coloration with Merck's "crystalline digitalin"
"crystalline digitoxin," whereas, on the other hand,
similar colorations were obtained with helleborein, stro
anthin, convallamarin, erythroplein, euonymin, cyclar
delphinin, saponine, silicin, amygdalin, benzaldehy
peronin, turpentine oil, terpene hydrate, abietic acid (c
talline), camphor, menthol, cubebin, solanine, bru
cytisine, veratrine, and agaricine. In the case of Tra
reaction (reduction of phosphomolybdic acid on heat
with the formation of a green coloration turning blu
the addition of ammonia) positive results were obta
with all the digitalin preparations tried, although in s
cases only after prolonged heating, whilst digitoxin
alcoholic solution only reacted after vigorous heating
long-continued cooling. The coloration was also obta
with helleborein, strophanthin, scillitoxin, convallama
cyclamin, delphinin, saponin, ricin, morphine, hero
peronin, strychnine, brucine, aniline, and phenacetin.
author concludes that if both tests give negative res
the absence of digitalin is certain, but that if the cha
teristic colorations be obtained, the absence of the o
substances named must be assured.—C. A. M.

ORGANIC—QUANTITATIVE.

Coal Analysis; A Frequent Cause of Error in ——
J. Alix and J. Bay. Comptes rend., 1904, **139**, 215—2

Coal nearly always contains considerable amounts
calcium carbonate, six samples tested showing a mean
4·99 per cent., corresponding to 2·06 per cent. of car
dioxide. When the coal is incinerated to determine
carbon content, a correction must therefore be made for
carbon dioxide arising from calcium carbonate, as oth
wise the carbon content would not give accurate indica
of the fuel value of the coal.—T. F. B.

Margarine; Characteristic Values of ——. E. Russell, and V. H. Kirkham. Analyst, 1904, **29**, 206—208.

Thirteen samples of commercial margarine examined by the authors gave the following results:—Valenta test (° C.) 62 to 96; Reichert value (7 samples), 0·5 to 5; water (6 samples), 9·9 to 18·7 per cent.; butyro-refractometer reading (10 samples), + 2·7 to + 9·4; oleo-refractometer reading (9 samples), − 4 to − 22; and iodine value, (4 samples), 48·5 to 79·8. They conclude from their results: (1) That Valenta figures above 89° C. are obtained when not more than traces of butter-fat or cotton-seed oil are present, butter-fat causing the greater depression. (2) That the presence of butter-fat reduces the butyro-refractometer and oleo-refractometer readings, whilst vegetable oil increases them. (3) That similar conclusions can be drawn from the iodine value. In the authors' opinion the amount of water and vegetable oil in margarine should be legally fixed.—C. A. M.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Radium; Origin of ——. H. N. McCoy. Ber., 1904, **37**, 2641—2656.

Radio-active substances are usually divided into those exhibiting permanent and those exhibiting temporary activity. The loss of activity is usually ascribed to change of chemical constitution. Sometimes two or more stages are passed through (the radium-emanation giving rise to the *x*-emanation, for example), but ultimately an inactive substance results. The permanence of the activity of the three so-called permanently active substances, uranium, thorium, and radium, is perhaps open to doubt. For, on the one hand, quantitative measurements of radio-activity are not very exact, and, such as they are, have only been made during a very few years; and, on the other, indications, if not proofs, of the slow decline of "permanent" activity are given by (1) the fact that at least the α- and β-radiations are material; (2) the proof, given by Rutherford and Soddy, that uranium-*x* (of temporary activity) is not an accidental impurity in uranium, but is generated from it, and that its rate of loss of activity indicates a "monomolecular reaction," *i.e.*, is proportional to its quantity; so that, though its mass is so small compared with that of the generating uranium that the latter may be considered as practically constant, yet it is undergoing loss in producing uranium-*x*, and that loss must become evident in time. The same is shown by the proof of Ramsay and Soddy that the ultimate transformation product of the radium-emanation is helium. (3) The almost certainty that radio-activity is not the result of external stimulation. As to the rate of loss of "permanent" radio-activity, Rutherford has estimated that in the case of radium the loss may be 1 1,000th of the total mass in a year, and in that of thorium about 1/1,000,000th as large. If that be so, many ages would be required for the final disappearance of radium from the earth, if it once existed in considerable quantity; while its present existence may be due to its being constantly formed from some much more slowly transforming substance to which radium would bear the same relation that uranium-*x* does o uranium. In theory, if a series of substances were transformable successively into one another—A→B→C→ ……N, he rate of transformation being in each case proportional to the mass of the transforming substance, then f the mass of A be supposed constant, B will be formed at a steady rate, but will decompose at a rate increasing with its quantity, till that rate rises to the rate of its formation; then its mass will be constant. The same will occur with C; and ultimately, if equilibrium is eached, the masses of B, C, &c. will be $\frac{k_a}{k_b}$ A, $\frac{k_a}{k_c}$ A, &c., where $k_a k_b$, &c. represent the amounts of A, B, &c., ransformed from unit mass in unit time. The amount of B, for instance, formed after any time t from the beginning, $\frac{k_a}{k_b}$ A $(1 - \epsilon^{-k_b t})$; an expression exactly similar to hat deduced by Rutherford and Soddy for the radioctivity produced by the formation of ThX in a thorium reparation. This last expression enables the time required for the production of any given fraction of the maximum or equilibrium-production of the substance concerned, to be deduced; thus for 99 per cent. and 99·9 per cent. of the maximum, the times required are $\frac{4\cdot6}{k}$ and $\frac{6\cdot9}{k}$. These times are inversely as the rates (k) of transformation; and a maximum will be practically reached in a very short time in any case in which the transformation-rate of the product is very great compared with that of the mother-substance. Applying this to radium, from the figure above given, we get t (for 99 per cent. of the maximum) = 4,600 years; so that any radium-containing mineral over 5,000 years old probably now contains practically its maximum amount of radium (on the assumption that k for the mother-substance is so small compared with k for radium that the mass of the former may be considered constant). The frequent association of radium with uranium-minerals, coupled with the fact that uranium is radio-active, and is probably transforming, though very slowly as compared with radium, suggest that uranium is possibly the mother-substance of radium. If this be so, all uranium minerals should contain radium, in amount proportional to their uranium-content. The author has examined 12 very different uranium minerals, and finds this to be very nearly the case, the figures representing the quotient of radio-activity by percentage of uranium varying from 18·9 to 24·7, with an average of 22·1. Pure uranium compounds gave a corresponding average figure (with greater variations, due no doubt to difficulties of purification) of 3·86; so that the old minerals, containing besides uranium their maximum amounts of its transformation products, are 5·7 times as active as the new uranium preparations. Apparently then, we have the series U → UX → Ra → RaEm → EmX → He, with possibly other end- or intermediate members. The transformation-rates of UX, RaEm, and EmX are vastly greater than that of radium; hence the amounts of these bodies present in the minerals are much smaller than that of radium. The activity of radium may be taken at 1½ million times that of uranium; and since the activity of radium in uranium minerals is (5·7 − 1 =) 4·7 times that of the uranium present, there should be about 1 part of radium to 300,000 of uranium in these minerals—a result agreeing well with those of experiment.—J. T. D.

Minerals; Examination of different —— *with respect to Radio-activity, by the Photographic Method.* F. Kolbeck and P. Uhlich. Centr.-Bl. f. Min. u. Geol., 1904, 206—208. Chem. Centr., 1904, **1**, 1632.

The authors find that the uranium pitchblende from the Vereinigt-Feld mine at Johanngeorgenstadt is more active than the Joachimstal ore. Other strongly active ores are uranotite and carnotite from Neustädtel - Schneeberg, orangite from Brevig, Norway, and monazite from Moss, Norway.—A. S.

Metals; Action of Radium on ——. N. Orloff. J. russ. phys.-chem. Ges., **36**, 41—45. Chem. Centr., 1904, **1**, 1639.

An aluminium plate, 0·1 mm. thick, which had been covered for some months with a small receptacle containing "0·03 grm." of radium bromide, was found to have numerous small globules of apparently fused metal on its under side. These protuberances were radio-active, and their activity was not diminished by seven months' exposure to the air, by washing the plate with alcohol, ether, or boiling water, nor by heating in a thermostat to 320° C.
—A. S.

Acid Sulphates; Decomposition of some —— *in Consequence of Mechanical Deformation.* W. Spring. Bull. Acad. roy. Belg, 1904, 290—309. Chem. Centr., 1904, **1**, 1630—1631.

A number of acid sulphates, both in the anhydrous condition and containing water of crystallisaton, were subjected to the action of strong pressure, with deformation, in a steel cylinder having a small hole in the bottom. Lithium hydrogen sulphate (lithium anhydrosulphate) was separated in this way into a constituent richer in acid (approximating to the composition, $9LiHSO_4.2H_2SO_4$) which flowed through the opening, and a residual portion nearly of the composition of the normal sulphate. With the salt $LiHSO_4.H_2O$, water also was separated. No distinct action was observed with sodium hydrogen sulphate (sodium anhydrosulphate) but with the various hydrates of this salt, especially at a somewhat higher temperature, large quantities of the water of crystallisation and a considerable amount of sulphuric acid were separated; at lower temperatures the water separated first. The acid sulphates of potassium, rubidium, and cæsium remained practically unaffected by the action of pressure. In a further series of experiments, mixtures of sodium hydrogen sulphate (anhydrosulphate) with various basic oxides (PbO, CuO, HgO, Ag_2O) were subjected to strong pressure. In completely closed cylinders no reaction took place, but when the pressure was accompanied by mechanical deformation, *i.e.*, when there was a small hole in the bottom of the cylinder, chemical reaction ensued until the acid contained in the acid salt was completely neutralised. A similar action is brought about by merely rubbing the two compounds together; *e.g.*, copper oxide forms a white compound, $CuSO_4.Na_2SO_4.H_2O$. (See also this J., 1904, 374.)—A. S.

Nitrogen; Solubility of —— in Liquid Oxygen.

E. Erdmann and F. Bedford. Ber., 1904, **37**, 2545—2550.

A REPLY to Stock (this J., 1904, 489). The authors' paper (*ib.* 441) described purely experimental work. No detailed description of the preparation of liquid oxygen was available, and experimenters had lamented the difficulty of obtaining it in quantity sufficient to work with; hence the publication of their method. The solubility of nitrogen in liquid oxygen below its boiling point was experimentally established by the authors. Oxygen boiling in a vessel open to the air does not absorb nitrogen, but if a stream of nitrogen or air be passed through the boiling oxygen, nitrogen is absorbed by the oxygen. As the result of experiments, the authors admit the probability of Stock's view, that by the passage of the current of nitrogen the temperature of the boiling oxygen is reduced below the boiling point, so that the absorption of nitrogen really occurs slightly below that point.—J. T. D.

Sugars; Action of Benzylphenylhydrazine on ——.

R. Ofner. Ber., 1904, **37**, 2623—2625.

THE statement of Neuberg to the effect that only ketoses yield osazones with secondary hydrazines has been refuted by Goldschmiedt, who found that with benzylphenylhydrazine, dextrose yields the same osazone as levulose. The author shows that neither dextrose nor levulose reacts with pure benzylphenylhydrazine, and that the compound obtained by Neuberg and by Goldschmiedt is phenylbenzylphenyldextrosazone, $C_{25}H_{28}O_4N_4$, the formation of which is due to the presence of phenylhydrazine in commercial benzylphenylhydrazine. This compound may also be prepared by the action of pure benzylphenylhydrazine on phenyldextrosazone.—T. H. P.

Enzymes that decompose Amides; Occurrence of —— in Mould-Fungi.

K. Shibata. Hofmeisters Beitr., 1904, **5**, 385. Biochem. Centralbl., 1904, **2**, 651.

THE mycelia of *Aspergillus niger* were pressed and triturated, or treated with acetone as in the method of Albert and Buchner, and then brought in contact with the amides under examination. The following amides were decomposed:—Urea, biuret (slightly), acetamide, oxamide, and asparagine (very slightly), whilst small amounts of ammonia were liberated from the amino acids, alanine and tyrosine. Hippuric acid was decomposed with the formation of glycocoll. The following were not attacked:—Urethane, guanidine, allantoin, uric acid, and benzamide. The author suggests the name *amidases* for this class of enzymes. —C. A. M.

IX. *Peroxydase Reaction; Velocity of the ——. Peroxides; Function of —— in the Chemistry of Living Cells.*

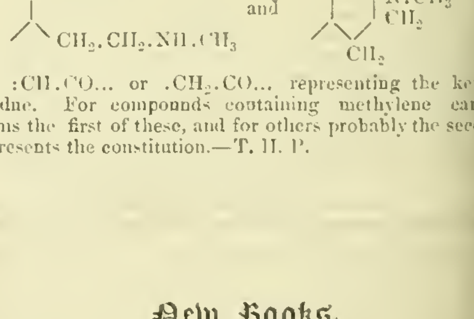
A. Bach and R. Chodat. Ber., 1904, 2431—2440. (See also this J., 1904, 766.)

FOR determining the velocity of this reaction, the authors made use of the oxidation of hydriodic acid by peroxydase and hydrogen peroxide, the course of the reaction being ascertained by titration with thiosulphate solution. The results show that the peroxydase, in rendering active the hydrogen peroxide during the oxidation, is used up, as was found to be the case in the oxidation of pyrogallol (this J., 1904, 505). In the present experiments the peroxydase exhibited a much greater activity than it did in the pyrogallol reaction. The velocity of the peroxydase reaction was found to follow the law of mass, in so far as it was not inhibited by the secondary products formed. The authors consider that peroxydase is a ferment. It differs from other ferments in being completely and quickly used up during the process of rendering hydrogen peroxide active, but, on the other hand, its origin, preparation, and genera properties are similar to those of other ferments. Its mass-reaction, when not interfered with, is also common to rennet-ferment, invertase, and catalase.—W. P. S.

Coartnine and Hydrastinine; Condensation of —— wit Ketones.

C. Liebermann and A. Glawe. Ber., 1904, **37** 2738—2744. Compare this J., 1904, 202.

COTARNINE and hydrastinine form condensation product not only with ketones and with most compounds containin methylene carbons between carbonyl groups, but also with many other compounds, such as quinol (hydroquinone) phloroglucinol, and pyrogallol. Descriptions are given o the condensed products formed with ethyl phenylacetate ethyl malonate, cumarone, and resorcinol, and of some o the derivatives of these products. Attempts were made, bu without success, to combine the two bases with meconin and so obtain narcotine and hydrastine. Many of thes condensation products, for example, those formed fro ethyl malonate, decompose so readily into their component that these latter are obtained in even the simplest changes With others, however, it is necessary to employ such vigorous agents as boiling mineral acids in order to de compose them, but in all cases the decomposition yields th components from which they were obtained. Some of thes products are more readily obtained when piperidine is used a condensing agent in place of sodium carbonate. There ar two possible constitutions for these compounds, namely:—



the :CH.CO... or .CH_2.CO... representing the keton residue. For compounds containing methylene carba atoms the first of these, and for others probably the second represents the constitution.—T. H. P.

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INERAL RESOURCES OF THE UNITED STATES. (Department of the Interior. United States Geological Survey. Chas. D. Walcott, Director.) Calendar year 1902. DAVID T. DAY, Chief of Division of Mining and Mineral Resources. Washington, U.S.A., Government Printing Office. 1904.

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Trade Report.

I.—GENERAL.

CANADIAN TARIFF CHANGES.

Bd. of Trade J., July 21, 1904.

A Customs Memorandum (No. 1,287 B), issued by the Canadian Commissioner of Customs on 28th June 1904, gives the details of the Tariff Resolutions proposed by the Canadian Minister of Finance in Committee of Ways and Means on 7th June 1904, as amended on 28th June 1904.

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Paraffin-wax candles, 25 per cent. *ad valorem.*

Paraffin wax, 25 per cent. *ad valorem.*

Illuminating oils, composed wholly or in part of the products of petroleum, coal, shale, or lignite, costing more than 30 c. per gall., 20 per cent. *ad valorem.*

Lubricating oils, composed wholly or in part of petroleum, costing less than 25 c. per gall., 2½ c. per gall.

Crude petroleum, gas oils (other than benzine and gasoline) above 0·775 but below 0·8235 sp. gr. at 60 temperature, 1½ c. per gall.

Oils, coal and kerosene distilled, purified or refined, naphtha and petroleum, and products of petroleum n.e.s., 2½ c. per gall.

Lubricating oils n.e.s., and axle-grease, 20 per cent. *ad valorem.*

Vaseline, and all similar preparations of petroleum for toilet, medicinal, or other purposes, 25 per cent. *ad valorem.*

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The following articles now dutiable to be transferred to the free list:—

Whale-oil soap.

Plain basic photographic paper, baryta coated, for albuminising or sensitising.

Hydrofluosilicic acid.

Glass cut to size for the manufacture of dry plates for photographic purposes, when imported by the manufacturers of such dry plates for use exclusively in the manufacture thereof in their own factories.

Ferment-cultures to be used in butter-making.

Quassia juice.

Crude petroleum, fuel and gas oils, 0·8233 sp. gr. or less, at 60° temperature.

Philosophical and scientific apparatus, utensils, instruments, and preparations, including boxes and bottles containing the same, of a class or kind not manufactured in Canada, when especially imported in good faith for the use and by order of any society or institution incorporated or established solely for religious, philosophical, educational, scientific, or literary purposes, or for the encouragement of the fine arts, or for the use or by order of any college, academy, school, or seminary of learning in Canada, and not for sale, subject to such regulations as the Minister of Customs shall prescribe.

GERMANY; TRADE OF —— IN 1903.

Foreign Office Annual Series, No. 3221.

The following tables show the value of some of the imports and exports of Germany for the year 1903, as compared with those of the year 1902. The figures for 1903 are calculated according to the prices fixed for 1902:—

Articles.	Value in 1,000 Marks (50*l*.).			
	Imports.		Exports.	
	1902.	1903.	1902.	1903.
Lead and leaden goods..	9,085	12,200	14,216	16,968
Drugs and dyes.........	263,392	267,407	380,629	100,149
Iron and iron goods.....	51,828	57,221	603,375	658,253
Ores, fine metals, asbestos, &c.	355,661	522,897	206,266	192,849
Glass and glassware	8,699	9,316	48,005	52,008
Hides	258,955	292,282	137,402	122,473
Caoutchouc, guttapercha, and goods thereof.....	73,263	76,252	50,000	52,815
Copper and copper goods	109,011	120,628	120,236	142,408
Leather and leather goods................	64,378	66,512	153,368	164,849
Candles.................	194	187	809	864
Oils, not otherwise mentioned, and fats.......	261,102	258,288	47,189	50,122
Paper and cardboard goods	15,207	18,447	109,322	129,431
Petroleum	93,109	101,232	1,459	1,885
Soap and perfumery	2,706	2,725	17,054	20,363
Stones and earthenware.	45,154	44,724	38,054	39,719
Coal, brown coal, coke, and peat	163,231	169,385	267,576	295,887
Tar, pitch, resin, and asphaltum	31,834	36,301	10,264	11,601
Clay goods..............	7,098	7,646	77,868	85,252
Oilcloth	863	876	2,655	3,037
Zinc and zinc goods.....	9,870	9,859	39,650	38,292
Tin and tinware	34,052	34,578	13,732	14,166

In the chemical industry, 1903 has witnessed an increased production, but the financial yield of the chemical works is decreasing, which is proved by the fact that the dividends of those among them which are share companies are following a downward tendency.

The importance of the German chemical industry is best characterised by the figures of its foreign trade; the import and export of its raw materials and the export of its produce have during the last 10 years risen by about 20 per cent., while the import of manufactured chemical articles has remained practically stationary:—

Raw Materials.

Year.	Imports.		Exports.	
	Quantity in 1,000 Tons.	Value in 1,000,000 Marks.	Quantity in 1,000 Tons.	Value in 1,000,000 Marks.
1902	1,998	212	765	44
1901	1,940	221	863	45
1900	1,928	218	727	45
1893	1,148	164	355	34

Manufactured Articles.

Year.	Imports.		Exports.	
	Quantity in 1,000 Tons.	Value in 1,000,000 Marks.	Quantity in 1,000 Tons.	Value in 1,000,000 Marks.
1902	318	111	810	386
1901	349	111	789	363
1900	322	113	750	352
1893	233	109	506	265

The number of establishments increased in 1902 fro 7,352 to 7,539; the number of adult workmen has rise from 156,488 to 160,841, *i.e.*, an increase of 2·78 per cent the sum of the wages earned has risen from 159,930,488 t 164,207,621 marks; the average annual wage amounted t 1,009 marks 67 pf., against 1,011 marks 10 pf. in the pr ceding year, so that after an uninterrupted rise durin many years the average wage in the chemical industr shows for the first time a decrease.

AUSTRIA HUNGARY; CHEMICAL TRADE OF ——.

Foreign Office Annual Series, No. 3199.

Chemical products to the value of 1,247,547*l*. were in ported during 1903, this being 141,057*l*. more than in 190 while "chemical auxiliaries" were exported to the value 569,393*l*., an increase of 83,814*l*. "Chemical products stand at 1,039,308*l*., an increase of 178,782*l*. In export dyeing and tanning materials total 703,306*l*., india-rubbe goods 461,186*l*., and glass and glassware 2,152,962*l*. Th following are imports from and exports to the Unite Kingdom:—

Imports.

Articles.	Quantity.	Value.
	Cwt.	£
Oils..................................	36,425	45,795
Medicine and perfumery..............	1,119	10,734
Dyeing and tanning materials.........	10,859	14,392
Gums and resins......................	16,614	20,994
Mineral oil..........................	1,875	635
Glass and glassware..................	1,118	6,798
Chemical substances..................	69,834	49,128
,, products..................	14,211	57,785
Soap and candles	1,923	2,699

Exports.

Articles.	Quantity.	Value.
	Cwt.	£
Oils.................................	53	99
Mineral water	37,924	28,011
Medicine and perfumery..............	61	686
Dyeing and tanning materials........	291,085	141,627
Gums and resins......................	9,964	1,889
Mineral oil..........................	39,985	9,450
India-rubber and india-rubber goods.	13,180	39,335
Chemical substances.................	27,896	34,076
,, products..................	90,782	131,677
Soap and candles	931	1,377

The following table shows what Austria-Hungary imorted from British India :—

Articles.	Quantity.	Value.
	Cwt.	£
ape-seed	37.768	16,737
astor oil	35,391	20,912
il seed	521,364	308,072
inseed	254,213	144,849
alm kernels	152,224	89,918
undries (seeds)	1.103	846
ils	1,713	2,109
ledicine and perfumery	146	2.003
yeing and tanning materials	88,237	77.969
ums and resins	15,056	57,747
ndia-rubber	509	8,866
hemical products	69	414

The exports to India included chemicals valued at about ,000*l*. From the West Indies 200*l*. worth of perfumery as imported in 1903 ; Cape Colony took 1,264*l*. worth of iemical products, and Ceylon 1,133*l*. worth of medicines id perfumery.

X.—*METALLURGY.*

Murchison Goldfield, Western Australia.

Bull. Imp. Inst. (*Suppl. to Board of Trade J.*), 1904, 2, 114.

The Murchison goldfield embraces the districts of Lennonlle, Mount Magnet, and Boogardie. The auriferous posits are of two types, white quartz reefs and laminated iartz and jasper veins, the whole being enclosed in a belt altered rocks containing diorite, diabase pyroxenite, and ists, termed greenstone. The principal mines of the ount Magnet district are seven in number, those of the oogardie, 12, and Lennonville, 13. The total amount of e worked from 1891 to 1902 was 191,820 tons, yielding 1,518 oz. of gold, or an average of 0·99 oz. per ton.

—A. S.

Ferro Alloys : U.S. Customs Decision.

Ferrochrome, ferrotungsten, ferromolybdenum, and rovanadium, made in the same manner as ferromangase, and used for the same purpose—to harden and ighen steel—were decided by the United States Circuit urt to be dutiable at 4 dols. per ton, by similitude to romanganese, under paragraph 122 of the present tariff. ie contention of the Government that they were dutiable 20 per cent. *ad valorem* under paragraph 183, as "metal wrought," was overruled. (Compare this J., 1903, 72).—R. W. M.

German Silver : U.S. Customs Decision.

July 14, 1904.

German silver in bars and sheets was held to be dutiable 45 per cent. *ad valorem* under paragraph 193 of the esent tariff as a "manufacture of metal." Paragraph 4 provides for "German silver unmanufactured" at per cent. *ad valorem*. The Board held that its proions cover only German silver in pigs or ingots, and not any other form.—R. W. M.

XII.—*FATS, FATTY OILS, Etc.*

Oil and Soap Trade of Marseilles in 1903.

Foreign Office Annual Series, No. 3230.

The Marseilles oil and oil-seed trade for the year 1903 s exceptionally good and the different companies and vate mills realised handsome profits, having been favoured a good market for oils in the early part of the year, ich enabled crushers to make large sales for forward monthly deliveries at full values ; and, as there were record crops of sesame seed and earthnuts in India and on the west coast of Africa, prices of raw materials declined steadily and thus crushers covered their requirements at very profitable rates. For the 12 months the total imports of all oil seeds, earthnuts, and copra amounted to 485,544 tons, as against 422,880 tons for 1902, and 333,474 tons, the average of the five years 1898—1902. The leading figures in these imports for 1903 comprised 122,431 tons of gingelly seed from East India, as against the average of 66,789 tons ; 86,291 tons of decorticated earthnut from India ; 92,784 tons of undecorticated earthnut from the west coast of Africa ; 27,631 tons of castor seed from East India (as against the average of 24,671 tons) ; and 106,678 tons of copra from all parts (as against the average of 86,185 tons). All these imports, with the exception of a few thousand tons of copra transhipped to Spain, have been crushed in Marseilles. By reason of the large increase in imports of oil seeds, the local mills have produced sufficient oils for edible and technical requirements ; and imports of manufactured oils from other sources have continued on a very reduced scale, being chiefly confined to some edible cottonseed oil chiefly from the United States, for mixing purposes. These imports of cottonseed oil have amounted to 13,811 tons, as against 27,216 tons for 1902 and 45,988 tons for the five years average from 1898—1902. Two kinds of unrefined glycerin are produced at Marseilles, the one extracted before soap boiling and the other extracted from the soap lyes after the soap is made. The latter contains 80 per cent. of anhydrous glycerin, 10 to 10½ per cent. of salts, traces of sulphides, and small quantities (¼ or even ½ per cent.) of thiosulphates. The former is sold at 15 c. the litre, with a density of 1·240 and a maximum of ½ per cent. of ash. The total production at Marseilles amounts to from 8,000 to 9,000 tons annually. There is a glycerin distillery at Marseilles which treats some 2,000 tons annually and turns out a white glycerin, doubly distilled, for current sale, as well as glycerin for the manufacture of dynamite. The rest of the output is exported in a raw condition to the United Kingdom, to Germany, and, especially, to the United States. Before the Transvaal war, Germany bought large quantities of glycerin for the manufacture of dynamite. Now, however, the business appears to have changed hands and to be done through the United Kingdom. The consumption of glycerin increases yearly, while the output has reached its maximum, which can only be increased by the development of the soap manufacture ; the demand, therefore, will probably shortly exceed the supply. For some years past prices have ruled at about 100 fr. the ton in bulk for saponification glycerin, and 80 frs. for glycerin from the soap lyes. These prices are kept up fairly easily during the dull months, but are bound to go considerably higher when there is a big demand. All the linseed and practically all the sesame and poppy cakes are consumed for feeding cattle in France, or, in the case of black gingelly, for manuring. The earthnuts, which are brought to Marseilles undecorticated, are shelled there, and the shells ground into a whitish powder, which is used for cattle feeding, and is exported mainly to Hamburg and Stettin, where it is mixed with molasses and forms a good, brittle feed cake. Some goes to London, Liverpool, and Glasgow. The sales of soap effected have been much the same as those of 1902, and as the oils required have gone down in price, so has the price of soap. Thus no larger profits seem to have accrued to the boilers. As enormous stocks of the necessary oils are in hand, and there is no fear of their being exhausted, a good all-round year of business is expected. Exportation to the Far East and to Canada has slightly fallen. An increasing trade with Canada has been fully expected, but these expectations have not been realised. The old-fashioned mottled soap for which Marseilles was famous is gradually dying out, being replaced by the more convenient and harder white soap, mostly made with 20 to 25 per cent. of copra oil, and 35 to 40 per cent. of either earthnut oil or sesame oil, or cottonseed oil, as the price of the latter three vary. Earthnut oil and sesame, cottonseed oils, tallow and other compounds are now hardly used. The finest soaps made here, known as olive-oil soaps, are composed of varying mixtures of earthnut and olive oil, probably never pure olive oil alone. When a pure olive-oil soap is absolutely required, a special vat is made up at about twice the price of ordinary soap.

Beeswax from British Central Africa.

Bull. Imp. Inst. (Suppl. to Board of Trade J.), 1904, 2, 85—86.

A sample of the clarified beeswax was submitted to brokers, who reported that consignments of similar quality would meet with a ready sale in the London market, at prices ranging from 6*l.* 17*s.* 6*d.* to 7*l.* per cwt. They recommend that the wax be shipped in blocks of 90—100 lb. each, cased in "gunny." Beeswax is already exported from British Central Africa, but it is stated that much larger quantities could be readily produced.—A. S.

XIII. A.—PIGMENTS, PAINTS, Etc.

Green Earth: U.S. Customs Decision.

July 7, 1904.

Green earth was assessed for duty at 30 per cent. *ad valorem* as a "color," under paragraph 58 of the present tariff. An analysis of the sample showed it to be coarsely ground celadonite,—a talc-like mineral. The Board of General Appraisers accordingly held it to be dutiable at 2 dols. per ton as a "wrought earth," under paragraph 93. —R. W. M.

XIV.—TANNING; LEATHER; GLUE, Etc.

Tannin; Export Trade of —— in India.

Bd. of Trade J., July 28, 1904.

According to *Capital* (Calcutta), a recent official report mentions that investigations made in the Madras Presidency have resulted in testifying that the forests and waste lands of the Presidency possess a very large number of trees and shrubs which are capable of yielding tannin in sufficient quantities to be of practical importance. In the Northern Circle of the forest department, there are believed to be 70 different kinds of tannin-yielding shrubs and trees. That the supply is large throughout is evidenced by the fact that the Provincial Forest Department derives a revenue of over a lakh of rupees from the sale of the right of collecting tannin-yielding materials. So far the only tannin materials exported from Southern India are myrabolams from Cocanada and the Vizagapatam coast ports, the exports varying from 6,000 to 7,000 tons per annum, of the value of about three lakhs of rupees. That there is no important export trade in Indian tannin is, according to the report, believed to be principally due to the fact that no serious and continuous efforts have ever been made to introduce Indian tannin material to the European markets.

XVI.—SUGAR, STARCH, Etc.

Sugar: Polariscopic Testing of ——.
U.S. Customs Decision.

June 1, 1904.

The United States Circuit Court of Appeals rendered a decision on testing sugar by the polariscope, upholding the action of the Secretary of the Treasury in instituting a system of corrections for temperature not in general use among chemists. This decision reversed that of the lower court, in which it was held that "testing by the polariscope" had a well established trade meaning at the time of the passage of the Act of 1897. The higher court holds that as long as the Secretary acts in good faith and prescribes no regulations tending to make the prescribed test less accurate than it was at the time of the passage of the act, the courts should not interfere with the administrative details confided to him. This decision affirms the correctness and authority of the system of corrections established mainly by H. W. Wiley. (See this J., 1903, 721.)—R. W. M.

XVII.—BREWING, WINES, SPIRITS, Etc.

Saké: U.S. Customs Decision.

May 25, 1904.

The United States Circuit Court held that saké, a beverage made from rice by processes similar to those employed in making beer, does not possess sufficient similarity to either wine or beer to be dutiable as either. The Court held it to be subject to a duty of 20 per cent. *ad valorem* under section 6 of the present tariff as a "manufactured article unenumerated," and reversed the decision of the Board of General Appraisers, holding it to be dutiable by similitude as a "still wine" under paragraph 296. —R. W. M.

XX.—FINE CHEMICALS, Etc.

Saccharin; Importation of —— into Greece Prohibited.

Bd. of Trade J., July 21, 1904.

By a law of the 28th April/11th May last, the importation into Greece or the employment in that country of saccharin or other artificial sweetening substances possessing a higher sweetening power than cane sugar, without its nutritive qualities, is prohibited except for pharmaceutical purposes.

A subsequent decree specifies "dulcine" "sucrase" and "sucramine" or "*sucre de Lyon*," as being the sweetening substances other than saccharin, the importation of which is prohibited under the law. It provides, however, that the prohibited substances may be imported by chemists or pharmacists exceptionally, on special permission of the Minister of Finance, but only through Custom Houses of the 1st or 2nd class, and in quantities not exceeding 50 dramia (3,000 grains) a year. This applies equally in the case of saccharin, &c., desired to be introduced by Parcel Post. Importations of saccharin, &c., as "samples without value" are not permitted.

Gardenia; Oil of ——. U.S. Customs Decision.

July 1, 1904.

Oil of gardenia, assessed for duty as "alcoholic perfumery" at 60 c. per lb. and 45 per cent. *ad valorem*, under paragraph 2 of the present tariff, was decided to be dutiable at 25 per cent. *ad valorem*, under paragraph 3 as a "chemical compound." (Compare this J., 1904, 345.)—R. W. M.

Rose; Artificial Oil of ——.
U.S. Customs Decision.

June 29, 1904.

Synthetic oil of rose, made to resemble the natural oil as closely as possible, and showing substantially the properties of the natural oil, was decided to be free of duty as "otto of roses" under paragraph 626 of the present tariff. Assessment of duty at 25 per cent. *ad valorem* as a "chemical compound" under paragraph 3 was overruled. —R. W. M.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 15,923. Rhodes. Valves for controlling acids and other chemical fluids and vapours. July 18.

,, 16,024. Leyer. Driers.* July 19.

,, 16,045. Walton. Coal and ore washing machinery. July 20.

,, 16,261. Brit. Thomson Houston Co. (Gen. Electric Co.). Apparatus for electrically heating liquids. July 22.

,, 16,316. Hantke. Process and appliance for raising liquids by means of compressed air.* July 23.

,, 16,354. Shields. Means for removing dust from gases.* July 23.

,, 16,427. Browne and McKinlay. Apparatus for subjecting gases or vapours to the action of liquids or vapours therefrom, especially applicable to scrubbing or enriching illuminating or other gases, or for recovery purposes. July 25.

,, 16,588. Matcham. Combined rotary kilns and driers. [U.S. Appl., Jan. 11, 1904.]* July 27.

,, 16,618. Robinson. Furnaces. July 28.

,, 16,652. Challis. Filters, filtering media, &c. July 28.

,, 16,826. Roche. Filtering apparatus. July 30.

[C.S.] 18,346 (1903). Michael and Roberts. Grinding machines. Aug. 4.

,, 19,320 (1903). Macfarlane and Macfarlane. Centrifugal machines. July 27.

,, 20,163 (1903). Bloxam (Dillon). Treatment of liquids with ozonised air or other gaseous ozone mixtures. July 27.

,, 1013 (1904). Kauffmann. Working and construction of furnaces for roasting ores and like materials. July 27.

,, 3003 (1904). Stade. Process and devices for filtering liquids. Aug. 4.

,, 12,164 (1904). Dahl. Centrifugal separators. Aug. 4.

,, 14,484 (1904). Wheelwright and Fiske. Apparatus for removing liquids from solids, applicable for the treatment of garbage and other purposes. Aug. 4.

II.—FUEL, GAS, AND LIGHT.

[A.] 15,908. Reichwald (F. Krupp, Act.-Ges.). Process of and apparatus for producing combustible gases from bituminous fuels. July 18.

,, 15,937. Boaler. Incandescent mantles. July 18.

,, 16,008. Koppers. Coke ovens.* July 19.

[A.] 16,067. Grice. Gas producers.* July 20.

,, 16,069. Smith. Manufacture of producer gas, applicable both to pressure and suction plants. July 20.

,, 16,113. Calvert and Snape. Method of treating incandescent lamp filaments to increase their density and also the density of the carbon deposited on them during the flashing process. July 20.

,, 16,288. Akt.-Ges. f. Selas Beleucht. Apparatus for the production of mixtures of gas and air. [German Appl., Oct. 21, 1903.]* July 22.

,, 16,425. Electric Equipment and Securities, Ltd., and Ruzicka. Manufacture of electric incandescence bodies. July 25.

,, 16,427. Browne and McKinlay. *See under* I.

,, 16,593. Hemingway and Booth. Apparatus for washing and purifying gas. July 27.

,, 16,658. Bateman. Mantles for incandescent gas lighting. July 28.

,, 16,763. Boutillier. Apparatus for producing poor gas free from tarry matters. [Fr. Appl., Aug. 25, 1903.]* July 29.

,, 16,765. Kirkham, Hullett, and Chandler, Ltd., and Hersey. Apparatus for washing or scrubbing gas. July 29.

,, 16,756. Colson. Manufacture and purification of illuminating gas. July 29.

[C.S.] 17,788 (1903). Lake (Selas Ges.). Apparatus for the production of mixtures of gas and air. Aug. 4.

,, 20,678 (1903). Cerasoli. Gas producers. July 27.

,, 21,964 (1903). Derval. Inclined gas retorts. Aug. 4.

,, 2547 (1904). Capitaine. Suction gas producers. Aug. 4.

,, 8993 (1904). Poetter. Gas-producing plant for heating retort furnaces. Aug. 4.

,, 12,361 (1904). Tobiansky. Refuse-consuming and gas-producing furnaces. Aug. 4.

,, 14,383 (1904). Poetter. Gas producers. Aug. 4.

,, 14,465 (1904). Klein. Gas-purifying plant. Aug. 4.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 16,543. Hanmer. Apparatus for treating peat, turf, wood, &c., to obtain valuable products therefrom. July 27.

,, 16,756. Lyndall and Costley-White. Process for rendering benzene or the like non-inflammable. July 29.

[C.S.] 24,801 (1903). Tabourin, Girard, and Portevin. Manufacture of solid and fluid mineral lubricants. July 27.

,, 12,122 (1904). Weyl. Distillation of coal tar. Aug. 4.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 15,920. Ransford (Cassella and Co.). Manufacture of sulphide colours. July 18.

[A.] 15,935. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of indophenols. July 18.

,, 15,982. Shillito (Aniline Colour and Extract Works, formerly J. R. Geigy). Manufacture of nitro-*o*-oxyazo colouring matters. July 19.

,, 16,119. Johnson (Kalle and Co.). Manufacture of new dyes. July 20.

,, 16,120. Johnson (Kalle and Co.). Manufacture of new dyes. July 20.

,, 16,121. Johnson (Kalle and Co.). Manufacture of new dyes. July 20.

,, 16,268. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of sulphur dyes and of materials for their production. July 22.

,, 16,269. Imray (Meister, Lucius und Brüning). Manufacture of violet sulphurised dyestuffs. July 22.

,, 16,538. Johnson (Badische Anilin und Soda Fabrik). Manufacture of violet blue colouring matters of the anthracene series and intermediate products of the said manufacture. July 26.

,, 16,566. Shillito (Aniline Colour and Extract Works, formerly J. R. Geigy). Manufacture of *o*-oxyazo colouring matters from 2-diazo-1-naphthol sulphonic acids. July 27.

[C.S.] 21,800 (1903). Imray (Meister, Lucius und Brüning). Manufacture of yellow, orange-yellow to orange sulphurised dyestuffs. Aug. 4.

,, 21,945 (1903). Imray (Meister, Lucius und Brüning). Manufacture of clear yellow, orange-yellow to yellow-orange sulphurised dyestuffs. July 27.

,, 12,270 (1904). Lake (Oehler). Sulphur dyes. Aug. 4.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 15,906. Hadden. Printed fabrics. July 18.

,, 15,943. Johnson (Badische Anilin und Soda Fabrik). Production of coloured discharges on dyed materials. July 18.

,, 15,944. Johnson (Badische Anilin und Soda Fabrik). The discharging of dyed textile fabrics. July 18.

,, 15,978. Bauersachs and Brückner. Processes of dyeing cops.* July 19.

,, 16,105. Möller-Holtkamp. Dressing or sizing yarns. July 20.

,, 16,185. Bartelt. *See under* VII.

,, 16,313. Boult (Poisson). Method of retting and washing vegetable textile fibres. July 23.

,, 16,351. Soc. Anon. des Rizières Françaises. Treatment of rice flour with a view to its substitution for various starches used in sizing and finishing. [Fr. Appl., Aug. 1, 1903.]* July 23.

,, 16,503. Wild. The dyeing of textile fibres or fabrics. July 26.

,, 16 594. Hulse and Co., Ltd., and Shaw. The production of printed fabric, such as calico. July 27.

[C.S.] 19,002 (1903). Armengol. Thread, and process of manufacturing the same. July 27.

,, 20,476 (1903). Mascelli. Apparatus for dyeing and similar purposes. July 27.

[C.S.] 20,925 (1903). Thompson (Wegmann and Co.). Method of dyeing cotton and the like, and apparatus therefor. Aug. 4.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 16,185. Bartelt. Apparatus for preparing bleaching liquor. July 21.

,, 16,353. Shields. Treatment of the gases issuing from pyrites burners.* July 23.

,, 16,504. Woltereck. Production of ammonia. July 26.

,, 16,672. Smith. Manufacture of monoxide of lead. July 28.

[C.S.] 5101 (1904). Bloxam (Gibbs). Manufacture of salts of oxyacids of chlorine and salts of chromic acid. July 27.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 16,279. Nolan. Process of and apparatus for fire-polishing glass. July 22.

[C.S.] 16,847 (1903). Martin. Means of decorating pottery, porcelain, glass, paper, or other medium. July 27.

,, 12,201 (1904). Fidler. *See under* IX.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 15,979. Schmidtgen and König. Process for manufacturing an isolating material. July 19.

,, 16,002. Mills. Bricks. July 19.

,, 16,029. Gesner. Incorrodible material and the method of its production. July 19.

[C.S.] 20,421 (1903). Howett. Manufacture of artificial stone. July 27.

,, 22,769 (1903). Perpignani and Candlot. Kilns for burning cement, lime, &c. Aug. 4.

,, 9914 (1904). Ducastel. Agglutinant or cement, and method of manufacturing the same. July 27.

,, 12,201 (1904). Fidler. Continuous kilns for burning blue and salt-glazed and vitrified bricks, tiles, and terra-cotta, &c. Aug. 4.

,, 14,374 (1904). Henry. Continuous kilns for burning fireproofing, tile, and other clay products. Aug. 4.

X.—METALLURGY.

[A.] 15,964. Slater. Method for the extraction and reduction of precious metals from ores, earths, sands, and tailings. July 19.

,, 16,028. Johnson (Meya). Manufacture of steel. July 19.

,, 16,112. Ogle and Woolford. Furnaces for the treatment of refractory ores. July 20.

,, 16,205. Edelmann and Wallin. *See under* XI.

,, 16,267. Gauntlett. *See under* XI.

,, 16,276. Kaufmann and Bouvier. Manufacture of steel. July 22.

,, 16,396. Abel (Siemens und Halske Act.-Ges.). *See under* XI.

,, 16,412. Lake (Cyanid-Ges.). Treatment of iron and steel for the hardening or case-hardening of the same. July 25.

[A] 16,419. Engels. Process for treating steel and armour plates. [Fr. Appl., March 21, 1904.]* July 25.

„ 16,448. Harmet. Process for refining cast iron, and apparatus therefor. [Fr. Appl., Aug. 28, 1903.]* July 25.

„ 16,449. Fink and Huguenot. Process and apparatus for granulating or pulverising certain fusible metals and alloys. [Fr. Appl., Jan. 7, 1904.]* July 25.

„ 16,491. Swinburne. Treatment of sulphide ores. July 26.

„ 16,492. Swinburne. Treatment of antimony, arsenic, bismuth, and gold ores. July 26.

„ 16,517. Broadbent and Herdman. The galvanisation of metal and the manufacture of metallic alloys. July 26.

„ 16,754. Tyars. Apparatus for treating and amalgamating metals. July 29.

[C.S.] 1013 (1904). Kauffmann. *See under* I.

„ 1941 (1904). Wilkins. Cement for iron and steel castings and the like. Aug. 4.

„ 4975 (1904). Moore and Heskett. Process of and apparatus for treating ferruginous ore for the manufacture of iron and steel therefrom. Aug. 4.

„ 12,976 (1904). Cutler. Furnace for calcining quicksilver ores. July 27.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 15,952. Berg. Electrode for electrical accumulators. [Appl. in Sweden, July 18, 1903.]* July 18.

„ 16,205. Edelmann and Wallin. Electric furnaces and the extraction of zinc by means of the same. July 21.

„ 16,267. Gauntlett. Deposition of zinc and other metals by means of electricity. July 22.

„ 16,396. Abel (Siemens und Halske Act.-Ges.). Method of producing zinc from sulphate solutions by electrolysis.* July 25.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[C.S.] 16,825 (1903). Westaway. Method of and apparatus for granulating and solidifying fat or the like. Aug. 4.

„ 13,451 (1904). Zimmermann and Stöhr. Floating soap, and process for the manufacture of the same. Aug. 4.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*B.*)—Resins, Varnishes.

[A.] 16,800. Bucklin. Lac derivatives and their application and process of production.* July 30.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

[A.] 16,275. Alilaire. Tanning hides and skins. July 22.

[C.S.] 20,063 (1903). Horn. Process for preparing a clear solution of casein. July 27.

XVI.—SUGAR, STARCH, GUM, Etc.

[A.] 15,934. Stiepel. *See under* XX.

„ 16,262. Börner. Manufacture of starch and sugar.* July 22.

„ 16,546. Stein and Loewenthal. Manufacture of sugar. July 27.

XVII.—BREWING, WINES, SPIRITS, Etc.

[C.S.] 17,975 (1903). Sleeman. Treatment of grain for the production of malt. July 27.

„ 14,517 (1904). Schreier. Malting drum. Aug. 4.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—Foods.

[A.] 16,189. Barbier. Method of converting whey into vinegar.* July 21.

„ 16,351. Soc. Anon. des Rizières Françaises. *See under* V.

[C.S.] 20,630 (1903). Roewer. Butyrometers. Aug. 4.

„ 13,689 (1904). Fölsing. Preservative for food. July 27.

(*B.*)—Sanitation; Water Purification.

[A.] 16,689. Tuckfield and Garland. Regenerative apparatus for water purification and the like. July 29.

[C.S.] 19,916 (1903). Woodall. Water-purifying apparatus. July 27.

„ 12,361 (1904). Tobiansky. *See under* II.

„ 14,482 (1904). Wheelwright and Fiske. Apparatus for cooking garbage and removing the oil therefrom. Aug. 4.

„ 14,483 (1904). Wheelwright and Fiske. Apparatus for cooking garbage and removing the oil therefrom. Aug. 4.

(*C.*)—Disinfectants.

[C.S.] 14,372 (1904). Marot. Process and apparatus for producing a gaseous germicide and insecticide. Aug. 4.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 16,281. Werle. Grinding wood for the manufacture of paper. [German Appl., Nov. 29, 1903.]* July 22.

„ 16,403. Nebrich. Pulp strainers for paper manufacture.* July 25.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 15,930. Liebreich. Preparations for the production of chloroform. July 18.

„ 15,934. Stiepel. Manufacture of betaine and its salts from the molasses and waste products of beetroot-sugar manufacture. July 18.

„ 16,602. Kalle and Co. Manufacture of bromine alkyl acetamides. [German Appl., Dec. 9, 1903.]* July 27.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 16,177. Edwards. Photographic films. July 21.

[C.S.] 20,325 (1903). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Photographic paper. July 27.

„ 20,434 (1903). Hill and Young. Direct reproduction of drawings by photography. Aug. 4.

XXII.—EXPLOSIVES, MATCHES, Etc.

[C.S.] 17,415 (1903). Bell. Method of and apparatus f forming blocks of guncotton. Aug. 4.

„ 17,890 (1903). Bell. Pressing of guncotton block and apparatus therefor. July 27.

„ 13,562 (1904). Möller. Manufacture of nitr glycerin. Aug. 4.

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ANNUAL GENERAL MEETING, NEW YORK, 1904.

The Annual General Meeting will be held in New York City on Thursday, Sept. 8th, and following days. Members who propose to attend the meeting are requested to inform he General Secretary, as soon as possible, by what steamer hey will travel. The principal boats will be met on arrival t New York by a representative of the Reception Committee, who will escort the guests to the Hotel Seville, Madison Avenue and 29th Street, which will be the ociety's Headquarters in New York. A similar system will be observed at all the other cities visited by the special rain. A revised programme appeared in the July 30th issue.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those members whose ames are printed in *italics* in the list of Council will retire rom their respective offices at the forthcoming Annual Meeting.

Mr. Wm. H. Nichols has been nominated to the office of President under Rule 8; Dr. Edw. Divers, Prof. W. R. Eaton Hodgkinson, Mr. Max Muspratt, and Mr. T. J. Parker have been nominated Vice-Presidents under Rule 8; and Sir Wm. Ramsay has been nominated a Vice-President under Rule 11.

Mr. Oscar Guttmann, Prof. W. R. Lang, Dr. Boverton Redwood, and Mr. Walter F. Reid, have been nominated under Rule 18 to fill four vacancies among the Ordinary Members of Council. No ballot will be required.

The Hon. Treasurer and Hon. Foreign Secretary have een nominated for re-election to their respective offices.

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Discharging or Filling Vats and like Receptacles; Apparatus for ——. W. P. Thompson, London. From H. W. Blaisdell, Los Angeles, Cal., U.S.A. Eng. Pat. 22,094, Oct. 13, 1903.

On a suitable support is arranged a central column, carrying rotating arms at its base. From the arms depend cup-shaped discs or plates for feeding the material to the centre of the vat. In the central column is an elevator for lifting the material and discharging it into a shoot. The whole apparatus can be raised or lowered, can be modified so as to be used for charging as well as discharging, and can be moved over a series of vats.—W. H. C.

Distributing Apparatus especially applicable for use in Filling Vats or the like. W. P. Thompson, London. From H. W. Blaisdell, Los Angeles, Cal., U.S.A. Eng. Pat. 22,095, Oct. 13, 1903.

A distributor consisting of curved spiral blades is mounted on a vertical shaft passing through a hopper arranged over a vat. Means are provided for rotating the shaft, thereby causing the material fed into the hopper to be evenly distributed. The distributor can be raised or lowered by suitable means, and a guard ring is provided to prevent the material from being thrown over the edge of the vat. The apparatus may be fixed, or movable over a series of vats. —W. H. C.

Centrifugal Extraction Apparatus. R. W. Strehlenert, Neu Babelsberg, Germany. Eng. Pat. 26,471, Dec. 3, 1903.

The apparatus consists of a centrifugal basket provided at its outer wall with a number of holes, and furnished at its centre with a truncated cone. Inside this conical aperture is placed a conical flange forming part of the casing surrounding the centrifugal basket, and through this passes the rotating shaft carrying the basket. Upon the casing rest two covers, one being fitted tightly to the edge of the casing by an indiarubber ring, whilst the other is suspended below, an annular space being thus formed between the two covers. The centrifugal force causes the extracting liquid to rise at the edge of the casing and to overflow into the annular space above, where the friction of the walls destroys the centrifugal velocity and allows the liquid to flow back into the basket through a central opening provided in the covers.—L. F. G.

Varnishing, Pitching, or similarly Treating Casks, Vats, or the like; Apparatus for ——. M. D. Krämer, Laeken-Brussels. Eng. Pat. 12,647, June 3, 1904.

The improvements which relate to the apparatus described in Eng. Pat. 25,362 of 1902, consist in placing a shallow bath over the pitch-melter. In this bath are several radially disposed rollers to facilitate the manipulation of the cask, whilst the bath itself serves to collect and return to the melter any excess of pitch, &c. The injector pipe can be raised or lowered by a lever.—W. H. C.

Desiccation [Evaporation] of Liquids. W. D. Neel, Chicago. Eng. Pat. 13,186, June 10, 1904.

To obtain the solid constituents of a liquid in the form of a powder, the liquid is sprayed into a closed chamber where the spray is subjected to the action of a "heated innocuous gas," such, *e.g.*, as air. The liquid is carried off in a state of vapour, and the solid falls to the bottom as a powder. The sides and top of the chamber are formed of pervious material, and the chamber itself is enclosed in an outer casing. The pressure in the space between the two is reduced by suitable means so that the vapour-laden gas passes outwards through the pervious material. Means are provided for spraying the liquid, for continuously removing the powder, and for introducing and exhausting the heated gas.—W. H. C.

United States Patents.

Funnel. W. E. Burgess, Aberbeeg, England. U.S. Pat. 764,422, July 5, 1904.

The combination is claimed, with a funnel for filling vessels with liquid, of a siphon of which one limb is adapted to dip into the vessel to be filled, and an upright transparent pipe, which connects the lower end of the other limb of the siphon with the exit-opening of the funnel.—W. H. C.

Dryer. J. D. Bourdeau, Assignor to Bourdeau Food Co. Battlecreek, Mich., U.S.A. U.S. Pat. 764,552, July 12 1904.

A series of vertically superposed, horizontal, paralle conduits, with perforated bottoms, have conveyor worm working in opposite directions in alternate conduits. The are connected at alternate ends, the material to be drie is fed into the top conduit and passes through each i succession to the outlet at the bottom. Means are provide for working the conveyors and for withdrawing the air fron each conduit.—W. H. C.

Muffle. J. C. Fox, Assignor to the Morgan Crucible Co., Ltd., London. U.S. Pat. 765,728, July 26, 1904.

The muffle consists of a horizontal chamber, with a movabl front wall, and its further end is provided with a discharg aperture for gases. Air passages extend longitudinally alon the sides within the muffle, which has air-inlet apertur at intervals throughout its length, to supply oxygen un formly to the contents. The apertures to the air passage are designed to receive plugs for controlling the admissio of air.—E. S.

French Patents.

Drying Machines [Centrifugal] with Several Chamber G. ter Meer. Fr. Pat. 341,131, Jan. 26, 1904.

See Eng. Pat. 1505 of 1904; this J., 1904, 537.—T. F. B.

Evaporating in Vacuo: Columns for ——. T. Suzuki. Fr. Pat. 341,356, Feb. 9, 1904.

See Eng. Pat. 3165 of 1904; this J., 1904, 483—T. F. B

Filter-Presses. P. Meura. Fr. Pat. 340,503, Feb. 13, 1904.

HE supply-channel is placed at the side of each plate, lightly above the top. The connecting passage, to the nterior of the chamber, has the same sectional area as the upply channel, in order to obviate any obstruction. —W. H. C.

Filter-Press. Soc. Française de la Viscose. Fr. Pat. 340,871, March 1, 1904.

HE filter-press, which is for vacuum filtration, has the oints between the plates made by rubber rings let into grooves. The supply, delivery and washing channels are ituated at the corners of the plates.—W. H. C.

Refining or Purifying Apparatus. C. W. Stanton. Fr. Pat. 340,620, Feb. 22, 1904.

SEE Eng. Pat. 5791 of March 9, 1904; this J., 1904, 538. —W. H. C.

Measuring Apparatus for Granulated or Powdered Materials. J. W. Pope, U.S.A. Fr. Pat. 340,638, Feb. 22, 1904.

Two discs are mounted on an axis in such a manner that he vertical distance between them can be regulated by a screw. The upper disc can be rotated and has several apertures, whilst the lower one is fixed and has but one opening connected with a delivery spout. Between the discs are a number of telescopic tubes forming measures and fitting into the holes in the upper disc. Above the upper disc is a feed-tube, connected with a hopper, containing the material to be measured. As the upper disc is rotated, the measuring tubes are first brought under the feed and filled, and then later, opposite the discharge, and emptied.—W. H. C.

Distilling; Apparatus for ——. O. Perrier. Fr. Pat. 340,700, Feb. 25, 1904.

IMPROVED analysers and temperature and pressure regulators are applied to continuous or discontinuous distillation columns.—W. H. C.

Muffles. The Morgan Crucible Co., Ltd. Fr. Pat. 341,045, March 8, 1904.

SEE U.S. Pat. 765,728 of 1904; preceding these.—T. F. B.

Separating Apparatus; Centrifugal ——. E. Seger. Fr. Pat. 341,083, March 9, 1904.

SEE Eng. Pat. 458 of 1904; this J., 1904, 363.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Sulphur; Forms in which —— occurs in Coal, their Calorific Values and their Effects upon the Accuracy of the Heating Powers, calculated by Dulong's Formula. E. E. Somermeier. J. Amer. Chem. Soc., 1904, **26**, 764—780. (See this J., 1904, 601.)

CONTINUING his experiments, the author finds that when the sulphur is present in the form of ferrous sulphate, the results given by Dulong's formula will be 10 cals. too low for each 1 per cent. present in that form. In the case of sulphur as pyrites, the results based on uncorrected ultimate analyses are about 9·6 cals. too high for each 1 per cent. of sulphur in that form, whilst if corrections be made for the amount of oxygen in the ash, the calculated results will be 6·6 cals. too low. When the sulphur is present in organic combination, the results given by the formula are probably 4·5 cals. too low for each 1 per cent. of such sulphur. From the average results obtained with five samples of coal, the general conclusion arrived at is that very satisfactory results for total sulphur are given by Dulong's formula (unmodified) applied to the figures of an uncorrected ultimate analysis. The formula gives lower results than those obtained by the use of Mahler's calorimeter, especially in the case of samples highest in moisture and oxygen, *e.g.*, Waterloo coal. By substituting Berthelot's value for amorphous carbon (8140) the formula gave results in close agreement with the calorimetric determinations, except in the case of the Waterloo coal, the average results with which were still 1 per cent. too low. The values obtained with this modified formula applied to certain samples of Ohio coals, agreed closely with values actually determined.—C. A. M.

ENGLISH PATENTS.

Fuel [Briquettes]; Artificial ——. C. Cory, Swansea. Eng. Pat. 14,014, June 23, 1903.

BRIQUETTES of the kind described in Eng. Pat. 4830 of 1901 (this J., 1902, 459) are rendered more waterproof by adding a small quantity (about 4 per cent.) of pitch or other similar hydrocarbon to the mixture of pulverised fuel and agglutinant material, before forming it into briquettes.—H. B.

Solidifying Petroleum and other Mineral Oils for their Application as Fuel and for Lighting Purposes; Process for ——. V. J. Kuess. Eng. Pat. 7481, March 29, 1904. III., page 817.

Peat [Briquettes]; Treatment of ——. A. McLean, London, and W. Paterson, Dumfries. Eng. Pat. 12,231, May 30, 1904.

UNSLAKED lime, in amount about 5 per cent. of the quantity of peat treated, is sifted over the latter, and the mass thoroughly mixed. After drying on a "hearth," the mass is formed into briquettes under a pressure of about 2 tons per square inch.—L. F. G.

Sewage [Sludge]; Treatment of —— [Fuel Briquettes]. A. McLean and W. Paterson. Eng. Pat. 12,232, May 30, 1904. XVIII. B., page 833.

Furnaces for Burning Liquid Hydrocarbons. W. P. Thompson. From W. N. Best, Los Angeles, Cal., U.S.A. Eng. Pat. 23,659, Oct. 31, 1903.

THE furnace is built of specially constructed fire-bricks, and comprises a fire-box open below, and situated above an air chest from which air is supplied to the furnace at suitable points, an arch of fire-brick slanting upwards and furnished with a refractory shield against which the atomised fuel is blown, a passage in the arch to pre-heat the air supplied to the furnace and prevent burning of the arch material, and means for controlling the air supply. —L. F. G.

Furnaces and Fire Boxes for burning Liquid Hydrocarbons. W. P. Thompson. From W. N. Best, Los Angeles, Cal., U.S.A. Eng. Pat. 23,660, Oct. 31, 1903.

THE invention relates to an improved form of burner having an oil outlet, and a steam or air nozzle arranged behind in such a way as to discharge across the oil outlet. The nozzle is reduced in area at the middle, and "flares" outwardly at the sides, so that the oil is carried by the steam or air in a fan-shaped blaze that completely fills the furnace. A plate is arranged over the outlet to regulate the supply of fuel. —L. F. G.

Vaporising and Burning Oils; Apparatus for ——. F. Dumontier, C. Chartier (*née* Paysant), L. H. Ninin, and M. Vénitien (*née* Leroy), Paris. Eng. Pat. 8596, April 14, 1904.

THE apparatus, designed for use with heavy oils, and of which two forms are described, consists of one or more vertical vaporising chambers heated by the flame of the burner itself; a collecting chamber at the top, leading the vapours to the burner; and recesses formed in the vaporising chambers for collecting any deposits which may be produced; all portions of the apparatus being so arranged as to be easily taken to pieces for purposes of cleaning.—H. B.

Oxy-hydrogen Combustion Apparatus. The International Oxy-generator Syndicate, Ltd., and A. Rosenberg, London. Eng. Pat. 14,663, July 1, 1903.

A HEAVY hydrocarbon is forced from a reservoir through a tube containing a wick, or through capillary tubes, into a volatilising chamber packed with asbestos or wire gauze, and heated by a burner. The vapour passes into a mixing chamber, provided with suitable baffle plates, where it is mixed with oxygen under pressure, and then issues to the burner jet. A by-pass from the oxygen supply-pipe leads to the reservoir, supplying the pressure requisite for forcing out the hydrocarbon, the rate of supply being therefore always proportional to the pressure of the oxygen, and to the consumption. The pressure in the reservoir may be augmented by heating.—L. F. G.

Siemens Regenerative Furnaces; Impts. in ——. A. Kurzwernhart, Zuckmantel, Austria. Eng. Pat. 8311, April 11, 1904.

The combustible gas remaining in the regenerative chamber of the Siemens furnace is forced, before the reversal of the gas and air current, into the furnace by means of waste gases drawn, for example, from the flue of the furnace itself. Suitable valves are provided for simultaneously shutting off the supply of producer gas, and admitting the supply of waste gases which is to drive the former into the furnace. The waste gases may be drawn from the flue and driven through the regenerative chamber by means of a fan, steam injector, or the like. Alternatively, the waste gases may be driven through the chamber by means of a current of air introduced at a suitable point behind them; in this case the air is introduced into a branch of the furnace flue, which is normally filled with waste gases, the branch being placed in communication with the gas-supply pipe at the time of reversal.—H. B.

Gas Producers [*for Moistor Bituminous Fuels*]. A. Cerasoli, London. Eng. Pat. 20,678, Sept. 25, 1903.

The upper region of the producer is divided into three compartments by two partitions depending from the top to different depths. Two of the compartments have feeding hoppers at the top, the gas-outlet pipe being arranged on the top of the third. An inclined grate, to which the blast of air, or air and steam, is supplied, is placed at the foot of the producer at the side opposite to that of the gas-outlet compartment; hence the main volume of gas produced in the zone of combustion is led off directly by this compartment. By means of a steam injector directed through an opening in the upper part of the partition between the other two compartments, part of the hot gas from the combustion zone is drawn up through the one column of raw fuel and driven down through the other; hence the moisture or tarry matter contained in the fuel (peat, soft slack, &c.) is distilled off and driven through the incandescent zone before reaching the outlet.—H. B.

Sealing Metal into Glass or other Vitreous Material [*Wires for Incandescent Lamps, &c*]; *Methods of* ——. E. A. Carolan, London. From The General Electric Co., of Schenectady, New York, U.S.A. Eng. Pat. 18,255, Aug. 24, 1903.

The metal is surrounded with a glass envelope, and heated electrically, and any gases driven off by the heating are removed from the envelope by a pump. While still hot, the glass is fused round the metal.—W. C. H.

Incandescent Mantles [*Wood Cellulose*]. Evered and Co., Ltd., Smethwick. From C. Weiblen, Metzingen, Germany. Eng. Pat. 22,451, Oct. 17, 1903.

"Wood cellulose, prepared in the ordinary way, is made suitable for weaving or knitting by drawing the threads or filaments of the same through preferably a fatty, saponaceous, watery liquid, such as soapy pulp containing fat and water." The prepared threads are woven into mantle fabrics, cleansed in an acid bath, washed with distilled water, and then impregnated as usual with salts of suitable earths. Fabrics of wood cellulose are stated to have a greater absorbing power than those of cotton.—H. B.

United States Patents.

Superheater for Gas Producers. A. B. Duff, Pittsburg. U.S. Pat. 764,137, July 5, 1904.

The superheater comprises a cylindrical casing; upper and lower tube-plates; two up-comer tubes and two down-comer tubes extending between the tube-plates; a dust-box at the foot of each set of tubes; and an inlet and an outlet on the casing to cause the air, or air and steam, required for the producer to circulate round the tubes; the cross-sectional area of the tubes being much greater than that of the gas-supply pipe from the producer, so as to reduce the speed of the gas and permit the deposition of dust.—H. B.

Combustible Gas from Petroleum-Oil or other Hydrocarbon Fluids; Apparatus for Producing ——. C. A. Kuenzel, Brooklyn, N.Y. U.S. Pat. 764,601, July 12, 1904.

A combustion-chamber, steam-chamber, and hydrocarbon-chamber are so combined that the heated air and hydrocarbon vapour are passed through a mixing vessel, having a perforated diaphragm, to the combustion-chamber. —W. H. C.

Gas Washer. O. N. Guldlin, Fort Wayne, Ind. U.S. Pat. 763,049, July 5, 1904.

The gas ascends through small perforations in a horizontal plate on to which the washing liquid is supplied from above. Adjacent to the perforations are small projecting plates which deflect the ascending streams of gas along the direction of the plate and accelerate the flow of the liquid on the plate.—T. F. B.

Smelting Compounds and Producing Carbides [*Electrically*]. W. S. Horry, Assignor to Union Carbide Co. U.S. Pat. 765,838, July 26, 1904. XI. A., page 828.

Fuel, Artificial; Process for the Manufacture of ——. J. J. Shedlock. Fr. Pat. 340,981, March 5, 1904.

The mixture of coal dust and tar, for example, is made in a suitable closed vessel, from which the air is expelled by superheated steam or gas. The gaseous current volatilises the resinous matter and renders the material adhesive, whilst any volatile bodies are carried into a condenser and recovered.—W. H. C.

French Patents.

Coal Mine; Artificial ——. R. J. P. Cottamin. Fr. Pat. 311,333, March 15, 1904.

Vegetable and mineral matters such as grasses, leaves, chalk, &c., are treated in closed tanks or pits with sewage, in order to obtain, by the action of bacteria, artificial coal, phosphates, sulphates, and ammonia.—W. H. C.

Liquid Air; Manufacture of —— [*Water-Gas, &c.*]. Soc. L'Air Liquide (Soc. An. p. l'Etude et l'Exploitatio des Proc. G. Claude). Fourth Addition, of Feb. 8, 1904, to Fr. Pat. 296,211, Jan. 16, 1900.

The apparatus and processes described in Fr. Pat. 296,211, Jan. 16, 1900, and in the Additions thereto of Oct. 1900, and of June 1902, for the manufacture of liquid air, are now claimed as applicable, including the expansion of the compressed gases at low temperature, to water-gas, to low-grade gas, and the like. Compare Eng. Pats. 12,905 of 1900, and 27,658 of 1902; this J., 1901, 1018, and 1903. 1339.—E. S.

[*Mineralised*] *Electrodes for Arc Lamps.* A. Blonde. Third Addition, dated Feb. 1. 1904, to Fr. Pat. 23,81 of Aug. 18, 1902 (this J., 1903, 487).

Electrodes of the kind described in the main patent having an external coating of pure carbon, are provided with a second sheath of carbon, baked beforehand at very high temperature; the inner layer of carbon, which is attached directly to the mineralised core, serving to ensure a good electrical contact between the core and the outer highly baked layer.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum and its Distillation Products; Optical Examination of ——. M. Rakusin. J. russ. phys.-chem. Ges. 1904, **36**, 554—559. Chem. Centr., 1904, **2**, 270.

The colourless and also the yellow distillation products o petroleum, from benzine (petroleum spirit) up to spindl oil, showed a dextro-rotation of 0·2°—2·3° (saccharimeter degrees). Of the oils examined, yellow spindle oil from Baku showed the greatest rotation. Benzine and kerosene from Grosny petroleum, yellow American spindle oil ("Viscolite"), and solutions of Baku petroleum in benzine and benzene also showed a dextro-rotation.—A. S.

Methyl Alcohol; Determination of —— in Products of Wood Distillation. M. J. Stritar and H. Zeidler. XXIII., page 841.

ENGLISH PATENTS.

Lubricants; Manufacture of Solid and Fluid Mineral ——. P. J. Tabourin, Paris, J. Girard, Saone et Loire, and L. Portevin, Paris. Eng. Pat. 24,801, Nov. 14, 1903. Under Internat. Conv., Nov. 15, 1902.

See Fr. Pat. 326,348 of 1902; this J., 1903, 791.—T. F. B.

Solidifying Petroleum and other Mineral Oils for their Application as Fuel and for Lighting Purposes; Process for ——. V. J. Kuess, Tunis. Eng. Pat. 7481, March 29, 1904. Under Internat. Conv., Nov. 6, 1903.

Ten kilos. of rosin, "or any other hydrocarbon of the turpentine series," is dissolved in 100 litres of petroleum, and 10 kilos. of melted animal fat is stirred in. A solution of 3 kilos. of caustic soda in 3 litres of water is then stirred in, and, after two hours, a litre of hydrochloric acid is added. After about four hours a further 2 kilos. of caustic soda, dissolved in 2 litres of water, is added, and the mixture, after standing two or three days, is heated "on a slow fire," under slight pressure, for about three hours, and poured into moulds. The resulting solid blocks are suitable for lighting, heating, and other purposes. (Compare Fr. Pat. 337,714, this J., 1904, 488.)—T. F. B.

UNITED STATES PATENTS.

Desulphurising Oils or Distillates; Process of ——. O. P. Amend, New York. U.S. Pat. 764,099, July 5, 1904.

Oils or distillates are treated with alkali in excess of the amount required to neutralise the acids present, and are then agitated with copper sulphate, thus precipitating copper sulphides. The product is now oxidised, *e.g.*, by addition of "ferrous hydrate" and injection of steam, to convert the copper compounds to sulphate, which is removed, and the oil is allowed to settle.—T. F. B.

Combustible Gas from Petroleum-Oil or other Hydrocarbon Fluids; Apparatus for Producing ——. C. A. Kuenzel. U.S. Pat. 764,601, July 12, 1904. II., page 816.

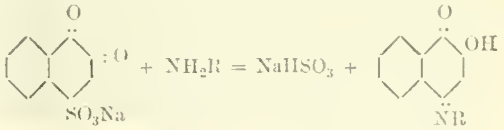
IV.—COLOURING MATTERS AND DYESTUFFS.

Ethylbenzylaniline. G. Schultz, O. Rohde, and E. Bosch. Annalen, 1904, **334**, 235—264.

p-Nitrosoethylbenzylaniline was obtained by adding hydrochloric acid and sodium nitrite to the alcoholic solution of ethylbenzylaniline. The product was extracted with ether after liberation by addition of sodium carbonate. The ethereal extract is green. A subsequent ethereal extract was dark red, but no definite substance could be isolated from it. The yield was about 70 per cent. of the theoretical amount and benzaldehyde was always formed as a by-product. *p*-Nitrosoethylbenzylaniline forms steel-blue plates and is quite analogous in its reactions to *p*-nitrosodimethylaniline. Thus it condenses with β-naphthol to form an oxazine dyestuff which is of a purer blue shade than its analogue, Meldola's Blue. A hydrochloride of *p*-nitrosoethylbenzylaniline was prepared, but is decomposed by water. On nitration of ethylbenzylaniline by adding nitro-sulphuric acid to its solution in strong sulphuric acid in the cold, the authors obtained mainly *m*-nitrobenzylethylaniline, together with a little *p*-nitrobenzylethylaniline. This does not agree with the results of Gnehm and Schentz (J. pr. Chem., 1901, **63**, 426), who state that they obtained *p*-nitroethylbenzylaniline. The *m*-compound forms reddish-brown prisms, and the *p*-compound yellow rhombs. *o*-Nitrobenzylethylaniline was obtained synthetically from *o*-nitrobenzylchloride and ethylaniline. All these nitrobenzylethylanilines form white hydrochlorides, decomposed by water. *o*-Nitro-ethylbenzylaniline was obtained as a reddish-brown oil, which refused to crystallise, by the action of *o*-nitrobromobenzene on ethylbenzylaniline. It is more basic in properties than *o*-nitrobenzylethylaniline. The authors also attempted to oxidise *p*-nitroso-ethylbenzylaniline to the *p*-nitro compound. A large number of oxidising agents were employed, but a crystalline product could only be obtained by oxidation with dilute nitric acid, and in this case a dinitro product was obtained. The same product was obtained by the action of fuming nitric acid on ethylbenzylaniline dissolved in a little glacial acetic acid. It shows no basic properties. *p*-Nitro-ethylbenzylaniline was obtained by nitrating ethylbenzylaniline, dissolved in 30 times its weight of glacial acetic acid, with the calculated amount of fuming nitric acid. The product was isolated with some difficulty. After reduction to the corresponding amino compound it gives the Methylene Blue reaction, which proves the *p*-position of the nitro group. It shows no basic properties. The authors find that the method of preparing aminobenzylethylanilines by adding nitrobenzyl chlorides to aniline, and at once reducing with iron and hydrochloric acid, described in Ger. Pat. 56,908, does not lead to the required result, aniline and toluidine being formed by decomposition of the molecule. Other reducing agents led to the same result. The amino compounds cannot be obtained by reduction of the formed nitro compounds for similar reasons. *p*-Amino-ethylbenzylaniline was obtained from *p*-nitroso-ethylbenzylaniline by reduction with zinc dust and dilute sulphuric acid. This base gives the Methylene Blue reaction. It is oxidised by the air. It also yields well-defined benzoyl and acetyl derivatives. After diazotisation it couples with β-naphthol to form an azo dyestuff which, after crystallisation, forms black crystals with a green lustre, which are red by transmitted light.—E. F.

Naphthoquinonesulphonic Acid; Applications of ——. P. Ehrlich and C. A. Herter. Z. physiol. Chem., 1904, **41**, 379—392. Chem. Centr., 1904, **2**, 112—114.

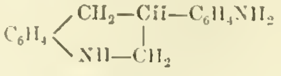
Witt's 1.2-naphthoquinone-4-sulphonic acid combines with all aromatic mono- and diamines, the dyestuffs produced being mostly orange when a monamine is used; a dimethylamino group in the para-position causes a change of colour from orange to violet. The acid also forms dyestuffs with so-called acid methylene compounds, resorcinol, phloroglucinol, secondary amines (piperidine, diamylamine, methylaniline), and also with bodies such as peptone, tyrosine, and uric acid. The reaction with amines proceeds according to the equation—



The condensation products are insoluble in water; by the introduction of an acid (COOH, SO_3H) group, they become soluble in alkali, and by the introduction of amino groups, soluble in acids. Among the "acid methylene" compounds from which dyestuffs were prepared were nitromethane, nitrotoluene, acetylacetone, benzoylacetone, aceto acetic ester, benzoyl acetic ester, desoxybenzoïn, cyanacetamide, phenylpyrazolone and rhodanic acid.—A. S.

Dyestuffs; New [Azo and other] ——. L. Paul. Chem.-Zeit., 1904, **28**, 702—704.

When amines are heated at about 220° C. with glycerin which has previously been freed from water by heating at 230°—240° C., compounds are formed belonging to three classes:—(1) L-bases, soluble in hydrochloric acid and diazotisable; (2) S-bases, soluble in hydrochloric acid and not diazotisable; and (3) Rx-compounds, apparently feeble dyestuffs, which are neither soluble in hydrochloric acid nor diazotisable. The L-base (A L-base, prepared from aniline) of the probable formula—



forms a greyish powder. On being diazotised and combined with salt-R, it yields a Ponceau which dyes wool similarly to the ordinary azo-Ponceaux; with resorcinol, it gives a yellow azo compound. This base is also formed from phenylhydrazine hydrochloride and glycerin. The L-base from benzidine (B L-base) dissolves readily in ether and 50 per cent. alcohol. Treated with nitrous acid, it gives a tetrazo compound which combines with phenols, &c., the compounds formed being more soluble and yellower in shade than the corresponding benzidine compounds. Bases were similarly obtained from sulphanilic acid, a-naphthylamine, *p*-aminoacetanilide, *p*-nitraniline and other amines. The products obtained by the L reaction from *p*-nitraniline, a-naphthylamine, dimethylaniline, *m*- and *p*-phenylenediamine, and other bases are for the most part more soluble than the bases from which they are derived. It would thus appear possible that the reaction may be of general utility in obtaining derivatives of greater solubility from sparingly soluble amines. In the case of *m*-phenylenediamine, the glycerin appears to take no part in the reaction, but to act solely as a solvent. On heating proportions of glycerin (30 c.c.) and of the hydrochloride salt (3·6 grms.) similar to those found most suitable for the preparation of the AL- and BL-bases, no diazotisable base is obtained. With a much larger proportion of the salt (25 grms. and 50 c.c. of glycerin) a different reaction takes place. Hydrochloric acid and ammonia are evolved and a diazotisable base is formed which dissolves readily in acetic acid, and from this solution dyes cotton mordanted with tannic acid in brown shades, which are very fast to light. On sulphonation, the base yields two sulphonic acids. When resorcinol (25 grm.) is heated with a small proportion of zinc chloride (5 grms.), two dyestuffs are obtained. That which is chiefly produced (yield—60 per cent.), when precipitated from its alkaline solution by sodium bisulphate, dyes silk a salmon-pink colour. It yields two sulphonic acids, which differ greatly in solubility, the more soluble dyeing wool in orange-red shades. With a larger proportion of zinc chloride (25 grms.) the dyestuff which with less of this reagent is formed in smaller amount (yield, 1½ per cent.), is chiefly produced. It dyes wool and silk in yellowish-brown colours and has greater dyeing power than the other dyestuff. The bromo derivatives of both compounds are bluish-red dyestuffs; their sulphonic acids dye wool in bright scarlet shades. A mixed dyestuff is obtained by adding *m*-phenylenediamine hydrochloride (7 grms.) to resorcinol (14 grms.) heated to a little below its boiling point. It dissolves in alkalis, and from a bath prepared by precipitating it in a fine state of division by the addition of an acid salt to its alkaline solution, it dyes wool and cotton in orange shades. It yields two sulphonic acids. Dimethyl-*m*-phenylenediamine hydrochloride gives with resorcinol a dyestuff of bluish shade soluble with difficulty.—E. B.

Galloflavin and Resoflavin. J. Herzig and R. Tscherne.

Monatsh. f. Chem., 1904, **25**, 603—610.

GALLOFLAVIN was first prepared by Bohn, and Bohn and Graebe, after investigating it, proposed $C_{13}H_6O_9$ as its most probable formula. The authors have re-examined the pure compound and its acetyl and methyl derivatives, and find that the analytical results correspond best with the formula $C_{15}H_8O_{10}$ or $C_{15}H_3O_5(OH)_5$. The methyl derivative was prepared by treating galloflavin with excess of diazomethane in ethereal suspension. An interesting point is that whilst acetylgalloflavin (m. pt. 232°—234° C.) can be obtained in almost white crystals, the crystals of methylgalloflavin (m. pt. 235°—237° C.) have a distinct yellow tinge. Resoflavin, obtained by the oxidation of *s*-dihydroxybenzoic acid has similar properties to galloflavin. Its acetyl derivative (m. pt. 274°—277° C.) is white, and its methyl derivative (m. pt. 282°—283° C.) distinctly yellow. The high melting points of the acetyl and methyl derivatives of the two compounds point to high molecular weights, and the authors consider it not improbable that the molecule of galloflavin is larger than $C_{15}H_8C_{10}$; the analytical figures would answer just as well for a multiple of $C_3H_2O_2$.—A. S.

Gallobromine, a Dyestuff Derived from Dibromogallic Acid.

P. Sisley. Rev. Gén. Mat. Col., 1904, **8**, 225—227.

DIBROMOGALLIC acid (50 parts) is dissolved in alcohol (300 parts), formaldehyde (30 parts of 40 per cent. aqueous solution) added, and sulphuric acid (300 parts of 98 per cent. strength) gradually run in, the solution being constantly agitated. After the mass has been left at rest for 12 hours, it is poured into water, the precipitate being collected, washed, and dried. The yield amounts to about 50 per cent. of the dibromogallic acid taken. The crude dyestuff obtained was purified by dissolving it in a solution of sodium carbonate. After purification it was finally obtained in the form of a dark brown powder. It is almost insoluble in water, soluble with a reddish-purple colour in alcohol, acetic acid, &c., with a bluish purple colour in dilute alkali solutions. It dyes metallic oxide mordants in shades closely resembling those of the corresponding logwood combinations. The dyeings are faster to soaping than those of logwood, but not fast to light. Gallobromine can also be prepared by brominating trihydroxyfluorone dicarboxylic acid (see Möhlau, this J., 1898, 571), and its formula must therefore be—

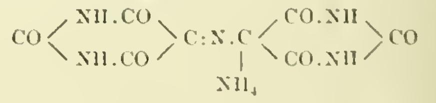
$$\begin{array}{l} CBr.C(COOH) : C\,.\,CH : C.C(COOH) : CBr \\ \ddot{C}(OH).C(OH) : \dot{C} - O - \dot{C} - C(OH) - \dot{C} : O \end{array}$$

The reddish dyestuff which is formed along with "gallobromine" from dibromogallic acid, is probably dibromotrihydroxyfluorone.—E. B.

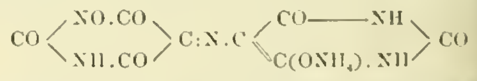
Purpuric Acid and Murexide; Constitution of ——.

R. Möhlau. Ber. 1904, **37**, 2686—2691.

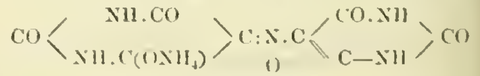
FROM the results of his investigations, on similar lines to those of Piloty and Finckh (this J., 1904, 656), and from theoretical considerations, the author concludes that the formula of murexide is probably—



or—



the first being a pseudo form of the other. He therefore comes to the same essential conclusions as Piloty and Finckh (*loc. cit.*) and as Slimmer and Stieglitz (this J., 1904, 656). He considers an alternative formula—



proposed by Piloty to be unlikely in view of the instability of murexide.—E. F.

English Patents.

Tetrazophenol Sulphonic Acid; Manufacture of a ——

O. Imray. From Farb. vorm. Meister, Lucius un Brüning. Hoechst-on-Maine, Germany. Eng. Pat 18,283, Aug. 24, 1903.

IF the disulphonic acid obtained by sulphonating *m*-phenylenediamine is diazotised in the usual manner, a mixture o a diazo-compound and of a Vesuvine dyestuff is formed If the dyestuff formation is avoided as much as possibl which can be done by using considerably more than th theoretical quantity of nitrite, and ensuring the continuou presence of at least one molecule of nitrous acid in excess a good yield of tetrazophenolsulphonic acid is obtained one sulphonic acid group being replaced by a hydroxy group. The operation is carried out by running th solution of diamino-acid and nitrite into mineral acid, o by rapidly mixing the mineral acid with the solution o diamino-acid and nitrite, or by rapidly mixing nitrit solution with that of the diamino-acid and mineral aci ius a solution of 1 mol. of the sodium salt of the diamino- ulphonic acid and 2·4 mols. of nitrite may be run at the dinary temperature below the surface of excess of dilute drochloric acid. The tetrazophenolsulphonic acid separates rtly as yellow crystals.—E. F.

lphurised Dyestuffs [Sulphide Dyestuffs]; Manufacture of Clear Yellow, Orange Yellow to Yellow Orange ——. O. Imray. From Farb. vorm. Meister, Lucius und Brüning, Höchst-on-Maine, Germany. Eng. Pat. 21,945, Oct. 12, 1903.

HE dyestuffs are obtained by heating to a high temperature toluylenediamine, or the products obtained by the action carbon bisulphide on *m*-toluylenediamine, or the products tained by heating the last-mentioned products, with sul- ur and an aromatic base, such as benzidine, or with lphur and formanilide. To make the products technically eful, they are then heated with sodium sulphide and dried *vacuo* Thus, for instance, equal molecules of *m*-toluylene- amine and formanilide are introduced into 28 atomic pro- rtions of molten sulphur, preferably at about 110°—130° C. ie temperature is gradually raised to 210°—220° C. The estuff changes from yellow to orange yellow. When ld, the melt is pulverised and introduced at about 80° C. o $2\frac{1}{2}$ times its weight of sodium sulphide, heated to 5° C., and dried.—E. F.

louring Matters [Sulphide Dyestuffs]; Production of ——. Read Holliday and Sons, Ltd., J. Turner, H. Dean, and J. Turner, Huddersfield. Eng. Pat. 18,924, Sept. 2, 1903.

IE yellow nitro dyestuff prepared, according to Eng. Pat. ,078 of 1902 (see this J., 1903, 1081) by nitrating itrodiphenylaminesulphonic acid, is heated alone, or th an equal weight of *m*-dinitro-*p*-hydroxydiphenylamine, th sulphur and sodium sulphide. The resulting dye- iffs dye vegetable fibres greenish-black or black from a th containing sodium sulphide.—T. F. B.

alogenised Nitro Compounds. H. H. Lake. From K. Oehler, Offenbach-on-Maine, Germany. Eng. Pat. 10,678, May 9, 1904.

2.4-Dichloronitrobenzene is obtained by the action of lorine on molten *p*-chloronitrobenzene in presence of a itable carrier such as anhydrous ferric chloride, iron, timony pentachloride, iodine or phosphorus pentachloride. ie most advantageous temperature for the reaction is 5° C. When phosphorus pentachloride is used it is lvantageous to raise the temperature to 150° C. When e mass has increased in weight by the theoretical amount, is poured into water and washed with water at 50° C. he product is thus obtained in theoretical quantity and fficiently pure for technical use. It can be distilled thout decomposition at 750 mm. pressure and 256—260° C. --E. F.

UNITED STATES PATENTS.

lphur Dye [Sulphide Dyestuff]; Black ——, and Process of Making same. R. Lauch, Uerdingen, Germany. U.S. Pat. 764,733, July 12, 1904.

SOLUTION of *p*-aminodinitrodiphenylamine in certain lvents is heated with sulphur and an alkali sulphide to out 180° C. The product is black, rather hygroscopic, d soluble in cold sodium sulphide solution with greenish lour, becoming blue with further sodium sulphide. This lution becomes bluish-black on oxidation in the air and elds a black precipitate with mineral or acetic acid. The estuff yields on unmordanted cotton from an alkali phide bath deep black shades without further oxidation, narkably fast and improved by further treatment with tallic salts such as bichromates and copper sulphate, racterised by fastness to acid, alkali and light.—E. F.

lphur Dye [Sulphide Dyestuff]; Direct Cotton ——, nd Process for Making same. R. Lauch, Uerdingen, ermany. U.S. Pat. 764,734, July 12, 1904.

Aminodinitrodiphenylamine is boiled with sulphur and phides in presence of certain diluting agents. The duct is a violet-black powder, dissolving in sodium sulphide solution to a violet liquid, and dyeing unmordanted cotton directly from a sodium sulphide bath. The dyeings are improved by further treatment with metallic salts. —E. F.

Sulphur Dyes; Process of Making Stable ——. R. Lauch, Uerdingen, Germany. U.S. Pat. 764,735, July 12, 1904.

THE dyestuffs obtained by the action of sulphur and alkali sulphide on *p*-aminodinitrodiphenylamine are rendered stable by exposing them in a powdered state to the action of air.—E. F.

Azo-Colour [Azo-Dyestuffs]; Red ——. P. Julius and C. Winter, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 765,079, July 12, 1904.

o-Chloro-*p*-toluidine is diazotised and coupled with 2-naphthol-3.6-disulphonic acid. The sodium salt of the dyestuff is brilliantly red and soluble with difficulty in cold, but easily in hot water. The barium lake of the dyestuff is brilliant red in colour and practically insoluble in water. —E. F.

Azo-Colour [Azo-Dyestuff]; Yellow-Red ——. P. Julius and F. Osthelder, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 765,080, July 12, 1904.

o-Chloro-*p*-toluidine is diazotised and coupled with β-naphthol. The product is a yellowish-red dyestuff yielding a yellowish-red lake when mixed with a substratum. —E. F.

Cyanmethylanthranilic Acid; Omega ——. O. J. Graul, Assignor to the Badische Anilin und Soda Fabrik, Ludwigshafen-onRhine, Germany. U.S. Pat. 765,576, July 19, 1904.

SEE Eng. Pat. 14,676 of 1903; this J., 1904, 604.—E. B.

Azo Dyestuff, and Process of Making same. P. Julius and S. Haeckl, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. U.S. Pat. 765,581. July 19, 1904.

SEE Eng. Pat. 16,995 of 1903; this J., 1904, 712.—T. F. B.

Indigo; Process of Purifying ——. P. E. Oberreit, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. U.S. Pat. 765,590, July 19, 1904.

SEE Eng. Pat. 7395 of 1903; this J., 1904, 248.—T. F. B.

Anthrarufin; Process of Making —— *[Anthracene Dyestuffs].* R. E. Schmidt, Elberfeld, and P. Tust, Vohwinkel, Assignors to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 765,201, July 19, 1904.

SEE Fr. Pat. 336,867 of 1903; this J., 1904, 438.—T. F. B.

Chrysazin; Process of Making —— *[Anthracene Dyestuffs].* R. E. Schmidt, Elberfeld, and P. Tust, Vohwinkel, Assignors to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 765,637, July 19, 1904.

SEE Fr. Pat. 336,867 of 1903; this J., 1904, 438.—T. F. B.

FRENCH PATENTS.

Indigo Dyestuffs; Process for Producing —— from Leuco-Compounds, obtained from Phenylglycin and its Derivatives by means of Alkali Amides. Cie. Paris. Coul. d'Aniline. Fr. Pat. 338,824, May 26, 1903.

SEE Eng. Pat. 11,630 of 1903; this J., 1904, 438.—T. F. B.

[Indigo Dyestuffs] Indoxyl, and its Homologues and their Derivatives; Production of ——. Fabr. Baloise de Prods. Chim. Fr. Pat. 340,695, Feb. 24, 1904.

SEE U.S. Pat. 761,440 of 1904; this J., 1904, 712.—E. F.

Acetyldiaminophenolcarbonic Acid and Azo-Dyestuffs derived therefrom; Preparation of ——. Soc. L. Cassella et Cie. Fr. Pat. 338,844, June 5, 1903.

p-AMINOSALICYLIC acid is acetylated in the usual manner, nitrated in strong sulphuric acid solution at 5°—10° C.

with strong nitric acid, and the nitro-acetylaminophenolcarbonic acid so obtained is reduced, preferably with iron and acetic acid. The 1-hydroxy-2-amino-4-acetylaminobenzene-6-carboxylic acid so obtained is isolated in the usual manner. It is soluble with difficulty in water, the salts being easily soluble. With nitrous acid it forms a golden-yellow diazo compound, very insoluble in water, and combining with naphthols, dihydroxynaphthalenes, aminonaphthols, and their sulphonic acids to form mordant azo dyestuffs which are much bluer in shade, more even, and faster to light than those derived from 1-hydroxy-6-aminobenzene-2-carboxylic acid. Thus, with β-naphthol, a dyestuff is obtained dyeing wool from an acid-bath in Bordeaux red shades turning to violet when treated with bichromate. With aminonaphtholsulphonic acid H a product is obtained dyeing unmordanted wool in violet shades, which become bright blue on treatment with bichromate.
—E. F.

Acid Cyanides [*ω-Cyanomethylaniline Derivatives*]; *Production of* ——. Badische Anilin und Soda Fabrik. Fr. Pat. 338,818, Dec. 5, 1903. Under Internat. Conv., Oct. 24, 1903.

Schiff's bases, produced by condensing an aromatic amine with an aldehyde, are converted into the corresponding nitriles of the general formula R.NH.CH(R′)CN on treatment with hydrocyanic acid. ω-Cyanomethylaniline is produced by stirring 110 grms. of anhydroformaldehyde-aniline into a solution of 70 kilos. of potassium cyanide in 200 litres of water and 300 kilos. of ice, to which the theoretical quantity of acid has been added; the mixture is heated at 100° C. for two hours in an autoclave, and the product filtered off. (See also Eng. Pat. 14,676 of 1903; this J., 1904, 604.)—T. F. B.

Orthohydroxy Azo Dyestuffs susceptible to Chroming on the Fibre; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 338,819, Dec. 17, 1903. Under Internat. Conv., Nov. 27, 1903.

α-Naphthylamine di- or tri-sulphonic acids, which have one sulphonic group in the *o*-position to the amino group, are diazotised, and the diazo compounds allowed to stand in neutral solution, or with dilute acid, or with alkali acetates or carbonates; the *o*-hydroxydiazonium compounds thus produced, when coupled with β-naphthol, give dyestuffs which dye wool violet-red to red-brown shades, converted to deep blue or bluish-black on chroming.—T. F. B.

Dyestuffs of the Anthracene Series [*Indanthrene Dyestuffs*]; *Production of Grey* ——. Badische Anilin und Soda Fabrik. Fr. Pat. 341,126, Jan. 12, 1904.

1.5-, 1.8-, 1.3-, 2.6-, or 2.7-Diamino-anthraquinone is fused with potassium hydroxide at 180°—200° C. The sulphonic acids of these diamines may also be used. The melt is boiled with water, and the insoluble dyestuff separated by filtration. The products form reddish-grey to olive-grey pastes, and, when dry, black powders, almost insoluble in ordinary solvents. Their properties resemble those of Indanthrene and Flavanthrene. They dye the vegetable fibres from a reduction vat containing alkali hydroxide in bluish-grey to reddish-grey shades, and can also be used for printing. The dye-liquor is brown in colour. The dyeings are remarkably stable. The dyestuffs from the 1.5- and 1.8-diamines give reddish, those from the 1.3-, 2.6-, and 2.7-diamines give greenish shades.
—E. F.

Anthraquinone Derivatives [*Anthracene Dyestuffs*]; *New Process for the Production of* ——. Soc. Anon. Prod. F. Bayer et Cie. Fr. Pat. 340,517, Feb. 17, 1904.

1.4-Aminohydroxyanthraquinone, 1.4-alkylaminohydroxyanthraquinones, and sulphonic acids of these compounds are obtained by heating α-aminoanthraquinone, α-alkylaminoanthraquinone, and their sulphonic acids with fuming, 100 per cent. or ordinary concentrated sulphuric acid, with or without addition of boric acid. The products either serve for the production of, or are themselves, dyestuffs of technical value. The product obtained from α-methylaminoanthraquinone with 20 per cent. fuming sulphuric acid and boric acid at 150°—160° C., which is probably 1-methylamino-4-hydroxyanthraquinone-2 sulphonic acid, dyes unmordanted wool in violet and chrom mordanted wool in blue shades. 1-Methylamino-4-hydrox anthraquinone-5-sulphonic acid, from 1-methylaminoanthr quinone-5-sulphonic acid, has similar dyeing properties.
—E. F.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Dyeing [*Mordanting*] *Process. VI. Theories of t Mordanting Process.* P. Heermann. Färber-Zei 1904, **15**, 165—170, 183—188, 197—200, 214—219.

Five theories which have been suggested to explain t mordanting process are discussed with respect to the f lowing practical matters of experience: (1) the nature the fibre has a great influence on the result; (2) t mordant cannot be rubbed off the fibre, or boiled out of i (3) the duration of treatment and the temperature, conce tration, and basicity of the mordant bath have very gre influence on the ultimate result (see this J., 1903, 361 a 623, and 1904, 57 and 439); (4) the efficiency of a morda is not proportional to its ionisation; (5) the temperature the mordant bath rises during the process; (6) chemical indifferent compounds (fibre and mordant) take part the process; (7) the fibre is not altered structurally chemically by the process, and can be obtained in original form by dissolving out the mordant base: (8) t basicity of the mordant (see this J., 1904, 439) remai constant during the process; (9) the mordant base (on t fibre) is capable of further combination and reaction: (1 the ratio between the weights of mordant and fibre influen the result of the operation. The "impregnation" theory contradicted by facts (1), (2), (3), (4), (5), and (10), a is quite untenable; the "solution" theory does not agr with facts (3) and (8) and possibly (6) and (9); t "organo-metallic" theory (assuming the formation of co pounds of the fibre and the mordant base) is not compati with facts (3), (6), (7), (8), and (9); the "catalyti theory (assuming that the fibre acts as a catalytic age decomposing the mordant, and precipitating a basic salt the fibre) and the "ionic" theory (that the affinity a fibre for a mordant depends on the ionisation of mordant, and on the difference between the elect affinities of the mordant ion and of the fibre) are b proposed by the author as agreeing with all the obser facts; the latter is preferred, as, although the former d not appear to have any flaw, the explanation of the vari facts seem in some cases less simple than in the case of "ionic" theory.—T. F. B.

English Patents.

Dyeing; Apparatus for —— and for similar Purpo L. Mascelli, Milan. Eng. Pat. 20,476, Sept. 23, 1903.

See Fr. Pat. 335,949 of 1903; this J., 1904, 320.—T. F.

Dyeing Hanks of Yarn: Apparatus for ——. G. St Magdeburg, Germany. Eng. Pat. 9311, April 22, 1904

A frame serving as a holder for transversely fixed r upon which hanks of yarn are loosely placed is so c structed as to be capable of being conveyed into and ou a dye-tank, and is so mounted that, when raised out of tank, it may be rotated around a horizontal axis through angle of 180°. Those parts of the hanks which were at top during one immersion in the dye-bath are thus brou to the bottom for the next immersion.—E. B.

United States Patents.

Mercerising [*Yarns*]; *Apparatus for* ——. J. E. Paln Middleton, Conn. U.S. Pat. 765,398, July 19, 190

The apparatus claimed is designed for the purpose stretching yarns, when these are being mercerised in form of hanks, on the inside as well as on the outside the hanks. It comprises (1) a stretching frame, (2) reels, engaging the hanks on the inside, one of whic mounted in stationary, the other in movable, bearings, th of which are laterally adjustable to facilitate the sertion and removal of the hanks, and (3) one or more terally adjustable intermediate reels, engaging the hanks the outside.—E. B.

Printing Yarns; Apparatus for ——. W. Shaw, Brooklyn, N.Y. U.S. Pat. 765,326, July 19, 1904.

E Eng. Pat. 12,483 of 1898; this J., 1898, 846.—E. B.

FRENCH PATENTS.

iscose; Automatic Machine for Fixing Filaments of ——. Soc. Franç. de la Viscose. Fr. Pat. 340,812, Feb. 27, 1904.

HE skeins of viscose threads are supported on a pair of llers, mounted in a vertical plane, in a vat. An acid rinkler is supported over the upper roller, which is fixed in sition. The lower roller can be raised or lowered by eans of a pump, to permit the skeins being put in position removed. Each of the rollers can be rotated by belts om the same shaft, which is fitted with an arrangement of ms, whereby each roller may be caused to perform a rtion of a revolution alternately, thus constantly altering e position of the skeins on the rollers and ensuring regular fixation."—T. F. B.

yeing and Bleaching of Textile Materials; Apparatus for ——. F. Scharmann. Fr. Pat. 340,736, Feb. 26, 1904.

HE machine consists of a closed vertical, cylindrical vessel which are placed two concentric, perforated cylinders, tween which is packed the material to be treated. The ace contained by the inner perforated cylinder is concted to a circulating pump, and by a suitable arrangement partitions and valves the liquid is made to pass in various rections through the material contained between the two rforated cylinders.—A. B. S.

yeing and Bleaching; Apparatus for ——. F. Scharmann. Fr. Pat. 340,792, Feb. 26, 1904.

the centre of the dye vessel a compartment is formed by ans of a number of superimposed segments. A man nds in this compartment and packs the material to be ated, in the surrounding portion of the dye vessel, on a rforated false bottom. As the depth of the material reases, extra sections are placed on the central compartnt until the vessel is full, when the material is covered th a perforated cover. By means of a circulating pump ich is connected with the central and outer parts of the sel, the dye or bleaching liquor is forced up through the terial, passes through the perforated top plate and overws into the central compartment, and then back into the mp. The liquids can be heated with steam-coils placed der the false bottom of the outer vessel.—A. B. S.

inting with Indigo by means of Hydrosulphites; Process for ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 338,831, May 30, 1903.

Eng. Pat. 13,116 of 1903; this J., 1904, 544.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

UNITED STATES PATENT.

Dyeing Skins; Apparatus for ——. P. Bruffaers, Schaerbeek, Belgium, Assignor to H. M. Peyser, Boston, U.S.A. U.S. Pat. 765,375, July 19, 1904.

SEE Fr. Pat. 336,992 of 1903; this J., 1904, 440.—T. F. B.

FRENCH PATENT.

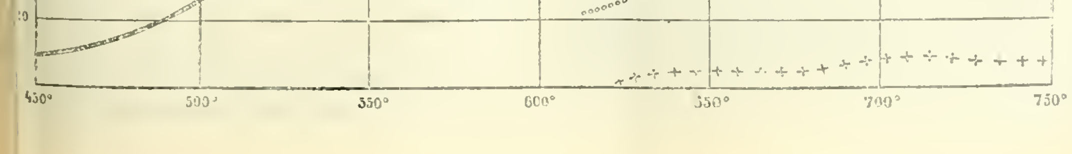
Pearly Effects on Paper, Card, &c.; Process for Obtaining ——. P. Dejey. Fr. Pat. 338,820, May 26, 1903.

PEARL-LIKE effects are produced on paper, &c., by coating it with a hot composition of lead acetate (80 parts), gelatin (5 parts) and glycerin (1 part), and allowing the acetate to crystallise in a strong current of air, or in any other manner which will produce wavy lines or designs on the surface. —T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Sulphur Trioxide; Catalytic Production of ——. G. Lunge and K. Reinhardt. Z. angew. Chem., 1904, **17**, 1041—1051.

THE authors have extended the work of Lunge and Pollitt (this J., 1903, 79), using, however, an electric resistance furnace to heat the tube containing the contact substance, by which means accurate regulation of the temperature, and thus determination of the influence of varying temperatures, is made possible. Lunge and Pollitt's method of passing a stream of mixed sulphur dioxide and air over the heated contact substance, and determining the composition of the mixture before and after contact, was retained; for though it has disadvantages, yet it imitates the conditions of the process as carried out on the industrial scale. The temperature was determined by a Le Chatelier thermo-electric pyrometer, and was found to be very nearly constant for the same strength of current. The results of the several series of observations are as follow:—1. With pure ferric oxide (Aguas Teñidas burnt pyrites), catalytic action begins, under favourable conditions, at about 400° C., and reaches its maximum at 625° C., at which temperature about 70 per cent. of the total sulphur dioxide is converted. 2. Drying the gases by phosphorus pentoxide instead of by ordinary concentrated sulphuric acid is practically without influence on the action. 3. When the burnt pyrites was impregnated with arsenic trioxide, the results in the most favourable case were practically the same as those with ferric oxide alone; they agreed with Lunge and Pollitt's results for ferric oxide containing arsenic, but were higher than those experimenters obtained with ferric oxide alone. 4. Pure ferric arsenate prepared in the wet way gave the same maximum conversion (70 per cent.) at the same temperature (625° C.) as ferric oxide, but ferric arsenite



acted much less favourably (it is doubtful whether the substance prepared and used as ferric arsenite is really a definite compound). 5. Pure arsenic pentoxide also acts as a strong catalyst, giving about 55 per cent. of conversion as a maximum at a temperature of 680° C. 6. The addition to ferric oxide of small quantities of cupric oxide or sulphate is without influence, but larger quantities act prejudicially, and the effect of cupric oxide alone is still less (48—50 per cent. conversion at 680°—740° C.). 7. Jena glass and glazed or unglazed porcelain are almost without action; their catalytic effect is just perceptible at 700° C. Silica, on the other hand, whether as rock crystal or as amorphous quartz, has a very perceptible action (about 10 per cent. conversion at 700° C.). The accompanying diagram, in which the abscissæ are temperatures and the ordinates percentages of conversion, summarises the results.

—J. T. D.

Chromates of Zinc and Cadmium. M. Gröger. Monatsh. f. Chem., 1904, **25**, 520—536.

The author has examined the action of potassium, sodium, and ammonium chromates on solutions of zinc and cadmium salts, in a manner similar to that in which he previously (Sitzungsber. d. k. k. Akad. d. Wiss., Wien, 1903, **112**, II*b*, 263) examined their action on copper salts. The results of the investigation may be summarised as follows:—When different alkali chromates are allowed to act upon solutions of the chlorides of copper, zinc, and cadmium, sodium chromate precipitates a basic chromate of the heavy metal, whilst potassium and ammonium chromates give precipitates of double chromates. Except in the case of the cadmium double chromates, the composition of the precipitate varies according to whether an excess of the salt of the heavy metal or of alkali chromate be used. The precipitates obtained with excess of the alkali chromate generally have a composition varying with the concentration of the reacting solutions; they are probably not definite compounds, but mixtures containing varying proportions of the more stable double chromates produced when excess of the salt of the heavy metal is used. An exception occurs however in the case of zinc chloride and ammonium chromate, the compound obtained with excess of the chromate being more permanent than that precipitated when excess of zinc chloride is present. The double chromates are all decomposed by water, the final products in the case of the zinc and copper compounds being $ZnCrO_4.3Zn(OH)_2$ and $CuCrO_4.2Cu(OH)_2$ respectively. Some of the compounds produced were as follows:—From zinc chloride (excess) and potassium chromate, $4ZnO.K_2O.4CrO_3.3H_2O$; zinc chloride and sodium chromate, $4ZnO.CrO_3.3H_2O$; zinc chloride and ammonium chromate (excess), $2ZnO.(NH_4)_2O.2CrO_3.H_2O$; cadmium chloride and potassium chromate, $4CdO.K_2O.4CrO_3.3H_2O$; cadmium chloride and ammonium chromate, $4CdO.(NH_4)_2O.4CrO_3.3H_2O$; cupric chloride (excess) and potassium chromate, $4CuO.K_2O.4CrO_3.3H_2O$.—A. S.

Dissolved Substances; Alteration of the Concentration of and Crystallisation of —— by Centrifugalising. R. P. Van Calcar and C. A. Lobry de Bruyn. Rec. trav. chim. Pays-Bas, 1904, **23**, 218—223. Chem. Centr., 1904, **2**, 5.

The experiments were made with solutions of potassium thiocyanate, ferrocyanide and iodide, saccharose and Glauber's salt. After centrifugalising, samples were taken at four different points from the periphery inwards. In all cases, an enrichment of the peripheral portion in dissolved substance was observed. For example a 0·2-N potassium iodide solution was centrifugalised for three hours in an apparatus working at 2400 revolutions per minute. The four samples then gave the following results:—(1) from inner portion ...; (2) 0·1-N; (3) 0·32-N; (4) from outer portion, 0·25-N. A crystallisation of the dissolved substance under the action of centrifugal force was observed with a solution of Glauber's salt containing 8·78 per cent. of sodium sulphate. After centrifugalising for five hours, a large quantity of crystals of $Na_2SO_4.10H_2O$ was filtered off, whilst the residual solution contained only 5·54 per cent. of sodium sulphate.—A. S.

Ozone; Formation of —— at High Temperatures. J. Clement. Ann. der Physik, 1904, **14**, 334—353. Che Centr., 1904, **2**, 79—80.

If oxygen be led rapidly over a Nernst's incandescent bo at about 2,200 C., and then passed into potassium iodi solution, iodine is separated so long as the apparat contains nitrogen, the separation being effected by t nitric oxide formed. No formation of ozone occurs, sir if nitrogen be not present in the apparatus no iodine separated. Also with an incandescent body cut into piec so that it acted both as an incandescent and an arc lam and which had a temperature of about 3,000° C., formation of ozone could be observed. Ozone was deco posed completely by passing through a hollow incandesce body. In the author's opinion, earlier workers who clai to have observed the formation of ozone at high tempe tures, have been misled by the production of nitric oxi By means of a simple de-ozoniser, the author shows t the decomposition of ozone at high temperatures (abo 127° C.) is a bimolecular reaction. The alteration of coefficients of velocity with the temperature may represented by the equation: $l\,n\,k = -\frac{5700}{T} + 14{,}9$ It follows, from this equation, that ozone decompo practically instantaneously at 1,000° C., the proportion ozone diminishing from 1 to 0·001 per cent. in 0·00 second.—A. S.

Sodium Chloride; Electrolysis of —— with Iron Mercu Cathodes. W. Kettembeil and C. F. Carrier. XI. page 827.

English Patent.

Soda and Caustic Potash, Chlorine and Hydrochlo Acid; Manufacture of —— by Electrolysis of Aque Solutions. J. Heibling, Fos, France. Eng. Pat. 15,2 July 9, 1903.

See Fr. Pat. 330,807 of 1903; this J., 1903, 1086.—T. F.

United States Patents.

Sulphuric Acid; Apparatus for Making ——. H. Hege and N. L. Heinz, Lasalle, Ill. U.S. Pat. 765,8 July 26, 1904.

The claim is for "the combination with a main f provided with a filled section and free open sections bef and after the filled section, of a fan in the free secti after the filled section and a secondary flue communicati with the main flue before and after the filled section a provided with a fan." Compare Eng. Pat. 254 of 190 and U.S. Pat. 752,677, 1901; this J., 1904, 489 and 370.

—E. S

Bromine; Method of Converting —— into Bromides Bromates. H. H. Dow, Assignor to the Dow Chemi Co., Midland, Mich. U.S. Pat. 765,417, July 19, 1901

Bromine, with a "fresh gas" or fresh air, practically f from carbon dioxide, is brought into contact with an alkal bicarbonate. Compare U.S. Pat. 752,332 of 1904; this 1904, 323.—E. S.

Alkaline Carbonates; Removing Carbon Dioxide f ——. H. H. Dow, Assignor to the Dow Chemical C Midland, Mich. U.S. Pat. 765,418, July 19, 1904.

The alkaline carbonate or its solution is brought into c tact with bromine combined with a large proportion of or of inert "fresh gas," and then the air or gas is discha from the apparatus into the atmosphere. Compare preceding abstract.—E. S.

French Patents.

Arsenious Gases [Sulphur Dioxide]; Purification of — Badische Anilin und Soda Fabrik. Fr. Pat. 338, Nov. 28, 1903.

See Eng. Pat. 11,549 of 1903; this J., 1904, 659.—T. F.

Glover Tower Process; Impt. in the ——. H. Hegeler N. L. Heinz. Fr. Pat. 341,257, Feb. 2, 1904.

See U.S. Pat. 765,834 of 1904, preceding these.—T. F.

itric Acid; Manufacture of —— by Means of Atmospheric Air. Soc. Chem. Fabr. Gladbeck G. m. b. H. Fr. Pat. 341,109, March 10, 1904.

.ir, or a mixture of air with an oxide of nitrogen, is heated
a very high temperature, and is then quickly cooled to a
mperature as low as possible.—E. S.

arium Oxide; Preparation of Porous ——. Siemens Brothers and Co. Fr. Pat. 341,200, March 12, 1904.

mixture of barium carbonate with barium nitrate, and
referably with carbon or its equivalent, is heated in an
ectric or other furnace to obtain porous barium oxide.
he materials may advantageously be taken in the propor-
ons indicated by the equation: $BaCO_3 + Ba(NO_3)_2 + 2C =$
$BaO + 2NO_2 + 3CO$. If a smaller proportion of the nitrate
e taken, a portion of the barium carbonate remains unde-
omposed, until the temperature has been elevated.—E. S.

odium Carbonate; Process and Apparatus for Obtaining —— Rapidly, in the State of Small Crystals. Soc. Hofmann and Bro. Fr. Pat. 341,206, March 12, 1904.

solution of sodium carbonate concentrated at about
° C. is run into a series of superposed water-jacketed
nks, through which jackets a flow of water is maintained,
hilst hollow agitators operated by a revolving vertical
ollow axle, passing through the centre of the tanks, are
ought into action. Both axle and beaters are provided
ith a system of water circulation. Above each tank,
bes with widened mouths, inclined downwards, are fixed,
r withdrawal of steam. The rapid cooling of the solution
us effected during agitation causes the deposition of
nall crystals.—E. S.

luorspar; Process of Pulverising and Purifying ——. G. C. Propfe. Fr. Pat. 338,811, May 4, 1903.

ee Eng. Pat. 16,848 of 1903; this J., 1903, 1130.—T. F. B.

ctive Oxygen; Salts of Acids containing easily liberated ——, Preparation of. G. F. Jaubert. First Addition, dated Feb. 12, 1904, to Fr. Pat. 336,062 of 1903 (this J., 1904, 323).

ccording to the principal patent, salts having the pro-
erties named in the title are obtained by reacting on a
eroxide by boric or other acid. In the present modified
ocess, the proportion of active oxygen in the salts obtained
increased by causing two acids (such as boric and
lphuric acids) to react on a peroxide. For example: to
mixture of 525 grms. of sulphuric acid with 10 litres of
ater, 1,240 grms. of boric acid and 780 grms. of sodium
roxide are slowly added. The crystals formed after
me hours contain the active oxygen, which may be easily
erated as above described.—E. S.

Phosphates; Purification of ——. L. Reymond. Fr. Pat. 340,726, Feb. 27, 1904.

osphates, whether calcic or other, are roasted to destroy
ganic colouring matters, as well as to render insoluble
e iron, alumina and silica that may be present; or, if it
desired only to render innocuous the organic matters,
e phosphates may be exposed to the action of super-
ated steam, or be acted upon by a hot or cold concentrated
id.—E. S.

yrites; Mechanical Furnaces having superposed Hearths for Roasting ——. A. L. Stinville. Fr. Pat. 340,940, March 3, 1904.

order to better obtain control of the temperature in
rnaces such as indicated in the title, a portion of the
sing is constructed with a series of vertical passages
ening to the air above and below, such passages being
parated from the interior heated spaces, and otherwise
ed, with conducting metal plates. A current of air
sses continually through these passages, or a fluid, as
ter, may be caused to traverse them, in either case
bject to adjustment. Canals may also be made in the
arths for passage of a fluid or of air.—E. S.

Lead Salts; Preparation of ——. W. Mills. Fr. Pat. 341,241, March 14, 1904.

See U.S. Pat. 754,668 of 1904; this J., 1904, 371.—T. F. B.

Air and Gaseous Mixtures; Separating —— into their Elements. Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des procédés G. Claude et R. J. Lévy). Fr. Pat. 338,842, June 3, 1903.

The process for the production of oxygen by means of liquid air or of mixtures of liquid oxygen and nitrogen, consists in bringing these liquids methodically into contact with gaseous oxygen, whereby they become successively enriched in oxygen in substitution for nitrogen, such residual liquid oxygen being finally evaporated in liquefying a corresponding quantity of air. Such an enriching of the liquid mixture may be preceded by application of a gaseous mixture less rich in oxygen. The apparatus consists of a column having a series of superposed platforms, perforated, or with capped openings; a vaporiser in the lower part of the column with an arrangement of tubes whereby the liquid is conveyed from the bottom of the vaporiser, for distribution, to the top of the column, and a portion of the gas formed in the vaporiser passes into the column. Arrangements may be made for the delivery of gas less rich in oxygen into the middle portion of the vertical column. The process and apparatus are claimed as applicable to other gaseous mixtures than of oxygen and nitrogen.
—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

English Patent.

Glass Sheets or Plates; Impts. in, and Apparatus for, the Manufacture of ——. E. Foureault, Lodelinsart, Belgium. Eng. Pat. 28,790, Dec. 31, 1903.

Continuous sheets of glass are drawn between pairs of asbestos rolls, which permit the sheet being drawn without deterioration, the rolls being composed of superposed asbestos washers, compressed between metal discs, and driven by toothed gearing. Above the rolls is placed a chimney, or casing, for cooling and annealing the sheet; the casing, lined with a non-conducting material, supports the shafts of the rolls, and is provided with gas-jets to re-heat the sheets, and at the top cold air is blown in to accelerate the cooling. Passages for the circulation of water or oil are provided above the drawing slot to cool the glass to the proper consistency for drawing into sheets; also means for throwing jets of cold air on to the sheet to solidify it—and when necessary to cool it more in the middle than at the edges—and gas-jets to re-heat it if necessary. Rails with divergent grooves, or rolls with helical grooves, give a slight stretch to the sheet in a horizontal direction as it leaves the drawing slot. Means are also provided for introducing metal wires into the edges of sheets to avoid contraction as it leaves the drawing slot. The claims also include a portable modification of the apparatus.—W. C. H.

United States Patents.

Glass-melting Furnace. W. T. Nicholls, Wellsburg, W. Va. U.S. Pat. 764,306, July 5, 1904.

A series of inclined retorts, one above another, each capable of removal without disturbing the others, is arranged in a furnace chamber, through which flame and gases pass. The retorts have feed openings at one end, and at the other discharge openings, containing partitions, by which molten glass is delivered into a working chamber, connected to the side of the furnace chamber.—W. C. H.

Glass; Manufacture of ——. S. O. Richardson, jun., Toledo, Ohio. U.S. Pat. 764,501, July 5, 1904.

Fresh material is continuously added to a body of molten glass, confined "in the presence of a reducing temperature," whereby a portion of the molten glass is caused to overflow into a casting zone, which is maintained at a temperature sufficiently high to allow the glass to be cast into definite form by the heat radiated from the reducing zone.—W. C. H.

Ceramic Articles; Process of Manufacturing Reinforced ——. J. Dansette, Paris. U.S. Pat. 765,358, July 19, 1904.

See Eng. Pat. 13,046 of 1903; this J., 1904, 660.—T. F. B.

French Patents.

Ceramic, Porcelain, Enamelled Objects; Production of Coloured Images on ——. E. Zerr. Fr. Pat. 340,628, Feb. 22, 1904.

Coloured images are produced on porcelain, enamel, faience, &c., by making three negatives of the original in yellow, red, and blue, and from these three engravings, and by means of these three proofs in oil colours on a sheet; the coloured image is transferred to the object to be ornamented, dusted with coloured powders, and burnt after each transference, or only after applying the powder for all three colours.—W. C. H.

Porcelain or Faïence capable of Flowing; Preparation of Paste for ——. E. Weber. Fr. Pat. 340,664, Feb. 23, 1904.

Ceramic paste, that will flow, is made by means of plastic clays with the addition of carbonate of soda, soda-lye, ammonia, potash, soluble glass, molasses, soap, &c. The paste is thinned by the addition, besides refractory clay of fine grain, of clays of grain up to 10 mm., for which may be substituted, wholly or in part, quartz, graphite, emery, corundum, &c.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Decayed Stone-work in the Chapter House, Westminster Abbey; Treatment of ——. Copy of Memoranda by A. H. Church. Furnished to the First Commissioner of H.M.'s Works, &c., May 28, 1901.

The stone affected belongs to an inferior sandstone of one of the lower beds of the Upper Greensand, and consists chiefly of silicious sands with some mica, &c., cemented by from 7 to 15 per cent. of calcium carbonate, and is very subject to injury from exposure to the London atmosphere, whereby in some cases the transformation of the carbonate into gypsum is practically complete. The decay arising from such exposure has occasionally penetrated to a depth of two or more inches, and in many portions, a crust of some thickness peels off on touching with the finger or with a sable brush. Whereas the reaction to test-paper of the watery extract of the unaltered stone is neutral, that of the decayed stone is strongly acid, and contains much soluble salts, due to the action of hydrochloric acid, the ratio of which to sulphuric acid as an attacking agent, comes out only as 1 : 27. Ammonia is sometimes found in the decayed stone. The remedy applied, consisted in repeated treatment of the stone with a saturated aqueous solution of barium hydroxide, by means of a White's pneumatic diffuser, after cleansing the surface from dust by an air jet, applied for instance by a Fletcher foot-blower. The liquid penetrated the decayed stone for the depth of several inches, but did not, until after several successive applications, form an impervious crust on the surface. The hardening proceeded from within outwards, and after, upon an average, about nine successive treatments, the stone became, not only reconstructed, but even harder than when in its original condition. The chemistry of the process consists in the conversion of the gypsum in the decayed stone into barium sulphate, with the simultaneous production of calcium hydroxide, which, gradually absorbing carbon dioxide, reconstitutes calcium carbonate. A slight white film of barium carbonate appears upon the face of the renovated stone, which may be brushed off, or dusted over with raw umber, and allowed to remain as a protective surface.

In a subsequent Report dated Nov. 18, 1903, in continuation of the preceding Report, the author describes the success that had followed the application of the process to the bays of the Chapter House; success was also attained by like treatment of decayed Purbeck marble. Reference is made to a patent (Eng. Pat. 220 of 1862) for the use of baryta water alternately with a solution of free silicic acid in water, a process which proved efficacious in protecting new stonework, but did not answer well with decayed stonework, owing to the silicic acid clogging the pores of the surface, and so obstructing the baryta solution from penetrating.—E. S.

Cement Roofing Tiles; Testing ——. Thonind. Zeit., 1904, **28**, 999—1000.

A number of cement roofing tiles supplied by members of the German Cement Ware Association were tested for weight, strength, and porosity. The mean results of 34 samples were as follows:—weight dry, 2·716 kilos.; after 24 hours under water, 2·902 kilos.; breaking strain, 46·7 kilos.; absorption of water, 6·85 per cent. Seven specimens allowed water to penetrate right through.—C. S.

Carbon Dioxide; Determination of —— *in Crude Cement Powder.* G. Sander. XXIII., page 838.

English Patents.

Emery and like Substances from Slag; Process for Obtaining a Substitute for ——. L. Wirtz, London. Eng. Pat. 14,366, June 27, 1903.

Emery, or like substances, and cleaning powders, are obtained by soaking slag in hydrochloric acid or a chloride, and evaporating the resulting liquid, with or without the addition of sodium chloride or other sodium compounds, until it attains a thick consistency. The precipitate formed on cooling is calcined, and washed to remove the heavier crystals of emery from the residue, which is dried and ground.—W. C. H.

Grinding, Polishing, or Smoothing Substance, or a Substance Refractory to Heat; [Electric] Process of Making ——. J. Windholz, Paris. Eng. Pat. 8859 April 18, 1904.

The substance described consists of an intimate mixture of carbide of boron, and corundum. The carbide of boron is obtained by melting a mixture of one or more boron compounds and alumina, glucina, and coal in a bath in an electric furnace, the bath consisting of silicate or quartz, iron ore, borate of calcium, and common salt.—W. C. H.

Fireproof Stone or Stoneware and Mortar; Manufacture of ——. H. Spatz, Düsseldorf, Germany. Eng. Pat 7736, March 31, 1904.

Finely divided quartz or other suitable silicious materia is combined with a calcareous binding medium, adapted t form silicate of lime, the medium consisting of caustic lim and waste liquor obtained from the manufacture of wood cellulose. This medium may also be used as a fireproof lime-mortar. Fireproof stones may also be produced by moulding and pressing a mixture of wood-cellulose lye and finely divided magnesite, or other highly basic mineral. —W. C. H.

Slabs or Sheets Imitating Marble; Manufacture of —— O. Devillers, Jumet, Belgium. Eng. Pat. 10,040, May 2 1904.

Fragments of burst glass bubbles, blown from refined glas of various colours, are spread on glass plates, and sprinkle with powdered or liquid enamel, with or without th addition of sand, and the whole fired at a temperature o about 800° C., and afterwards gradually cooled.—W. C. H.

Wall Paper [Rendering Adhesive]. A. J. Boult, London From the Fabrik Gebrauchsfertiger Holz- u. Marmor Imitationen. Fr. Schwartz & Co., Berlin. Eng. Pat 9487, April 25, 1904.

The invention relates especially to papers on which ar printed coloured representations of wood or marble graining or the like, and to the method of attaching the same t walls or other surfaces. The back of the paper is coate with a mixture of dextrin and a substance capable of forming with sodium silicate an insoluble double silicate, *e.g.* an alkaline earth, metallic oxide, &c. The surface t ich the paper is to be applied is first oiled or varnished, d is then coated with "water-glass." The paper is then ached while the "water-glass" is still moist.—E. B.

ment for use in repairing Retorts, and for like purposes; Manufacture of ——. J. E. Williams, Manchester. Eng. Pat. 18,064, August 21, 1903.

FIREPROOF cement composed of the following ingredients approximately the proportions mentioned:—25 per cent. magnesite, and 75 per cent. of a mixture of 200 cwt. of ina clay, 100 cwt. of barytes, 40 gallons of silicate of a (100° Twaddell), 24 gallons of water, and 28 lb. of ax.—W. C. H.

United States Patents.

gnesia-Cement Composition. H. Mielck, New York, Assignor to J. L. Sackman, Brooklyn, N.Y. U.S. Pat. 64,250, July 5, 1904.

COMPOSITION for use as artificial stone composed of a xture, in which reaction has taken place, of 100 parts of nt magnesia, 35 parts of magnesium chloride, 5 parts of ked lime, 5 parts of the residue from ammonia-soda nufacture, 25 parts of clay, and 1,000 to 1,200 parts of d.—W. C. H.

nent or Cementitious Material; Making Products of ——. W. E. Jaques, Grand Rapids, Mich. U.S. Pat. 64,361, July 5, 1904.

cement or artificial stone is made by mixing sand, the like, with a cementing substance in the dry state, lding the mixture, and subjecting it to pressure, at the e time introducing and impregnating the mass with sture and finally compacting the moistened mass by ernal pressure.—W. C. H.

French Patents.

tective and Insulating Coating for Wood and Metals. . L. Béthisy and Soc. Myrthil Rose et Cie. Fr. Pat. 40,622, Feb. 22, 1904.

coating consists of nitro-cellulose, and a solution alcium chloride, dissolved in amyl acetate, together ether, and alcohol, and a powder such as alum, fibrous asbestos, or mica. To render the coating it, vaseline oil and oil of aspic may be added. The ing is applied in the liquid state to wood and metals, is said to make the surface resistant to moisture, flame, osion, and to the electric current.—W. C. H.

ing [from Asphalt]; Process for Making an Arti- ial ——. Soc. des Usines Westdeuts. Thomas-phosphat. r. Pat. 341,272, March 3, 1904. Under Internat. Conv., eb. 3, 1904.

Eng. Pat. 7343 of 1904; this J., 1904, 750.—T. F. B.

ous Bodies [Refractory]; Production of ——. Cie. ançaise de l'Acétylène Dissous. Fr. Pat. 341,329, arch 14, 1904.

rder to prepare porous bodies capable of resisting high eratures, the main constituent, such as magnesia, a, baryta, chalk, &c., is mixed with carbon, and an oxidising substance, such as nitrate or chlorate e main constituent metal, and the mixture is strongly ed. The carbon is thus burnt away, not only by the n of external air, but also by that of oxygen internally ed, so that a body porous throughout is produced. saline nitrate or chlorate, such as sodium or potassium te or chlorate for instance, is used, the soluble car- te remaining after the furnacing, may be washed out e product by water.—E. S.

and Cement Furnaces; Impts. in ——, to Increase Draught, and Carry Off the Fumes from the rnace Mouth. Cie. des Fours à Chaux de la Gare Beffes (Cher). Fr. Pat. 340,461, Feb. 15, 1904.

ncrease the draught of lime and other furnaces, an ted truncated cone of metal is arranged at the bottom of the chamber and perforated with orifices to allow external air to enter the chamber and become heated. In the upper part of the furnace, a little below the top, is arranged a circular channel, which communicates through openings with the interior of the combustion chamber, to draw off fumes and gases from the chamber and convey them to the chimney.—W. C. H.

Cement; Manufacture of ——. K. Müller. Fr. Pat. 340,479, Feb. 16, 1904.

CEMENT is made by mixing sulphate of lime with barium chloride, with the addition of a base, suitable for the formation of oxychloride, such as the oxide of calcium, magnesium, or lead.—W. C. H.

Cement and Similar Substances; Process for Preparing and Burning ——. Levie Frères. Fr. Pat. 341,211, March 12, 1904. Under Internat. Conv., March 30, 1903.

SEE Eng. Pat. 7028 of 1904; this J., 1904, 607.—T. F. B.

X.—METALLURGY.

Monell [Steel] Process. Leo. Oesterr.-Z. Berg.- u. Hüttenw., 1904, **52**, 355. Chem.-Zeit., 1904, **28**, Rep. 215.

THIS process is a modification of the Martin process. A charge consisting of 3 tons of limestone, and 1—1·2 tons of iron ore is placed on the magnesite hearth, and after $1\frac{1}{2}$ hours, when the ore is nearly fused, 40 tons of molten pig-iron direct from the blast furnace are added. A vigorous reaction takes place, phosphorus, silicon, and manganese going rapidly into the slag, which after about two hours is almost completely run off through an outlet at the back of the furnace. The steel now has the following composition (A):—

—	Pig Iron.	Ore.	Steel (A).	Steel (B).
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Carbon	3·90	..	2·0—2·5	0·25—0·30
Silicon	0·5—0·9	3·0	trace	..
Manganese	0·8—0·9	0·1	0·1—0·15	0·38—0.40
Phosphorus	0·5—0·8	0·1	0·04	0·015—0·016
Sulphur	0·04—0·07	..	0·04	0·024
Iron	..	64·0	..	..

140—180 kilos. of ore are then added, and the bath of metal, almost entirely free from slag, is heated further until the desired degree of decarburisation is attained (see col. B in table). The slag contains silicic acid, 20; iron, 20—25; phosphoric acid, 3—5; lime, 20—25.—A. S.

Steel Rails; Effects of Annealing on ——. T. Andrews and C. R. Andrews. Proc. Inst. Civil Eng., 1904, **156**, [2].

FOLLOWING a suggestion made in 1900 by W. C. Roberts-Austen and T. E. Thorpe, the authors have determined the effect of annealing finished steel rails at temperatures of 770°, 850°, and 940° C. The results indicate that no great practical advantage would accrue from the general annealing of finished steel rails, although in some special cases it might be useful. If careful attention be paid to the physical composition of the finished rails, and to their thermal treatment during manipulation, good rails can be obtained from both acid-Bessemer and acid-Siemens steel, provided that the chemical composition be kept within the following limits or near thereto: combined carbon, 0·390—0·411; manganese, 0·697—0·775; silicon, 0·058—0·065; sulphur, 0·066—0·076; and phosphorus, 0·063—0·066 per cent. The detailed results obtained are set out in a series of tables, and four micro-photographs are given showing the difference in structure before and after annealing.—A. S.

Gold and Silver Extraction; Refining of the Precipitates Obtained by Means of Zinc in the Cyanide Process of ——. G. H. Clevenger. Trans. Amer. Inst. Min. Eng., Oct. 1903.

THE author considers that the best method of refining the gold-silver-zinc precipitates from cyanide solutions is by smelting with lead after distilling off the zinc. He prefers this to the ordinary acid treatment, since most of the zinc is thus at once recovered in a form available for re-use as a precipitant. The process recommended is to mix the dried precipitate with granulated lead (one to three times the weight of the dried precipitate) and charcoal (about one-tenth the weight of the lead). The mixture is placed in a graphite retort, which is heated by means of a gas furnace. The greater part of any mercury that may be present is driven off while the temperature is still very low, and may be readily collected. On further heating, zinc begins to distil off at about 700° F., and practically all is driven off in four or five hours, the temperature being finally raised to 1300° F. Very little gold or silver is thus volatilised, and that little remains with the zinc, which is used for subsequent cyanide precipitation. When the metallic vapours are received in a well-cooled condenser most of the zinc condenses as dust, especially while carbon monoxide is being evolved. The material in the retort at the end of the distillation is in appearance the same as at the start; but upon closer examination there will be found small shots of bullion all through it, and, usually, one or two larger masses. This residue can be poured from the retort like so much sand. It should be mixed with four or five parts of litharge and melted down on a test, a little iron filings and silica being added when necessary. After thorough fusion the slag is skimmed off and the lead cupelled, the resulting litharge being used for the next operation. The bullion after re-melting is cast into bars which are ready for parting.—J. H. C.

Aluminium Wire for Electrical Transmission; Application of ——. F. Krull. Z. angew. Chem., 1904, **17**, 1058—1060.

The author gives a list of nine large power transmission lines in the United States, Canada, and Italy, which have used, and still use, aluminium instead of copper wire. Aluminium wire installations are not yet to be found in Germany and England, except in the case of factories where aluminium is made. Reference is made to the work of J. B. C. Kershaw, according to which the corrosion of exposed aluminium wires at St. Helens and Waterloo (Liverpool) is considerable, and sufficient to make the use of aluminium unsuitable for transmission purposes in those districts.—R. S. H.

Aluminium-Tin Alloys. E. S. Shepherd. J. of Phys. Chem., 1904, **8**, 233-247. Chem. Centr., 1904, **2**, 181.

The author first discusses the work of Guillet (this J., 1902, 121) and of Anderson and Lean (this J., 1903, 1245), and then gives the results of his own experiments, which consisted in determining the cooling curves and densities of various mixtures of aluminium and tin. The cooling curves and examination of the microstructure gave no indication of either of the alloys, AlSn and Al_4Sn. Also, no proof could be discovered of the existence of two layers in the mixtures, but the presence of a solid solution (containing about 20 per cent. of tin) was ascertained. The densities of the products were as follows:—

Percentage of Aluminium.	Density.	Percentage of Aluminium.	Density.
100	2·680	50	3·829
95	2·760	40	4·199
90	2·845	30	4·671
80	3·001	20	5·306
70	3·241	10	6·176
60	3·489	5	6·679

—A. S.

Lead Assay; Commercial Wet ——. H. A. Guess. XXIII., page 838.

ENGLISH PATENTS.

Furnaces for Roasting Ores and like Materials; Working and Construction of ——. W. Kauffmann, Kalk, Germany. Eng. Pat. 1013, Jan. 15, 1904.

See Fr. Pat. 334,528 of 1903; this J., 1904, 67.—T. F. B.

Calcareous Ores [chiefly of Zinc]; Enriching —
E. Leduc, Gagny, and C. Griffiths, Pierrafitte, Fran
Eng. Pat. 12,797, June 6, 1904.

Calcareous ores, and especially poor calamine ores,
calcined, the carbon dioxide evolved is stored, and
residue, after being slacked in heaps, and powdered,
necessary, is agitated with a solution of sugar, where
the lime is dissolved. The residue, after washing a
drying, constitutes the enriched ore. The solution
calcium saccharate is decomposed by the carbon dioxi
previously collected, to recover the sugar solution
re-use.—E. S.

Quicksilver [Mercury] Ores; Furnace for Calcining —
J. M. Cutler, Ukiah, Cal., U.S.A. Eng. Pat. 12,9
June 8, 1904. Under Internat. Conv., June 10, 1903.

See U.S. Pat. 740,539 of 1903; this J., 1903, 1197.—T. F.

UNITED STATES PATENTS.

Case-hardening; Process of ——. C. Lamargese, Ro
U.S. Pat. 765,706, July 26, 1904.

See Fr. Pat. 333,076 of 1903; this J., 1903, 1297.—T. F

Steel; Treating Scrap ——, *and Recarburising sa*
H. B. Atha, East Orange, N.J. U.S. Pats. 765,724
766,131, July 26, 1904.

See Eng. Pat. 2187 of 1904; this J., 1904, 609.—T. F.

Steel, Cast; Manufacture of ——. M. Meslans, Par
U.S. Pat. 765,932, July 26, 1904.

See Eng. Pat. 14,693 of 1902; this J., 1903, 96.—T. F.

Filtering Process [for Slimes]. G. Moore, Salt Lak
City, Utah. U.S. Pat. 764,486, July 5, 1904.

A closed perforated box covered with cloth or o
medium is immersed in the "slimes" or other materia
be filtered. A vacuum is then produced in the box, and
liquid drawn through, leaving a deposit on the outer surf
The filter is then removed to another tank containing wa
the suction being maintained, and the water is dr
through to wash the deposit. The box is then lifted
and the deposit removed by forcing a current of ai
water from within outwards. The filtering medium
then be washed in another tank, and the process repeate
—W. H.

Crucible Furnace. C. W. Spiers, Assignor to Mo
Crucible Company, Ltd., London. U.S. Pat. 765,
July 19, 1904.

See Fr. Pat. 337,802 of 1903; this J., 1904, 548.—T.

Ore-Roasting Furnace. G. H. Shellaberger, Dekalb,
Assignor to Apex Manufacturing Company, Kansas
Mo. U.S. Pat. 765,997, July 26, 1904.

The furnace is of the long horizontal revolving type,
has a central primary ore chamber, with passages
municating between it and numerous separate return
chambers, with interspaced longitudinal heat passages.
annular "air-trunk" surrounds and encloses the pri
ore chamber. A heat-generating furnace, through
combustion chamber of which the body of the ore fu
extends, and beyond which the receiving end of the fu
body projects, communicates with the several return
chambers. Means are provided for feeding ore into
receiving end of the primary ore chamber, and into
contiguous end of the annular air-trunk. The ore cham
are sealed against the admission of products of combus
A fume chamber and hopper communicate with the
charge ends of the return ore chambers. A series of va
air-pipes lead from the annular air-trunk into each of
return ore chambers. There is a closed receptacle
introducing a granular refining agent, mounted upon
exterior of the revolving furnace body, having an o
pipe communicating with the interior of the roa
chamber, controlled by a valve, with which a weighted
is connected, whereby the valve is caused to rotate upo
own axis as the furnace revolves, and alternately opens
closes by gravity.—E. S.

e-Roasting Furnace. G. H. Shellaberger, Dekalb, Ill., Assignor to Apex Manufacturing Company, Kansas City, Mo. U.S. Pat. 765,998, July 26, 1904.

E furnace, as to its general features, belongs to the type that described in the preceding abstract. A number of ly sections are joined end to end to form an extended izontal revolving furnace. There is a central "air-nk" with a number of concentric air-chambers, a responding series of interspaced heat flues, and radial flues affording communication between the air-trunk l ore chambers at intervals throughout the length of the nace. The radial air-flues are controlled by hollow ton valves operated by rods. Means for feeding and charging the ore are described.—E. S.

loy, and Method of its Manufacture. R. B. Wheatley, London. U.S. Pat. 766,085, July 26, 1904.

about 160 parts of molten zinc, 8 parts of strontium phate are added; second, to about 640 parts of copper l 240 parts of molten zinc, 8 parts of an alloy of 6 parts copper to 2 parts of manganese, 4 parts of an alloy of art of iron to 3 parts of tungsten, 3 parts of aluminium l 4 parts of tin are added; third, the product of the first ing is added to that of the second mixing while the er is in the molten state. An alloy is also claimed sisting of about 98·5 parts of an alloy of 60 parts of per with 40 parts of zinc, to which is added about parts in all of stated proportions of iron, tungsten, minium, tin, and strontium.—E. S.

lter; Process of Making ——. O. Nagel, Hamborn, Germany. U.S. Pat. 766,279, Aug. 2, 1904.

: Fr. Pat. 322,253 of 1902; this J., 1902, 303.—T. F. B.

FRENCH PATENTS.

ruginous Ores; Treating —— for the Manufacture f Iron and Steel. M. Moore and T. J. Heskett. Fr. at. 341,169, March 4, 1904.

RRUGINOUS sand or crushed iron ore is fed into the top tower, furnished inside with a series of baffling pas-es inclined in opposite directions, and having one part erposed vertically upon the other. The upper part, the ting chamber, receives reduced gases from the lower t, and has inlets for air, at its base; the lower part is reducing chamber, the heated ore passing into which is by a current of carbon dioxide or of a gaseous hydro-on. The tower communicates at its bottom with a nens or other melting furnace, into which the reduced is delivered without contact with air. The tower, ead of being vertical, may consist of two rotating nders set at a slight angle to the horizontal, and com-icating by a vertical passage, suitable arrangements g made for feeding the ore, and for discharging it when iced into the furnace on a lower level.—E. S.

minium and all Alloys containing it; Process for oldering and Brazing ——. L. Trezel and A. J. e Monthy. Fr. Pat. 341,136, Feb. 9, 1904.

Eng. Pat. 4973 of 1904; this J., 1904, 492.—T. F. B.

elting Furnace. H. J. J. Charlier. Fr. Pat. 340,625, Feb. 22, 1904.

furnace is mounted on trunnions to be capable of ing on its longitudinal axis; it has an axial opening at end to admit a combined gas and air jet, and an ing on the top, near the end receiving the flame, for rtion of a removable charging hopper. Thus, the lucts of combustion pervade the interior of the furnace, coursing back from the closed end, find exit through charging hopper. The same opening that admits the per, on removal of the latter, serves, after tilting the ace, as the discharging opening for the molten contents. —E. S.

zing Composition and its Application. J. C. Bassett, . E. Parker, and H. F. Strout. Fr. Pat. 340,180, arch 8, 1904.

U.S. Pat. 756,079 of 1904; this J., 1904, 444.—T. F. B.

Zinc; Extraction of —— [Free from Lead]. C. S. Brand. Fr. Pat. 341,345, March 15, 1904.

IN the distillation of zinc in the usual retorts, a mass of refractory bodies, such as fragments of earthen crucibles, is placed within the tubulures of condensation at the ends adapted to the retort, or within the retorts themselves near their outlets, in order to arrest by filtration the lead accompanying the zinc-vapour.—E. S.

Zinc; Extraction of —— [Free from Lead]. C. S. Brand. Fr. Pat. 341,346, March 15, 1904.

IN order to remove lead from the vapour of zinc in the ordinary process of distillation, the tubulure to the retort is formed with a closed perforated end, from the bottom of which the under side rises upwards at an acute angle so as to approach the level top of the tubulure, forming a bridge, beyond which the lower side is curved downwards, to form a basin wherein the distilled zinc collects. The lead present in the vapours is arrested by the pocket formed by the bridge and end of the tubulure, as described, and, condensing there, flows back through an orifice in the end into the retort. Compare the preceding abstract.—E. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Sodium Chloride; Electrolysis of —— with Iron-Mercury Cathodes. W. Kettembeil and C. F. Carrier. Z. Elektrochem., 1904, **10**, 561—566.

THE authors have examined a recently patented process (Gurwitsch, Ger. Pat. 145,749 of 1902), in which the cathode consists in a slanting plate of corrugated iron on which is dropped mercury, which then covers the whole plate. These cathodes are useless when they begin to rust, and must be constantly kept under current. The best possible yield of alkali is obtained at a current density of not less than 0·38 ampère per sq. cm., with a somewhat rapid flow of mercury, the anode being separated by a porous septum; the current efficiency is then about 85 per cent. The losses are attributed mainly to eddies set up by the mercury, whereby chlorine is continually brought into contact with the amalgam. Nickel presents no advantages as a cathode material. One of the authors (Carrier) subsequently shows that a good yield, without using a diaphragm, can only be obtained if the surface of the mercury be kept either in a condition of slow and even motion or in one of entire rest. —W. A. C.

Bismuth; Electrolytic Determination of ——. A. Hollard and L. Bertiaux. XXIII., page 839.

Manganese; Electrolytic Determination of ——. J. Koster. XXIII., page 839.

ENGLISH PATENTS.

Sealing Metal into Glass or other Vitreous Material [Wires for Incandescent Lamps, &c.]; Methods of ——. E. A. Carolan. From the General Electric Co. Eng. Pat. 18,255, Aug. 24, 1903. II., page 816.

Grinding, Polishing, or Smoothing Substance, or a Substance Refractory to Heat; [Electric] Process of Making ——. J. Windholz. Eng. Pat. 8859, April 18, 1904. IX., page 824.

UNITED STATES PATENTS.

Gases [Batteries]; Method of Separating Mechanically-entrained Globules from ——. T. A. Edison, Llewellyn Park, N.J., Assignor to Edison Storage Battery Co., Orange, N.J. U.S. Pat. 764,183, July 5, 1904.

THE mechanically-entrained globules are separated from the gases generated in a storage battery, and the gases are rendered non-explosive, by forming a liquid film in the path of the escaping gases. The escape of the gases is prevented until a sufficient pressure is attained, and, by suddenly releasing the pressure, the gases and entrained globules are projected against the film with sufficient velocity to overcome the surface tension of the film, whereby the entrained globules coalesce with the film. Simultaneously with the escape of the gases, the surplus quantity of the film not retained by capillarity is returned to the solution. The gases escape through a contracted vent and are spread, diffused and attenuated, the attenuated gases finally passing through a cooling medium.—B. N.

Electrical Energy; Method of Converting the Energy of Fuel into ——. H. Jone, Chicago. U.S. Pat. 764,595, July 12, 1904.

A METAL, such as tin, which is capable of forming a higher and lower oxide, is used as the positive plate in a solution of an alkali as the electrolyte, the negative plate consisting of a porous carbon vessel, the latter serving also as a container for a metallic oxide acting as a depolariser. The metal is oxidised, and the tin remains in solution in the alkali, and is afterwards precipitated as barium stannite by addition of barium hydroxide. The barium stannite is reduced to metallic tin by means of carbonaceous fuel, and the waste gases from the furnace are used to heat the galvanic cell.—B. N.

Smelting Compounds and Producing Carbides [*Electrical*]. W. S. Horry, Assignor to Union Carbide Co., Niagara Falls, N.Y. U.S. Pat. 765,838, July 26, 1904.

ELECTROLYSABLE compounds, with or without mixture with a reducing agent, are smelted by subjection to an alternating electric current, having a frequency of more than 133 periods per second. Calcium carbide is produced by heating in like manner, and under the same conditions as to frequency of alternations of the current, a mixture of a calcium compound with carbon. In any case the frequency of the alternations of the current should be such as to "substantially eliminate losses due to electrolytic decomposition," the energy of the current being thus made available as heat.—E. S.

Water: [Electrical] Method of Purifying ——. W. M. Jewell and W. J. McGee. U.S. Pat. 766,146, July 26, 1904. XVIII. B., page 833.

FRENCH PATENTS.

Electric Energy direct from Coal; Process and Apparatus for Producing ——. H. J. Keyzer. Fr. Pat. 341,144, Feb. 16, 1904.

SEE Eng. Pat. 3913 of 1904; this J., 1904, 611.—T. F. B.

Protective and Insulating Coating for Wood and Metals. L. L. Béthisy and Soc. Myrthil, Rose et Cie. Fr. Pat. 340,622, Feb. 22, 1904. IX., page 825.

Carbides; Apparatus [Electric Furnace] for Making ——. LeRoy W. Stevens and B. Timmerman. Fr. Pat. 341,125, Jan. 12, 1904.

SEE U.S. Pat. 749,461 of 1904; this J., 1904, 192.—T. F. B.

Barium Oxide: [Electrical] Preparation of Porous ——. Siemens Bros. and Co. Fr. Pat. 341,200, March 12, 1904. VII., page 823.

(B.)—ELECTRO-METALLURGY.

Sodium: Electrolytic Production of —— from Mixtures of Sodium Hydroxide and Carbonate. C. F. Carrier. Z. Elektrochem., 1904, **10**, 568—572.

IN discussing Becker's process (Ger. Pat. 104,955) the author points out that the addition of carbonate to the fused electrolyte can be of little use unless the carbonate itself is directly split up with evolution of carbon dioxide. Experiments were made with mixtures of caustic soda and sodium carbonate containing up to 66 per cent. of the latter, at temperatures of 230° to 630° C. and current-densities rising to 2 ampères per sq. cm. In no case was an evolution of carbon dioxide detected. It is concluded that Becker's process is no advance upon Castner's, in which fused caustic soda alone is electrolysed.—W. A. C.

UNITED STATES PATENT.

Nickel-Plating; Process of ——. J. W. Aylswo Assignor to Edison Storage Battery Co., Orange, U.S. Pat. 765,371, July 19, 1904.

THE strip-like article, or a connected series of sepa articles, is passed continuously through a heating cham in which the articles are heated, and surrounded b reducing atmosphere in order to deoxidise them. They then passed continuously through a plating bath, wash and finally subjected to a welding temperature, produ electrically, and cooled while surrounded by a non-oxidi atmosphere.—B. N.

FRENCH PATENTS.

Furnace; Electric ——. E. F. Côte and P. R. Pier Fr. Pat. 340,632, Feb. 22, 1904.

VOLATILE metals, such as zinc, are extracted from ores by displacing the metal with a second, such as i The mineral and reacting metal are melted separately in crucibles by electric arcs, and the melted substances flow into a closed chamber, in which they are mixed maintained in a fluid state, during the reaction, by the J effect.—B. N.

Heating of Carbon [Electrically]; Process of — Applicable in Chemical and Other Analogous Proce Soc. Anon. L'Ind. Verrière et ses Dérivés. Fr. 340,846, March 1, 1904.

THE carbon is heated by the resistance which it offe the passage of an electric current. Forms of apparatu described in which the method is applied to the manu ture of carbon bisulphide and the cementation of iron. —B.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Bees-wax of British India. D. Hooper. Indian Ag Ledger, 1904, 73—110.

AFTER describing the species of bees found in India centres of the wax and honey trade are discussed, the met of preparing the wax and its local uses are referre and finally the character and chemical composition o various kinds of bees-wax are given. Indian bees-w derived from three species of bees, *Apis dorsata*, *A. in* and *A. florea*, but chiefly from *A. dorsata*. In the fo ing table the chemical and physical characteristics of waxes are shown :—

Origin.	—	Melting Point.	Acid Value.	Saponification Value.	H lo Va
		° C.			
Apis dorsata, 23 samples	Average	63·1	7·0	96·2	[illegible]
	Maximum	67·0	10·2	105·0	[illegible]
	Minimum	60·0	1·4	75·6	[illegible]
Apis indica, 7 samples	Average	63·25	6·8	96·2	7
	Maximum	64·0	8·8	102·5	9
	Minimum	62·0	5·0	90·0	5
Apis florea, 5 samples	Average	64·2	7·5	103·2	[illegible]
	Maximum	68·0	8·9	138·5	11
	Minimum	63·0	6·1	88·5	[illegible]

It will be seen that, whilst the waxes are almost ide in composition, they differ considerably from Euro waxes. The acid value is much lower, and the usual of cerotic acid to myricin is consequently altered.

Another source of wax in India is from the Dan bees, *Melipona (Trigona) spp.*, a species also occurri South America. This wax has an average melting of 70·5° C., acid value 20·8, saponification value 110·4 iodine value (Hübl) 42·2.—W. P. S.

Unsaponifiable Matter in Oils and Fats [Determin of ——]. J. Huwart. XXIII., page 841.

Halogen Absorption of Oils; Comparison of the Wijs, Hanus, and McIlhiney Methods of Dete ing the ——. L. M. Tolman. XXIII., page 841.

rd from Hogs fed on Cottonseed Meal; Reaction of —— vith Halphen's Reagent. E. Fulmer. XVIII. A., age 832.

ycerides; Solutions of —— in Acetic Acid. L. Hoton. XXIII., page 840.

swax; Detection of Artificial Colouring Matter in ——. P. Lemaire. XXIII., page 840.

cerol; Notes on the Determination of —— [Bichromate Method]. Taurel. XXIII., page 841.

ENGLISH PATENTS.

h, Fish Refuse, and the like; Treatment of ——. W. I. Sandison. Eng. Pat. 15,319, July 10, 1903. XV., ge 831.

-liver Oil; Manufacture of a Substitute for ——. . F. Töllner. Eng. Pat. 2081, Jan. 27, 1904. XX., ge 836.

nographic Cylinders, &c.; [Celluloid-Stearin] Composition for the Manufacture of ——. A. Defavrie. ng. Pat. 19,163, Sept. 5, 1903. XIX., page 834.

FRENCH PATENTS.

il Press. Soc. A. Pifre et Cie. Fr. Pat. 340,565, Feb. 19, 1904.

body of the press consists of two symmetrical parts
together by bands and enclosing a hollow space within
h are packed the layers of material. The pressure is
ted by the head of a piston which rises into the central
e, and in which outlets are provided for the escape of
il.—C. A. M.

ltering Material for Fats and Oils. G. Gautier. Fr. Pat. 341,167, March 3, 1904.

material consists of dry powdered skins or hides,
ially the artificial leather made as described in Fr. Pat.
26 of 1901. (See Eng. Pat. 19,249 of 1901; this J.,
, 1405.)—W. P. S.

Substances from Moist Materials; Extraction of ——. F. Frank. Fr. Pat. 341,344, March 15, 1904.

is a process for extracting oils, fats, or waxes from
raw materials such as peat, fruits, oily effluents, &c.,
ining much water. For this purpose the material is
d in a cylindrical vessel and treated in its moist
tion with vapour of benzene, carbon bisulphide,
ol, acetone, chloroform, ether, or like solvent. The
f the cylinder is attached to a condenser, whereby
scaping vapours of the solvent, together with water
r, are collected and separated. That part of the
t which condenses in the cylinder is drawn off and
rated to obtain the residue of oil, fat, or wax.
—W. P. S.

for Use by Lead Workers; Manufacture of ——. m. Werke G. m. b. H. vorm. C. Zerbe. Fr. Pat. ,159, Feb. 25, 1904.

UTION of soap is mixed at a temperature of 30° C.
powdered alkali sulphides, and allowed to cool.
ered marble may be added to form a more solid soap.
, the sulphides convert any lead on the hands into
ble lead sulphide. The soap will also prevent similar
ing by copper or mercury.—W. P. S.

III.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

White and White Lead; Relative Covering Power ——. E. Lenobie. Bull. Soc. d'Encouragement, , **106**, 513—537.

xpression "covering power," as applied to a pigment,
en understood in two different senses, viz., power of
ion over a larger or smaller area, and power of concealing the subjacent surface. The author considers the latter to be the true meaning of the expression, since the former can obviously be varied for the same pigment by altering the proportion of vehicle with which it is mixed. Covering power is therefore directly related to opacity. As the result of numerous comparisons it is found that when white lead (Dutch) and zinc white (Vieille Montagne) are mixed with equal proportions of vehicle (oil and turpentine), 7 parts by weight of white lead are required to give the same degree of opacity as 5 parts of zinc white, or 7 volumes of white lead as 6 volumes of zinc white. Therefore, whether equal weights or equal volumes are regarded, zinc white has the greater covering power. In practice, however, zinc white requires a much larger proportion of vehicle than white lead. As a consequence, it results that when coats of equal thickness of the two paints are laid on (containing those proportions of vehicle which render them applicable with equal facility), it is necessary to apply four coats of the zinc white paint to obtain the same opacity as that produced by three coats of white lead.

—M. J. S.

UNITED STATES PATENTS.

White Lead; Treating the Residue resulting from Manufacture of ——. J. W. Bailey, F. T. Bailey, and M. Bailey, New York, Assignors to the United Lead Co., New Jersey, U.S.A. U.S. Pat. 766,133, July 26, 1904.

THE waste products from the corroding process, consisting of lead carbonate, lead oxide, and metallic lead, are fed into a revolving drum arranged obliquely. The lower part of the drum contains acetic acid, the upper part air or a corroding gas. The mixture is therefore alternately submerged in the acid and exposed to the air, whilst the attrition of the metallic particles constantly presents new surfaces to the action. With a suitable strength of acetic acid, the metallic lead and lead oxide are converted into lead acetate, which remains in solution, whilst the lead carbonate is automatically discharged from the drum.—M. J. S.

Paints and Paint Vehicles; Production of ——. E. H. Strange and E. Graham, London. U.S. Pat. 766,740, Aug. 2, 1904.

SEE Eng. Pat. 8335 of 1903; this J., 1904, 448.—T. F. B.

(B.)—RESINS, VARNISHES.

ENGLISH PATENT.

Oilcloth or Linoleum; Substitute for ——. W. Melville, W. V. Rees, and P. L. Rees, Manchester. Eng. Pat. 12,663, June 4, 1904.

SHEETS of fibrous paper pulp are hardened and rendered non-absorbent by treatment with oil and size, to which lime or "soda" has been added. When dry the material is coated with oils and staining colours, again dried, and finally printed with the desired pattern.—T. F. B.

UNITED STATES PATENTS.

Distilling Crude [Turpentine] Oils; Apparatus for ——. J. C. Mallonee, Charlotte, W.C., Assignor to J. J. Mallonee, Crichton, Ala. U.S. Pat. 764,138, July 5, 1904.

THE apparatus is designed for distilling turpentine from crude turpentine oils, and consists of a still provided with a vertical vapour outlet of sufficient length to permit the heavier oils to flow back to the still, the lighter vapours passing through a condenser to the separator. A pipe fixed in the bottom of the still carries the residue to a second still, which is also connected with a condenser and separator, whence the distillate passes to a third still. The residues from the second and third stills are run together into a fourth still, where they are fractionated.—T. F. B.

Resinous Matter; Process of Extracting —— from Long-leaf or Pitch Pine. W. B. D. Penniman, Baltimore, Md. U.S. Pat. 764,863, July 12, 1904.

THE wood is steeped in hot liquid in a suitable vessel, the atmospheric pressure is then reduced above the liquid and the exuded resinous matter is later decanted from the surface of the liquors.—R. L. J.

French Patent.

Varnish; Process of Making Quick-drying ——. T. Abelmann. Fr. Pat. 338,807, May 18, 1903.

A resin, such as colophony, is melted and incorporated with an equal weight of a mixture of four parts of heavy mineral oil (sp. gr., 0·820—0·890) and one part of petroleum naphtha (benzine lourde) (sp. gr. 0·730—0·740), or with the intermediate petroleum fraction known as solar oil. This product is then oxidised by atmospheric air, diluted to an appropriate fluidity with oil of turpentine, and treated with 1·5—3 per cent. of a siccative.—M. J. S.

(*C.*)—INDIA-RUBBER, &c.

Venezuelan Rubber-Latexes. Marckwald and Fr. Frank. Gummi-Zeit., 1904, **18**, 850—851.

Three latexes, one unnamed, of Venezuelan origin were found to have the following composition and characters:—

——	1. "Leche de Marima."	2. "Leche de Pendare."	3. Unnamed.
	Per Cent.	Per Cent.	Per Cent.
Rubber substance.....	0·65	2·26	20·56
Resins..............	19·38	17·62	73·52
Albuminous matter ...	1·36	0·29	..
Impurities...........	1·60	4·80	1·85
Ash..................	0·75	0·01	0·62
Water removed at 100° C...............	76·25	74·74	3·45
Appearance of latex...	Reddish-white acid fluid, preserved by formalin.	Yellowish acid fluid, somewhat coagulated.	Cheesy appearance.
Nature of rubber......	Very inferior; no α-caoutchouc present.	Poor; 13·11 per cent. of α-caoutchouc present.	Good; 66·42 per cent. of α-caoutchouc present.
Nature of resin	5 per cent. soluble in acetone with m. pt. 62·5°.	18 per cent. of m. pt. 64° C.; 82 per cent. of high m. pt.	Similar to Pontianac resin.

The impurities of No. 2 consisted almost entirely of sugar and the ash of 1 and 2 was chiefly lime and magnesium salts.—R. L. J.

Para Rubber; Decomposition of —— *by Ozone.* C. Harries. Ber., 1904, **37**, 2708—2711.

Para rubber, in chloroform solution, whilst only polymerised by the action of permanganate, forms an ozonide under the action of ozone. When warmed with water this decomposes into keto- and di-aldehydes and hydrogen peroxide, which last oxidises the aldehydes to the corresponding acids. The ozonide, readily purified by solution in ethyl acetate and precipitation with light petroleum spirit, is a vitreous mass, explodes like other ozonides, when heated on platinum, and has the composition $(C_{10}H_{16}O_6)x$. Molecular weight determinations made it uncertain whether the value of x should be 2 or 3. On digestion with water for a short time, the solution when tested indicated the presence of levulinic and succinic aldehydes. After complete digestion, the main product was identified as levulinic acid. A smaller product gave reactions characteristic of succinic acid but could not be identified with the known acid. These results indicate the presence of the complex $\begin{matrix}C\\C\end{matrix}>C:CH.CH_2.CH_2.C(CH_3):CH.C$ in the original $C_{10}H_{16}$ molecule. Oxalic acid was not found and is probably only a secondary oxidation product of rubber. Like other ozonides the caoutchouc ozonide is much more highly active to a sensitised plate than ozone itself.—R. L. J.

United States Patent.

Raw Rubber; Apparatus for Treating ——. J. R. C. Danin, Para, Brazil. U.S. Pat. 765,167, July 19, 1904.

A hollow drying-drum with open ends is fitted with a flattened, "flaring," nozzle inside, which delivers the products of combustion received by means of a tube fr an outside combustion funnel, close up to the wall of drum.—J. K. B.

French Patents.

Vulcaniser; Improved ——. Soc. F. Clouth, Rheinis Gummi-Waarenfabrik. Fr. Pat. 340,670, Feb. 23, 190

Mechanical details are given of an improved vulcani with (*a*) means for applying mechanical pressure thro the top upon the enclosed moulds or forms; and (*b* laterally disposed cover or lid secured by screws, tl features being in combination.—R. L. J.

Rubber Substitutes; Manufacture of Substances for as ——. The Velvril Co., Ltd. Fr. Pat. 341, March 17, 1904.

See Eng. Pat. 13,306 of 1903; this J., 1904, 670.—T. F

XIV.—TANNING; LEATHER, GLUE, SIZ

Chromed Hide-Powder Question. F. Kopecky. Collegium, 1904, 211—214, 217—222.

The results obtained by the author show that a satisfac chromed hide-powder may be made from the inferior p of a hide (belly) which are unsuitable for the ma facture of ordinary hide-powder. As compared with ordinary powder, *e.g.*, Freiberg, the absorptive powe less per grm. but is regular, whilst the powder can packed closer, so that the usual filter bell is large eno for all purposes. The quantity required for anal may be packed dry or wholly or in part moistened the liquor under analysis without affecting the result. absorptive power increases as the powder is more fi ground, though for stirring and shaking methods of anal a somewhat coarse powder used in larger quantities 10 grms. per 100 c.c. of liquor (0·35—0·45 per cent. tan is desirable. The absorptive power of this powder dimini as it is more highly chromed, but if underchromed solubility is greater, and especially for the analysis of liquors, which really has caused the demand for alternative powder, it must be sufficiently chrome prevent swelling. Chrome alum crystals (10 per ce and crystallised sodium carbonate (3·5 per cent.) gi suitable chroming liquor. A basic liquor made bichromate by reducing with glucose is less satisfac As regards neutralisation, this must not be carried far; if too highly neutralised the powder becomes absorptive and at the same time the hide substanc again rendered soluble. In the analysis of oak extract this powder, tanned as indicated, neutralised wi 3 per cent. solution of borax, washed, dried, ground. washed, and again ground and dried, gave results cl agreeing with Freiberg hide-powder in the hands of diffe workers. Its behaviour with other materials, especially liquors, will be described later.—R. L. J.

United States Patent.

Waterproof Dressing and Preservative for Lea A. Aagaard, Everett, Wash. U.S. Pat. 764,971, 12, 1904.

Dogfish oil (5—14 parts), pine or pine-root tar (parts), turpentine, and a suitable solvent (one or mor these constituents being omitted as desired) are m together to form a leather-dressing.—R. L. J.

French Patents.

Tannin Extract Soluble in the Cold; Process for maki Colourless ——. G. Klenk. Addition, dated Mar 1904, to Fr. Pat. 316,570, Dec. 5, 1901.

See U.S. Pat. 740,283 of 1903; this J., 1903, 1140.—T. I

Glacé Leather [from Intestines]. B. Trenckman Fr. Pat. 340,486, Feb. 16, 1904.

The outer walls of intestines, particularly the cæcum o gut of the ox, at present turned into gold-beater's skin cleaned, very lightly tanned with chrome, alum, or veget tannins, and then stuffed with egg-yolk, flour, &c. Tw re prepared membranes are superimposed on one another, ually grain to grain, so that on drying they form a solid nogeneous sheet without the aid of any adhesive. This ather" is then degreased by the use of benzine The liminary tanning may be omitted or applied after the fting process.—R. L. J.

tering Material [Hide Powder] for Fats and Oils. G. Gautier. Fr. Pat. 341,167, March 3, 1904. XII., page 829.

XV.—MANURES, Etc.

e; Influence of Varying Ratios of Lime to Magnesia n the Growth of ——. K. Aso. Bull. Coll. Agric., Tokyo, **6**, 97—102. Chem. Centr., 1904, **2**, 255–256.

GETATION experiments, in which varying amounts of ium carbonate and magnesium carbonate were added to oil containing lime and magnesia in the ratio 1 : 1, showed t the most suitable "lime factor" for rice is, as in the e of other species of *Gramineæ*, between 1 and 2. The ld of rice varies to a considerable extent with varying os of lime to magnesia, an excess of lime over the proper portion being more injurious than an excess of magnesia. —A. S.

e Culture; Practical Application of Manganese Chloride in ——. K. Aso. Bull. Coll. Agric., Tokyo, , 131—133. Chem. Centr., 1904, **2**, 256.

application of manganese chloride, a by-product in the nufacture of bleaching-powder, corresponding to 25 kilos. manganese protosesquioxide, Mn_3O_4, per hectare, re- ed in a yield of rice (grains) one-third greater than that ained without manganese chloride. The yield of straw increased to an even greater extent.—A. S.

English Patent.

h, Fish Refuse, and the like; Treatment of ——. V. M. Sandison, Ayton, Berwick. Eng. Pat. 15,319, uly 10, 1903.

E fish or fish refuse is reduced to a semi-fluid consistency boiling and diluting with water. The mixture, while l hot, with or without the addition of chemicals, is anted to remove the more liquid portion, the liquid and re solid portions being then independently subjected to trifugal action in machines of the non-perforated drum e. The liquid albuminoid portion obtained is subse- ntly subjected to further heating or treatment by micals, and again passed through the centrifugal machine separate the fish-oil. The solids are dried to form a nure or "guano."—W. P. S.

French Patent.

Manure, and Process for its Manufacture. J. Hammerschlag. Fr. Pat. 340,449, Feb. 15, 1904.

KALI or other silicates or silicic acid are added to an aline solution or magma of humous substances. The er are preferably prepared by treating decomposed mal or vegetable bodies with caustic or carbonated alis or with ammonia. Such a "silico-humic" prepara- n may be used as a manure, in some cases, with the tial or entire substitution of phosphates (powdered es, Thomas slag, or the like) for the silicates; or the mic solutions may be treated with alkaline phosphates. example is given of a manure made up by adding a xture of turf, bog earth, lignite, or the like, in small ces, to an alkaline solution; silicates or phosphates are n added, and the mass is set to ferment in heaps. —E. S.

XVI.—SUGAR, STARCH, GUM, Etc.

ess-diffusion [Beet Sugar]; Continuous ——. Hyroš nd Rak. Oesterr. Z. Zuckerind, 1904, **33**, 360. Chem.-Zeit., 1904, **28**, Rep. 212—213.

E authors have tested their process of combined diffu- n and pressing (Fr. Pat. 318,451 of 1902; this J., 1902, 1462) on the large scale, with a plant consisting of seven vessels, capable of treating 3600 kilos. of beetroots in 24 hours. It is stated that within 40 minutes a juice is obtained of the same concentration as ordinary beet juice, but of higher purity, together with 30 per cent. of "chips," containing 22 per cent. of dry substance with only one per cent. of sugar.—A. S.

Gum Acacia; Detection of —— *in Powdered Tragacanth.* E. Paget. XXIII., page 840.

XVII.—BREWING, WINES, SPIRITS, Etc.

Yeast; Note on Top-fermentation ——. J. J. van Hest. Z. ges. Brauw., 1904, **27**, 540—542.

In connection with the question whether the cells of top-fermentation yeast exercise their chief vital functions in a periodic manner, samples of wort were pitched with different quantities of yeast, the progress of attenuation and extent of yeast reproduction being noted at regular intervals. With the smallest amount of yeast (4 c.c. per hectolitre) attenuation commenced between the second and third days, the extract consumed being for the most part utilised by the newly-formed cells, the bulk of which were produced during the same period. After the fourth day the yeast entered into the stage of physiological activity (production of zymase), the attenuation increasing up to the sixth day, to thereafter recede, owing to the exhaustion of fermentable sugar. In this case, therefore, the periodic action was clearly observed, the biological activity predominating during the first three days and the physiological action during the last three. In proportion as the amount of pitching yeast was increased, the difference became less marked, the attenuation commencing earlier owing to the presence of a larger number of cells sufficiently mature to discharge their physiological functions at the outset. These results are considered to harmonise with those obtained by the author in connection with the absorption of nitrogen and formation of alcohol during fermentation (this J., 1904, 73).—C. S.

Yeast; Note on the Longevity of Culture ——. H. Wichmann. Allgem. Z. f. Bierbrau., 1904, **32**, 322.

Confirming Henneberg's observation that yeast cells on the surface of the culture vessel live longer than those at the bottom (this J., 1904, 672), the author finds that greater longevity is exhibited by cells in the ring of yeast adhering to the walls of the flask when cultures are made in wort, than by the cells of sedimental yeast. Since no aerospores could be detected in the ring cells, the greater longevity of the latter seems due to the presence of a more favourable environment in that situation. For re-inoculation the author finds that the ring cells give more vigorous growth, and he therefore shakes the flask, to ensure proper admixture of the ring and sedimental cells, before making the transfer to the new medium. It is regarded as a sign of weakly or dead cells when the sedimental yeast diffuses too readily on shaking.—C. S.

Amylase. [Influence of Various Substances on the Diastatic Power of Malt.] J. Effront. Monit. Scient., 1904, **18**, 561—565.

Ford has concluded from his experiments (this J., 1904, 414) that asparagine does not augment diastatic action unless there has been previous restriction, due to alkalinity of the starch or to some other cause. As this conclusion is in opposition to previously published statements of the author (this J., 1893, 368, 851; 1896, 127), the latter has repeated his experiments, the results of which confirm his first statement. The influence of other amino bodies was also tried. Aspartic acid had practically the same effect as asparagine, *viz.*, 9 to 10 times more maltose formed. Glycocoll, sarcosine, leucine, hippuric acid, creatine, &c., also favoured the diastatic action. Succinamide was found to retard the action. The action of the amides is independent of the temperature and degree of alkalinity of the starch paste.—W. P. S.

Sulphurous Acid in Wine. W. Kerp. Arbb. Kais. Gesund.-Amt. **21**, 141—225; 372—376. Chem. Centr., 1904, **2**, 56—59.

The author deals with the amount, condition, and action of sulphurous acid in wine. A review is given of the statements in literature with respect to the amount of sulphurous acid in wine, from which it appears that of 1,071 samples, 460, or 42·95 per cent., contained up to 50 mgrms. of sulphur dioxide per litre; 366, or 34·18 per cent., contained from 51 to 100 mgrms.; 150, or 14·00 per cent., contained from 101 to 150 mgrms.; 63, or 5·88 per cent., contained from 151 to 200 mgrms.; and 32, or 2·99 per cent., contained more than 200 mgrms. of sulphur dioxide per litre. With regard to free sulphurous acid, of 475 wines, about 75 per cent. contained from 1 to 10 mgrms. and a further 5 per cent. from 11 to 20 mgrms. per litre. The sulphurous acid addition compounds of aldehydes undergo hydrolytic dissociation in aqueous solution to a degree depending upon the nature of the aldehyde, the temperature, and the concentration of the solution. The dissociated sulphurous acid can be titrated directly with iodine solution and is reckoned as free sulphurous acid on analysis. Acetaldehyde-sulphurous acid is dissociated to only a small extent, but dextrose- and levulose-sulphurous acid are dissociated to a much greater degree. In sulphited musts and in strongly sulphited sweet wines, dextrose- and levulose-sulphurous acid are present, but in moderately sulphited, completely fermented wines, the sulphurous acid is combined with acetaldehyde. The pharmacological action of aldehyde-sulphurous acid compounds is due to the dissociated sulphurous acid, and its intensity can therefore be measured by the iodine-absorption of the aqueous solution of the compounds.—A. S.

Enzymes; Study of the Instability of ——. K. Aso. XXIV., page 842.

English Patents.

Non-deposit Beer; Apparatus for the Production of ——, *and for Clarifying Liquids and Carbonating the same.* A. P. Blaxter, A. P. Blaxter, jun., and G. W. Chaloner, trading as Barnett and Foster, all of London. Eng. Pat. 23,327, Oct. 28, 1903.

Instead of employing a vessel with internal stirring arrangements, the patentees use apparatus for chilling or carbonating liquids, so constructed as to be rotated as a whole. The vessel is cylindrical in shape, is provided with runners which rest upon grooved rollers, and is fitted with internal trough-like blades, which, as the vessel rotates, raise up some of the liquid and spill it back again into the bulk. The various connections in and out of the vessel are made by way of the trunnions.—W. P. S.

Varnishing, Pitching, or similarly treating Casks, Vats, or the like; Apparatus for ——. M. D. Krämer. Eng. Pat. 12,647, June 3, 1904. I., page 814.

United States Patents.

Fermentation of Bottom-fermented Beer under Pressure; Process of carrying through the ——. V. Lapp, Leipzig, Germany. U.S. Pat. 766,271, Aug. 2, 1904.

See Fr. Pat. 320,264 of 1902; this J., 1903, 157.—T. F. B.

Fermentation-Gas [Carbon Dioxide]; Apparatus for Treating ——. J. F. Wittemann, Brooklyn, Assignor to The Wittemann Co., New York. U.S. Pat. 766,481, Aug. 2, 1904.

See Eng. Pat. 64 of 1900; this J., 1900, 459.—T. F. B.

Storage Vessels [for Beer]; Process of Treating ——. V. Lapp, Leipzig, Germany. U.S. Pat. 766,506, Aug. 2, 1904.

See Eng. Pat. 3682 of 1904; this J., 1904, 556.—T. F. B.

French Patent.

Spirit; Process for Maturing ——. L. Wittenberg and H. Kaufmann. Fr. Pat. 340,861, March 1, 1904.

In order to colour and to remove unpleasant taste from freshly distilled spirit (brandy and the like), the latter is treated with finely divided cork, or passed through a fil containing the same.—W. P. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Texas Cottonseed Meal; Composition of ——. H. Harrington and G. S. Fraps. Texas Agric. Exp. St Bull., **70**, 3—15. Chem. Centr., 1904, **2**, 245—246.

Of 46 samples of Texas cottonseed meal from 31 differ districts, 14 contained over 7·9 per cent. of nitrog 19 from 7·5 to 7·9 per cent., and 13 from 7 to 7·5 cent. Of 151 samples from other States, only 8 contain more than 7·5 per cent. and none more than 7·9 per ce of nitrogen. The average composition of American cotto seed meal obtained from 400 samples was:—Water, 8·5 ash, 7·2; proteïn, 43·26; crude fibre, 5·44; non-nit genous extractive matter, 22·31; fat, 13·45 per cent. T samples of Texas meal richest in nitrogen came from western portion of the State, and those poorest in nitrog from the eastern portion. It is probable that the differen is connected with the varying moistness of the soil, as t western portion of Texas has the smallest rainfall. T cottonseed husks had the composition:—water, 11·36; a 2·73; proteïn, 4·18; crude fibre, 45·32; non-nitrogen extractive matter, 34·19; fat, 2·22 per cent. Th contained 0·69 per cent. of nitrogen, 0·25 per cent. phosphoric anhydride, and 1·02 per cent. of potassi oxide.—A. S.

Lard from Hogs fed on Cottonseed Meal; Reaction of — with Halphen's Reagent. E. Fulmer. J. Amer. Che Soc., 1904, **26**, 837—851.

Experiments were made with 23 animals which were with varying quantities of cottonseed meal during a peri of 84 days, the minimum amount eaten by one individ being 7·7 lb. and the maximum 154 lb. Lard render from samples of fat from each animal gave distinct a in some instances, strong colorations with Halphe reagent, the intensity of coloration expressed in equivale of cottonseed oil ranging from 0·4 to 15 per cent. general, lard from kidney fat gave the greatest degree coloration, and lard from intestinal fat the least. T substance producing the coloration is transmitted to parts of the animal, though in unequal amounts. On deposited in the fat of the animal the colour-produci substance is very persistent. Thus, an animal killed thr months after it had received its last portion of cottonse meal yielded lard giving a coloration equivalent to 4 cent. of cottonseed oil, and lard from another killed fi months after the last portion gave a coloration equival to 3 per cent. of oil. (See also this J., 1903, 113.) —C. A. M.

English Patents.

Treating Finely Dicided Materials such as Flour with Gaseous Agent; Apparatus for ——. S. Leetham, Yo Eng. Pat. 16,472, July 27, 1903.

The apparatus is intended for effecting the conditionin sterilising, &c., of flour, meal, bran, and the like. T flour is fed into one end of a horizontal box or troug the bottom of which is provided with transverse ribs its upper surface, and which is capable of a horizont reciprocating motion. The top of the box is provided wi partitions projecting downwards, and is capable of vertical reciprocating motion. Specially constructed g inlets are provided, and when the apparatus is in use, t flour is carried forward, stirred up, and thoroughly expos to the action of the gas.—W. H. C.

Preservative for Foodstuffs, Articles of use, and t like. A. J. Boult, London. From K. Rücker a D. J. Pickée, both of Gorinchem, Holland. En Pat. 18,428, Aug. 26, 1903.

The articles of food, or boxes for containing the same, a dipped in the preservative claimed, which consists of linse l, 60 per cent.; colophony soap, 20 per cent.; and shellac,) per cent. Glycerin and wax may also be added to nder the skin formed on the articles sufficiently flexible. he preservative is melted by heating before dipping the rticles in it.—W. P. S.

'asein; Process for the Preparation of a Clear Solution of ——. A. P. Horn, Hamburg. Eng. Pat. 20,063, Sept. 17, 1903.

ee Fr. Pat. 335,799 of 1903; this J., 1904, 265.—T. F. B.

United States Patent.

lbumin from Milk; Process of Extracting Soluble ——. C. Lewis, Toronto. U.S. Pat. 765,898, July 26, 1904.

Eng. Pat. 11,094 of 1904; this J., 1904, 797.—T. F. B.

French Patent.

ood Product from Sweet Cassava; Production of a ——. H. W. van Dalfsen. Fr. Pat. 340,845, March 1, 1904.

he root is reduced to a pulp by boiling in a closed vessel by roasting, and is then rolled into sheets, the latter eing finally dried or baked and ground. If desired, rmicelli may be added to the pulp.—W. P. S.

(B.)—SANITATION; WATER PURIFICATION.

English Patents.

iquids [Sewage]; Biological Purification of ——; *with Continuous Operation and Plant used in connection therewith.* C. Peters, Borsfleth, Germany. Eng. Pat. 16,494, July 27, 1903.

he liquid is fed on to a series of basins by suitable means, e said basins consisting of an upper layer of fine slag and lower layer of coarser slag. These basins are placed on bed of coarse slag, bricks, or coke, either sunk in the ound or raised above it. The basins are surrounded by orders sloping upwards, and between the basins the coarse derstructure is exposed to the air. Suitable channels are aced below the understructure to drain off the effluent d also to supply air to the bed.—W. P. S.

anks; Settling or Precipitating ——. A. Fidler, Northampton. Eng. Pat. 18,570, Aug. 28, 1903.

he tank circular in shape and similar to that described Eng. Pat. 19,249, 1897 (this J., 1898, 787), is provided ith a blade or spiral moving concentrically, which carries e sludge into a sump placed at the bottom of the tank. hen the sump is full of sludge a valve on the discharge pe is opened and the sludge forced out by the head of uid in the tank. A horizontal plate fixed just above the mp, and of slightly larger diameter than the latter, revents any sudden rush of liquid into the sump and nsequent disturbance of and mixture with the sludge. —W. P. S.

ewage, Bacterial or Septic Tank; Treatment of ——. V. Bordigoni, Paris. Eng. Pat. 11,900, May 25, 1904.

he septic tank described is preferably made of concrete d is covered so as to be air-tight. It is divided into four mpartments. In the first the sewage is received through pipe. A partition reaching from the top of the tank to arly the bottom separates the first compartment from the econd. As the sewage flows from the first to the second mpartment it passes between baffle plates placed at the ttom of the latter. A syphon-tube establishes communiation between the second and third divisions. The fourth mpartment is separated from the third by a partition, rforated at its base and reaching nearly to the top of the nk. This last compartment contains filtering materials d is provided with a discharge pipe for the purified fluent. The latter two compartments are only one-half e size of the first two.—W. P. S.

ewage [Sludge]; Treatment of —— *[Fuel Briquettes].* A. McLean, London, and W. Paterson, Dumfries. Eng. Pat. 12,232, May 30, 1904.

he sludge obtained from a settling tank is partially dried placing it in a vessel having a filtering cloth for its bottom, and producing a reduced pressure below this vessel. The partially dried sludge is then mixed with from 5 to 10 per cent. of powdered unslaked lime, and completely dried on a "hearth." The dry residue may now be mixed with about 5 per cent. of coal tar or the like, and pressed into briquettes for use as fuel.—W. P. S.

Air for Respiration Purposes; Process and Apparatus for Regenerating Breathed Out ——. M. Bamberger, F. Bock, and F. Wanz, all of Vienna. Eng. Pat. 8865, April 14, 1904.

The apparatus described is intended for use with a mask. It has the shape of a cylinder, and is divided into two chambers by means of asbestos partitions. A tube filled with water is placed down the centre of the apparatus. When required for use, a tube at the top is connected to the mask and a piston rod pressed down, thereby puncturing lead partitions in the apparatus, and allowing the water in the tube to flow into the lower chamber, which contains sodium peroxide or potassium tetroxide. The oxygen evolved is collected in a gas bag at the lower part of the apparatus. The breathed-out air enters the upper chamber, which is also filled with the alkali peroxide, through a filter. The moisture and carbon dioxide are thus removed, and the air, after being mixed with a quantity of the oxygen in the gas bag, is drawn back into the mask.—W. P. S.

Water Purifying Apparatus. A. Woodall, Manchester. Eng. Pat. 19,916, Sept. 16, 1903.

In order to remove the suspended impurities from the waste water of mills, bleach works, &c., especially matters of a fibrous nature, the water is passed through a perforated trough arranged in a trench. A series of brushes are arranged in, and parallel with, the axis of the trough, and are rotated so as to "sweep" the suspended matters out of the water on to a perforated plate at one side of the trough. —W. H. C.

Liquids [Water], Treatment of ——, *with Ozonised Air or other Gaseous Ozone Mixtures.* A. G. Bloxam, London. From E. Dillan, Berlin. Eng. Pat. 20,163, Sept. 18, 1903.

In the process of sterilising water by means of ozonised air, described in Eng. Pat. 9183 of 1901, the ozonised air was found to become vitiated owing to gaseous impurities present in the water. To overcome this difficulty, the water to be sterilised is caused to fall, in the form of spray, first through a vessel placed above the steriliser proper. A current of air blown across the falling spray removes the impurities.—W. H. C.

United States Patents.

Organically Contaminated Liquids [Sewage]; Apparatus for Testing ——. W. D. Scott-Moncrieff. U.S. Pat. 765,794, July 26, 1904. XXIII., page 837.

Water; Method of Purifying ——. W. M. Jewell, Winnetka, and W. J. McGee, Oak Park, Ill., Assignors to themselves and to O. H. Jewell, Chicago. U.S. Pat. 766,146, July 26, 1904.

Barium carbonate and a "soluble reagent" are added to the water and the mixture electrolysed.—W. P. S.

French Patents.

Soap for use by Lead Workers; Manufacture of a ——. Chem. Werke G. m. b. H. vorm. C. Zerbe. Fr. Pat. 341,159, Feb. 25, 1904. XII., page 829.

Sewage and other Refuse; Treatment of ——. J. L. F. Garrigou. Fr. Pat. 340,740, Feb. 26, 1904.

The liquid and solid portions of the sewage are separated either by filtration or allowing them to settle. The liquid portion is heated with slaked lime in a retort, whilst the solids are mixed with felspar and heated in a second retort. The products of distillation are collected in suitable absorbing chambers attached to each retort. The whole plant is enclosed in a dome-shaped building, from which the air is continuously drawn and passed through absorbing vessels, in order to collect volatile gases evolved during the filtration, &c.—W. P. S.

Coal Mines: Artificial ——. R. J. P. Cottangin. Fr. Pat. 341,333, March 15, 1904. II., page 816.

Pressure Filters, for Water and other Liquids. C. E. Chamberland. Fr. Pat. 340,587, Feb. 20, 1904.

The inner cylindrical filtering bodies have each an enlargement at the top, the shoulder of which fits upon the top of an outer vessel enclosing the filter, and thus completing the whole apparatus. The joint is rendered tight by means of a clamp and some kind of suitable packing material. The water to be filtered enters at the bottom of the outer vessel by a perforated cross tube, whilst the filtered water leaves by a similar tube in the enlargement at the top of the filter body or cylinder. Such filters can be used singly, or may be grouped together to form a battery.—W. H. C.

(*C.*)—DISINFECTANTS.

English Patent.

Antiseptic Compounds and Process for Manufacturing the same. H. H. Lake, London. From F. Stearns and Co., Detroit, U.S.A. Eng. Pat. 8415, April 12, 1904.

On treating intermolecular anhydrides of dibasic acids with hydrogen peroxide, peroxide acids having antiseptic properties are obtained. Five parts of succinic anhydride are agitated for about half an hour with 13 parts of 7 per cent. hydrogen peroxide. The precipitate consists of the succinic peroxide acid, probably $HO.CO(CH_2)_2CO.O.O.CO(CH_2)_2COOH$. It is a soluble, crystalline substance, melting at 128° C. with evolution of gas, contains 6·8 per cent of active oxygen, and is non-toxic. On long standing with water, the substance is hydrolysed to succinic acid and succinic mono-per acid, $HO.CO(CH_2)_2CO.O.OH$. —T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

Kaolin [for Paper-making]; Amount of Water in ——. Papier-Zeit, 1904, **29**, 2285.

Attention is drawn to the widely varying amounts of water in the various clays used by paper-makers for "filling" purposes. For instance, Bohemian clays contain from 3 to 6 per cent. of water, whilst in English clays, the quantity varies from 10 to 20 per cent. Some limit is considered necessary to prevent waste as regards price and freight.—W. P. S.

English Patents.

Oilcloth or Linoleum; Article of Manufacture for use as a Substitute for —— *[from Paper Pulp].* W. Melville and W. V. Rees. Eng. Pat. 12,663, June 4, 1903. XIII. B., page 829.

Paper Coated on one Side with Coloured Material, Process and Apparatus for Producing ——. C. Tittel, Josefsthal, Austria. Eng. Pat. 10,798, May 10, 1904.

Colouring materials are allowed to flow in a regulated horizontal stream upon a wet layer of paper as this is formed on the wire frame of a paper-making machine, being united with the paper by the operations of couching, pressing, and drying. The special apparatus employed to this end consists of a tipping trough, extending across the layer of paper, rendered adjustable by means of screw gear at its front, and communicating with a sluice-box fitted with a vertically adjustable gate, in combination with an apron, a squeezing roller, and a perforated pipe lying horizontally along the back of the trough, and connected with a vertical pipe, provided with a cock and an indicator, for the supply of the colouring materials from a mixing tank to the trough. The colouring materials flow through the sluice upon the apron, from which they are uniformly distributed on to the squeezing roller, which applies them to the layer of paper travelling along underneath.—E. B.

Solutions of Cellulose in the Manufacture of Filaments; Apparatus for Pumping and Controlling the Passag of Liquids or Semi-liquids, and more especially of ——. C. H Stearn, London, and C. F. Topham, Kew. Eng. Pat. 16,605, July 28, 1903.

The cellulose solution is kept under sufficient pressure to raise the inlet valve and pass into the body of the pump, but the delivery valve is held in position by a spring sufficiently strong to resist this pressure. By throwing the plunger of the pump into motion, however, sufficient pressure is obtained to open the delivery valve. Hence n air bubbles can get into the solution on suction and th pump can be used to regulate the thickness of the filament by altering the speed. In order to give an even flow o solution from the pump, an air chamber is in communicatio with the passage leading from the delivery valve to th outlet.—G. W. McD.

Phonographic Cylinders, &c.; [Celluloid-Stearin] Com position for the Manufacture of ——. A. Defavri Paris. Eng. Pat. 19,163, Sept. 5, 1903.

Celluloid containing a certain proportion of stearic ac in addition to the usual ingredients.—C. A. M.

Incandescent Mantles [Wood Cellulose]. Evered & Co Ltd. From C. Weiblen. Eng. Pat. 22,451, Oct. 17, 1903 II., page 816.

United States Patent.

Drying Machine [for Paper]. S. A. Cohen, New York U.S. Pat. 764,561, July 12, 1904.

The paper to be dried passes over a set of feed rollers wit tapes, in a straight path, and is subjected to an air blas issuing from a perforated plate. The paper then passe over a semicircular set of rollers to a second straight se where it is again subjected to an air blast. Means ar provided for preventing anything coming into contact wit the paper except the air.—W. H. C.

French Patents.

Viscose; Treatment of ——. Soc. Franç. de la Viscose. Fr. Pat. 340,563, Feb. 19, 1904.

Viscose, which has been gelatinised and cooled, is treate in a rotating drum, with a solution of sea salt, with without sodium bicarbonate. For example, for 100 kilo of viscose containing 10 per cent. of cellulose, may be use a solution of 10 kilos. of sea salt and 10 kilos. of sodiu bicarbonate in 100 litres of water. The mother liquor then run off, and the viscose again treated with a 50 p cent. solution of sodium chloride. The effect of th treatment is the removal of alkali sulphides and pol sulphides.—T. F. B.

Viscose; Apparatus for Extracting the Air and Fr Carbon Bisulphide contained in ——. Soc. Franç. de Viscose. Fr. Pat. 340,690, Feb. 24, 1904.

An air-tight conical vessel is provided with a rotati conical plate, on which the viscose is fed through a pipe the top of the vessel. Projections are fixed on to t lower part of the conical plate, to throw the viscose on the sides of the vessel, which is evacuated during t operation; this treatment removes all air and dissolv carbon bisulphide from the viscose, which finally falls in a trough at the bottom of the vessel, and is run off throug a side tube.—T. F. B.

Viscose; Automatic Machine for Fixing Filaments ——. Soc. Franc. de la Viscose. Fr. Pat. 340,81 Feb. 27, 1904. V., page 821.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Cerium Compounds: Study of some ——. J. Sterl Ann. Chim. Phys., 1904, **2**, 193—232. Chem. Cent 1904, **2**, 84—85. (See this J., 1901, 927.)

Preparation and Purification of Cerium Oxide.—For t separation and the detection of iron in presence of exce f cerium, the following rapid method is useful. It is ased upon the fact that a solution of a cerous salt is not mediately precipitated by a small excess of ammonia. he solution containing the cerium in the cerous condition : treated with ammonia till all the cerium is precipitated, nd the liquid has a strongly alkaline reaction; glacial cetic acid is then added till the precipitate is just redisolved, leaving the liquid still alkaline, and the solution is aturated with hydrogen sulphide. The precipitate is ltered off, the solution acidified with acetic acid, and the ydrogen sulphide expelled. For the separation of larger uantities of iron from a smaller quantity of cerium, the ethod proposed by Rose for the separation of zirconium nd iron appears to be the most useful one. The solution treated with tartaric acid, made alkaline with ammonia, nd the iron precipitated by hydrogen sulphide.

Ceric Oxide.—Ceric oxide prepared by ignition of the xalate, formate, succinate, acetate, or sulphate, or of the ydrated oxide, may have a faint lemon yellow colour, due the formation of higher oxides, even when foreign earths e absent. Hydrated ceric oxide, CeO_2H_2O, is obtained treating a solution of cerous nitrate with a cold solution sodium peroxide. The voluminous precipitate becomes enser and acquires a lemon-yellow colour on boiling. rystalline ceric oxide is pure white, but becomes somewhat ddish-brown if it comes in contact with the air.

Cerium Sulphide.—By the action of hydrogen sulphide n ceric oxide, hydrated ceric oxide, cerous sulphate or rous carbonate at a bright red heat, cerous sulphide, e_2S_3, is produced. It is a purple-red microcrystalline owder, which, when heated in air, loses sulphur, and is nverted into a mixture of ceric oxide and cerous sulphate. is decomposed by cold dilute acids, but is practically nacted upon by cold or boiling water, ammonium sulphide nd alkali polysulphides. If white ceric oxide be heated utiously for 1 hour in a current of moist hydrogen lphide, a golden-yellow oxysulphide is formed, having pproximately the composition Ce_2O_2S, which, when exposed the air, changes slowly into a more stable, grass-green xysulphide. According to the author the golden-yellow ystalline sulphide described by Mosander does not exist.

—A. S.

Stovaïne: a new Local Anæsthetic. E. Fourneau. J. Pharm. Chim., 1904, **20**, 108—109.

HE hydrochloride of the benzoyl ether of dimethylaminoentanol $(CH_3)(C_2H_5)[CH_2.N(CH_3)_2.HCl]C.O.COC_6H_5$, hich has been introduced into medicine under the name f stovaine, possesses anæsthetic properties comparable with ith those of cocaine. It is obtained by acting on dimethylninoketone with ethylmagnesium bromide; ethyldimethylninopropanol or dimethylaminopentanol is thus obtained, hich, when treated with benzoyl chloride, gives stovaïne. occurs in small brilliant lamellæ, m. pt., 175° C. It is ery soluble in water, alcohol, and acetic ester, sparingly luble in acetone.—J. O. B.

opulin [Benzoylsalicin]; Simple Method of preparing ——. L. Doblin and A. D. White. Brit. Pharm. Conf., Aug. 1904; Pharm. J., 1904, **73**, 233.

OPULIN may be satisfactorily obtained by benzoylating licin by Schotten-Baumann's reaction. A solution of 0 grms. of salicin in a litre of water, was rendered alkaline ith potassium hydroxide, and 10 grms. of benzoyl chloride lded very slowly with constant agitation; more alkali ing added from time to time, to avoid the formation of uch free acid. The populin formed separated at once, rming a bulky white precipitate, which was collected, ied, powdered, and extracted with ether. On recrystal-ing the residue insoluble in ether from boiling water, then om hot alcohol, pure populin, m. pt., 180° C., was obtained.

—J. O. B

ux Vomica Seeds; Distribution of Fats and Strychnine in ——. H. W. and S. C. Gadd. Brit. Pharm. Conf., Aug. 1904; Pharm. J., 1904, **73**, 246.

HE hairs covering the seeds of *Strychnos nux vomica* are und to contain much more fat, and relatively less rychnine than the embryo of the seeds, and this fat is ore readily removed by 70 per cent. alcohol from the hairs than from the other parts. Consequently decorticated seeds are recommended for the preparation of galenical products of nux vomica.—J. O. B.

Amorpha Fruticosa; Constituents of the Essential Oil of ——. V. Pavesi. Estr. aus Rendiconti del R. Ist. Lomb. di sc. e lett., **37**, 487—494. Chem. Centr., 1904, **2**, 224. (See this J., 1904, 558.)

THE portion of the oil boiling below 250° C. contains a terpene boiling at 80°—120° C. under 30 mm. and 150°—220° C. under 750 mm. pressure; sp. gr. at 15° C., 0·8717; refractive index, 1·4811 at 15·5° C. The portion boiling between 250° and 270 C. contains cadinene and another terpene, for which the author proposes the name *amorphene*, $C_{15}H_{24}$, sp. gr. at 15° C., 0·916; refractive index at 15° C., 1·50652. Amorphene differs from cadinene in that its hydrochloride is liquid.—A. S.

Burdock Root; Essential Oil of ——. Haensel's Report, July 1904; through Apoth. Zeit., 1904, **19**, 557.

BURDOCK root yielded 0·176 per cent. of a brownish-yellow oil having an acid reaction; sp. gr. at 25° C., 0·9695; $[\alpha]_D = +1·24°$ at 30° C.; acid value, 13·5; saponification value, 236·6; readily soluble in 80 per cent. alcohol. The oil contains palmitic acid.—J. O. B.

Conium Maculatum; Essential Oil of ——. Haensel's Report, July 1904; through Apoth. Zeit., 1904, **19**, 557.

Essential Oil of Conium Herb.—The herb free from flowers gave 0·0765 to 0·078 per cent. of a dark brown, unpleasant smelling, acid essential oil which deposited stearoptene at low temperatures. It had the sp. gr. 0·9502 at 15° C.; acid value about 60; saponification value about 70. On rectification by steam distillation only 25·15 per cent. of the original oil distilled over, the dark-coloured residue solidifying on cooling. The rectified oil was brownish, acid in reaction and had an odour almost similar to that of the crude product. It had the sp. gr. 0·9310 at 20° C.; $[\alpha]_D = -12·4°$ at 20° C.; saponification value 36. It was readily soluble in 90 per cent. alcohol and in about 80 parts of 80 per cent. alcohol. Palmitic acid was isolated from the residue.

Essential Oil of Conium Fruits.—The fruits yielded 0·0179 per cent. of essential oil of a brownish-black colour, with a repulsive odour and taste, neutral in reaction; saponification value, 34; sp. gr., 0·8949 at 15° C. On rectifying 51 per cent. of a greenish-yellow oil was obtained having the sp. gr. 0·8313 at 15° C.; $[\alpha]_D = -2·16°$ readily soluble in 96 per cent. alcohol, sparingly dissolved by 80 per cent. alcohol.—J. O. B.

Odorous Principles; Mechanism of the Circulation of —— *in the Plant.* E. Charabot and G. Lalone. Bull. Soc. Chim., 1904, **31**, 884—896.

FROM experiments performed with the bitter orange *Citrus bigaradia* in various stages of growth, it is concluded that the chemical changes undergone by the terpene compounds of the portion of the essential oil contained in the stem of the tree renders it less soluble in water than the corresponding essential oil of the leaves. This difference, slight at first, increases as vegetation advances. The osmotic pressure in the stem tends to diminish, whilst a certain amount of the more soluble constituents, following the laws of diffusion, are transferred from the leaves to the stem. On arrival there, they throw out of solution, if the stem sap be nearly saturated, the least soluble of the dissolved odorous bodies. A transference is, therefore, constantly in progress from the leaf to the stem, or from the point where the odorous substances are most actively formed to where they become, relatively, less soluble. The oil of the leaves is found to be distinctly less rich in esters than that of the stem. In young leaves the total esters amounted to 30·8 per cent. of the oil, calculated as linalyl acetate, against 39·0 per cent. in the young twigs; mature leaves gave 31·1 per cent.; and mature twigs 62·0 per cent. The free alcohols in young leaves amounted to 31·3 per cent., in young twigs to 28·4 per cent., in old leaves to 30·0 per cent., whilst old twigs contained but 3·2 per cent.—J. O. B.

Thorium from Cerium, Lanthanum, and Didymium; Separation of —— by Metanitrobenzoic Acid. A. C. Neish. XXIII., page 839.

Methyl Alcohol in Commercial Formaldehyde; Determination of ——. M. J. Stritar. XXIII., page 841.

English Patents.

Pyrimidine Derivatives [Alkyl Barbituric Acids]; Manufacture of ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld. Eng. Pat. 18,246, Aug. 24, 1903.

See U.S. Pat. 744,732 of 1903; this J., 1904, 35.—T. F. B.

Cod-liver Oil; Manufacture of a Substitute for ——. K. F. Töllner, Bremen, Germany. Eng. Pat. 2081, Jan. 27, 1904.

Algaceous plants rich in iodine are dried and extracted with a suitable fatty oil (*e.g.*, sesamé oil) or mixture of fatty oils and the oily extract filtered; or, the dried seaweed may be roasted and pulverised before the extraction, and alcohol used as a solvent in addition to the fatty oil.
—C. A. M.

Oil from the Rind of Limes and other Citrus Fruits; Machine for Extracting ——, R. G. Hunter, Whitely Bay, Northumberland. Eng. Pat. 13,171, June 10, 1904.

The limes pass down a shoot to a partitioned hopper, being admitted to the latter by alternately operated feeders, and then through feed tubes to an extracting device consisting of plates provided with points on their surfaces and capable of moving horizontally and vertically in opposite directions at different speeds. The rinds are thus punctured and the extracted oil flows off by suitable channels. The fruit then passes out of the machine into a lateral receptacle.
—W. P. S.

United States Patents.

Cyclic Ketones [Ionone]; Process of Making ——. P. Chuit, Geneva, and F. Bachofen, New York, Assignors to the Firm of Chuit, Naef, and Co., Geneva. U.S. Pat. 765,459, July 19, 1904.

See Fr. Pat. 326,982 of 1902; this J., 1903, 880.—T. F. B.

Sulpho-Acid Ester and Process of Making Same. E. Sapper and F. Reubold, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. U.S. Pat. 765,597, July 19, 1904.

See Eng. Pat. 17,347 of 1903; this J., 1904, 798.—T. F. B.

Sulphur Baths; Process of Preparing Compositions for ——. W. Matzka, Vechelde, Germany. U.S. Pats. 765,291, July 19, 1904, and 766,154, July 26, 1904.

See Eng. Pat. 20,548 of 1903; this J., 1903, 1306.—T. F. B.

Cod-liver Oil; Process of Making a Substitute for ——. K. F. Töllner, Bremen, Germany. U.S. Pat. 765,943, July 26, 1904.

See Eng. Pat. 2081 of 1904; preceding these.—T. F. B.

French Patents.

Trimethylcyclohexenone Carboxylic Ester; Process for Manufacturing ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 338,814, May 23, 1903.

See U.S. Pat. 743,305 of 1903; this J., 1903, 1307.—T. F. B.

Hydroxy-cyclohexanecarboxylic Acids and their Esters, Cyclohexenecarboxylic Acids and their Esters, and Hydroxycyclohexene Carbinols; Process of Making ——. Cie. Paris. Coul. d'Aniline. Fr. Pat. 338,815, May 25, 1903.

See Eng. Pat. 11,137 of 1903; this J., 1904, 502.—T. F. B.

Heating of Carbon [Electrically]; Process of ——, applicable in Chemical and other Analogous Process [Manufacture of Carbon Bisulphide]. Soc. Anon. Prod. l'Ind. Verrière et ses Dérivés. Fr. Pat. 340,846, March 1, 1904. XI. B., page 828.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Emulsions [Photographic]; Pyridine as a Ripening Agent for ——. O. N. Witt. Phot. Mitt., 1904, **41**, 235—236.

Pyridine may be advantageously used to accelerate the "ripening" of emulsions; the process can be prolonged for a considerable time at 100° C., without fear of the emulsions being liable to fog, and there is no great tendency to form coarse-grained emulsions. The process may be carried out by sensitising the emulsion, not with silver nitrate, but with the double salt of pyridine and silver nitrate, $AgNO_3(C_5H_5N)_2$; the unripened emulsion gives very "slow" plates, which produce negatives of good contrast, whilst on heating the emulsion, it becomes highly sensitive, without losing the power of giving clear negatives.
—T. F. B.

English Patent.

Photographic Paper. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 20,325, Sept. 21, 1903.

See Fr. Pat. 335,807 of 1903; this J., 1904, 268.—T. F. B.

French Patents.

Photography [in Colours]. B. Jumeaux and W. N. L. Davidson. Fr. Pat. 341,359, Feb. 13, 1904. Under Internat. Conv., Feb, 17, 1903.

See Eng. Pat. 3730 of 1903; this J., 1904, 336.—T. F. B.

Flash-light Powder; Photographic ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 340,159, Feb. 15, 1904.

Two parts of magnesium or aluminium powder are mixed with two parts of cerium or thorium nitrate, or with one part of zirconium nitrate; the double salts of these nitrates with other nitrates may also be employed. These flash-lights are said to burn with practically no smoke, giving a flash of great actinic power, and of much shorter duration than those prepared with chlorates or peroxides.—T. F. B.

Ceramic, Porcelain, and Enamelled Objects; Production of Coloured Images on ——. E. Zerr. Fr. Pat. 340,628, Feb. 22, 1904. VIII., page 824.

XXII.—EXPLOSIVES, MATCHES, Etc.

English Patents.

Gun-cotton Blocks; Pressing of ——, and Apparatus therefor. G. W. Bell, Ipswich. Eng. Pat. 17,890, Aug. 18, 1903.

See Fr. Pat. 340,473 of 1904, following these.—T. F. B.

Explosives. C. O. Lundholm (Nobel's Explosives Co., Ltd.), Stevenston, Scotland. Eng. Pat. 19,438, Sept. 9, 1903.

By the addition of nitro-glycerin to ammonium nitrate explosives, products are obtained which can easily be exploded with a No. 6 detonator. A suitable composition for blasting consists of ammonium nitrate, 80 parts; nitroglycerin, 10 parts; wood-meal, 10 parts. Such explosives are hygroscopic, and must be enclosed in waterproof wrappers.—T. F. B.

Explosives or Blasting Compositions. M. Bielefeldt, Berlin. Eng. Pat. 20,216, Sept. 19, 1903.

See Fr. Pat. 335,801 of 1903; this J., 1904, 269.—T. F. B.

Explosives; Impts. in ——. C. H. Curtis, C. L. W. Smith, D. J. Metcalfe, and A. C. Pearcy, London, and A. F. Hargreaves, Roslin. Eng. Pat. 20,965, Sept. 30, 1903.

A safety non-detonating explosive which yields when exploded a large proportion of carbon monoxide together with non-inflammable gases, in such proportion as to protect the carbon monoxide from the oxygen of the atmosphere until its temperature has fallen within the safety limit. The explosive consists of two separate mixtures—(A) Saltpetre (75 per cent.), charcoal (22·5 per cent.), and sulphur (2·5 per cent.). (B) Paraffin wax (23 per cent.), and rice or maize starch (77 per cent.) which are blended together in the proportion of (A) (85—87·5 per cent.) to (B) (15—12·5 per cent). Mixture (B) is prepared as follows :—Paraffin wax is melted and granulated starch added until the entire charge of molten wax is absorbed, thus rendering the starch granules harder, more coherent, and less susceptible to atmospheric influences. The two mixtures are then blended and pressed into a compact pellet.—G. W. McD.

Fuses; Means for Igniting ——. W. Reine, Quartz Mountain, U.S.A. Eng. Pat. 12,238, May 30, 1904.

A device especially suitable for damp mines, in which a cap of conical shape (the apex being filled with sodium) is attached to the fuse end. On breaking the cap the sodium is ignited by the moisture in the atmosphere.—G. W. McD.

United States Patents.

Powders; Apparatus for Measuring the Duration of Combustion of ——. A. Ciolfi. U.S. Pat. 764,350, July 5, 1904. XXIII., next col.

"*Smokeless" Gunpowder, and Method of Making same.* W. H. Simpson, Peoria, Ill. U.S. Pat. 765,999, July 26, 1904.

A mixture is made of potassium chlorate, 37 parts, and potassium ferrocyanide, 25 parts, with sufficient water to make a dough-like mass, to which are added a saturated ethereal solution of eight parts of flowers of sulphur, and 30 parts of tannic acid dissolved in "Columbian spirits." The mixture is granulated and dried.—E. S.

French Patents.

Guncotton; Method and Apparatus for Compressing Blocks of ——. G. W. Bell. Fr. Pat. 340,473, Feb. 16, 1904.

The press block is mounted horizontally and is made in two parts, the upper being hinged to facilitate the introduction of the mould. The plungers work from opposite ends, and have a longitudinal motion independent of each other. It is claimed that a greater uniformity of density is thus obtained, and the pressure required is less than that usually necessary.—G. W. McD.

Nitrocellulose, Nitrohydrocellulose and Nitro-oxycellulose; Process for Manufacture of ——. Patronenfabrik, Saxonia. Fr. Pat. 340,527, Feb. 18, 1904.

See Eng. Pat. 5126, 1904; this J., 1904, 560.—G. W. McD.

Chlorate and Nitrate Explosives. E. Louis. Fr. Pat. 340,913, March 2, 1904.

The following are given as examples of these explosives. Potassium chlorate (75—94 per cent.), potassium nitrate (0—15 per cent.), lard (0—10 per cent.), beef fat (0—14 per cent.), and mutton fat (0—18 per cent.), and also potassium chlorate (60—80 per cent.), potassium nitrate (0—20 per cent.), mononitronaphthalene (0—15 per cent.), mononitrobenzene (0—5 per cent.), dinitrobenzene (0—16 per cent.), rosin (0—15 per cent.), and lard (3—10 per cent.). The finely powdered dry chlorate and nitrate are ncorporated with the melted fats and nitrohydrocarbons and the mass, after cooling, is broken up into grains of he desired size.—G. W. Mc.D.

Explosive Mixture of Great Shattering Power. X. Ceipek. Fr. Pat. 341,021, March 1, 1904.

Small quantities of potassium nitrate and of picric acid are added to a mixture of ammonium nitrate and aniline nitrate in order to improve its keeping properties.—W. H. C.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

United States Patents.

Organically Contaminated Liquids [Sewage]; Apparatus for Testing ——. W. D. Scott-Moncrieff, London. U.S. Pat. 765,794, July 26, 1904.

See Eng. Pat. 18,061 of 1899; this J., 1900, 1032.—W. P. S.

Powders; Apparatus for Measuring the Duration of Combustion of ——. A. Ciolfi, Cleveland, U.S.A. U.S. Pat. 764,350, July 5, 1904.

A timing apparatus (consisting of a rotating drum on which a record is traced by means of a vibrating fork) is set in motion simultaneously with the electrical ignition of the powder, and similarly thrown out on completion of combustion.—G. W. McD.

French Patent.

Cupels; Manufacture of ——. The Morgan Crucible Co., Ltd. Fr. Pat. 341,015, March 7, 1904.

See Eng. Pat. 1695 of 1904; this J., 1904, 623.—T. F. B.

INORGANIC—QUALITATIVE.

Gold; Microchemical Detection of —— by means of Colloidal Coloration of Silk Fibre. J. Donau. Monatsh. f. Chem., 1904, **25**, 545–554.

The fact that various fibres become coloured purple when they are immersed in a gold solution has been long known. The author has determined the best conditions under which the phenomenon may be applied to the microchemical detection of gold. The best results are obtained by use of a silk fibre, which has been previously treated with stannous chloride and pyrogallol, a red coloration being produced with the gold solution. The fibre is perferably one which has been prepared from raw silk by from 2 to 4 hours treatment with about 10 per cent. caustic potash or soda solution followed by thorough washing with water. The fibre is then immersed for a considerable time in a stannous chloride solution containing a little pyrogallol, and then washed a few times with water and dried between filter-paper before being immersed in the solution of gold hydrogen chloride. The reaction is carried out in a way exactly similar to that used by Emich with litmus-silk (this J., 1901, 1142; 1902, 498); it is much more sensitive than the ordinary microchemical test for gold, and is especially useful for the detection of small quantities of gold in presence of large amounts of other substances. For this purpose the solution containing the gold, but no free chlorine, is treated with lead parings and slowly evaporated almost to dryness. The residue is treated with water, washed by decantation, and dissolved in *aqua regia*. The small amount of dissolved lead is precipitated by dilute sulphuric acid, the solution evaporated first on the water-bath and later on the sand-bath, till sulphuric acid is expelled, the residue taken up with water and tested for gold as described above. The reaction is not affected by the presence of magnesium, alkaline-earths, aluminium, chromium, zinc, manganese, nickel, cobalt, mercuric, lead, bismuth, and copper salts. It is prevented by bases, concentrated mineral acids, arsenious, arsenic and silicic acids, tartar emetic and antimoniates. Silver salts alone colour the silk fibre yellow, but this is covered by the red gold coloration and is also destroyed by treatment with nitric acid. Platinum salts in small proportions have no influence, but when present in excess colour the fibre black.—A. S.

Cerium Compounds; Study of some —— [Detection of Iron in Presence of Cerium]. J. Sterba. XX., page 834.

INORGANIC—QUANTITATIVE.

Volumetric Analysis; Standard Substances for ——, and Iodometry. F. Raschig. Z. angew. Chem., 1904, **17**, 577—585. (See Higgins, this J., 1900, 958.)

The author prefers hydrochloric acid, prepared by dissolving a known weight of the gas in water, to either oxalic acid or sodium carbonate as a standardising substance. The method of preparation is as follows:—Place 90 c.c. of water in a 100 c.c. flask, provided with a bent capillary tube hanging over the neck and reaching close to the bottom. Weigh accurately: then place on one pan of a balance turning with a centigram, attach a 30 cm. length of narrow indiarubber tubing (cycle-tyre valve tubing) to the capillary and to a Kipp apparatus delivering hydrochloric acid gas, from the action on ammonium chloride of strong sulphuric acid; counterpoise the flask and contents; place 3·7 grms. weight on the other scale, and then admit hydrochloric acid gas till equilibrium is re-established. If the Kipp and its sulphuric acid wash-bottle had the air expelled before connecting, absorption takes place with practically no bubbling and no evaporation. Disconnect, cool the flask, and weigh flask and capillary accurately; this gives the exact weight of gas absorbed. Rinse the capillary into the flask, and make up to the calculated volume for N/1 acid (adding the quantity of water over 100 c.c. from a graduated pipette, or making use of a flask graduated on the neck between 100 and 110 c.c.). The acid so obtained is accurately normal, and its preparation requires no excessive skill in manipulation. By its help N/1 sodium hydroxide solution is standardised, and from this sulphuric acid and other acids.

A similar solution of sulphurous acid, made by passing sulphur dioxide from a siphon into water, serves to standardise iodine. This, however, must not be made stronger than N/20, or it loses sulphur dioxide readily, and even the N/20 solution requires some care and skill in its preparation. It loses no gas in half-an-hour or more, and can be measured and transferred by a pipette, but cannot be poured from one vessel to another without loss of at least 2 per cent. of its sulphur dioxide. To standardise iodine, place 25 c.c. of the nominally N/10 solution in a conical flask, plunge the point of a 50 c.c. pipette containing the sulphur dioxide solution, to the bottom, and let the contents slowly out, keeping the liquid in constant rotation. If exact, the yellow tint of the iodine just disappears with the last drop of the sulphurous acid. If not quite exact, a few drops of the N/10 thiosulphate or iodine solution, as the case may be, are added to the point of disappearance or re-appearance of the yellow tint, the solution is corrected accordingly, and re-standardised. With practice, there is no need to use starch as an indicator. If then, the colourless liquid from the iodine standardisation be titrated with N/10 sodium hydroxide it should require exactly 50 c.c., and we can thus check the iodine, standardised from the sulphurous acid solution, against the sodium hydroxide, standardised from the hydrochloric acid, and establish the correspondence of all these solutions. From the iodine, permanganate can now be standardised:—Exactly decolorise 25 c.c. of N/10 iodine by means of 50 c.c. of N/20 sulphurous acid. Add 25 c.c. of N/10 permanganate, and decolorise again:—Exactly 50 c.c. should be needed. Whilst, however, the author hopes his hydrochloric acid standardising may come into general use, he feels this is not likely to be the case with the sulphurous acid standard; the weighing of flask and contents (about 250 grms.), in order to get the exact weight of 0·32 grm. of sulphur dioxide, being undoubtedly a weak point.

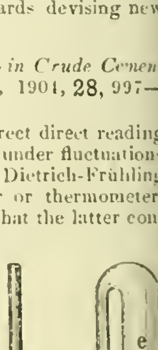
The direct titration of sulphurous acid by sodium hydroxide is not very satisfactory. If phenolphthaleïn be used, a pink colour is struck when about 95 per cent. of the required soda has been added; though when neutralisation is complete, the sudden deepening of the red colour with the last drop is fairly conspicuous. If Methyl Orange be used, though the change from sulphurous acid to bisulphite is sharp, yet the titration is inexact, and more soda solution is required than corresponds to the sulphurous acid. This is due to oxidation; the bisulphate formed is acid to Methyl Orange, though the corresponding bisulphite would have been neutral. The author finds that sulphurous acid itself is very unsensitive to oxygen, but that at the moment of being converted into or being liberated from a sulphite it rapidly absorbs oxygen. This explains the fact that if, instead of treating sulphur dioxide solution with iodine and then titrating with sodium hydroxide, 20 c.c. of N/10 sulphur dioxide be very slowly introduced under 20 c.c. of N/10 sodium hydroxide and then iodine be added, only 17 c.c. instead of 20 c.c. will be needed. That this is not due to loss by escape of gas is shown by the fact that the liquid now requires 17 c.c. of sodium hydroxide solution for neutralisation, a total of 20 + 17 = 37 c.c., instead of 2 × 17 = 34 c.c. To this character, too, and partly to escape of gas, is due the fact that in titrating sulphurous acid with iodine, too low results are always obtained if the iodine be added to the sulphurous acid—neither Bunsen's explanation of this, nor that of Volhard, involving the separation of sulphur, being satisfactory.—J. T. D.

Indicators; Mixed ——. M. Scholtz. Z. Elektrochem., 1904, **10**, 519—553.

When an acid is titrated with alkali in presence of two indicators, that indicator will be first affected, which is the stronger acid; in titrating with acid the converse holds good. Transition tints are thus produced just before neutralisation, and by this method the comparative strengths of numerous indicators, taken in pairs, have been ascertained. It is suggested that the results may help towards devising new volumetric methods.—W. A. C.

Carbon Dioxide; Determination of —— *in Crude Cement Powder.* G. Sander. Thonind. Zeit., 1904, **28**, 997—998.

The apparatus is designed to give a correct direct reading of the alterations in the volume of gas under fluctuations of temperature and pressure, so that the Dietrich-Frühling apparatus can be used without barometer or thermometer. The measuring tube *a* is widened at *e* so that the latter contains, up to the zero-mark *o*, exactly 100 c.c. (at 0° C. and 760 mm.). The tube *a* is graduated in one-fifths of 1 c.c. (total 30 c.c.), and is filled to the zero mark with mercury, balanced by the tube *b*. To set the apparatus, mercury is poured into the tube *a*, which is closed by the thumb and turned over to allow the mercury to escape until the surface coincides with the mark corresponding to the volume occupied by 100 c.c. of air at the prevailing temperature and pressure. The mercury is poured into a basin, and the air in *e* is moistened by introducing a drop of water which is then vaporised by heat, the open end of *a* being closed by the mercury tube *b*. When the air is re-cooled, the measured mercury is returned to *e*, and *c* is re-closed by the rubber tube attached to *b*, whereupon the apparatus is tilted to allow the mercury to run from *e* into *a*, leaving the standard volume of air in *e*. Assuming that 200 c.c. of carbon dioxide are furnished by 0·89388 grm. of calcium carbonate, then if the crude cement powder is to give 75 per cent. of carbonate (*i.e.*, 150 c.c. of carbon dioxide), the volume of air recorded in the apparatus must be multiplied by 1·5, and from the result can be calculated the weight of calcium carbonate corresponding t the volume of gas formed in the Dietrich-Frühling test. The author has compiled a table of these weights at temperature between 0° and 30° C.



In a modification of the apparatus the part *e* is turne upright, to form a direct continuation of the tube *a*, in orde to facilitate the primary adjustment, the open end of being dipped into a trough of mercury, and the rubbe tubing attached whilst *a* is in this position.—C. S.

Lead Assay; Commercial Wet ——. H. A. Guess. Trans. Amer. Inst. Min. Eng., 1904.

The following methods are convenient for all lead deter minations, but especially suitable for the assay of poor ore containing about 0·5 per cent. 1 The ore is dissolved i nitric acid and evaporated with sulphuric acid, water adde the whole heated to dissolve soluble sulphates, the solution filtered, and the residue well washed. Filter and residue are now returned to the original flask, and digested with slightly acid ammonium acetate solution till all lead sulphate is dissolved. The liquid is diluted with water, and potassium chromate solution (9·396 grms. per litre) added in known quantity and slight excess. The solution is filtered and the residue washed free from chromate; the filtrate is acidified with 25 c.c. of hydrochloric acid (sp. gr. 1·1), a crystal of potassium iodide added, and the liberated iodine determined by titration with sodium thiosulphate solution (36 grms. of the pure crystallised salt to the litre. Half-strength, however, usually preferred) and starch. The liberated iodine affords a measure of the unused chromate, and hence of that used in precipitating the lead. The chromate solution and the stronger thiosulphate solution are equivalent per c.c. to 0·01 grm. of lead. The only substance which interferes with this process is antimony, which tends to prevent solution of the lead sulphate. If antimony be present, slightly ammoniacal ammonium acetate solution is used for the digestion, and is acidified after solution is complete, before diluting and precipitating with chromate. With much lead, the quantities of ammonium acetate solution and of water are not of moment; but with 1 per cent. or less, the strong ammonium acetate solution should not exceed 10 c.c., nor should the bulk after dilution exceed 50 c.c. A large excess of chromate hastens the completion of precipitation of these small quantities, but makes the subsequent washing tedious, and gives an objectionably large amount of chromate to titrate. Unless antimony be present, instead of back-titration, hot dilute hydrochloric acid may be poured, first into the precipitation-flask to dissolve any lead chromate contained in it, then through the filter (the funnel being placed in the neck of a clean flask) till all the lead chromate is dissolved; flask and filter are well washed with warm water, and the solution of lead chromate is titrated with iodide and thiosulphate. 2. This method is especially adapted for heavy lime-ores, in the case of which the previous method would be found tedious, on account of the large bulks of calcium sulphate to be washed:—To 1—5 grms. (according to richness) of the ore, in a 250 c.c. flask, add 3—5 c.c. of strong nitric acid and 15 c.c. of strong hydrochloric acid: heat till all is dissolved and the excess of acid has been reduced to about 8 c.c. Then add dilute ammonia till in slight excess, and afterwards excess of 80 per cent. acetic acid slowly, with vigorous shaking, and finally 5 c.c. of strong ammonium acetate solution. If antimony and gelatinous silica be absent, and the undissolved siliceous residue be slight, add excess of 10 per cent. potassium chromate solution to the hot undiluted liquid, shake, allow to settle for five minutes, filter, and wash free from soluble chromates. Place funnel in neck of original flask, dissolve lead chromate with hot hydrochloric acid, wash with water containing 0·5 per cent. of acetic acid and titrate the solution with iodide and thiosulphate solution as before. By using not too much iodide (0·5—2·0 grms.), and having say 50 c.c. of 1·1 hydrochloric acid in 200 c.c. of warm liquid, there is hardly any tendency for lead iodide to separate and obscure the reaction. This "short-cut" method gives good results in presence of most other metals; but interference may be caused by barium, if present as carbonate, for barium chromate is insoluble; the addition of 1—2 c.c. of 10 per cent. ammonium sulphate remedies this. Interference also occurs with bismuth, antimony, and silver, and then the first method should be used. Either of these methods is much to be preferred, in the case of poor ores, to the molybdate method (this J., 1893, 376), which is so generally used; for the end reaction in the molybdate method is not sharp, and may involve an error of 0·3—0·5 c.c. (= 3—5 mgrms. of lead), which, though permissible in a rich ore, may be as much as the total quantity of lead in a poor ore.—J. T. D.

Bismuth; Electrolytic Determination of ——. A. Hollard and L. Bertiaux. Comptes rend., 1904, **139**, 366—367.

Separation from Copper.—To the solution of the sulphates containing not too great an excess of sulphuric acid, and heated to boiling, phosphoric acid is added in excess, and the solution allowed to stand overnight, to complete the precipitation of the bismuth. The precipitate is filtered, washed with dilute phosphoric acid (1 vol. of acid of sp. gr. 1·711 diluted to 20 vols.) and finally, to remove the copper more readily, with a mixture of potassium cyanide and ammonium sulph-hydrate, 100 c.c. of which contain 5 grms. of cyanide and 5 c.c. of the sulph-hydrate obtained by saturating 10 per cent. ammonia with hydrogen sulphide. The bismuth phosphate is now dissolved in nitric acid diluted with an equal volume of water, and evaporated with 12 c.c. of sulphuric acid till thick white fumes are given off. The solution, which now contains the bismuth as pyrophosphate, is diluted to 300 c.c., and the liquid electrolysed with a current of 0·1 ampere, for 24 hours. The deposited bismuth should be free from copper, but should it contain any, the copper can be estimated colorimetrically, and its amount deducted.

Separation from Lead.—The solution of the nitrates is evaporated with 12 c.c. of sulphuric acid, together with the quantity equivalent (approximately) to the contained metals, till thick white fumes appear. Allow to cool, dilute with water to 300 c.c., add 35 c.c. of absolute alcohol and electrolyse with a current of 0·1 ampère for 48 hours. Very small amounts of bismuth can in this way be accurately separated from large amounts of lead; the deposited bismuth is absolutely free from lead.—J. T. D.

Manganese; Electrolytic Determination of ——. J. Köster. Z. Elektrochem., 1904, **10**, [31], 553—554.

It has been hitherto found impossible to deposit manganese peroxide coherently under a rotating cathode. The author succeeds by adding 10 grms. of ammonium acetate and 10 c.c. of 96 per cent. alcohol to the electrolyte (which must be free from chlorides) and using a roughened dish of platinum-iridium. The temperature must be kept at 75°—85° C. A current density of 4 ampères per sq. dcm. may be applied.—W. A. C.

Thorium from Cerium, Lanthanum and Didymium; Separation of —— by Metanitrobenzoic Acid. A. C. Neish. J. Amer. Chem. Soc., 1904, **26**, 780—793.

The method is based on the fact that metanitrobenzoic acid precipitates thorium from a neutral solution of the nitrate as $Th(C_6H_4NO_2CO_2)_4$. Thus, on treating 25 c.c. of a solution containing an amount of thorium equivalent to 0·1128 grm. of thorium oxide, with about 150 c.c. of a 0·35 to 0·4 per cent. solution of the acid at 80° C., and keeping the beaker at 60° to 80° C. for 15 minutes, a bulky precipitate is deposited which, after being washed with a 5 per cent. solution of the precipitating acid and ignited in a platinum crucible, leaves the quantitative amount of thorium oxide. For the ignition the filter paper should be placed whilst still moist in the uncovered crucible, and heated first in the Bunsen flame, and then for 15 minutes in the blast flame. For the complete separation of thorium from cerium, &c., reprecipitation is necessary. For this purpose the precipitate is dissolved off the paper by means of hot dilute nitric acid (1 : 5), the paper well washed with hot water, and the solution diluted to about 150 c.c. and treated with 25 c.c. of the *m*-nitrobenzoic acid solution. Sufficient Methyl Orange to give a decided red tint to the liquid is now added, and dilute ammonia solution (1 : 10) run in until the colour changes to pink, the liquid being thoroughly stirred after each addition. Care must be taken not to continue the neutralisation until the liquid becomes yellow, or the other earths will be reprecipitated. To insure complete precipitation of the thorium compound an additional 50 c.c. of the reagent are now added, the beaker heated on the water-bath as before, the precipitate collected, washed, dissolved in dilute nitric acid, and once more precipitated, before final ignition. *m*-Nitrobenzoic acid gives no precipitate with glucinum, gadolinium, yttrium, titanium, and samarium; zirconium gives a white opalescence and precipitate which increases on heating; whilst erbium gives a white curdy precipitate. Mercurous and mercuric nitrate give heavy curd-like precipitates which dissolve on heating.

Analysis of Monazite Sand.—2 grms. of the sand in a fine state of division are mixed with 10 to 15 c.c. of concentrated sulphuric acid in a porcelain crucible which is gradually heated on a plate until the excess of acid has evaporated. More acid is then added, the contents stirred, and digestion continued for three hours, after which time the phosphates are converted into sulphates. The crucible is now cooled in ice water and the mass introduced drop by drop into 600 c.c. of water also cooled to 0° C., the crucible itself being finally placed in the beaker and left over night. The solution is heated to boiling, and treated with a boiling solution of oxalic acid (saturated in the cold), which is added in large excess with constant stirring. The white crystalline precipitate that separates on cooling, consisting of thorium, cerium, lanthanum, and didymium oxalates, is collected and washed with a dilute solution of oxalic acid, after it has stood for several hours. The filter paper containing the precipitate is returned to the same beaker and boiled with 10 to 15 grms. of potassium hydroxide and 25 to 50 c.c. of water, and the resulting hydroxides filtered off from the liquid which has previously been diluted to about 300 c.c. The precipitate is washed free from alkali and dissolved in hot dilute nitric acid (1 : 5), the solution evaporated to dryness on the water-bath, and the residue moistened with water and evaporated until free from all traces of free nitric acid. The nitrates are dissolved in 500 to 600 c.c. of water, 150 to 250 c.c. of the solution of *m*-nitrobenzoic acid slowly introduced with constant stirring, and the liquid heated at 60° to 80° C., and filtered from the precipitate, which is dissolved in dilute nitric acid, reprecipitated, and ignited whilst moist as described above. A pure white thorium oxide is more readily obtained by neutralising the solution of the thorium *m*-nitrobenzoate with potassium hydroxide instead of with ammonia, a slight excess of the reagent converting the flocculent *m*-nitrobenzoate first reprecipitated into the more compact hydroxide.—C. A. M.

ORGANIC—QUALITATIVE.

Beeswax; Detection of Artificial Colouring Matter in ——. P. Lemaire. Bull. Soc. Pharm. de Bordeaux, 1904, **44**, 182—182.

A SMALL fragment of the wax is dissolved in chloroform, and two or three drops of hydrochloric acid are added to the solution. The production of a rose-red colour indicates artificial colouring matter. Another portion is saponified by boiling with caustic soda solution, then treated hot with excess of hydrochloric acid. If a fugitive rose-red colour be obtained, which turns green on adding excess of ammonia, the wax is artificially coloured. Another piece of the wax is melted in a capsule with saturated boric acid solution; on evaporating to dryness the residue acquires a reddish colour with wax containing added colouring matter.

—J. O. B.

Gum Acacia; Detection of —— *in Powdered Tragacanth.* E. Payet. Rep. Pharm., 1904, **16**, 301.

TRAGACANTH does not, like acacia, contain an oxydase capable of giving a brown colour with guaiacol in the presence of hydrogen peroxide. This reaction, therefore, enables the fraudulent admixture of gum acacia to be detected in powdered gum tragacanth. A 5 per cent. solution of the suspected gum is prepared with cold water; to this is added an equal volume of 1 per cent. aqueous solution of guaiacol, and one drop of hydrogen peroxide; on agitating the mixture and allowing it to stand, a brown colour is rapidly developed if gum acacia be present, whilst, if the tragacanth be pure, the mucilage remains perfectly colourless.—J. O. B.

Glycerides; Solutions of —— *in Acetic Acid* [*Distinction between Butter and Margarine*]. L. Hoton. Bull. Soc. Chim. Belg., 1904, **18**, 147—165.

WHEN a solution of acetic acid in a fat is chilled, there is a separation into two layers, the upper of which may be regarded as fat + acid and the lower as acid + fat. In the case of butter, the glycerides dissolved first, are those with low critical temperatures of solution, low melting points, and low refractive indices. In the case of other fats and oils, however, those portions with high refractive indices are the first to pass into solution. On these facts the following analytical method is based :—5 grms. of the melted filtered butter-fat are mixed with 10 c.c. of acetic acid (sp. gr. 1·057) in a tube (16 mm. in diameter, graduated in mm.), which is heated to 60° C., with occasional agitation, in the water-bath. The contents are then cooled to 40° C., and the height of the upper layer measured. As soon as the temperature falls to 35° C., the lower layer is decanted into a weighed flat dish, and evaporated at about 70° C. until constant in weight (= Extract A). The portion left in the tube is mixed with a fresh 10 c.c. of acetic acid, and treated in the same way as the original fat, yielding Extract B and a residue C, which is also dried and weighed. The critical temperature of solution, Valenta test, and refractive index of each of the three fractions is then determined, and conclusions drawn from the ratio in which they stand to one another.

The following table shows representative results given by pure butter and different raw materials of margarine :—

Fraction.	Butter.			Oleomargarine.			Neutral Lard.		
	Centigrms.	Critical Temp. of Solution.	Valenta Figures.	Centigrms.	Critical Temp. of Solution.	Refraction at 40° C.	Centigrms.	Critical Temp. of Solution.	Refraction at 40° C.
		° C.	° C.		° C.			° C.	
A..........................	109	48	39	30	72	49·8	31	63	50·5
B..........................	182	49	43	48	74	49·5	50	67	49·7
C..........................	193	57	55	423	80	49·0	420	78	49·3

Fraction.	Crude Cottonseed Oil.			Arachis Oil.			Sesamé Oil.		
	Centigrms.	Critical Temp. of Solution.	Refraction at 40° C.	Centigrms.	Critical Temp. of Solution.	Refraction at 40° C.	Centigrms.	Critical Temp. of Solution.	Refraction at 40° C.
		° C.			° C.			° C.	
A..........................	65	52	63·0	42	57	59·0	55	60	62·7
B..........................	70	54	63·2	68	67	58·8	65	67	59·3
C..........................	360	70	59·2	395	78	56·0	370	77	57·0

The solubility of butter-fat in acetic acid is independent of the proportion of volatile acids present. In the author's opinion the most important factor is the difference between the critical temperatures of solution of the fractions C and A. Thus 11 samples of pure butter-fat gave on the average 11·5 for values of C—A, whilst butter-fats containing 10 to 20 per cent. of margarine gave an average of 15·5. In like manner the mean difference between the Valenta numbers of C and A was 22 for the pure butter-fats and 27 for the adulterated butter-fats. On the other hand, certain pure butter fats gave figures for the critical temperatures of C—A as high as those containing 10 to 15 per cent. of margarine, so that the method by itself does not furnish proof of adulteration. The author considers, however, it may be of great service in the case of butter-fats having a Reichert-Meissl value of 23 to 27, and when such samples give a value of less than 11 for the critical temperatures C—A, they may be regarded as pure. There is a concentration of margarine in the fractions, the quantities of a mixture dissolved by acetic acid not being proportional to the coefficients of solubility of butter and other fats in that mixture.—C. A. M.

ORGANIC—QUANTITATIVE.

Incineration of Organic Matter facilitated by the use of Pumice Stone ——. Duyk. Ann. Chim. anal. appl., 1904, **9**, 252—254.

Coarsely powdered, recently calcined pumice stone, mixed n equal weight with the solid or extractive to be incinerated, s recommended to facilitate the burning off of organic matter. By its aid a perfect ash is readily obtained with the most refractory nitrogenous substances, such as albumin, wool, or yeast, which are notoriously difficult to incinerate completely by ordinary methods.—J. O. B.

Methyl Alcohol; Determination of —— in the Products of the Distillation of Wood. M. J. Stritar and H. Zeidler. Z. anal. Chem., 1904, **43**, 387—400.

The authors employ the iodine method for this purpose and use an apparatus similar to that described by Zeisel and Fanto for the determination of glycerin (this J., 1902, 992). The reaction between the methyl alcohol and the hydriodic acid (sp. gr. 1·70) is allowed to take place lirectly in the apparatus, and not in a closed tube.

Crude Wood Spirit.—5 c.c. are measured out in a pipette (the weight of the volume delivered being previously scertained) and diluted to 500 c.c. This solution is used or the determination.

Crude Dilute Wood Spirit.—10 c.c. are diluted with bout 40 c.c. of water and shaken with 0·5 grm. of animal charcoal for 15 minutes. The mixture is then filtered and he filter washed with water until the filtrate measures 00 c.c.

Crude Wood Acid.—50 c.c. are neutralised with sodium arbonate, diluted to 250 c.c. and filtered. 100 c.c. of the ark coloured filtrate are then rendered alkaline with odium hydroxide and distilled. 50 c.c. of distillate are ollected, treated with animal charcoal, and the etermination proceeded with.

With regard to the influence of other substances in these istillation products, only allyl alcohol and esters greatly nterfere with the results. The first is separately determined by the bromine method and allowed for, whilst the uantity of esters in the sample is obtained from a etermination of the ester value.—W. P. S.

Iethyl Alcohol in Commercial Formaldehyde; Determination of ——. M. J. Stritar. Zeits. anal. Chem., 1904, **43**, 401—402.

ive c.c. of the formaldehyde solution are diluted with 00 c.c. of water, an excess of ammonia added, and the nixture distilled. Fifty c.c. of distillate are collected, made ightly acid with acetic acid and diluted to 100 c.c. The ethyl alcohol is then determined by the iodide (Zeisel) nethod as modified by the author. The small quantities of ormaldehyde found in the distillate, do not affect the result. —W. P. S.

nsaponifiable Matter in Oils and Fats [*Determination of* ——]. J. Huwart. Les Corps gras ind., 1904, **30**, 194—195, 210—211, 228—229, 242—243, 258—259, 274—275, 290—291, 306—307, 322—323. Chem. Centr., 1904, **2**, 158—159.

ccording to the author the usual methods for the determination of the unsaponifiable matter in oils and fats are inaccurate. The following method is recommended:— grms. of the oil or fat are boiled for at least ½ hour with c.c. of a 20 per cent. alcoholic caustic potash solution under a reflux condenser, and N/1 hydrochloric acid is then added until the liquid is nearly neutral. The liquid soap whilst still warm is transferred to a separating funnel, the flask being rinsed several times with 35 c.c. of warm water; 15 c.c. of glycerin of sp. gr. 1·26, are added, and the whole well shaken, and extracted with 50 c.c. of ether. The aqueous layer is separated, and again extracted with ether. The combined extracts are distilled to a small bulk, and the residue treated with 1 drop of phenolphthaleïn solution and a few drops of a 3 per cent. alcoholic caustic potash solution, and a few grms. of finely-broken glass added. The remainder of the ether is then distilled off, the residue dried for 2—2½ hours at 95°—100° C., and then treated with 45—50 c.c. of anhydrous ether or light petroleum spirit (b. pt., below 80° C.). After 12 hours, the solution is filtered, the residue washed several times with ether, the filtrate and washings are evaporated very slowly, and the residue is dried for 1½—2½ hours at 100° C. The author obtained the following results with this method:—Oil from *Lotta molva*, 1·02—1·07; oil from *Merlangus virens*, 0·88—0·09; oil from *Clupea sprattus*, 1·362; oil from *Lamina cornubica*, 1·51—1·66; olive oil, 0·7—0·8; pure butter fat, 0·33—0·44; and margarine fat, 0·65 per cent. The unsaponifiable matter consisted for the most part (75—85 per cent.) of cholesterol, which was determined by converting it into its acetic ester, and determining the combined acetic acid in the latter.—A. S.

Halogen Absorption of Oils; Comparison of the Hübl, Wijs, Hanus, and McIlhiney Methods of Determining the ——. L. M. Tolman. J. Amer. Chem. Soc., 1904, **26**, 826—837. (See also Archbutt and Harvey, this J., 1902, 1437—1439.)

The author's experiments have led him to the conclusion that the results obtained by the methods of Wijs and Hanus are more reliable than the Hübl values. The solution of Hanus is readily prepared, and gives results agreeing more closely with current figures, but for rapid absorption an excess of 60 to 70 per cent. is required. In the case of Wijs' solution an excess of 35 per cent. is sufficient, but the results are higher. With either method 80 minutes is a sufficient time for complete absorption, though Wijs' method is about three times as rapid. The solution of Hanus is less affected by light than the other solutions. Acetic acid is a more suitable solvent for the active agent than carbon tetrachloride, which gives unsatisfactory results in ordinary work. If, however, the amount of substitution is to be determined, a solution of iodine chloride in carbon tetrachloride is the best reagent. For instance, in the case of rosin oil the following iodine values were obtained after 30 minutes:—

——	Total.	Addition.	Substitution.
Iodine chloride in carbon tetrachloride	257·0	5·46	125·7
Iodine bromide in carbon tetrachloride	190·8	24·50	83·8
Bromine	257·0	5·46	125·7

—C. A. M.

Glycerol; Notes on the Determination of ——. [*Bichromate Method.*] Taurel. Monit. Scient., 1904, **18**, 574—577.

Several details are mentioned, the observance of which is considered to be necessary in order to obtain correct results by this method. In the first place, the glycerin should be carefully neutralised before precipitating the impurities with lead solution. The latter should consist of a solution of di-basic lead acetate or a mixture of sesqui-basic and di-basic lead acetate. Any excess of the latter added, must be removed before adding the chromic acid solution. It is preferable to carry out the oxidation in a flask attached to a reflux condenser.—W. P. S.

Chromed Hide-Powder Question. F. Kopecky.
XIV., page 830.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Diamond; Action of Radium Emanations on ——. Sir W. Crookes. Proc. Roy. Soc., 1904, **74**, 47—49.

It has previously been shown that when diamonds are exposed to the impact of radiant matter in a high vacuum, they exhibit phosphorescence of different hues, and assume a dark colour, owing to the formation of a coating of graphite. The author selected two Bingara diamonds, A and B, weighing respectively 0·960 and 1·020 grains; and of the same very pale yellow "off colour." B was kept first for a fortnight, and then for a further six weeks, close to a quartz tube containing about 15 mgrms. of pure radium bromide sealed *in vacuo*; it phosphoresced brightly and continued to glow the whole time of the experiment. At the end, no appreciable difference in colour between the two diamonds could be detected. B was then kept for 78 days in direct contact with radium bromide, at the end of which period, it was distinctly darker than A and had a bluish-green tint. After removing the graphite from B by treatment with nitric acid and potassium chlorate, the two diamonds were equally bright and transparent, but B had a pale bluish-green colour. This alteration of colour may be of commercial importance. It was found that the diamond B was strongly radio-active after it had been removed from the radium bromide for 35 days, during 10 of which it was being heated in the mixture of nitric acid and potassium chlorate, to remove its outer skin of graphite.—A. S.

Photochemical Reactions in a Homogeneous System; Reversible ——. I. Anthracene and Di-Anthracene. R. Luther and F. Weigert. Sitzungsber. Kgl. pr. Acad. Wiss., Berlin, 1904, 828—839. Chem. Centr., 1904, **2**, 117.

Under the influence of sunlight, anthracene in solution, as observed by Fritzsche, and also, according to the authors, in the solid condition and as vapour, changes into dianthracene which, in the dark, is again converted into anthracene. The transformation is especially rapid under the action of light from a mercury vapour electric lamp. The conversion of dianthracene into anthracene in the dark, is complete; but, in the case of the reverse reaction in the light, a condition of equilibrium is finally attained, the proportions of the two compounds depending upon various factors, such as the nature of the solvent and of the source of light, the intensity of the light, the surface illuminated, the volume of the solution, &c. The reactive power of anthracene is considerably increased under the influence of light, *e.g.*, when exposed to light, anthracene is oxidised by the air with the production of a yellow coloration.—A. S.

Diphenylcarbonic Ester; Action of a Trace of some Salts and of Caustic Alkali on ——. R. Fosse. Comptes rend., 1904, **139**, 141—143.

The author has previously shown that diphenyl carbonate, when heated with a small quantity of dry sodium carbonate, decomposes with formation of carbon dioxide, phenol, and phenyl-*o*-phenoxybenzoate, in accordance with the equation: $2(C_6H_5)_2CO_3 = CO_2 + C_6H_5OH + C_6H_4(CO_2C_6H_5)(OC_6H_5)$. He now finds that small quantities of trisodium phosphate, disodium arsenate, sodium bi- and tetraborate, di- and monosodium salicylate, sodium ethylate, sodium hydroxide, and potassium hydroxide are also capable of causing this decomposition.—A. S.

Enzymes; Study of the Instability of ——. K. Aso. Bull. Coll. Agric., Tokyo, **6**, 57—75. Chem. Centr., 1904, **2**, 79.

In order to elucidate the nature of the labile groups present in enzymes, the author studied the action of cyanogen, nitrous and nitric acids, hydrazine, methylhydrazine, and hydroxylamine on different enzymes. It was found that: (1) The activity of enzymes is not destroyed in very dilute solutions by small quantities of cyanogen; this is a further essential difference in the behaviour of living protoplasm and that of enzymes. (2) Very dilute nitrous acid has a greater destructive action on the activity of enzymes than nitric acid of the same concentration. (3) Hydrazine, methylhydrazine, and hydroxylamine in dilute neutral solutions destroy the activity of enzymes. The behaviour of the enzymes can be best explained if the active groups are aldehyde or ketone groups. (See also this J., 1904, 687.)—A. S.

New Books.

Das Photographieren mit Films. "Photographische Bibliothek," Bd. II. Dr. E. Holm. Gustav Schmidt' Verlag, Berlin, W., 10. 1904. Price M. 1.20.

8vo volume, containing 64 pages of subject-matter and table of contents. The pages are illustrated with 51 engravings, and the subject is treated under the followin heads:—A. Functions and Varieties of Films. Ordinar and Orthochromatic Films, and Films for Tricolour Photography. Celluloid, Paper, and Gelatin Films. B. Advantages and Drawbacks in Films as opposed to Glass Plates I. Advantages of Films. II. Disadvantages. C. Preparation of Films. (i.) Mechanical Preparation, &c. (ii.) Exposure. (iii.) Development. (iv.) Further Treatment o Films. (v.) Different kinds of Film-Cameras, &c.

Electro-Chemistry. Part I. General Theory. By R. A Lehfeldt, D.Sc., Professor of Physics at the East Londo Technical College. Including a chapter on the Relatio of Chemical Constitution to Conductivity. By T. S Moore, B.A., B.Sc., Lecturer in the University o Birmingham. Longmans, Green, and Co., 30, Paternoste Row, London, E.C.; also New York and Bombay. 1904 Price 5*s*.

8vo volume, containing 260 pages of subject-matter, wit 55 illustrations. Pages 255—260 are devoted to table pages 261—268 to alphabetical indexes of names of author &c., and subjects. The subject-matter is treated under th following arrangement:—I. (R. A. Lehfeldt) Mechanis of Conduction in Electrolytes. II. (T. S. Moore) Relatio of Chemical Constitution to Conductivity. III. (R. A Lehfeldt) Theory of Chemico-Electromotive Force.

Trade Report.

I.—GENERAL.

National Bureau of Standards, U.S.A.: Annua Report of the Director of the —— for the Fiscal Year ended June 30, 1903.

Government Printing Office, Washington, U.S.A.

The Office of Standard Weights and Measures of th Treasury Department was, on July 1, 1901, in pursuanc of an Act of Congress approved March 3, 1901, supe seded by the Bureau of Standards. On July 1, 1903, Department of Commerce and Labour was establishe to which the Bureau was transferred. The functio of the Bureau of Standards are as follows:—The custod of the standards; the comparison of the standards used scientific investigations, engineering, manufacturing, com merce, and educational institutions, with the standar adopted or recognised by the Government; the constructio when necessary, of standards, their multiples, and su divisions; the testing and calibration of standard measuri apparatus; the solution of problems which arise in conne tion with standards; the determination of physical constan and properties of materials. The Bureau will also furni such information concerning standards, methods of measur ment, physical constants, and the properties of materia as may be at its disposal. For all comparisons, calibration tests, or investigations, except those performed for t Government of the United States or State Government reasonable fees will be charged.

In the Annual Report of the Director, detailed descriptions of the various departments of the Bureau and of their equipment are given. The number and value of the tests completed during the fiscal year ended June 30, 1903, are given in the following table :—

Nature of Test.	For Government.		For Public.		Total.	
	No.	Value.	No.	Value.	No.	Value.
		Dols.		Dols.		Dols.
Length	368	130·90	111	133·55	479	264·45
Weight	291	345·00	109	100·25	400	445·25
Capacity	294	173·75	10	6·75	304	180·50
Photometry	1	2·50	..	..	1	2·50
Temperature	284	220·63	115	40·19	399	260·82
Electrical	13	71·00	56	172·50	69	243·50
Sundry	10	40·00	4	2·10	14	42·10
Total	1,261	983·78	405	455·34	1,666	1,439·12

	Dols.
Fees received, 1902-3	488·99
Fees for tests not completed during 1902-3	33·65
Fees for tests completed, 1902-3	455·34

Accompanying the report are seven Bureau circulars dealing with : (1) Verification of Standards and Measuring Instruments ; (2) Verification of Metal Tapes ; (3) Verification of Standards of Mass ; (4) Verification of Standards of Capacity ; (5) Testing of Clinical Thermometers ; (6) Verification of Electrical Standards and Measuring Instruments ; (7) Pyrometer Testing and Heat Measurements.

—A. S.

FEDERATED MALAY STATES ; EXPORTS OF THE —— IN 1903.

Bd. of Trade J., Aug. 4, 1904.

Tin and tin ore contributed 71½ million dols. to the exports, an increase of 14½ per cent. in value and of 7 per cent. in quantity of tin, and over 10½ per cent. in that of tin in ore. Pahang sent out an increase of 2,000 piculs of tin (25,275 against 23,114 piculs). Gold bullion from Pahang fell to 12,441 oz., representing a value of 565,366 dols., a decrease of 7,113 oz. and of 170,000 dols., but the export from Negri Sembilan rose from 199 oz. in 1902 to 2,370 oz. in 1903, and in value from 7,000 dols. to 98,000 dols. Sugar, almost entirely from Perak, amounted to 391,595 piculs, valued at 1,807,679 dols., a decrease in quantity but an increase in value, as compared with the figures for the previous year, which were 421,880 piculs and 1,705,504 dols.

Rubber was exported from Negri Sembilan to the value of 250 dols. in 1902 and 3,713 dols. in 1903. Gambier exports reached 386,675 dols., a decrease of some 25,000 dols in value and of 3,000 piculs in quantity ; the decrease occurred in Negri Sembilan. Jungle guttas of all kinds rose in value from 41,000 dols. to 68,000 dols., and in quantity from 531 to 625 piculs, Pahang alone contributing to the extent of 53,000 dols., an advance of 19,000 dols., and Selangor having a trade of 13,000 dols. compared with less than 1,000 dols. in 1902.

LYONS (FRANCE) ; CHEMICAL INDUSTRY IN ——.

Foreign Office Annual Series, No. 3243.

The following table shows the consumption of pyrites in Lyons in 1901-3 :—

——	1901.	1902.	1903.
	Tons.	Tons.	Tons.
Production of mines of St. Bel	307,000	315,000	320,000
Export	53,000	64,000	117,000
	254,000	251,000	203,000
Import of pyrites	205,000	171,000	205,000
Consumption	459,000	422,000	408,000

The consumption of pyrites, and consequently the production of sulphuric acid, has decreased slightly. The manufacture of "concentrated" sulphuric acid, begun in 1902 at Lyons by the Volta company, continued in 1903.

The glue and gelatin trade suffered from over-production. The general industrial crisis throughout France prevented the French industry from absorbing the surplus production, nor has production lagged behind in other countries ; the import into France also increased from 1,992 tons in 1902 to 2,428 tons in 1903. The increase in export from 7,794 tons in 1902 to 7,948 tons in 1903 did not suffice to relieve the congestion of the market, and a considerable fall in prices resulted. The activity of the bone manure industry, on the other hand, keeping up the price of raw material, placed the glue and gelatin industries in an abnormal position. This brought about an appeal from the manufacturers for a higher protective tariff, which was granted, it being fixed at 11 fr. per 100 kilos. general tariff, and 7 fr. 50 c. per 100 kilos. minimum tariff.

Reduction in the output of phosphorus was general in 1903. The consumption is stationary and the activity of the factories is dependent on the export demand. The export of white phosphorus fell from 89½ tons in 1902 to 61½ tons in 1903, whilst red phosphorus increased from 48¾ to 65½ tons for the same period.

The consumption of stearine and soap was as follows :— 1884, 30,500 tons ; 1900, 28,000 ; 1901, 25,750 ; 1902, 25,400 ; 1903, 24,600. The export is maintained, but does not counterbalance the decrease of consumption in France itself. The export of candles during the last three years was as follows :—1901, 4,402 tons ; 1902, 4,348 ; 1903, 4,381. Small factories are gradually disappearing.

There are two manufactories at Lyons for turning out rubber goods. The factory at Lacollonge has produced a new article—hardened imitation rubber—at a cost far below ordinary hardened rubber. A curious economic phenomenon has taken place of late years in the French rubber industry. Bordeaux has recently taken the place of Antwerp as the rubber market for France. The figures showing the imports into Bordeaux are as follows :—1898, 89 tons ; 1899, 175 ; 1900, 239 ; 1901, 235 ; 1902, 678 ; 1903, 1,113. The consumption of indiarubber both at Clermont-Ferrand and at Lyons for electrical machines, and for tyres for automobiles and bicycles, has brought these cities to form new commercial connections.

MADAGASCAR ; TRADE OF —— IN 1903.

Bd. of Trade J., Aug. 4, 1904.

Below are given the values of certain articles exported from Madagascar in 1903. The figures in brackets are those for 1902 :—Gold, 5,856,778 fr. (4,123,612 fr.) ; rubber, 2,581,439 fr. (545,630 fr.) ; hides, 1,214,686 fr. (734,890 fr.); wax, 556,018 fr. (789,519 fr.).

VII.—ACIDS, ALKALIS, Etc.

SULPHUR TRADE OF SICILY.

Bd. of Trade J., Aug. 4, 1904.

The exports of sulphur from Sicily during the 12 months ended June 30, 1904, amounted to 505,629 tons, as compared with 484,850 tons in the similar period of 1902–3.

The stock of sulphur remaining in Sicily at the end of June last was 278,025 tons, as compared with 287,878 tons and 276,589 tons respectively on the same date in 1903 and 1902.

X.—METALLURGY.

NEW SOUTH WALES ; MINERAL PRODUCTION OF ——

Bd. of Trade J., Aug. 4, 1904.

According to the annual report of the Department of Mines, New South Wales, the value of the mineral production of the State for the year 1903 was 6,059,486*l.*, this being a net increase of 421,341*l.* over that of the previous year (see this J., 1903, 767). All the principal minerals show satisfactory increases in value.

The production of gold from ores, &c. mined in the State during 1903 was 295,778 oz. crude (equal to 254,260 oz. fine), valued at 1,080,029*l*., as compared with 190,316 oz. crude (equal to 161,255 oz. fine), valued at 684,970*l*., for the preceding year. A statement of the yield obtained by dredges during the past four years shows an increase from 8,882 oz. in 1900 to 27,238 oz. in 1903. The chief centre of the gold dredging operations is in the Araluen division. There were fourteen plants at work there at the close of the year, and they contributed 53 per cent. of the value of the yield obtained by this branch of of the industry.

The total quantity of coal produced in New South Wales to the end of 1903 is estimated at 109,741,916 tons, valued at 44,021,103*l*. The production for 1903 was 6,354,846 tons, valued at 2,319,660*l*., as compared with 5,942,011 tons, valued at 2,206,598*l*. for the previous year.

The total production of kerosene shale for 1903 was 34,776 tons, valued at 28,617*l*., this being a decrease of 28,104 tons, and 31,100*l*. in value, on that of the previous year.

The estimated net value of silver, silver-lead, concentrates, ores, &c. for 1903 was 1,501,403*l*., and with lead and zinc added, the total value was 1,626,576*l*., or an increase of 128,114*l*. in the value of the output as compared with the previous year.

From ores raised in the State during the year, the value of the copper produced was 431,186*l*., as compared with 308,923*l*. for the previous year. The quantity of tin ore obtained by the dredges during the year amounted to 244 tons, valued at 20,100*l*.

At the close of the year there were six plants equipped primarily for saving tin at work, while three dredges were saving tin as well as gold. Several additional plants were on the point of starting operations, and others were in the course of construction. The output of tin ore during the year 1904 is therefore likely to be largely augmented from this source.

Manganese Ore Industry of Russia.

Foreign Office Annual Series, No. 3206.

The following figures show the quantities of manganese ore exported from Batoum during the year 1903 to the countries named :—Russia, 53,420 tons ; Netherlands, 50,900 tons ; Belgium, 5,125 tons ; total, 109,445 tons.

The stock of manganese ore at Tchiatouri at the end of 1903 was over 323,000 tons, mostly of good quality, and the market prices varied from 6 to 7 kopeks per poud (1½*d*. to 2*d*. per 36 English lb.), less an allowance of 15 to 20 per cent. on the weight for waste. Steamers are loaded almost entirely at Poti from waggons coming direct from Tchiatouri.

Minerals in Barcelona (Spain).

Foreign Office Annual Series, No. 3237.

Further progress has been made in the working of the arsenic and galena mines, from which, during the year, 6,982 tons of arsenical pyrites were sent to the smelting works at Badalona, producing 2,350 tons of white arsenic which, with the exception of 43 tons, was exported at a very profitable price.

The past year has seen the first shipment of iron ore from a mine in Catalonia, a British firm having shipped at Culera (a small port near Port Bou) 2,200 tons of iron ore, proceeding from the mines of Celra, in the province of Gerona, for Newport, Mon.

XII.—FATS, FATTY OILS, Etc.

Olive Oil ; Production of —— in Spain.

Monit. Offic. du Commerce. Bd. of Trade J., Aug. 4, 1904.

In 1903, the area of land devoted to the cultivation of olives amounted to 1,333,303 hectares,* an increase of 173,042 hectares over the average for the last 10 years. The production, however, shows a decrease, being 1,975,803 quintals, as compared with an average of 2,195,743 quintals during the last 10 years.

A large portion of the oil produced is consumed in Spain ; the remainder is sent to France, chiefly to Nice, Aix, and Salon, where it is refined and mixed with oil produced in Provence, consumed in France, or exported to other countries.

XIII. A.—PIGMENTS, PAINTS, Etc.

Sienna ; Burnt Italian —— : U.S. Customs Decision.

July 18, 1904.

Burnt sienna earth, showing on analysis water 9·80 per cent., iron oxide 82·75, and alumina, silica, and sulphates 7·45 per cent., was assessed for duty at 30 per cent. *ad valorem*, as a "colour," under paragraph 58 of the present tariff. The Board of General Appraisers overruled this action, and sustained the claim of the importer that it was properly dutiable at ⅜ cent per lb., under paragraph 49, as "sienna, washed, powdered, or pulverised," on the ground that the evidence showed it to be sienna, and that there was no recognised dividing line between sienna earth and iron oxide.—R. W. M.

XIII. B.—RESINS, VARNISHES, Etc.

Wood Turpentine ; Manufacture of —— in Savannah, U.S.A.

Foreign Office Annual Series, No. 3240, *Aug.* 1904.

"Wood turpentine," that is, a somewhat inferior quality of spirit of turpentine, is now being manufactured in the Southern States from pine knots, roots, &c., which sources of supply have hitherto been allowed to go to waste in abandoned pine lands. The new industry, as yet, is only in the experimental stage, but it is being watched with interest by naval store dealers, who hope that an article produced in this way may be useful in the industrial arts, where cheaper grades are utilisable, and where it is not necessary to use the high standard qualities of spirits of turpentine which so far can only be obtained by distilling the pure gum of the pine tree.

XIII. C.—INDIA-RUBBER, Etc.

Crude Gutta-Percha Trade ; Control of —— by the Chinese.

India-Rubber J., 1904, **28**, 127—128.

In a pamphlet recently issued by the Philippine Department of the Interior, P. L. Sherman states that the entire crude gutta-percha trade is practically controlled by the Chinese in Singapore, the secrets of boiling, working over, mixing, adulterating, and colouring being closely guarded. Philippine gutta-percha is collected by natives, who receive from the middleman about 10 Mexican dols. per picul of 162½ lb. The middleman carries the material to the coast and sells it to the Chinese exporter at the rate of 40—80 dols. per picul of 137½ lb. The forestry dues (5—7 Mexican dols.) are paid by the exporter, who sends the gutta-percha to Sandakan (North Borneo) or Singapore, where it is sold for 100—150 Mexican dols. per picul of 133½ lb., as North Borneo gutta-percha. It is stated that the Chinese in preparing the crude material for the European market are guided by smell, colour, toughness, and the softening and hardening test in hot and then cold water. So long as the collecting of the gutta-percha is in the hands of wild natives, and the manipulating and sale are controlled by the Chinese, there is no hope of the gutta-percha trade being placed on a fair basis.—A. S.

Rubber Production of the Congo Free State.

Bd. of Trade J., Aug. 4, 1904.

The total value of the rubber exported from Congo during 1903 is estimated at 1,893,754*l*.

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* Hectare = 2·47 acres. Quintal = 220½ lb.

XIV.—TANNING; LEATHER; GLUE, Etc.

QUEBRACHO IN PARAGUAY.

Foreign Office Annual Series, No. 3241.

The quebracho extract business of Paraguay has greatly increased of late years, the value of the export having risen from 5,056*l.* in 1900 to 18,779*l.* in 1901, 44,032*l.* in 1902, and 60,125*l.* in 1903.

CHESTNUT WOOD EXTRACT; EXPORTS OF —— FROM BASTIA (FRANCE).

Foreign Office Annual Series, No. 3246.

In 1902 the total export of extract of chestnut wood for anning to the principal markets outside France were ,000 tons, Hamburg taking more than half; but Liverpool vas the largest buyer in 1903, when the shipments were:—

——	Barrels.	Tons.
iverpool	15,200	4,100
lamburg	14,500	3,900
ntwerp	5,600	1,500
ondon	2,600	700
Total	37,900	10,200

XVI.—SUGAR, STARCH, Etc.

SIZING STARCH: U.S. CUSTOMS DECISION.

July 28, 1904.

A mixture of tapioca and potato starches was decided to e dutiable at 1½ c. per lb., under paragraph 285 of the resent tariff, notwithstanding that tapioca by itself is free f duty. The claim of the importer that it was dutiable at 0 per cent. *ad valorem* under section 6 as a "manufactured rticle unenumerated" was overruled.—R. W. M.

XVII.—BREWING, WINES, SPIRITS, Etc.

ALCOHOL; OCTROI TAX ON ——. U.S. CUSTOMS DECISION.

The Treasury Department has directed an appeal to the ircuit Court of Appeals from the decision of the United ates Circuit Court on the above (see this J., 1904, 734). util this question is finally settled by the Circuit Court of ppeals, the decision of the lower court will not be followed the United States Customs.—R. W. M.

XX.—FINE CHEMICALS, Etc.

PETIT-GRAIN OIL; EXPORTS OF —— FROM PARAGUAY.

Foreign Office Annual Series, No. 3241.

The value of the export of oil of petit-grain from Paraguay ring the last few years was as follows:—1898, 1,920*l.*; 99, 2,442*l.*; 1900, 3,818*l.*; 1901, 5,350*l.*; 1902, 5,831*l.*; 03, 7,183*l.*

GLYCERIN TANNATE: U.S. CUSTOMS DECISION.

July 22, 1904.

A compound of glycerin and tannin made by a patented ocess, was assessed for duty at 50 c. per lb. as "tannic id" under paragraph 1 of the present tariff. The Board General Appraisers overruled this action, and sustained e claim of the importer that it was dutiable at 25 per cent. *valorem* under paragraph 3 as a "chemical compound."
—R. W. M.

COUMARIN: U.S. CUSTOMS DECISION.

July 18, 1904.

Synthetic coumarin, produced from coal tar, was decided be dutiable at 20 per cent. *ad valorem*, under paragraph of the present tariff as a "preparation of coal tar, not a colour or dye, and not medicinal." The assessment of duty at 25 per cent. *ad valorem*, as a "chemical compound," under paragraph 3, was overruled.—R. W. M.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted; those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 16,855. Heinrich, Dierks, and Möllmann. Centrifugal liquid separators. [German Appl., Jan. 30, 1904.]* Aug. 2.

„ 17,097. Wills. Furnaces. Aug. 4.

„ 17,098. Wills. Furnaces. Aug. 4.

„ 17,199. Mertens. Uniform coating of cylinders with deposit forming liquids. Aug. 5.

„ 17,301. Doulton and Hopkins. Furnaces. Aug. 8.

„ 17,314. Howorth (Soc. Franç. de la Viscose). Cocks or taps for viscid liquids. Aug. 8.

„ 17,357. Bell. Drying apparatus. Aug. 9.

„ 17,435. Heymann and Hey. Apparatus for separating and condensing the vapours of volatile liquids. Aug. 10.

„ 17,536. Steele. Furnaces. [U.S. Appl., Aug. 11, 1903.]* Aug. 11.

[C.S.] 16,724 (1903). Schnöckel. Process and apparatus for the cooling of liquids. Aug. 10.

„ 16,725 (1903). Schnöckel. Jet condensers. Aug. 10.

„ 20,777 (1903). McNeil and McNeil. Evaporating or concentrating apparatus. Aug. 17.

„ 21,183 (1903). Simpkin. *See under* X.

„ 21,471 (1903). Newton (Bayer and Co.). Steam meter. Aug. 10.

„ 21,396 (1903). Thomas, Richardson, and Davis. Apparatus for roasting chemicals and the like. Aug. 17.

„ 5094 (1904). Soc. Anon. l'Ind. Verrière et ses dérivés. Processes for heating carbonaceous material applicable for chemical and other similar processes. Aug. 17.

„ 5485 (1904). Browne and Chandler. Condensing and cooling of gases, vapours, and liquids. Aug. 10.

„ 8481 (1904). Sagasser. Apparatus for purifying liquids by centrifugal force. Aug. 10.

„ 11,752 (1904). McKenna (Holst and Fleischer). *See under* XVII.

„ 14,075 (1904). Gostling. Continuous vertical kiln. Aug. 10.

II.—FUEL, GAS, AND LIGHT.

[A.] 16,869. Affleck. Method of improving the yield of hydrocarbons from carbonaceous matter. Aug. 2.

„ 16,895. Bloxam (Bradley). Gas producers. Aug. 2.

„ 16,916. Mitchell and Marriott. Binding material for coal dust and the like. Aug. 2.

[A.] 17,191. Imray (De Madaillan). Manufacture of filaments for electric glow lamps. Aug. 5.

„ 17,247. Kelly, Billington, and Weir. Fuel for gas, oil, and other fires, for lighting purposes, and for utilising the waste products of combustion. Aug. 8.

„ 17,497. Bessey. Manufacture of peat fuel. [German Appl., April 25, 1904.]* Aug. 11.

„ 17,570. Williams. Gas producers. Aug. 12.

„ 17,580. Patterson. Method of treating coal for coking purposes.* Aug. 12.

„ 17,661. Redfern (Poetter and Co.). Coking ovens. Aug. 13.

[C.S.] 10,687 (1903). Grayson. Manufacture of artificial fuel. Aug. 17.

„ 17,074 (1903). Plate and Lieb. Process for producing pit-coal and coke briquets. Aug. 17.

„ 17,283 (1903). Koppers. Coke ovens. Aug. 17.

„ 17,471 (1903). Middleton. Agglomerant for use in the manufacture of compressed fuel and a process of preparing the same. Aug. 17.

„ 14,718 (1904). Carpenter. Apparatus for use in the gasification of coal or other materials in the production of illuminating and heating gas. Aug. 10.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 17,435. Heymann and Hey. *See under* I.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 17,274. Shillito (Aniline Colour and Extract Works, formerly J. R. Geigy). Manufacture of red and bluish-red azo colouring matters. Aug. 8.

„ 17,318. Ransford (Cassella and Co.). Manufacture of sulphine colours. Aug. 8.

„ 17,589. Newton (Bayer and Co.). Manufacture of new anthraquinone derivatives. Aug. 12.

„ 17,590. Newton (Bayer and Co.). Manufacture of new dyestuffs of the anthracene series. Aug. 12.

[C.S.] 22,966 (1903). Cosway and The United Alkali Co., Ltd. Manufacture of sulphur dyes and of an intermediate product of the said manufacture. Aug. 17.

„ 23,179 (1903). Johnson (Badische Anilin und Soda Fabrik). Production of colouring matters of the anthracene series and of intermediate products relating thereto. Aug 17.

„ 23,188 (1903). Imray (Soc. Chem. Ind. in Basle). Manufacture of sulphurised dyestuffs. Aug. 17.

„ 9932 (1904). Oakes. Processes for extracting from vegetable matters, glucosides possessing colouring or tanning properties, and also the products resulting from such processes. Aug. 17.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 17,152. Howorth (Soc. Franç. de la Viscose). Devices for spinning and drawing artificial silk. Aug. 5.

„ 17,240. Destrèe and Wiescher. The dyeing of hanks or yarns.* Aug. 6.

„ 17,242. Krais and The Bradford Dyers Assoc., Ltd. Finishing piece goods. Aug. 6.

„ 17,330. Mitchell. Process of removing grease from cotton waste. Aug. 9.

[A.] 17,334. Parkinson. Method of producing piece-dyed striped cotton venetians, and like cloths. Aug. 9.

„ 17,368. Howorth (Soc. Franç. de la Viscose). Machines for spinning artificial silk. Aug. 9.

„ 17,437. Heymann and Hey. Method and plant for removing grease and other impurities from woollen and other materials. Aug. 10.

„ 17,447. Howorth (Soc. Franç. de la Viscose). Devices for spinning viscose. Aug. 10.

[C.S.] 19,404 (1903). Müller. Felt, and felted and like fabrics. Aug. 10.

„ 7172 (1904). Wiley. Apparatus for waterproofing fabrics. Aug. 17.

VII.—ACIDS, ALKALIS, AND SALTS.

[C.S.] 19,505 (1903). Hardingham (Soc. Minere e Fonderie d'Antimonio). Production of oxysulphide of antimony. Aug. 10.

„ 14,848 (1904). Artigue. Apparatus for the commercial manufacture of oxygen. Aug. 10.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 17,230. Fleming. Manufacture of earthenware and the like. Aug. 6.

„ 17,235. Robin. Composition for the manufacture of ceramic products. [French Appl., Aug. 7, 1903.]* Aug. 6.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 16,867. Sellars. Manufacture of cement. Aug. 2.

„ 16,940. Müller and Jarck. Heat non-conducting material. Aug. 2.

„ 17,370. Rüsager. Revolving cement burning furnaces. Aug. 9.

[C.S.] 15,181 (1904). Steenbock. Manufacture of a material for the production of cement. Aug. 17.

X.—METALLURGY.

[A.] 17,010. Wild. Method of extracting gold from ores, concentrates, tailings, and the like. Aug. 3.

„ 17,031. Jackman, Woodcock and Ledgard. Manufacture of solder for aluminium. Aug. 3.

„ 17,121. Cowper-Coles. *See under* XI.

„ 17,209 Hunt (Williamson). The cyanide process of extracting precious metals from ores containing them. Aug. 6.

„ 17,231. Davies and Clark. Method of uniting or coating iron or steel with other metals. Aug. 6.

„ 17,345. Evans. Treatment of zinc and other ores. Aug. 9.

„ 17,407. Wolf. Separation of metals from their ores. Aug. 10.

„ 17,430. Metals Corporation, Ltd., and Cowper-Coles. *See under* XI.

„ 17,481. Monroe. Gold milling. Aug. 11.

„ 17,521. Swinburne and Rudorf. Treatment of poor ores. Aug. 11.

„ 17,624. Leisel and Küpper. Manufacture of soldering paste. Aug. 13.

„ 17,630. Lark. Metallic alloys. Aug. 13.

[A.] 17,660. Davies and Clark. Method of uniting or coating iron and steel with other metals, and fluxes employed for that purpose. Aug. 13.

„ 17,670. Heyl-Dia. Condensing of metal vapours from blast and other furnaces and apparatus therefor. Aug. 13.

[C.S.] 17,109 (1903). Sulman, Cattermole, and Kirkpatrick-Picard. Concentration of minerals from ores. Aug. 17.

„ 21,183 (1903). Simpkin. Furnace for baking briquettes made of ore, concentrate, or other material. Aug. 10.

„ 21,299 (1903). Garrard and Ferranti, Ltd. Removal of scale from iron and similar metals. Aug. 10.

„ 21,854 (1903). Chaudoir. Cadmium alloy. Aug. 17.

„ 24,148 (1903). Weiller and Weiller. Production of metals, alloys, metallic oxides, and high temperatures. Aug. 17.

„ 24,825 (1903). Imbert. Process for extracting from their sulphides, zinc and lead and all metals whose affinity for sulphur is inferior to that of copper. Aug. 17.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 17,011. Delafon. Voltaic cell or element. Aug. 3.

„ 17,121. Cowper-Coles. The electrolytic deposition of metals. Aug. 4.

„ 17,196. Schauli and Petrides. Manufacture of plates and electrodes for storage batteries. Aug. 5.

„ 17,430. The Metals Corporation, Ltd., and Cowper-Coles. The electrolytic refining of copper. Aug. 10.

„ 17,639. Thomson. Electrolytic cells. Aug. 13.

„ 17,672. Dymond (Watson and Wheeler). Batteries.* Aug. 13.

[C.S.] 21,609 (1903). Creswick and Shaw. Electrodeposition of metals upon aluminium. Aug. 17.

„ 9468 (1904). Neuburger and Minet. Method and apparatus for heating the charge of electric furnaces. Aug. 10.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 17,218. Armstrong and Armstrong. Manufacture of soap and detergent compounds. Aug. 6.

[C.S.] 14,216 (1904). Brown (Warden). Apparatus for filtering and washing oils. Aug. 17.

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(*A.*)—Pigments, Paints.

[C.S.] 22,806 (1903). Newton (Bayer and Co.). Manufacture of colour lakes. Aug. 17.

(*B.*)—Resins, Varnishes.

[A.] 17,222. Walton. Manufacture of floorcloth, wall coverings, &c. Aug. 6.

(*C.*)—India-Rubber.

[A.] 17,313. Price. Process for devulcanising and regenerating rubber waste. [U.S. Appl., May 26, 1904.]* Aug. 8.

„ 17,579. Tiehsen. Manufacture of a substitute for indiarubber.* Aug. 12.

[C.S.] 17,156 (1903). Frankenburg, Ltd., Frankenburg and Betteridge. Rubber solutions or compounds. Aug. 17.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

[A.] 16,888. Hannemann. Non-desiccating depilatories.* Aug. 2.

[C.S.] 9932 (1904). Oakes. *See under* IV.

XVI.—SUGAR, STARCH, GUM, Etc.

[C.S.] 16,750 (1903). Harrison (F. Hlavati and Co.). Manufacture of sugar. Aug. 10.

„ 23,703 (1903). Bate. Drying starch from rice or other amylaceous products. Aug. 17.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 16,992. Baker and Ling. The sulphuring of hops, malts, and other materials, with special reference to the avoidance of contamination with arsenic, and apparatus therefor. Aug. 3.

„ 17,438. Hunt. Manufacture and maturing of spirit. Aug. 10.

„ 17,651. Linzel and Bischoff. Production from fermented fluid of a drink free from alcohol, by means of a vacuum. Aug. 13.

[C.S.] 19,472 (1903). Henry. Apparatus for assisting the aerating of grain for malting, distilling, &c., during the steeping process. Aug. 10.

„ 11,752 (1904). McKenna (Holst and Fleischer). Malting and drying drums. Aug. 10.

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(*B.*)—Sanitation; Water Purification.

[A.] 16,931. Dorling. The sterilisation of water.* Aug. 2.

„ 16,934. Lake (Jewell). The purification of water. Aug. 2.

„ 17,307. Walter. Water purifying apparatus. [Ger. Appl., Sept. 21, 1903.]* Aug. 8.

[C.S.] 17,661 (1903). Boult (Vasseux). Treatment of wash and other waste waters or residues. Aug. 17.

„ 20,021 (1903). Turner. Treatment of trade effluents. Aug. 17.

„ 14,709 (1904). Wheelwright and Fiske. Apparatus for removing oil and grease from garbage or offal. Aug. 10.

„ 15,235 (1904). Wheelwright and Fiske. Process of cooking garbage or offal and removing the oil or melted grease therefrom. Aug. 17.

(*C.*)—Disinfectants.

[A.] 17,320. Stephan. Disinfectant. Aug. 8.

„ 17,607. Endemann. Antiseptic compositions and process of producing the same.* Aug. 12.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 17,232. Homberger. Method of imparting lustre to objects made of celluloid and the like. Aug. 6.

[C.S.] 19,541 (1903). Harrison (Vellumoid Paper Co.). Manufacture of waterproof paper and the like. Aug. 10.

[C.S.] 14,447 (1901). Hennessen and Spix. Process of manufacturing figured glazed paper. Aug. 17.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 16,996. Merck. Manufacture of new cyan derivatives of pyrimidine. [Ger. Appl., Sept. 15, 1903.]* Aug. 3.

,, 17,003. Newton (Bayer and Co.). Manufacture of pyrimidine derivatives. Aug. 3.

[C.S.] 24,723 (1903). Imray (Meister, Lucius und Brüning). Manufacture of compounds of the active substance of suprarenal glands. Aug. 17.

,, 25,546 (1903). Verley. Manufacture of protocatechuic aldehyde and its derivatives. Aug. 17.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 17,009. Lake (Jacobson). Photographic reproductions.* Aug. 3.

,, 17,036. Lake (Jacobson). Photographic reproductions.* Aug. 3.

,, 17,192. Strasser. Photographic process. Aug. 5.

,, 17,610. Schmidt. Pigment photographic processes.* Aug. 12.

XXII.—EXPLOSIVES, MATCHES, Etc.

[C.S.] 17,414 (1903). Bell. Pressing of gun-cotton blocks, and apparatus therefor. Aug. 10.

,, 14,625 (1904). Hill. Matches. Aug. 10.

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REPORT OF COUNCIL.

The number of members on the register on July 31, 1904, was 4,134, as compared with 3,950 at the last annual meeting. During the year 400 new members have been elected, as compared with 380 last year; and the losses have been 216, as against 224.

There have been 29 deaths, as compared with 44 last year, *viz.*, Dr. A. P. Aitken, Mr. Alfred H. Allen, Capt. H. C. Aspinwall, Sir Frederick Bramwell, Baron W. de Bush, Messrs. Alexander Dick, E. E. Ewell, Harry Grimshaw, Jas. Hands, Dr. E. Hantke, Messrs. Jas. Heriot, Edwin Hunt, G. B. Jackson, H. C. Kohl, R. W. McKinlay, W. G. Macmillan, R. Preston, Geo. Rae, Julius Schad, C. Simeons, H. E. Slade, Major W. Staempfli, Jno. Stanning, W. Van Slooten, E. Robinson Walker, A. W. Walls, A. Weightman, Thos. Whiffen, and W. H. White.

The Journal for 1903 numbered 1,378 pages, equal to 57·5 pages per issue, as against 65·5 in 1902. During the past session 90 original papers, with discussions, have appeared in the Journal, as compared with 81 in the previous session. Of 20 papers returned to authors by the Publication Committee for amendment or condensation, 17 have been published after being recast, rewritten, or condensed, and three have been withdrawn.

The exchange list has been revised; journals which have ceased to be of value to the Society have been discontinued, and others, more useful, substituted. The decennial index for the years 1896—1905 is in a satisfactory state of advance, and it is hoped that it will be issued as contemplated in 1906. Pains have been taken to improve the illustrations in the Journal.

The Hon. Treasurer's financial statement, which was issued in the Journal for June 30th last, will be laid before the meeting.

Since the last annual meeting, the Sydney Section has been duly constituted, its by-laws approved, and papers from the Section published in the Journal.

From the Board of Trade the Council continues to receive for consideration important papers relating to the tariffs and trade regulations of other countries.

Allusion was made last year to the appointment of a committee to collect information from members as to the incidence of railway freights upon the chemical and allied industries. The replies received enabled that committee to report that the burden of freight was highest on the cheaper articles, and ranged from 15—30 per cent. of the value. Whether railways can carry at appreciably cheaper rates is regarded as doubtful; but, as proved by the experience of America, Belgium, France, and Germany, heavy freight can be carried much more cheaply by canals, if they be brought up to date and placed under independent management.

It has long been urged that Government, through a department, should be in closer touch with commerce and industries. In Germany the functions of the Minister of Commerce comprise the control of "all matters affecting handicrafts," and to it, as a consultative body, is attached the Technical Committee for Industry, which studies the scientific progress of industries, and keeps the minister in touch with them. America has recently established a Department of Commerce and Labour, and France has had a Minister of Commerce for some years. The Council two years ago appointed a committee to co-operate with Members of Parliament and others who were in favour of this reform.

The Society of Chemical Industry has during the past year been able to render effective assistance to the Royal Commission for the St. Louis Exhibition in respect of the British chemical exhibit. The chemical industries are represented at St. Louis by a collection which is described by the *Times* as "an excellent show on both the theoretical and practical sides," and it may fairly be said that the success which has attended the labours of the organising committee, all of whom are active members of the Society, would have been more difficult of achievement in the absence of the facilities which the Society was able to afford for making known the merits of the project. It is gratifying to record that the thanks of the Royal Commission have been conveyed to the Society for the services thus rendered. The important section of the Society represented by the American membership cannot fail to share the satisfaction which the Council feels in having contributed in this manner to the carrying out of the wishes expressed by the President of the United States.

The concessions made by the British Government in respect of the use of untaxed denatured alcohol for manufacturing purposes have not yet proved of general value in chemical manufactures. There have been some variations in the denaturants used in some instances, notably in the manufacture of fulminates and celluloid, both of which manufactures are under continuous supervision by revenue officials. The Council is of opinion that the range of denaturants should be greatly extended, and that no increase of drinking or "illicit distillation" is probable as a consequence of granting concessions to British manufacturers under guarantee. The Council regards with satisfaction the indications that the subject of reductions in the differential duty on British-made alcohol, and an alteration in the regulations for the sale of suitably denatured spirit, are receiving the sympathetic consideration of the authorities. The extension of the use of internal combustion engines, and the consequent increase in the demand for volatile fuel, have also directed attention to alcohol as a source of power; and the employment of methylated spirit for domestic use and lighting and heating purposes has been found economical and practicable. The Council has long co-operated with the Chemical Trade Sections of the London and Manchester Chambers of Commerce, and the Joint Committee of this Society and these Chambers has been further strengthened by the addition of representatives of the motor, lighting, distilling, agricultural, and engineering industries. At the instance of this Committee, supported by many Members of Parliament, the Chancellor of the Exchequer has consented to appoint a departmental committee, including recognised commercial and scientific representatives, to examine into and report upon the best method of providing untaxed alcohol, denatured or otherwise, for industrial purposes. The Council desires to express its appreciation of the persistent efforts of Mr. Thomas Tyrer in connection with this industrial need.

The Executive Committee of the National Physical Laboratory at Bushy Park, on the governing body of which the Society is represented, and to which the Council has made grants from time to time, has petitioned the Treasury for a larger annual grant and an increased equipment to fit it for its scientific work. At the same time a series of constructive proposals for the future working of the Institution have been presented. The Council has given its support to a petition asking the Treasury that the Laboratory may be placed in a position to do its important international work by means of a grant for capital expenditure and an increased annual subvention. Among the more important researches carried out by the Laboratory during the past year may be mentioned those on pure iron-carbon alloys, certain nickel-steel alloys, mercury standards of resistance, a comparison of thermometers up to 1,100° C., and measurements of the specific heat of superheated steam up to a pressure of 200 lb. to the square inch.

In response to a request from the Director of the Department of Commerce and Labour at Washington, the Council has granted a free copy of the Journal for the use of the new Bureau of Standards. The Director of the Department states that the purposes of this Bureau are similar to those of the Physikalisch-Technische Reichsanstalt at Charlottenburg, and that in the future it will issue bulletins containing much valuable matter on the scientific work of the Bureau.

The Association of Chambers of Commerce, at a recent meeting in London, passed a resolution welcoming the instalment of reform secured by the Patent Law Amendment Act of 1902, to which allusion was made last year. It also expressed the opinion that all foreign-owned patents for inventions and designs workable in the country, which were not so worked within a reasonable limit of time, should be forfeited. The Council has since been invited to appoint delegates to a deputation to bring this subject before the President of the Board of Trade, and has consented, subject to a reservation in regard to the words "foreign-owned."

In the opinion of the Council, if patents granted in Great Britain are worked elsewhere, they should also be worked here or lapse, whether they are "foreign-owned" or not.

The Society's medal, founded in 1896, and awarded by the Council once in every two years for conspicuous service rendered to Applied Chemistry by research, discovery, invention, or improvements in processes, has this year been awarded to Ira Remsen, President of the Johns Hopkins University of Baltimore. In 1896 the medal was awarded to John Glover, in 1898 to W. H. Perkin, in 1900 to Edward Schunck, in 1902 to Jos. Wilson Swan.

An invitation will be laid before this meeting from the Local Section of the Society to meet in London in 1905. It is hoped that this invitation will receive favourable consideration. American, Canadian, and Australian members will receive that cordial welcome which the Society has always experienced on these occasions. The Council trusts that American members will be present in force to support the President, who, as in 1900, will be a member of the New York Section of the Society.

The expenses of the Journal are necessarily heavy, and the Council trusts that members will make known to others the aims of the Society and the character of its Journal, so as to secure a constant addition to the membership, and thus permit of an equally constant extension of the Society's sphere of usefulness.

HONORARY TREASURER'S REPORT.

In the first place allow me, through Mr. Tyrer, who has kindly consented, with the Council's permission, to occupy my position as your honorary treasurer during this meeting, to express the very great disappointment which I feel in being unable personally to make the acquaintance of so many good and hospitable friends and brother industrials.

Last autumn I fully hoped and intended to be with you to-day, but have been forbidden; and after three-quarters of a century of life one is bound to attend to what one's doctor says.

To me it would have been an immense pleasure to have met again those of you whom I have the good fortune to know, to have enjoyed the magnificent programme you have set before us, and to have seen something of your vast country and works; but this is denied me, and I can only trust to your kind forbearance for any apparent dereliction of duty towards you.

Turning from myself to my duty as treasurer, it is with pleasure that I am able to place before you the accounts for last year, 1903; these have been published in the 30th June number of the Journal, and you will, I think, find them clear and explicit.

The first account, that on page 642, shows the Revenue and Expenditure for 1903. There was a net balance to the good of 840*l.*, and this, with the entrance fees (which are not reckoned as revenue, but are always invested), has been funded in good securities during this year.

It may be well to explain that this account is dated as made up to the 20th May 1904, and it will be seen that it includes all subscriptions for 1903, whether paid in former years or during 1904. On the other side of the account all liabilities for 1903 have been paid and are included, so that the statement shows accurately the year's working.

In connection with this, I should mention the rule, of which probably some of you are not aware, that the Journal is not forwarded after February in any year to those members whose subscriptions have not been received in London by that time, but on their subsequent receipt the back numbers are sent.

As treasurer it is right that I should explain to you that after this year it is probable that there may not be such a balance on the year's working. Publishing twice a month, and giving abstracts of American and French patents, has very materially increased the cost of editorial work, printing, and posting. Our present contract expires at the end of this year, and a considerable increase appears probable. The decennial index, combining the 10 years 1896 to 1905 inclusive, will be costly, both for editing and printing, although considerable sums have already been paid in preparing it to date, and debited to expenditure in each year. When finished it will be a complete index to all the available information to the end of 1905 in the 24 sections into which the chemical industries are divided in our Journal.

I am only expressing the unanimous feeling of your Council in saying that they desire to keep the Journal up to the highest standard for information and promptness of publication, and to publish, subject to the rules of the Society, papers which have been read before the Sections, containing new and useful matter; but it must be borne in mind that every page has to be paid for, that lengthy papers are apt to be merely glanced at, and not read, so that it is very desirable to condense as far as possible, to avoid redundancy of expression, and to make judicious use of references.

Like other journals, advertisements form an important item, though they do not appear in the present balance sheet, being included in the contract. Those who can advertise will be assisting the Society by so doing, and also by obtaining the addition of new members.

Referring again to the accounts, the second statement, on page 643, shows the actual position of cash and securities in your honorary treasurer's hands on the 31st Dec. 1903. The securities are in the names of three trustees, and are all first-class. You will see by the chartered accountants' certificate that they have all been verified by them, as have also all receipts and payments during the year. The interest on the funded property amounts to over 400*l.* a year.

Allow me to detain you for a few minutes longer with that side of our Society which not only benefits ourselves individually, but the world generally. I mean its cosmopolitan or international character. One can see its far-reaching usefulness from the fact that, whilst reckoning the British Isles, the United States, Australia, Canada, Germany, India, as only one country each, your fellow members live in 62 different countries; your New York Section, with its vast area, has just over one-quarter of the whole. Germany has over 50 members, "Far Cathay" 2, and Japan 30, whilst such places as Siam, Korea, Turkey, Syria, Borneo, and 50 others are represented.

Can anything more be wanted to show the value of the Society and the Journal? Is it too much to say that it is the best journal of the kind published? Judging by the care your Publication Committee give to the work, to which I can personally testify, and from the reports one hears from outside, it seems to me by no means too big a claim.

Believing as I do that the intercommunication of knowledge useful to all is for the general welfare of the world and the gradual reduction of jealousies, it has been much pleasure to me to serve the Society in the office in which it has done me the honour to place me. My only regret is not being with you to-day.

PRESIDENT'S ADDRESS.

On this occasion of the first visit of our Society to America, let me thank you for the hospitable reception which you have given us. We are proud of our New York Section; we are glad to be associated with your great nation; and although separated by an ocean, though we differ as regards methods of government, and as regards some of the items of policy which the Governments of both nations pursue, we admire your energy, your progress, and the inventive ability of your people.

Gratitude has been defined as a sense of favours to come, and we know that we have reason to be grateful, for you are about to give us, your guests, a token of your regard; you are going to show us your magnificent country, and to demonstrate to us the enormous developments in chemical industry which you have made. We look forward with pleasurable expectancy to the treat which you have in store for us; and we ask you to accept our heartfelt thanks.

It is customary in our Society for the President to give his address when he is on the eve of retiring, and I have looked for hints in those of my predecessors. I had thought that perhaps some suggestions dealing with the training of technical chemists—a subject of which I have now had over 30 years' experience—might have been favourably received, and I find that this has been a favourite subject with the Presidents of our Society, and that it has been discussed at length by Mr. Beilby in an address delivered in 1899 to the London Section. The history of our industries in London has been described by Sir Frederick Abel in 1882; Sir Frederick also discussed the early history of explosives in 1883; in 1884 Mr. Weldon gave an account of the development of the alkali and chlorine industry; he was followed in 1885 by Dr. Perkin, who, in a charming sketch, told the history of the foundation of the manufacture of colouring matters; Mr. Muspratt, in 1886, gave some interesting information regarding the early manufacture of alkali in Liverpool; in 1889 Dr. Mond described attempts which have been made to produce compounds of nitrogen from free nitrogen; in 1890 Sir Lowthian Bell discoursed on blast-furnaces; in the following year Mr. Rider Cook gave an account of the processes in use at that date for the disposal of sewage.

We find Prof. Emerson Reynolds lecturing on coal, peat, and oil as fuels; Sir John Evans, on the paper industry; Mr. Stanford, on the kelp industry; Dr. Thorpe, on the carburation of gas; Dr. Schunck, on his remarkable researches on the colouring matters of plants; Mr. Beilby, on smoke consumption; Dr. Swan, on electro-chemistry; while Prof. Chandler gave a sketch of the development of chemical industry on this side of the Atlantic.

In short, we have had specialists each discoursing on his own subject in a masterly way. The memory of many of these eminent men is all that remains to us; but we are glad to realise that many still remain among us, working enthusiastically for the progress of the science which they love so well.

For it is impossible to sever science from industry. Many of the addresses emphasise this point. Sir Henry Roscoe, in 1882, said: "My object has been to show that in certain branches of chemical industry, at least, it is only the highest and most complete scientific training that can command commercial success." Dr. Perkin, in 1885, in discussing technical education, emphasised the fact that "what is wanted is a thorough knowledge of chemical science, and knowledge how to use it by conducting research . . ." "The linking together of industrial and theoretical chemistry has undoubtedly been the cause of its wonderful development." Mr. Stanford, in the year of the foundation of the New York Section, said: "I think it could be easily proved that nothing ultimately pays better than original research." And in defining research he wittily divided the human race into two classes: "those who go ahead and do something, and those who sit still and inquire why it wasn't done the other way."

Much has been said about the right course of training for a technical chemist, and the example of our Continental friends has been freely cited. No doubt we have much to learn from them; yet there are some first principles which lie at the root of the whole matter, and which I will venture to lay before you, in the hope that they will commend themselves by being self-evident.

I am aware that all of them have often been laid down before; "there is nothing new under the sun," so far as first principles are concerned, at least. Yet that is no reason why they should not be stated again, for perchance constant attrition may soften the stony hearts of those whose decision is important in such matters.

The education of a chemist (and the word "chemist," of course, includes the qualification "technical chemist") must be conceived in the sense that it consists in an effort to produce an attitude of mind, rather than to instil definite knowledge. Of course the latter must not be neglected; the definite knowledge may be likened to the bricks which the architect has at his disposal in erecting a beautiful building; he knows their shapes, their capacity for resisting stresses, and, in short, what can be done with them. But the conception of the design is the result of many attempts to create; just as the poet has to utilise words, or the architect bricks, so the chemist has to know the materials with which he is dealing. The training of a bricklayer, however, will never make a man an architect; nor will the dry research of a grammarian train a poet. In short, it is the inventive faculty which must be cultivated.

Here I am met by the criticism—"The inventive faculty must exist; it cannot be implanted." "Poeta nascitur, non fit." I deny it. There are some persons whose dislike for the investigation of Nature is ingrained. I remember at Bristol advising a lad to abandon the study of chemistry for that of literature on learning his disgust for the former and partiality for the latter. He became the editor of a newspaper. But such persons are few. It is unlikely that they will ever begin the study of natural science, unless impelled by too expectant parents; as soon as the horse begins to trot, "they do not remain." My contention is that most of the lads who enter a chemical laboratory are able to receive some inspiration, or to have a latent inspiration developed, which will fit them to become inventive chemists.

Now how can this be brought about? The answer is perfectly simple: by offering them examples. Every teacher in the laboratory, from senior professor to junior assistant, must be engaged in research, and, most important of all, they must not be reticent, but willing to converse freely on their problems. It is that which creates a "chemical atmosphere." The objection may be raised that junior students are not ripe enough to make any use of such examples. True; and for that reason it is well for the juniors to spend the first year attending lectures and practical classes in rooms for the purpose, and not to let beginners enter the general laboratory. Moreover, they should be spending the major part of their time in attending courses on physics and mathematics, and in the drawing-office. But during the second year the initiation should begin. Even during the first year the seniors will talk occasionally about what occurs in the main laboratories; the publication of some discovery is sure to be discussed in the junior laboratory, just as the servants' hall discusses the doings of the drawing-room; and the criticism is sure to be somewhat keen, even though—perhaps the more so because it is—founded on insufficient information.

There are some simple ways of furthering this spirit of research. First, as regards the students. I regard it as a mistake to provide special laboratories for different classes of students. If students of organic chemistry are walled off from those who are working at analysis, then neither set knows what the other is doing. The best instruction that a student can get, he acquires in having to explain his operations to his neighbours. Now it is customary for the study of organic chemistry to follow on that of inorganic; the organic student is usually the senior; and it keeps up his knowledge of inorganic chemistry if he has frequently to place it at the disposal of his neighbours who are making routine analyses. They, on the other hand, cannot help seeing the very different processes employed by the organic man; and they insensibly learn a number of tips and dodges which prove of service to themselves at a later stage.

There is a further advantage. The junior, to whom everything is at first strange, meets at once with ancient mariners who have sailed seas unknown to him, and who are proud to be able to display a little erudition; to do so does not imply love of ostentation, or spiritual pride; it is simply human nature. A little care makes it possible to assort one's students, so that a shy boy is placed next a kindly senior, and a cocky youngster who thinks that he knows everything is placed next a man who will stand no nonsense, and whose chaff and banter soon dispel the inflated ideas of his own powers which the youngster has brought from his science school. Indeed, the lesson learnt is, that the chief question is not—"What does he know?" but "What has he done?"

Of course, for complicated researches, where much elaborate apparatus is erected, special rooms are necessary, but I have noticed frequently that the inhabitants of these rooms hold informal receptions, and have pleasure in exhibiting the result of their skill in manipulation and in glass-blowing.

In some laboratories a tame glass-blower is kept on the premises. There cannot be a greater mistake. If the members of the teaching staff are glass-blowers, "es geht von sich," as the Germans say. The whole laboratory becomes proficient. Each imitates the other. No doubt advice is often given which refers to the folly of paying sums for apparatus which it is possible to construct with little trouble, after knowing how; and the money is better spent. And glass-blowing is an all-important adjunct to research. I cannot imagine how anyone can stand the annoyance of having to wait for hours, possibly for days, for the repair of a piece of apparatus, which would probably take fewer minutes if the owner was able to manipulate a blow-pipe. Nearly the same may be said of the mechanic's place in the laboratory. Here, however, the work is slower, and in many cases the mechanic's services may be required; but for small repairs, such as soldering, repairing, contriving stirring apparatus, electrical apparatus, &c., much may be done by the student himself without any direct teaching. I confess, however, that a mechanic is necessary, if only to see that the tools are kept in order.

After the preliminary year I do not think it advisable for the student at once to commence research. There are the usual subjects of complex qualitative and simple quantitative analysis to be mastered, separations, gas analysis, and the preparation of typical organic and inorganic compounds, besides physico-chemical operations, such as vapour densities, determinations of molecular weights, conductivities, and electrical separations. But the time spent on these may easily be too much extended. A fairly good student should have done enough, in a year and a half or two years, to place him in such a position that, if necessary, he can help himself when he is face to face with an analysis which he has not made before. By mixing research students in the same laboratory with others at all stages of advance, the man who is working at analysis insensibly gets to regard his operations as partaking of the nature of a problem, and pursues his work with the greater interest. Moreover, it is not difficult to intensify this view of the question by contriving variations on ordinary routine: the determination of calcium and magnesium in a shell; the estimation of phosphoric acid in a bone; the Dumas method for nitrogen applied to a dried mouse; the analysis of the gases of respiration of a fly kept in air confined in a tube over mercury, and so on. When an analysis is regarded as a problem, it gains greatly in interest. And it can always be checked by a duplicate, and if necessary a triplicate. It often happens, moreover, that the research-work of a senior student is greatly helped by analytical work which can be safely entrusted to a junior. In this way double interest is gained—in the problem set, and in the research which the solving of the problem furthers.

Above all, not too much teaching. The essence of scientific progress is the well-worn method of trial and failure. It is simply horrible to think of the travesty of teaching in vogue in some of our colleges, where everything is provided, and where the students add one solution to another by word of command, and record their results in special notebooks constructed for the purpose. What do they learn? To obey? That should have been taught in the nursery. Manipulation? Manipulation consists in constructing what is required, not in using what is given. I had rather see a youth commit the Æneid to heart than carry out such time-wasting, soul-destroying routine operations. The first may result in a stronger memory; the second is fatal to all originality.

It may be said that by thus leaving the students very much to themselves, much time is lost. Yes; possibly at first. But the ultimate rate of progress is very much more rapid. Unless the pupil learns to be of use to himself, he cannot possibly be of any use to others. And the training consists in finding out how to do it: not in doing it; that is easy, if one knows how.

Let me consider the matter next from the point of view of the junior staff—the assistants, or whatever they may be called, "Privat-docenten," lecturers, instructors. It must never be forgotten that these young men have their way to make in the world; that it is unjust to treat them as teaching-machines; and that the only opportunity given them to make their mark is to afford them all possible encouragement to further the aims of their science, for in doing so they will further their own aims. They must become known; and without publication of their work they will remain unknown; and without reasonable leisure for research they will be unable to publish. Hence the duties of the members of the staff of a laboratory should be so arranged that at least half their time is available for research. Again, I am a firm believer in encouraging joint work done by assistants and students; the student gains much, and the assistant gains an assistant. Moreover, he learns the chief duty of a professor—the need of retaining in his mind problems for solution, and the art of getting the most out of his students in encouraging them to think for themselves. It is, indeed, an apprenticeship, where the young teacher learns his trade. He must have tools to work with; these tools are the students who act as his assistants. I regard it as essential, therefore, that the laboratory should have such a number of assistants that each one has half his time at his own disposal.

But, it may be urged, the number of assistants must necessarily be much greater than the possible vacancies in chairs, and it must therefore follow that many men will grow old in subordinate posts, and grow sick with hope deferred. Here the manufacturers should step in. A man who has had such an experience as I have sketched is invaluable, if he is not too old, as a works chemist. It is true that he may have had no special experience; but that matters little; in six months he will have grasped the principles of the manufacture, and if he is a man with the experience I have tried to sketch, he will be able to get the most out of men—perhaps the most valuable quality which a works manager can possess—and he will have a great deal of experience, experience perhaps not of a kind to be immediately useful in the particular work in which he is employed, but possibly of great value if the processes used in the work are to be altered. It must be remembered that the assistant must have proved his capacity for research and his ability to deal with other men before he is appointed; and he must have justified his choice. Here I may justify my own opinion by citing the practice of many German manufacturers; it is the rule, not the exception, to induce the assistants from university laboratories to enter their works.

I come next to a question which I have some delicacy in alluding to—the pay of an assistant. While it should be sufficient to enable him to live an unmarried life with comfort, it should not be sufficient to induce him to spend his life in a subordinate university post. He should have reason to wish to better his condition. It is impossible to lay down a hard and fast rule in such matters; but the point should be borne in mind.

If the assistants are to be given leisure for research, the number must be considerable; in fact, a double staff, in a sense, must be employed. This raises the question, How many students should be in the charge of each assistant? The question does not admit of a definite answer; yet an approximate one may be given. It necessarily depends on the class of work which the students are doing. If each assistant is told off to superintend the work of two or perhaps three students who are pursuing investigations—the junior assistants will necessarily have fewer, the seniors perhaps as many or more—each of these men may take much attention on some one day, and need not be looked at for perhaps a week or more, except in a general way. In that case perhaps ten or twelve systematic students might be allotted to each assistant; but it necessarily depends greatly on the nature of the work, and of the assistant himself. My experience is that assistants are disposed to be almost too conscientious, and to devote not only an unnecessary but almost an injudicious amount of attention to each student. I am not sure that the students look at it quite in the same light; it is so much easier to be taught than to learn. Very few of us care to think if we can possibly avoid it; I confess that I have frequently spent far more time in looking over papers in order to find a calculation which I had previously made than would have sufficed to make the calculation anew.

We come next to the senior teachers, or professors. The first point I would urge is that, while it is possible to lecture to as many students as the largest lecture-room will hold, it is not possible to supervise the practical work of more than, say, forty or fifty students. The professor should always know what every man is doing. It is not necessary that those who are engaged in routine-work should be visited every day; they are under the care of assistants; but it is necessary that the professor should be able to gauge the capacity of each of his laboratory students; for only thus can he tell whether they are profiting by their studies. The reason why the old laboratories of Liebig, of Wöhler, and of Bunsen are regarded with such loving memory by those who were the students of these great men is that the total number of students was small; they formed a family party, where the individual character of each was known, and where the father lived among his children, and was able to distribute correction, reproof, and instruction in righteousness. Hence the necessity for limiting numbers. Now, if there are forty students, and the professor spends ten minutes each day with each—no great allowance of time—simple calculation shows that more than six hours are gone. I think that two hours is ample for the professor to spend daily in teaching laboratory students. Of course at some critical moment he must spend a much longer time with one; it may be several hours; but that should absolve him from attendance on that individual for the best part of a week. It is better to mix example with precept, and unless a large part of every day is given to research, the professor loses the attitude of mind which it is his duty to cultivate in his students. It does not do to let a day pass without making some effort to continue research; the habit is only too easily lost; it is like all arts; the successful pianist or violinist spends many hours each day at his instrument, and if the acrobat were to take a month's holiday, he would require to begin to learn his trade again. Moreover, it is only by continually keeping his hand in, and his mind turned on his own research, that the professor can conceive new problems, some of which are simple enough to form the best introduction to research to be carried out by his students.

Again, in a large laboratory, the time occupied in the details of organising is so great as to make a heavy call on the energies of the professor, who is necessarily the director. There are parents to be seen; notebooks to be read; correspondence with old students in search of employment; apparatus to be ordered; servants to be directed; in short, the whole management of a business in addition to the work of teaching and research. The cares of management grow very rapidly with the increase in size of the laboratory, and many of the duties cannot be delegated. Moreover, there are the calls of public duty which often press very heavily on the successful scientific man. Add to these the share which it is always necessary to take in attending university councils, and it is manifest that the administrative duties should be simplified as much as possible.

If the reputation of the professor is such that students crowd to his laboratory, my counsel is, do not build larger laboratories, but appoint a new professor, with a separate chair, and a new laboratory; but do not make your man of talent a mere administrator.

This leads me to touch again on the technical side of my subject; I must refer to the question of remuneration. If the best men are to be attracted towards any career, an inducement must be offered, of such a nature that a young man, deciding on his future prospects, may be influenced to choose it. It is not necessary that all the members of the profession should be highly remunerated; but it is necessary that some should. Although I am not here to defend the particular case which I am going to mention, I wish to refer to it as specially applicable: the Archbishop of Canterbury has an income of 15,000*l.* a year; many bishops receive an annual income of 5,000*l.*, and the result is that young men take orders who will ultimately have to be contented with very small emoluments. Now in the payment of university professors, it must be kept in mind that the men who fill the chairs are withdrawn from the practice of medicine, law, engineering, and other professions, including that of technical chemistry; and if they are to teach others, it is greatly to be desired that they themselves should be of the best of their kind. Hence there should be prizes for the best, comparable in amount with what a successful lawyer, doctor, or manufacturer would earn. If this is not done, then one of two things will result: either the standard of teachers, and consequently of teaching, will be lowered, to the great disadvantage of the next generation of professional men; or the position of teacher may be accepted by enthusiasts, who could have made a much larger income had they entered professional or commercial life, and who will therefore be making a life-long sacrifice for their country. Probably both will happen; a few chairs will be filled by such enthusiasts, while the average professor will be much below par.

Of course other considerations must enter into the question of remuneration. The life is a regular and pleasant one; there are practically no risks; the standing is good; but I submit that, making due allowance for these, the prizes should exist. And they should reach the right men. How can this be achieved?

This brings me to consider the method of appointment to chairs, and that involves the government of the university. It is a large question; but as the reputatation of a university is entirely dependent on the standing of its professors and teachers, it must be considered.

There are as a rule three methods of appointing to chairs: one is selection by a council or committee—by the governing body of the university; and this, in fact, amounts to selection by the principal or president, for as a rule the principal or academic head of the university is regarded by the council of outsiders as the best judge of scholastic matters. The second method is selection by a committee of specialists appointed by the university; if, for example, a physical chair is vacant, it is filled by a committee consisting of four or five eminent physicists, themselves not connected with the university in which the vacancy occurs. The third method, and it is the one which commends itself to me, is selection by a committee of the faculty in which the vacancy occurs, after a reasoned report in which the relative merits of all the possible candidates are discussed.

The reason for my preference is a very simple one: it is because selection by persons belonging to the same faculty of the university unites two qualifications in the persons of the electors—competent knowledge on the one hand, and self-interest on the other. Choosing, as an instance, a vacant chair of physics, the committee of selection would consist of any other professors of physics in the university, provided there were more than one; the professors of chemistry, biology, mathematics, botany—of all sciences to which physics is a fitting introduction. These men of science either know, or can make written inquiries about possible candidates. They discuss all the *pros* and *cons.* of each one; and they finally resolve to ascertain whether two or three persons would accept the vacant chair, if offered to them. They then make their recommendation either to the governing body of the university, or to some state official; and the question is asked and the post accepted.

Now it is the interest of every one of the members of the committee to secure the best man; and as it is to be presumed that they are themselves all engaged in investigation, they will select an occupant of the chair who has already made his mark, and shown that he can be relied on to continue to carry out investigations. His reputation will reinforce theirs; his tenure of the chair will add lustre to the university. Moreover, as all sciences touch, they will have a colleague from whom they can get advice; who will aid in the development of their own sciences.

It is true that the academic head of the university—the principal or president—may be influenced by like motives, and that any selection which he may make may be made on very similar lines, after a similar inquiry. But the filling of a chair is not a single-handed job; if it is single-handed, it is likely to become a job; either the principal is not able to get the required information, or his judgment is not so sure as that of those colleagues more intimately connected with the subject of the vacant chair. Selection by the principal *may* succeed; selection by colleagues of the same faculty practically always succeeds.

As for selection by a committee of outsiders, they have no feeling of responsibility. From personal experience, I know that their aim is satisfied when they have elected a man who will not disgrace their choice; they do not necessarily select the best man. I know, having had to act as an elector by all three methods, that one is much more particular when one has to choose a fellow-teacher with whom one has to pass one's days. It is like choosing a wife. A lady chosen by the vote of the families may prove a success, and no doubt often does. If the wife were chosen in cool blood by the man who is to live with her, after careful inquiry into her antecedents, hereditary and otherwise, her temper, her suitability for the duties which a wife is supposed to perform, there would be fewer unsuccessful marriages. The analogy breaks down; for, unless it is a case of marrying a widow, previous experience should not be a possible consideration. But in selecting to a chair it must; and this leads me to ask, From what group of persons should a professor be chosen?

There are large universities, and there are small ones; and obviously the professors in the smaller institutions will be available for selection to the larger ones, with their greater field of usefulness and their higher emoluments. Should the professors in the smaller universities have justified their election, they will doubtless be the first to be considered in filling the more important chairs. And for the chairs in the smaller institutions, the assistants will be available. They will have published work of a nature to make their names known as promising investigators, and they will have commended themselves to their chiefs as capable men to whom the management of a department may well be entrusted.

The choice of the assistant from among the senior students may be left entirely to the professor with whom he has worked, and who is best able to judge of his powers. He will doubtless have filled the position of a student-demonstrator, in looking after junior classes; and his frequent appearances at the local scientific society will render it possible to estimate his ability as a lecturer.

And now let me discuss a question which has not given difficulty in America, I understand, but which has greatly retarded the advance of knowledge and research in England. I refer to examinations. It may well be introduced here, for it may be asked, Should only a graduate be recognised as worthy to occupy a junior teaching position? To this I would reply, Let the choice be free. I have often seen men whose circumstances, or whose character, or whose deliberate choice has led them to abstain from taking a degree, and who, nevertheless, are most successful investigators, well able to increase the knowledge of their subject, and who have proved most inspiriting teachers; and, on the other hand, I have perhaps more frequently come in contact with graduates whose only claim to recognition was a parrot-like ability to repeat what had been told them, and a knack in gauging the idiosyncrasies of an examiner. The older I get, the less I believe in university degrees as a test of capacity. Perhaps the reason is the manner in which degrees are awarded in England; the degree follows on one, or at most two examinations, often by men who know the candidate only as a number, and whose idea of examination often is to set questions to trip the candidate, and not to draw out what he can do. Indeed, it raises the question which I have mentioned earlier in this address: the examination is so contrived as to elicit what a man knows, rather than what he can do.

Now here, again, there are certain obvious truths which have often been stated, but too often ignored. The student, working under the eye of the professor and of his assistants, undergoes a daily examination. He may not earn marks; but, none the less, he impresses his teachers with some conception of his character; and the impression is made rather by what he can do, than by what he knows. The qualities tested by such examinations as have been customary for the past forty years in England are the last which one would wish to have in a student of science—readiness of memory to the exclusion of deliberate judgment; the faculty of spreading knowledge thin, and making a veneer of scientific facts instead of the power to correlate them and increase their value; and the skill to gauge the capacity of and hoodwink the examiner, instead of the power to incite enthusiasm in others. They are ideal qualities for a successful barrister, because they pay in his profession; but their reward has been the bane of science. A sound judgment, though it may be a slow one; persistence in struggling against obstacles; the knowledge where to get information when required, and to use it when found; and the inventive faculty—these are the qualities required, and they can be gauged only after long-continued observation. Moreover, the pernicious system of competitive scholarships and fellowships, instead of eleemosynary support given to the necessitous and deserving youth, has also contributed much to the debasement of the scientific spirit; for it has early implanted in the young mind the idea that to outrun his fellows, and to work solely for a money reward, are the ends to be aimed at, instead of the joy of the exercise of a divine gift, and the using that gift for the benefit of man. It is true that to earn money is a necessity; it is in no way a wrong aim; but it is not the chief aim; and money should be earned as a reward for useful labour, not for success in scholastic competitions. I am aware that these evils are much less noticeable in America than in England; and also, fortunately, public opinion is beginning to recognise, in England, that such inducements to work do not select the best men, so far as science is concerned. Under present circumstances, however, as scholarships exist, and must be awarded by examination, it requires considerable ingenuity to devise a method of examination which shall pick out men who will make a good use of them. I recently gave as a question for my own students, "Describe shortly the researches which have been going on in this laboratory during the past six months"; and I found the result very satisfactory. The question put a premium on the interest which a student should take in his friend's work, on the intelligence in following it, on his powers of description, and on his suggestiveness where invention had to stand for want of accurate knowledge. The after-effect of such a question, too, will be considerable. The students will endeavour in future to follow the researches of their neighbours with more understanding than they have done.

A question sometimes debated is whether the professor should lecture to junior or to senior students. Should he introduce the young student to the study of chemistry, or should he lecture to the most advanced students on recent developments of the subject? My reply would be, that students are much over-lectured. The object of lectures is more to open out a subject, and to direct a student what to read, than to give definite information. And for that reason I think the senior teacher is the best for junior students. Experience has generally taught the older man how to make his subject interesting to beginners; he has learned the art of repetition without showing that he repeats: he does not travel too fast on roads untravelled before by the young student; and he is more lenient to their often absurd efforts to form correct conceptions. On the other hand, the senior student is less exacting than the junior; to him the matter is more important than the manner of delivery; if the lectures prove useful to him he is ready to excuse any want of judgment on the part of the young teacher. For these reasons, therefore, I incline to think that the junior courses are better entrusted to the senior man, and the more advanced courses to the junior teachers. But we have found it advisable to ask individual advanced students to deliver short courses of lectures on special subjects of which they have made a study; no fee is charged for admission to these lectures; and they are much appreciated both by the deliverers of the lectures, as a field for practice, and by the students, as an easy way of becoming acquainted with special branches. We do not usually insist on the attendance on lectures beyond the third year; indeed, the formal lectures end in the second year. We find that more progress is made by the students through reading and conversation than in a more formal way. But here, again, the course followed must depend more on the individual cases than on any general rule; some learn more easily through the eye, others through the ear. On the whole it is better to appeal to both organs of sense, and utilise, as it were, a system of double entry.

It consequently appears to me futile to extend courses of lectures to more purely technical subjects. The ideal plan of education for technical chemists would be some system analogous to the apprenticeship of engineers, after they have been educated in the science; that is, after the correct habit of mind has been largely formed. But it is difficult see how this can be brought about. The obstacles in the ay appear to me to be insurmountable. The chemical anufacturer is not willing to throw open his work to udents, nor would he do so even if very considerable remiums were paid. Indeed, in England, it is not uncom-on for the "chemist," so-called, to be refused admission the works, and to be confined to the laboratory. In the rger German works, where many chemists are employed, is possible for a young man to gain the requisite experience. have been informed by the managing director of a emical work in Germany where 70 chemists are em-oyed, that nature has divided the young men into three rge classes, the members of which are fairly easily stinguished, and do not greatly overlap. There is first e routine chemist; the young man who declines responsi-lity, but who is hardworking and trustworthy; he finds s place as an analyst, testing raw materials and analysing e products at various stages, including the finished pro-icts. Second, there is the young man to whom the anagement of some department may be entrusted; one th a firm will, plenty of energy, and the quality of verning men. And third, there is the research chemist, 10 delights in new problems, whether suggested by others conceived by himself. All three classes are utilised; d after forming one of the analysts for some time, the ung men naturally range themselves in one or other partment, where their natural tendencies find scope. it even in Germany the number of works which iploy 70 chemists is not great; and with a small number is more difficult to effect the division of labour so tisfactorily.

I have wondered if it might not be possible to establish raining school for technical chemists somewhat on the lowing lines:—To start an association having for its ject the encouragement of invention, each member of iich would subscribe a certain sum for the erection of ildings and plant. There would need to be a number of lated buildings, and a considerable collection of stock ut of a small scale—stills, tanks, evaporating pans, er-presses, vacuum-filters, centrifugal machines, crystal-ing vats, and so on. The work should be furnished with am and electric current. Such a syndicate might let it known that they were willing to make arrangements th inventors, or with syndicates which had secured the tents of an invention, or secured an option on such tents. The superintendent or professor should be provided th a staff of assistants, who would be each in charge of e building—that is, of one operation. Students would be mitted for an appropriate premium, as in engineering rks. Supposing an idea to be brought to the notice of directors, they would consult as to whether it should accepted or not. If accepted, then the share of profits uld be arranged with the patentee, should it prove cessful. It would be committed to the charge of one of staff, who would first work it out in the laboratory with aid of a staff of students. If it then seemed feasible, would be tried on a comparatively small scale, dealing h hundredweights, in one of the special buildings, those dents who had investigated the process in the laboratory aring in the larger-scale operations. The surmounting difficulties in the transition, the perfecting of the process, making working drawings of the requisite plant, would afford the best of all training to students; and in case the process proved a commercial success, these students who had helped to elaborate the process would be naturally the first to obtain employment in works, should they be erected. At the same time, manufacturers would naturally be anxious to obtain the services of men trained in so good a school, so that many students would be drafted off to works. Indeed the scheme may be paralleled from the medical side; after receiving a medical education, for example, in preliminary scientific subjects, such as chemistry, physics, and biology, the medical student devotes himself to professional studies for three years. Then his technical education begins when he becomes house physician or house surgeon. After such experience, he is available for junior positions, for becoming "locum tenens," and so on.

The students in such an experimental works would, of course, have to do labourers' work; employees always respect a man who can "take his coat off." In this way he gets to know their difficulties, and to judge them fairly; to know what they can do, and what reasonably to expect.

I am by no means sanguine that such a scheme of technical education can be started. I acknowledge that it is an imperfect imitation of the magnificent schools of technical chemistry which form part of every large German chemical work. But such schools are unlikely to find a footing, so far as I can judge, in England. I cannot judge of America. Our system is, when trade is good, to let well alone; the manufacturer thinks, "I have done very well without a chemist so far; why have one now?" or, "the class of man who has served us as analyst has sufficed for our needs; he costs only 2*l.* a week; why burden ourselves with a more expensive, even if a more skilled man?" And when trade declines, he naturally shrinks from spending money. It is the policy of "penny-wise and pound-foolish."

In conclusion, let me make one more remark. It is that the scientific curiosity of to-day often becomes the trade necessity of to-morrow. A scientific friend of mine once drew my attention to the fact that most of the changes which have been introduced in industry have had their origin in the universities. Why? Because the investigator is unfettered. If a man sets himself to improve an existing process, he very likely may succeed, but he will not effect a revolution in manufacture. The purely scientific investigator who is free to follow indications of no apparent commercial import has not infrequently made discoveries of a radical nature, which have entirely changed some particular industry. I do not recommend the one to the exclusion of the other; both are best; and both are best attained by an intimate association between the universities and the chemical works. The investigator often learns much by the study of industrial processes. The chemical manufacturer who is keenly alive to his own interests will not fail to keep himself in touch with every discovery, however little it appears to be connected with his own industry.

To quote from the "Rules of Political Conduct," written for the people of Japan thirteen hundred years ago: "The imperative duty of man is to sacrifice his private interest to the public good. Selfishness forbids co-operation; and without co-operation there cannot be any great achievement."

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I.—PLANT, APPARATUS AND MACHINERY.

English Patents.

Steam Meter. H. E. Newton, London. From the Farbenfabriken vormals F. Bayer and Co., Elberfeld. Eng. Pat. 21,471, Oct. 6, 1903.

The steam is passed through a closed vessel, over the outlet of which a hollow truncated cone is arranged. In the opening of the cone, a float is arranged to work; it is supported by a wire working through the cover over a pulley and balanced by a weight. Attached to this wire, and on the outside of the vessel, is a pen or pointer which operates in connection with a moving scale. From the indications of the pointer, the position of the float and consequently the area of the discharge opening can be deduced, and from the pressure, recorded on a registering gauge, the quantity of steam passing can be calculated. —W. H. C.

Condensing and Cooling of Gases, Vapours, and Liquids. A. F. Browne and D. Chandler, London. Eng. Pat. 5485, March 5, 1904.

The gases, &c., to be condensed and cooled are led through a chamber or series of chambers, the outer surfaces of which are exposed to the air, so that radiation and consequently cooling may take place. Within each chamber is a series of other chambers or pipes, through which a current of air is transmitted. The interior of the walls of these pipes is kept constantly wetted by a film of water, supplied in the form of spray by an atomiser, or drawn up by capillary attraction by cotton wicks or cloths attached to wire netting and dipping into water. A number of shallow trays filled with water are superposed one over the other in these pipes, so that the water overflows from each pipe to the next lower one. A partial vacuum may also be maintained in the pipes. In this way, the heat abstracted from the gases to be cooled, is rendered latent by the continuous evaporation of a film of water, in the air current.—W. H. C.

United States Patents.

Centrifugal Separator. H. McCornack, Westchester, Pa. U.S. Pat. 766,837, Aug. 9, 1904.

A suspended shaft, to which a tubular centrifugal vessel is coupled, is supported and enclosed by the upper portion of a frame, the lower part of which forms a fixed casing below the coupling and surrounding the depending centrifugal vessel. The casing supports the lower end of the centrifugal vessel and has diverging walls, so that the latter, when uncoupled, can be tilted sufficiently to enable it to be freely lifted out of the casing.—E. S.

Drying Apparatus. H. Baetz, St. Louis, Mo. U.S. Pat. 767,198, Aug. 9, 1904.

Within a suitable casing are contained a blower, one or more pairs of superposed and spaced air chambers, with steam heater, the adjacent faces of the chambers on either side of the open space separating them being provided with nozzles for discharge of the air; exhaust pipes leading from the casing back to the blower; also suitable feed mechanis for advancing the articles to be dried, through the spa separating the chambers in the path of the air curre issuing from the nozzles.—E. S.

Drying Apparatus. F. E. Allen, Boston, Mass. U.S. Pat. 767,727, Aug. 16, 1904.

A vertical series of horizontal conveyors, between each which are horizontal radiators, is arranged in a casin, The material to be dried, is fed into the top from a hopp and passes downwards over the conveyors, to the outlet the bottom. Means are provided: for supplying a suitab heating agent to the radiators; for agitating the materia for forcing a current of air across the conveyors; and f withdrawing the moisture-laden air from the apparatus. —W. H. C.

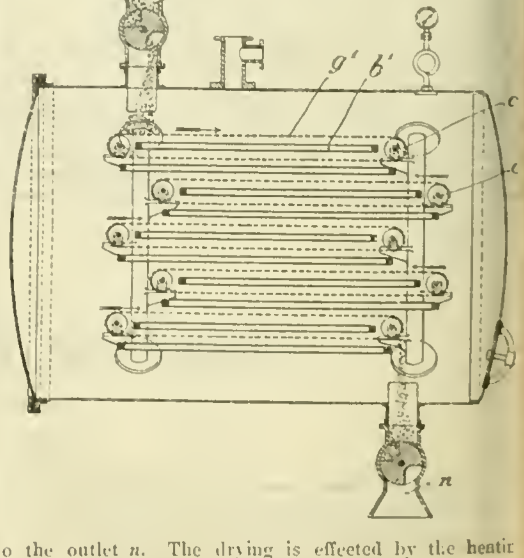
Exhausting Vapours or Gases; Apparatus for —— V. Schwaninger, Oggersheim, Germany. U.S. Pa 767,502, Aug. 16, 1904.

See Eng. Pat. 5119 of 1902: this J., 1903, 407.—T. F. B.

French Patents.

Vacuum Drier; Continuous ——. R. Haack and th Surther Maschinen-Fabr. vorm. H. Hammerschmi Fr. Pat. 341,672, March 26, 1904.

The material to be dried is introduced at O and carried, the endless band conveyor g^1 in the direction of the arrow



to the outlet *n*. The drying is effected by the heatir boxes b^1.—W. H. C.

apours of Volatile Solvents; Process and Apparatus for Collecting, Drying, and Recovering ——*from the Air.* E. Bouchaud - Praceiq. Fr. Pat. 311,690, March 26, 1904.

HE air is automatically aspirated through a filter, then rough a drying tower, and finally passes into an absorbing amber filled with porous material through which percolates suitable liquid for absorbing the volatile solvents. The ethod is particularly applicable to the vapours of alcohol id ether. The absorbed vapours are recovered as solvents suitable distillation of the absorbing liquid.—W. P. S.

II.—FUEL, GAS, AND LIGHT.

lame of Different Fuels; Calorific Value of the ——. P. Mahler. Rev. Univ. des Mines, 1904, 1. Proc. Inst. Civil Eng., 1904, **156**, 47—48.

the following table the flame temperature is that obtainble when the fuel is burnt with air at 0° C. and 760 mm.:—

——	Calorific Power.		Flame Temperature.
	Water Condensed.	Water as Vapour.	
	Calories.	Calories.	° C.
ik wood, Lorraine	4690	4370	1865
at, Bohemia	5900	5590	2020
gnite Trifail, Styria	6650	6370	1960
aming coal, Blanzy	8350	8060	1990
„ Decazeville	7840	7530	1960
idised (weathered) coal, Commentry	6380	6200	1960
is coal, Commentry	8410	8110	1950
„ Bethune	8670	8380	1990
„ Lens	8740	8450	2010
king coal, St. Etienne	8860	8580	2010
nithy coal, Roche la Moliere	8860	8600	2030
mi-bituminous coal, Auzin	8660	8430	1980
ithracitic coal, Commentry	8460	8290	2030
„ Kebao, Tonkin	8530	8370	2020
„ Creusot	8690	8480	2010
nnsylvanian anthracite	8265	8140	2000
hyl and methyl alcohol	..	..	1700
nyl alcohol	..	..	1850
ude American petroleum	..	10,400	2000
nerican petroleum spirit	..	10,270	1920
„ refined petroleum	..	10,280	1660
ydrogen	..	..	1930
rbon monoxide	..	..	2100
ethane	..	..	1850
etylene	..	..	2350
uminating gas, average	..	..	1950
ater-gas in industrial use	..	..	2000

The true measure of value of a fuel is not the flame mperature, however, but the calorific power; for example, e flame of peat is hotter than that of St. Étienne coal, but e body of flame is much larger in the case of the coal than that of the peat. 100 grms. of the peat yield 28 vols. gas at 2000° C., whilst the same weight of coal yields vols. of gas at the same temperature. From a thermoetric point of view, the use of hot blast for improving the ime would appear to be more efficacious in furnaces fired ith coal than in those using fuels of an inferior character. —A. S.

lagnetite Arc-Lamp. C. P. Steinmetz. Elect. World and Eng., 1904, **43**, 974; J. Gasbeleucht., 1904, **47**, 751—753.

HE lamp is provided with a copper positive electrode, hich does not require renewal, and a negative electrode onsisting substantially of magnetite (Fe_3O_4). The elecodes themselves take no part in the light emission, which due solely to the luminous arc, containing volatised agnetite. In the preliminary experiments, which led to e construction of the lamp, it was ascertained that, in minous-arc lamps, the substance which conducts the arc given off more rapidly from the negative than from the sitive electrode, and, impinging upon the latter, heats it highly. If the positive electrode be a good enough heat-conductor and of suitable dimensions, the heat developed is led away and the electrode is not consumed. If it has too great a heat conductivity, material from the negative electrode is deposited upon it. Thus, in the magnetite lamp, if the copper electrode is not thick enough to conduct away a sufficient proportion of the heat generated, it is destroyed; and, on the other hand, if too thick, drops of magnetic oxide condense upon it. The electrodes are therefore so chosen as to avoid both difficulties, and the positive electrode forms a permanent, fixed part of the lamp. The metals of the iron group give a brilliantly luminous arc, emitting white light; but electrodes made of the metals themselves have little durability, whereas the oxides, being incombustible, are suitable for use. Of these oxides, magnetite gives the best results, and it is found that a steadier arc and a higher efficiency result, if titanium and other compounds are mixed with the magnetic oxide. The electrodes are manufactured in compact form, and it is claimed that in use they are consumed at the rate of only 0·8 to 1 mm. per hour. An electrode 200 mm. long therefore lasts about 150—200 hours; but with a slight decrease in efficiency, the durability can be increased to 500—600 hours. The life of the electrodes is then about equal to that of an ordinary glow lamp. The most favourable length of arc is 20—30 mm., and this is maintained by means of a simple automatic regulating device. According to A. Holmes, a 320-watt magnetite lamp emits rather more light than an ordinary 340-watt lamp with open arc, or a 460-watt lamp with enclosed arc. The lamp is adapted for use with a direct current; if an alternating current be employed, there is a considerable diminution in efficiency. —H. B.

English Patents.

Gas and Air; Apparatus for the Production of Mixtures of ——. H. H. Lake, London. From Selas G. m. b. H., Berlin. Eng. Pat. 17,788, Aug. 17, 1903.

Apparatus for the production of gaseous mixtures, by the separate suction of gas and air, is provided with a regulating device for automatically varying the amount of the mixture produced in accordance with the consumption, the said device being interposed between the suction and forcing chambers and subjected to the pressure in the outlet service main of the apparatus in such a manner that when alterations in the pressure occur, a communication between the suction and forcing chambers is opened more or less. The effect is that the operation of the suction apparatus (piston pumps, blowers, or the like) never varies, the regulation being effected merely by repumping more or less of the already formed mixture back through the apparatus from the forcing side. The regulating valve between the suction and forcing chambers may be actuated by means of a float, diaphragm, or the like connected to a branch pipe from the forcing side of the apparatus.—H. B.

Gas Producers; Suction ——. E. Capitaine, Frankfort on-the-Maine, Germany. Eng. Pat. 2547, Feb. 2, 1904.

A vertical water-vaporiser is arranged concentrically above the combustion chamber inside the shell of the producer, the hot gases flowing up through the vaporiser. The annular space between the vaporiser and the shell is utilised as a storage chamber for the charging fuel, which serves as a heat insulator and falls into the combustion chamber as required.—H. B.

Gas Retorts; Inclined ——. E. Derval, Paris. Eng. Pat. 21,964, Oct. 12, 1903.

The bottom of the inclined retort is provided with one or more longitudinal ribs extending the whole of its length, in combination or not with a series of channels, hollows, or projections at the lower end of the retort, for the purpose of facilitating the disengagement of gas, preventing the coal from slipping down to the lower end during the distillation, and rendering the discharge of the coke easier. The effectiveness of the non-slipping devices may be increased by employing curved retorts, as described in U.S. Pat. 762,578 (this J., 1904, 745).—H. B.

Gas-Producing Plant for Heating Retort Furnaces. H. Poetter, Dortmund, Germany. Eng. Pat. 8993, April 19, 1904.

A plant for the production of coal-gas, having beneath the retorts a gas producer which generates water-gas and producer-gas, both for heating the retorts and for admixture with the retort gases, is so arranged that the outlet flue for the water gas and the outlet flue for the producer-gas open into a pipe leading to the retort space, and are also connected with the gasholder by a branch pipe, the pipe junctions being controlled by three-way valves in such manner that when the valves are in one position the producer-gas passes exclusively to the retort setting, and when in the other position the water-gas passes partly to the retort furnace and partly to the gasholder.—H. B.

Gas Producers. H. Poetter, Dortmund, Germany. Eng. Pat. 14,383, June 25, 1904.

In order to keep the fire grate cool and to provide for an automatic generation of steam, cooling tubes, having lateral perforations through which the cooling water may overflow into collecting troughs below, are arranged beneath the firebars, and may be adapted to support the fire-bars. The air-blast pipe is arranged below the cooling tubes. An auxiliary grate may be provided to support the fuel whilst the grate proper is removed for cleaning or repairs.—H. B.

Refuse-consuming and Gas-producing Furnaces. L. Tobiansky. Eng. Pat. 12,361, May 31, 1904. XVIII. B., page 878.

Gas Purifying Plants. J. D. L. Klein, Copenhagen. Eng. Pat. 14,465, June 27, 1904.

The purifiers are connected together by separately valved pipes in such a manner that the gas may be directed through any one or more of the purifiers, and in any desired order. The grids for supporting the purifying material are made of horizontal parallel bars, the cross section of which is diamond-shaped or which are roof-like on the top. The bars are spaced far apart, experience having shown that the purifying material, instead of falling through, forms arches from bar to bar, the inclined top surfaces of the bars serving as abutments. The lowest grid of each purifier is of the usual closely-set form, and is covered with a layer of bark.—H. B.

United States Patents.

Coke-Oven; Horizontal ——. H. Poetter, Dortmund, Germany. U.S. Pat. 766,898, Aug. 9, 1904.

See Eng. Pat. 16,807 of 1902; this J., 1903, 899.—T. F. B.

Gas and Coke; Process of Manufacturing ——. J. C. H. Stut, Oakland, Cal. U.S. Pat. 766,400, Aug. 2, 1904.

A body of coal, contained in one of a series of parallel contiguous ovens, is heated to incandescence by passing air over and up through the burning fuel; the air supply is shut off and crude oil is fed upon the surface of the fuel, whereby oil-gas is generated and oil residue is deposited; then steam is introduced from below, the water-gas produced mingling with the oil-gas at the surface of the fuel. Simultaneously a body of coking coal, contained in a contiguous oven, is carbonised by the heat transmitted through the dividing wall, and the coal-gas produced is led along with the water-gas and oil-gas through a fixing chamber. The operation is then reversed by filling the second oven with fresh coal and introducing steam below and oil above the fuel as already stated, whilst the heat transmitted through the dividing wall produces coke and coal-gas from the coal and oil residue in the first oven, the various gases being mingled and fixed as before. See following abstract.—H. B.

Gas and Coke; Apparatus for the Manufacture of ——. J. C. H. Stut, Oakland, Cal. U.S. Pat. 766,553, Aug. 2, 1904.

The apparatus consists of a series of parallel contiguous ovens, connected to carburetters and regenerators, suitable for carrying out the process described in the preceding abstract.—H. B.

Gas; Process of Manufacturing ——. J. C. H. Stut, Oakland, Cal. U.S. Pat. 766,554, Aug. 2, 1904.

An oven, having a layer of incombustible porous materia at the bottom, is heated to redness. Crude oil is injecte on to the incandescent porous material, forming oil-ga and a carbonaceous deposit, and, after the latter ha become coked, it is consumed in the production of water gas by passing steam up through it. The oil-gas an water-gas are mixed. The heat transmitted through th walls of the oven may be employed in producing coal-ga from a body of coking coal in a contiguous connected oven the several gases being mixed together. See the followin and the two preceding abstracts.—H. B.

Gas and Coke; Apparatus for Making ——. J. C. H Stut, Oakland, Cal. U.S. Pat. 766,555, Aug. 2, 1904.

The apparatus consists of contiguous ovens, having perforated hearths and connected to carburetters and regenerators, suitable for carrying out the process described in th preceding abstract.—H. B.

Gas [for Oil Engine]; Apparatus for Generation of —— W. A. Salisbury, Assignor to C. O. Goss, Winona, Minn U.S. Pat. 766,530, Aug. 2, 1904.

The generator consists of a number of retorts, each havin an independent oil-supply under pressure; a gas-mixin chamber, having independent valved communication wit each retort; burners beneath the retorts and gas-mixin chamber, communicating with the latter and with the air a main mixing chamber communicating with the gas chamber, and having an exit and hot-air supply controlled b valves carried by a common stem; and a governor mounte on the same stem and actuated by the engine fed with th gas produced.—H. B.

Gas Producer. J. R. George, Assignor to Morgan Construction Co., Worcester, Mass. U.S. Pat. 766,88 Aug. 9, 1904.

See Eng. Pat. 16,263 of 1903; this J., 1903, 1189.—T. F. B

French Patents.

Coke; Process and Apparatus for Extinguishing an Bleaching ——. E. A. Moore. Fr. Pat. 341,499, Marc 21, 1904.

See U.S. Pats. 755,154 and 755,155 of 1904; this J., 1904 436.—T. F. B.

Generator for Low-Grade Gas. Lerouge, Formas, & Ci First Addition, dated March 2, 1904, to Fr. Pat. 339,817 Jan. 22, 1904 (this J., 1904, 710).

This addition refers to an automatic rubbish grate that i mounted on an axis, and capable of oscillating to allow o the removal of portions of ash that are too large to pass th long-toothed wheel which regulates the discharge of ordinary-sized cinders into the ash-pit.—W. C. H.

Gas Generators; Arrangement for the Automatic Supply o Water and Steam in ——. F. L. A. Paguy. Fr. Pat 341,402, March 17, 1904.

Each aspiration of gas by the piston causes a certai amount of water, kept at constant level, to flow from a tank into a receptacle inside the upper part of the scrubber, fro which receptacle the water falls into the scrubber, whilst b the weight of the water drawn in, the receptacle works a lever and spring arrangement which controls the gas valve. —W. C. H.

Generators for Low-Grade Gas. Gay and Vivier. Fr. Pat 341,414, March 19, 1904.

In the type of gas-generator in which the steam required i derived from a vaporiser arranged in the upper part of th generator, it is found that a sediment from the water collect in the vaporiser. To allow of the easy removal of suc sediment, it is proposed to incline the bottom of the vaporiser, so that the sediment may collect in the lowest part and be removed through a plug-hole.—W. C. H.

hting and Heating Gas ; Apparatus for the Production f ——. W. Lord. Fr. Pat. 341,708, March 28, 1904.

HOT-AIR engine, driven by means of a Bunsen burner, nps air through a carburetter consisting of a chamber ntaining vertical partitions covered with flannel and satued with petrol or the like, between which partitions the pursues a tortuous course. An automatic device for ulating the air pressure is interposed between the engine l the carburetter. It consists of a cylindrical vessel into ich the air is pumped, a column of water, on which a ball its, being maintained within the cylinder at a height pending upon the air-pressure therein. The ball is linked by means of levers to the cock of the pipe which supplies to the Bunsen burner of the engine, so that a reduction air pressure at once causes an increase in the speed of engine, and *vice versâ*. The air, on leaving the cylinder, ses through the cooling-jacket of the hot-air engine ore passing through the carburetter.—H. B.

monia and Cyanogen Compounds ; Obtaining Simultaeously —— *by Treatment of [Coal] Gas, with Partial Regeneration of the Scrubbing Materials.* W. Feld. r. Pat. 341,614, Jan. 18, 1904.

HTING gas is scrubbed with a solution of 280 grms. of ous sulphate crystals, and from 1000 to 1300 grms. of ium chloride, for each 100 cb. m. The solution proed, containing calcium ferrocyanide and ammonium oride, with a deposit of calcium carbonate and sulphate, reated with lime and steam to obtain ammonia (free n sulphide) and calcium chloride, suitable for re-use. m the turbid solution the cyanogen may be precipitated Prussian blue, and the mud, separated by filtration, r addition of an iron salt, may be again used in the ubber. Several formulæ are given, showing the use proportions of various scrubbing agents, including ous hydroxide, or ferrous or manganous sulphate in bination with magnesium or calcium chloride or the , adapted to be used with gas of certain stated types. Pats. 41,030 and 112,159 are referred to. Compare . Pat. 10,876, 1902 ; this J., 1903, 691.—E. S.

from Water-Gas ; Process of Utilising the ——. Scholvien. Fr. Pat. 340,995, March 7, 1904. III., ext column.

rry Vapours ; Recovery of —— *in the Manufacture of arbon Electrodes.* Soc. Franc. des Electrodes. Fr. Pat. 41,698, March 29, 1904.

gas and vapours, issuing from the furnace in which the trodes are baked, are blown by means of a fan through ries of condensing pipes and thence to the chimney. tar is thus condensed and recovered, whilst the gas ses on.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

English Patent.

oal Tar ; Distillation of ——. C. Weyl, Mannheim, Germany. Eng. Pat. 12,122, May 27, 1904.

tar is heated in a horizontal, cylindrical boiler or , furnished with several narrow tubes fixed in its ends ; furnace gases circulate through these tubes and heat tar, whilst a high vacuum is maintained in the still, hat the boiling point of the tar at the end of the distilla- is about 270°—280° C., thereby preventing coking, as l as accelerating the distillation.—T. F. B.

United States Patents.

e Wood ; Process of Distillation of Crude Oils from ——. J. C. Mallonee, Charlotte, N.C., Assignor to . J. Mallonee, Crichton, Ala. U.S. Pat. 766,717, Aug. 2, 1904.

E wood is heated in a retort by means of a perforated m coil, and also by external heating ; the distillate is collected in three fractions, the first consisting of oils of specific gravities of 0·855 to 0·92, the second from 0·92 to 0·96, and the last fraction of oils above 0·96 sp. gr., and having an average specific gravity of 1·015. These three fractions are further fractionated both by steam and external heating.—T. F. B.

Wood Distilling Apparatus. B. Viola, New York, Assignor to R. G. G. Moldenke, Watchung, N.J. U.S. Pat. 767,090, Aug. 9, 1904.

A CYLINDRICAL retort is mounted in a furnace, at a slight inclination to the horizontal, and in such a manner that it can be rotated. The lower end of the retort is connected by an air-tight joint with a fixed discharge chamber, which is provided with discharge pipes. The upper end of the retort is connected, also by an air-tight joint, with a curved elbow piece, which leads the products of distillation to a vertical receptacle, provided with a stirrer. The retort is also provided with a stirrer. The retort, elbow-piece, and "vertical receptacle" are all of approximately the same diameter.—T. F. B.

Wood Distilling Apparatus. B. Viola, New York, Assignor to R. G. G. Moldenke, Watchung, N.J. U.S. Pat. 767,091, Aug. 9, 1904.

THE apparatus is similar to that described in the preceding specification, with the addition of an arrangement for raking the non-volatile residue from the retort down a shoot into a water-tank.—T. F. B.

French Patents.

Tar from Water-Gas ; Process for Utilising the ——. L. Scholvien. Fr. Pat. 340,995, March 7, 1904.

THE tar obtained in the carburetting of water-gas is distilled till the residue consists only of pitch. The distillate is treated with acid and then with alkali, and distilled as long as the distillate remains clear ; any further distillates are treated in the same manner as the original tar, and the resulting products mixed with the clear distillate. The resulting liquid has a specific gravity of 0·82 to 0·9, flashing point 30° C., and consists principally of unknown hydrocarbons, with small quantities of toluene, xylene, mesitylene, and traces of naphthalene ; it contains no sulphur or phenols, and can be used as a solvent for gums, resins, fats, &c.—T. F. B.

Denaturation of Industrial Alcohol by Carbialine and its Compounds. A. Leoni, A. Pelizza, and E. Stringa. Fr. Pat. 341,617, Feb. 2, 1904. XVII., page 878.

Soap [containing Benzene] ; Manufacture of ——. J. F. G. de Roussy de Sales. Fr. Pat. 341,568, March 24, 1904. XII., page 872.

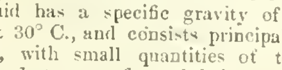
Distillation of Fats, Oils, and Tars of all kinds in Vacuo ; Continuous Process for the ——. G. Bokelberg and J. Sachse. Fr. Pat. 341,571, March 24, 1904.

SEE Eng. Pat. 7204 of 1904 ; this J., 1904, 655.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

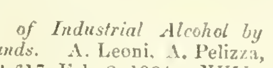
Galangin ; Synthesis of ——. St. v. Kostanecki, v. Lampe, and J. Tambor. Ber., 1904, **37**, 2803—2806.

2′-HYDROXY-4′.6′-DIMETHOXYCHALKONE, $(CH_3O)_2(OH)C_6H_2.CO.CH:CH.C_6H_5$, was converted, by boiling with alcoholic hydrochloric acid, into 1.3-dimethoxyflavanone—



$$(OCH_3)_2C_6H_2\left\langle\begin{array}{l}O\,.\,CH.C_6H_5\\ \qquad\;\;\cdot\\ CO.CH_2\end{array}\right.$$

This was treated with amyl nitrite and hydrochloric acid, yielding an isonitrosoderivative, which was converted in the usual manner into 1.3-dimethoxyflavonol—

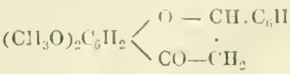


$$(CH_3O)_2C_6H_2\left\langle\begin{array}{l}O - C.C_6H_5\\ \qquad\;\;\cdot\cdot\\ CO - C - OH\end{array}\right.$$

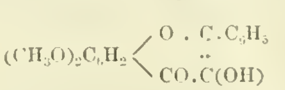
On demethylation with hydriodic acid, this forms Galangin, which is 1.3-dihydroxyflavonol. It was absolutely identical in properties with the product from the galanga-root. In strong sulphuric acid solution it shows blue fluorescence. On alumina mordant it dyes in fine yellow shades, though not very strongly.—E. F.

Galangin: An Isomeride of ——. F. Dobrzyński and St. v. Kostanecki. Ber., 1904, 37, 2806—2809.

By the action of benzaldehyde on gallacetophenonedimethylether, 2′-hydroxy-3′.4′-dimethoxychalkone, $(CH_3O)_2(OH)C_6H_2.CO.CH:CH.C_6H_5$, is obtained. By treatment with alcohol and dilute sulphuric acid, this is converted into 3.4-dimethoxyflavonone—



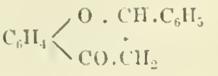
the isonitroso derivative of which, when boiled with dilute mineral acid, yields 3.4-dimethoxyflavonol—



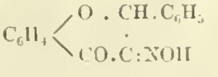
On demethylation with hydriodic acid, this yields 3.4-dihydroxyflavonol, an isomeride of Galangin. The product dyes strongly on mordanted fabrics. On alumina mordant it gives orange-yellow shades. It is readily soluble in aqueous alkalis, with a reddish-yellow colour. In concentrated sulphuric acid it dissolves to a yellow solution.
—E. F.

Flavonol; Synthesis of ——. St. v. Kostanecki and W. Szobrański. Ber., 1904, 37, 2819—2820.

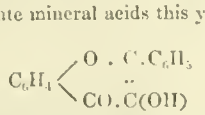
Flavanone—



(this J., 1904) is nitrosated in the usual manner to form isonitrosoflavanone—



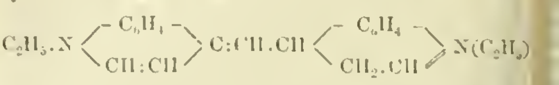
On boiling with dilute mineral acids this yields flavonol—



Flavonol forms colourless needles almost insoluble in cold sodium hydroxide solution, but soluble with a yellow colour on warming, forming a sodium salt which crystallises in yellow needles on cooling. It dyes in bright yellow shades on an alumina mordant.—E. F.

Cyanine Dyestuffs; Constitution of ——. A. Miethe and G. Book. Ber., 1904, 37, 2821—2824.

Diethylcyanine was obtained by acting on a mixture of 2 mols. of quinoline-ethyl iodide and 1 mol. of lepidine-ethyl iodide with 2 mols. of alkali hydroxide in alcoholic solution. The product forms dark-green needles, soluble with difficulty in alcohol, almost insoluble in water, and having the formula, $C_{23}N_{25}N_2I$. The dyestuff is quite similar in its reactions to Ethyl Red (this J., 1203, 712). The iodine atom can be replaced by other acid radicles through the medium of the corresponding silver salt. The nitrate produced in this way is also exceptionally soluble in water, and has a very powerful sensitising action on a silver-bromide-gelatin plate. Diethylcyanine resembles Ethyl Red further in forming a di-iodo addition product from which iodine is not set free by dilute hydrochloric acid or b solution in acetone. The authors therefore assign to Diethy cyanine the constitutional formula—



—E. F.

Dibenzalacetone and Triphenylmethane. V. A. v. Baey and V. Villiger. Ber., 1904, 37, 2848—2880. (Se this J., 1902, 607, 1326; 1903, 1124; 1904, 318.)

The authors have succeeded in preparing stable forms (the true colour bases (phenylated quinone-imines) of vario triphenylmethane dyestuffs, and their results show th Nietzki's quinone formula represents most correctly th constitution of the dyestuffs. Since, now the true quinono colour bases have been isolated, the old system of nome clature is not a rational one, the following new method proposed, 7.7-diphenylquinomethane, the root substance (aurin, discovered by Bistrzycki (this J., 1903, 901) bein taken as the basis. The name fuchsone is proposed f this substance, fuchsone-imine for the imide derived from i and fuchsone-imonium salts for the salts of the latter. Tl following are examples of the new system :—

Old Name.	New Name.
Aurin group:—	
Diphenylquinomethane...	Fuchsone.
Benzaurin................	Hydroxyfuchsone.
Aurin	Dihydroxyfuchsone.
Colour Bases of Carbinols not completely alkylated:—	
Imide of Diphenylquinomethane..............	Fuchsone-imine.
Colour Base of Dobner's Violet	Aminofuchsone-imine.
Homolka's Fuchsine base.	Diaminofuchsone-imine.
Colour base of triphenylpararosaniline	Diphenylaminofuchsonephenylimine.
Colour Salts or Dyestuffs:—	
Hydrochloric acid colour salt of aminotriphenylcarbinol	Fuchsone-imonium chloride.
Dobner's Violet...........	Aminofuchsone-imonium chlori
Malachite Green..........	Tetramethylaminofuchsone-imonium chloride.
Viridine	Phenylaminofuchsonephenylimonium chloride.
Parafuchsine	Diaminofuchsone-imonium chloride.
Hexamethyl Violet	Hexamethyldiaminofuchsone-imonium chloride.
Aniline Blue..............	Diphenylaminofuchsonephenylimonium chloride.
New Fuchsine............	Diaminotrimethylfuchsone-imonium chloride.

p-Dimethylaminotriphenylcarbinol was obtained by co densing benzophenone chloride with dimethylaniline presence of zinc chloride. After purification it crystallis in tufts of colourless needles melting at 92°—93° C., eas soluble in chloroform and benzene, somewhat less solul in alcohol and ether, and only slightly soluble in petrole spirit. It dissolves in acids with an orange-red colour a dyes tannin-mordanted cotton orange-red. *p-Monomethy triphenylcarbinol* was obtained by condensing diphen carbinol with methylaniline. It also dissolves in acids wi an orange-red colour.

Döbner's Violet.—Döbner prepared di-*p*-aminotriphen carbinol from aniline hydrochloride, nitrobenzene, ben trichloride and iron filings, but did not obtain a pure produ The authors' method consists in converting di-*p*-amino phenylmethane into its diacetyl derivative, treating t latter with sulphuric acid and manganese dioxide to obta the diacetyl-carbinol and separating the carbinol by hyd lysis with 30 per cent. sulphuric acid. Di-*p*-aminotriphen carbinol loses water below its melting point, which is 173 175 C., when the compound is heated fairly quickly, a 167°—168 C. when the heating is more gradual. It slightly soluble in ether and cold benzene, more readily alcohols and boiling benzene or xylene, and easily solul in pyridine. It is also somewhat soluble in hot water, t

nsiderably less so than pararosaniline. When warmed
th acids it is readily converted into the corresponding
ninofuchsone-imonium salts. These colour-salts crystallise
ll, and are only slightly soluble in cold water. When
aken with caustic soda solution and ether or benzene, they
ld the colour-base of Döbner's Violet (aminofuchsone-
ine), which resembles in properties Homolka's Fuchsine
se, but is yellower and much more unstable than the latter.
benzene solution the colour-base readily polymerises,
rming a violet powder.

*Colour-base of Viridine (p-Phenylaminofuchsone-
enylimine).*—This was prepared by heating on the water-
th a mixture of dianisylphenylcarbinol, aniline, and
nzoic acid and purifying the product by means of its
rate, from which the base is set free by dilute caustic
la solution. The base melts at 166°—168° C., dissolves
th difficulty in ether and cold benzene to a brownish-red
ution, and is more easily soluble in hot benzene. It has
nilar properties to the fuchsonephenylimine previously
scribed (this J., 1904, 318). On treatment with alcohols
aniline, decolorisation takes place, the alkyl ethers or
anilide of diphenylaminotriphenylcarbinol being pro-
ced; the colourless carbinol is also produced by treat-
nt with very dilute acids. Reducing agents convert it
o the leuco-base. The *p*-phenylaminofuchsonephenyl-
onium salts give green solutions.

*Fuchsone-imines of Parafuchsine and New Fuchsine
lomolka's Base).*—The authors confirm the statements of
molka and Hantzsch as to the behaviour of the bases.
ey can be dissolved unaltered in water and re-precipitated
caustic soda, if the experiment be carried out quickly,
t if the aqueous solution be allowed to stand, a precipitate
a faint violet colour is deposited, consisting mainly of the
rbinols. With sodium chloride and nitrate the phenyi-
ines give the corresponding dyestuffs; with ethyl alcohol,
d more readily, methyl alcohol, the alkyl ethers of the
binols; and with aniline, the anilides of the carbinols.

*Colour Base of Triphenylpararosaniline Blue (Di-
enylaminofuchsonephenylimine).*—This was prepared in a
nilar manner to the colour-base of Viridine, by heating
gether a mixture of *p*-trianisylcarbinol, benzoic acid, and
line, an approximately quantitative yield of the imonium
nzoate being obtained. The pure colour-base forms a
ck crystalline powder, easily soluble in pyridine and
stallising from boiling xylene in aggregates of plates
lting at 237°—238° C. It has similar properties to the
er phenylimines.—A. S.

*uorazones: a New Group of Dyestuffs formed by Melt-
ing Amino-azo Dyestuffs with Resorcinol.* L. Paul.
Chem.-Zeit., 1904, **28**, 765—772.

he author finds that the reaction which takes place when
ino-azo dyestuffs are melted with resorcinol is quite
ferent from that which occurs when they are heated with
enol. Two new groups of dyestuffs are formed, accord-
to whether the amino-azo dyestuff is heated with
orcinol alone or in presence of a second component,
ch as aniline or its derivatives. It is possible to so
ry out the reaction that only dyestuffs of the first
oup (Fluorazones) are formed, whilst these when heated
h aniline, &c., are converted into dyestuffs of the
ond group. The Fluorazones appear to be of no tech-
al value. The dyestuffs of the second group differ in
aracter, according to whether the benzene ring in the
xed amino-azo dyestuff contains a substitution group in the
ra position or not. For example, when the benzene ring
ntains a hydroxyl or an amino group in the para position,
Fluorazones obtained, give, when heated with amines
120°—150° C., red dyestuffs very similar to those of the
gdala Red group. When the benzene ring contains no
bstitution group in the para position, the reaction with
ines fails altogether at 120°—150° C., but at 180°—
0° C., a different reaction takes place, Rosinduline deri-
tives being produced. The dyestuffs similar to Magdala
d, mentioned above, are also converted into Rosinduline
rivatives when heated to 180°—190° C. For example,
rting with Meldola's base (*p*-aminobenzene-azo-α-naph-
lamine), Aminorosinduline, a red basic dyestuff, is
finally obtained, probably useful for printing cotton goods. On cotton mordanted with tannin and antimony, it gives a bluish-red shade, fast to soaping and light, distinctly superior to that obtained with Safranine or Magenta. The method of preparation is as follows:—10 grms. of resorcinol and 5 grms. of aniline are heated to 160° C., and 5 grms. of Meldola's base and 2·6 grms. of aniline hydrochloride rapidly added. The melt is extracted with dilute hydrochloric acid, and the bluish-red dyestuff, which separates on standing, is filtered off. In the filtrate the base is precipitated by ammonia, filtered off, redissolved in 10 per cent. acetic acid, again precipitated with ammonia, and so on, until the precipitate dissolves readily in hot water. The yield of Aminorosinduline obtained in this way was 10 grms.; the residue insoluble in hydrochloric acid, weighed 1·7 grms.
—A. S.

Sensitisers [Dyestuffs]; Supplementary ——. A. Miethe.
XXI., page 881.

English Patents.

Sulphurised [Sulphide] Dyestuffs; Manufacture of Yellow, Orange-Yellow to Orange ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maire. Eng. Pat. 21,800, Oct. 9, 1903.

The reaction product of 1 mol. of *m*-phenylenediamine and 1 mol. of carbon bisulphide when heated with sulphur at 170°—195° C., or with sulphur and sodium sulphide to 120° C., gives dyestuffs dyeing unmordanted cotton clear yellow shades. If, previous to heating with sulphur, the parent compound be heated to about 235° C., evolution of gas occurs, and the product, when heated with sulphur to 220° or 250° C., gives yellow to orange dyestuffs according to the temperature employed. When these latter dyestuffs are heated with sodium sulphide to 130° C., the shade of the product is somewhat modified. (See U.S. Pat. 760,110 of 1904; this J., 1904, 712.)—T. F. B.

Sulphur Dyes [Sulphide Dyestuffs]. H. H. Lake, London. From K. Oehler, Offenbach-on-Maine, Germany. Eng. Pat. 12,270, May 30, 1904.

Seventy-five parts of 2.4-dinitrophenyl-3′-chloro-4-hydroxy-5′-tolylamine (obtained by condensing 1.3.4-dinitrochlorobenzene with *p*-amino-*o*-chloro-*o*-cresol) are heated with 300 parts of sodium sulphide, 120 parts of sulphur, and 200 parts of water, with reflux condenser, at about 100° C., for about 20 hours, and the product is evaporated to dryness at 105°—110° C.; the resulting dyestuff gives fast deep blue shades on cotton from its solution in sodium sulphide.—T. F. B.

United States Patents.

Indigo; [Electrolytic] Manufacture of Brominated ——. A. Schmidt and R. Müller, Assignors to Farbw. vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine, Germany. U.S. Pat. 765,996, July 26, 1904.

See Fr. Pat. 322,348 of 1902; this J., 1903, 360.—E. B.

Wool Dye [Azo Dyestuff]; Dark Brown ——. A. L. Laska, Assignor to K. Oehler, Anilin- und Anilinfarben Fabr., Offenbach-on-the-Maine, Germany. U.S. Pat. 767,069, Aug. 9, 1904.

Azo dyestuffs, which give blackish-brown shades on wool after chroming, are obtained by combining diazotised naphthylamine sulphonic acids with *m*-hydroxydiphenylamine.
—T. F. B.

Mordant Dye [Azo Dyestuff]; Brown ——. A. L. Laska, Assignor to K. Oehler, Anilin- und Anilinfarben Fabr., Offenbach-on-the-Maine, Germany. U.S. Pat. 767,070, Aug. 9, 1904.

Diazotised aminonaphtholsulphonic acids (which have the amino- and hydroxy-groups in different benzene nuclei) are combined with *m*-hydroxydiphenylamine; the dyestuff obtained from heteronuclear-β-amino-α-naphtholsulphonic acid is specified. These dyestuffs dye wool from acid baths orange to violet shades, converted, on subsequent chroming, to reddish-brown to brownish-violet.—T. F. B.

French Patent.

Lakes from Sulphide Dyestuffs; Process for Making ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 341,246, March 14, 1904. XIII. A., page 873.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

English Patent.

Dyeing Cotton and the like: Method of——, and Apparatus therefor. W. P. Thompson, Liverpool. From Wegmann and Co., Baden, Switzerland. Eng. Pat. 20,925, Sept. 29, 1903.

See Fr. Pat. 335,596 of 1903; this J., 1904, 251.—T. F. B.

United States Patents.

Stearamide Mordant. A. Muller-Jacobs, Richmond Hill, N.Y. U.S. Pat. 767,114, Aug. 9, 1904.

Stearamide, dissolved in an appropriate solvent, is used, in combination with aniline colours, as a mordant in colouring textile fibres or fabrics.—E. S.

Bleaching and Dyeing Apparatus. A. Holle, Düsseldorf, Germany. U.S. Pat. 767,563, Aug. 16, 1904.

See Eng. Pat. 18,756 of 1902; this J., 1903, 1013.—T. F. B.

Dyeing Apparatus. S. W. Cramer, Charlotte, N.C. U.S. Pat, 765,883, July 26, 1904.

A dye-vessel, closed by a cover when in use, is provided with perforated, false top and bottom, means for securing the cover, an annular dye-liquor-supply pipe fixed below the false bottom, a liquor discharge pipe at the top and means for withdrawing the liquor, expressing this from the materials dyed, and removing the latter from the dye-vessel. —E. B.

Printing Machinery; Pattern ——. C. L. Burdick, London. U.S. Pat. 767,684, Aug. 16, 1904.

See Fr. Pat. 328,714 of 1903: this J., 1903, 994.—T. F. B.

French Patents.

Collodion-Silk; Apparatus for Spinning ——, *with Recovery of the Solvents Used.* M. Denis. Fr. Pat. 341,173, March 5, 1904.

Artificial cellulose fibres are produced from collodion, whilst the alcohol and ether present in the latter are recovered, by causing the collodion to flow from a system of spinnerets into a pipe through which water or an aqueous denitrating solution, maintained at a temperature above the boiling point of ether, is passed. The vaporised ether ascends into a receiving pipe whence it is drawn off into a condenser. The water or aqueous solution is circulated until it is sufficiently saturated with alcohol, when it is replaced, the alcohol being recovered from it by distillation. The nitrocellulose or cellulose fibres are drawn through a trap in the pipe and are spun together in the usual manner. —E. B.

Dyeing in Several Colours on the Same Thread of Cotton; Process of ——. Teinturerie Clément Marot. Second Addition, dated Feb. 25, 1904, to Fr. Pat. 337,027, Nov. 26, 1903. (See this J., 1904, 440 and 605.)

The thread wound on the bobbin is only dyed in parts, this result being brought about by mordanting a portion of the thread, or by a partial discharge, or by allowing only a portion of the bobbin to come in contact with the dye bath, or by other similar means.—T. F. B.

Dyeing Tissues [Mechanical Reserves]; Process for ——. L. Fanchamps-Philippe. Fr. Pat. 341,341, March 15, 1904.

Tissues are placed between perforated plates upon which pieces, of appropriate shape and size, of an elastic material are fixed. The plates are then immersed in a dye vat, o dye-liquor is drawn or forced through them, the tissue becoming dyed only in the less tightly compressed parts. —E. B.

Dyeing Fibres in the Loose State or in the Form of Slubbing, &c.; Apparatus for ——. Hartmann & Co. Fr Pat. 341,403, March 17, 1904.

The object of this invention is to facilitate the removal o textile fibres from portable receptacles in which they hav been bleached or dyed by the circulation of dye- or othe liquors through them. The apparatus devised to this en consists of a receptacle composed of a perforated drum o slightly conical shape, forming the body of the receptacl fitted to a detachable bottom open at its centre and extende upwards to form an inner tube, which is perforated fo the admission of liquors from a circulating pump. Th top of the inner tube is closed and is surmounted by a ring by means of which the whole apparatus can be lowere and raised. After dyeing, the inner tube and bottom along with the mass of fibres, are raised from the dye-vess in which the operation has been effected, the outer vesse adhering to the fibres and being simultaneously removed The receptacle is then placed upon a draining frame, upo which the outer cylinder is secured. The bottom and inne tube, with the fibres on or around them, are now raise and withdrawn from the outer vessel. The fibres bein thus freely exposed to the air quickly become cool and ar easily removed for further treatment.—E. B.

Dyeing and Printing Yarns and Printing Slubbing Apparatus for ——. G. Masurel-Leclercq. Fr. Pat 341,281, March 15, 1904.

Chiné-printed warp yarns are dried, either alone o together with dyed warp yarns, in a continuous manner i a vertical hot air chamber, provided with ventilators an radiators. Printing slubbing, alone or along with dye slubbing, may be similarly treated.—E. B.

Printing [Fabrics]; Process of ——. Soc. Anon. Pro F. Bayer et Cie. Fr. Pat. 341,007, March 7, 1904.

Acetyl derivatives of cellulose, soluble in alcohol (se Fr. Pat. 317,007 of 1901, and Addition thereto; this J 1902, 870; and 1903, 1015), may be substituted for th thickening agents usually employed in textile printing White designs on a red ground are obtained by printin cotton, dyed, for instance, with "Geranin G," with a past composed of zinc white, 10 grms.; glycerin, 20 grms. acetone, 10 grms.; a 5 per cent. alcoholic solution of acety cellulose, 60 grms. The fabric is finally dried and steame for 10 minutes.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

Paper Dyeing. J. Nonnenmühlen. Färber-Zeit., 1904, **15**, 229—230.

Mottled Papers may be manufactured by mixing in th cylinder short lengths of dyed jute or cellulose fibres wit dyed and sized paper pulp.

Coloured Papers, which will not lose colour on immersion in water, are produced by "staining" with colour lakes. These are obtained by precipitating (i) basic, (ii acid, (iii) resorcinol (Eosine, &c.), and (iv) direct cotto dyestuffs, in the presence of kaolin, calcium sulphate starch, or barium sulphate, with (i) tannic acid and basi aluminium sulphate, (ii) basic aluminium sulphate an barium chloride, (iii) lead acetate, and (iv) barium chlorid respectively. The precipitates are filtered off, drie powdered, mixed with glue or gelatin solution, and applie to the paper, which is afterwards "satin" glazed.—E. B.

French Patent.

Dyeing Skins for Gloves and other Purposes. P. Sorel. Fr. Pat. 341,450, March 19, 1904.

The skins, after the usual preparation, are stained throug to a uniform shade in a bath of a chromium compound. —R. L. J.

VII.—ACIDS, ALKALIS, AND SALTS.

'itric and Sulphuric Acids; Properties of Mixtures of ——. A. Saposchnikoff. J. russ. phys.-chem. Ges., 1904, 35, 1098—1112; 36, 518—532. Chem. Centr., 1904, 1, 1322—1323; 2, 396—397.

ie author examined mixtures of nitric acid with increas- g amounts of sulphuric acid with regard to the partial essure of the nitric acid; the composition of the vapour rried over by air at 25° C.; the vapour densities of the ixtures; and their specific conductivity. The acids used ere sulphuric acid containing about 97 per cent. of the onohydrate, and the strongest nitric acid (containing, of urse, oxides of nitrogen). The curves expressing the sults obtained give no indication of the formation of com- unds, such as the nitrosulphuric acid of Markownikoff, t point to the production of nitric anhydride to a small tent in presence of a large proportion of sulphuric acid. periments were also made with pure sulphuric acid onohydrate and nitric acid of sp. gr. 1·478 at 15° C., ntaining 0·4 per cent. of oxides of nitrogen. The vapour essure of this nitric acid is only 16·64 mm., *i.e.*, much ver than that of acid of sp. gr. 1·52. With increasing ditions of sulphuric acid, the vapour pressure rises, aining a maximum in a mixture containing about 35 per nt. of sulphuric acid. Further addition of sulphuric acid uses a gradual diminution of the vapour pressure, almost accordance with Henry's law. Analysis of the vapours owed that from mixtures containing from 100 to 30 per nt. of nitric acid, they consisted of the pure monohydrate tric acid); from this point onwards, the nitrogen content the vapours increased (up to 24 per cent. of nitrogen), parently owing to a dehydration of the nitric acid, with mation of nitric anhydride. The results show distinctly t sulphuric acid dehydrates nitric acid containing water, l makes it thereby more active for the purpose of ration.—A. S.

mmonia-Soda Process from the Standpoint of the Phase Rule. P. P. Fedotieff. Z. physik. Chem., 1904, 49, 62—188.

e reaction: $NH_4HCO_3 + NaCl = NH_4Cl + NaHCO_3$, n which the ammonia-soda process is based, is reversible, l thus represents the phenomena of equilibrium of four stances, *i.e.*, one of the most complicated cases of the se rule. The author in attacking the problem makes cf the method proposed by Löwenherz (Z. physik. em., 1894, 13, 459), for representing graphically the erimental results. These results are set out in a series ables and curve-diagrams. It should be possible, prac- lly, to convert into sodium bicarbonate 75 per cent. of sodium chloride taken, as against the theoretical 79—80 cent. From the purely chemical standpoint the author siders that the later method of Schlösing, in which ium chloride in the solid form or in solution, is treated ectly with solid ammonium bicarbonate, is more rational n the so-called Solvay process, *viz.*, carbonation of an moniacal solution of sodium chloride.—A. S.

ali Chlorates and Zinc Chloride; Simultaneous Pre- aration of ——, by K. J. Bayer's Method. L. Friderich, C. Mallet and P. A. Guye. Chem.-Zeit., 1904, 28, 63—765.

authors have investigated Bayer's process (Eng. Pat. 978 of 1894; this J., 1895, 658), both in the laboratory on a semi-manufacturing scale. The method consists in sing chlorine into a solution of alkali chloride containing oxide in suspension, and subsequently heating the liquid ined, the final result being expressed by the equation: $3ZnO + NaCl + 3Cl_2 = 3ZnCl_2 + NaClO_3$. The best ds are obtained by working with an excess of alkali oride, and it is found that the following reactions occur, des the one given above: $2ZnO + 4Cl = Zn(OCl)_2 +$ l_2; $Zn(OCl)_2 + H_2O = ZnO + 2HClO$; $3HClO +$ $l = NaClO_3 + 3HCl$. The chlorination is best carried at 40°—50° C., and a yield of 100 per cent. of dissolved li chlorate is obtained under normal conditions. If the rination be stopped before the last traces of the zinc oxide are dissolved, any impurities (*e.g.*, iron) present in the latter do not pass into the solution. For the separation of the alkali chlorate, the solution must be evaporated under reduced pressure at a relatively low temperature (*e.g.*, that of the water-bath), as at higher temperatures, the reaction expressed by the equation (1) proceeds from right to left. The yield of chlorate is 96 per cent. of the total quantity in solution, and the crude product, if washed by the mother liquor from a previous crystallisation, yields, by one recrystallisation, crystals containing only a trace of zinc. The mother liquor contains zinc chloride contaminated with alkali chlorate. The latter is converted into sodium chloride by treatment with hydrochloric acid, metallic zinc, or ferrous hydroxide or carbonate. The only impurity contained in the zinc chloride finally obtained is a small quantity of sodium chloride. The authors conclude that the process would give good results technically, one great advantage being that practically the whole of the chlorine is obtained in the form of valuable products, which is not the case with the ordinary chemical methods for the preparation of chlorates.—A. S.

Calcium Sulphate; Solubility of —— in Aqueous Solutions of Sodium and Potassium Sulphates. F. K. Cameron and J. F. Breazeale. J. of Phys. Chem., 1904, 7, 335—340. Chem. Centr., 1904, 2, 501—502.

The determinations were made at 25° C. The results are set out in curve-diagrams and tables. The following are some of the figures obtained:—

Potassium Sulphate.	Calcium Sulphate.	Sodium Sulphate.	Calcium Sulphate.
Grms. per Litre.		Grms. per Litre.	
9·85	1·446	9·535	1·157
19·57	1·485	24·369	1·171
30·66	1·587	36·979	1·563
35·79	1·213	46·159	1·650
40·53	0·970	94·229	1·980
96·00	0·257	146·612	2·234

The potassium sulphate curve consists of two parts, of which the upper one represents the solubility of calcium sulphate in potassium sulphate solution, and the lower one the solubility of syngenite, $CaSO_4.K_2SO_4.H_2O$, in solutions containing more than 32 grms. of potassium sulphate per litre. The point of intersection is a triple point, corresponding to 32 grms. of potassium sulphate and 1·585 grms. of calcium sulphate per litre (32·47 grms. and 1·582 grms. respectively by direct determinations). The solid phases corresponding to this triple point are gypsum and syngenite. The sodium sulphate curve gives no indication of a stable double salt.—A. S.

Copper Oxide, Hydroxide, and Carbonate; Solubility of —— in Ammonia Solutions. E. Murmann. Oesterr. Chem.-Zeit., 1904, 7, 272. Chem. Centr., 1904, 2, 110

The author finds that in the preparation of ammoniacal solutions of cupric hydroxide or carbonate, solution takes place immediately if a quantity of commercial ammonium carbonate or some other ammonium salt equal to half the weight of the copper compound be added. Ignited pure copper oxide, which is very slightly soluble in ammonia, is considerably more soluble in presence of ammonium salts. —A. S.

Borax; An Abnormal ——. L. Spiegel. Chem.-Zeit., 1904, 28, 750—751.

A sample of refined borax was melted until its water of crystallisation was expelled. It was then dissolved in water, and titrated with sulphuric acid. The titration indicated the presence of the hitherto unknown sodium triborate, $Na_2O.3B_2O_3$. When the triborate is crystallised from water ordinary sodium biborate separates out first, and from the mother-liquor crystals of tetraborate can be obtained. The new compound is not easily prepared from sodium hydroxide and boric acid in aqueous solution, but experiments showed that it could be formed in, and crystallised from, a solution

containing biborate and an excess of boric acid. Its occurrence in commercial borax appears to be extremely rare.
—E. H. T.

Tungstates of Sodium; Action of Zinc on ——. L. A. Hallopeau. Comptes rend., 1904, **139**, 283—284.

Zinc has no appreciable action on normal sodium tungstate ($Na_2O.WO_3.2H_2O$) at the boiling point of zinc. With the paratungstate ($5Na_2O.12WO_3.28H_2O$) crystals of normal zinc tungstate, $ZnWO_4$, form the chief product; but golden-yellow scales, probably Wöhler's tungsto-sodium tungstate, $Na_2WO_4 + WO_2.WO_3$, are also obtained in small quantity and a little tungsten as a grey powder. The reaction therefore differs from that of tin on sodium paratungstate, and from that of zinc on ammonium tungstate or on tungstic anhydride (this J., 1900, 829 and 908).
—F. Sdn.

Manganese Solution: Self-purification of —— from Contained Iron. G. Kassner. Arch. Pharm., 1904, **242**, 407—409.

A manganous sulphate solution containing iron equivalent to 0·0162 per cent. of its manganous sulphate content, deposited, when left to itself, a blackish-brown sediment. It was found that this sediment contained the whole of the iron present, the supernatant solution being absolutely free from iron. The author supposes that the catalytic action of the manganese salt hastens the atmospheric oxidation of the ferrous salt, and that a basic ferric salt is deposited. To take advantage of this reaction for the purification of manganous salts from iron, the iron present must be reduced to the ferrous condition, and the solution must be carefully neutralised.—J. T. D.

Nitric Oxide and Oxygen; Reaction between —— at Low Temperatures. L. Francesconi and N. Sciacca. Gaz. chim. ital., 1904, **34**, 447—457. Chem. Centr., 1904, **2**, 397.

The authors' results were briefly as follows:—Nitric oxide and oxygen both in the liquid condition, or nitric oxide in the liquid or solid condition, and oxygen as gas, or nitric oxide as gas and oxygen in the liquid state, always yielded, in whatever proportions they were mixed, nitrous anhydride. Nitric oxide and oxygen (in excess), both in the gaseous condition, gave nitrous anhydride at temperatures below − 110° C. Nitrous anhydride was converted by oxygen into nitrogen peroxide only at temperatures above − 100° C. Reduction of nitrogen peroxide to nitrous anhydride by nitric oxide began at − 150° C. Nitrous anhydride under normal pressure was stable up to a temperature of − 21° C.—A. S.

Electrolysis of Alkali Chlorides. Theory of Diaphragm Electrolysis. P. A. Guye. XI. A., page 869.

Electrolysis of Alkali Chlorides: Physico-Chemical Studies on the ——. A. Tardy and P. A. Guye. XI. A., page 869.

Persulphates; Quantitativ Determination of ——. E. Pannain. XXIII., page 882.

Sulphur; Commercial Valuation of ——. J. Ceruti. XXIII., page 883.

English Patent.

Oxygen; Apparatus for the Commercial Manufacture of ——. B. Artigue, Paris. Eng. Pat. 14,848, July 1, 1904. Under Internat. Conv., July 6, 1903.

See Fr. Pat. 333,603 of 1903; this J., 1903, 1318.—T. F. B.

United States Patent.

Denitrating Plant [for Sulphuric Acid]. R. Evers, Förde, Germany. U.S. Pat. 767,335, Aug. 9, 1904.

See Fr. Pat. 323,397 of 1902; this J., 1903, 195.—T. F. B.

French Patents.

Bichromates and Chlorates; [Electrolytic] Process o Manufacturing ——. A. E. Gibbs. Fr. Pat. 341,223 March 12, 1904.

A solution of a chromate is treated with chlorine, eithe by passing the gas into a concentrated solution or by electrolysing a solution of alkali chromate and alkali chloride the products are separated from one another and fron unchanged chloride by fractional crystallisation. If larger proportion of chromate be required, alkali can b added to the solution from time to time, to reconvert son of the bichromate into chromate.—T. F. B.

Filling Materials; Manufacture of ——, *for variou Applications.* Soc. Solvay et Cie. Fr. Pat. 341,35 Feb. 8, 1904.

Various substances, inert chemically, but used in the art for filling purposes and the like, are prepared, such a calcium carbonate or sulphate, barium sulphate, kaolin, &c and in illustration, the following processes, all starting wit lime obtained by calcining limestone, &c., are given:—(a A solution of lime in a saccharine liquid is treated with carbo dioxide to obtain precipitated calcium carbonate. (*b*) Mil of lime is passed through a sieve, the cleared portion is prec pitated by carbon dioxide, and the residue may be utilise to obtain an inferior product. (*c*) Sodium carbonate treated with milk of lime, the calcium carbonate formed filtered off, and the caustic solution is carbonated for re-us (*d*) Ammonium chloride is treated with lime, whereb calcium chloride is formed, with liberation of ammoni (*e*) The calcium chloride thus formed may be treated (i solution) with ammonia and carbon dioxide, to precipita calcium carbonate, and reproduce ammonium chlorid (*f*) Or, calcium chloride solution is treated with a liqu containing sodium carbonate or bicarbonate such as th produced in the ammonia-soda process, whereby calciu carbonate is precipitated, and sodium chloride remain Some of the calcium compounds indicated may be replac by corresponding magnesium compounds.—E. S.

Ammonia and Cyanogen Compounds; Obtaining Sim taneously —— by Treatment of [Coal] Gas. W. Fel Fr. Pat. 341,614, Jan. 18, 1904. II., page 861.

VIII.—GLASS, POTTERY, ENAMELS.

United States Patent.

Glass; Process of Manufacturing ——. S. O. Richards jun., Toledo, Ohio. U.S. Pat. 766,771, Aug. 2, 1904.

The process is continuous and consists in supplying batch and reducing it in a substantially closed chamb heated externally. The resulting product is conduct into a "plaining" chamber during the reducing process, a the resultant "metal" flows continuously into a direct heated receiving chamber, which is at a lower temperat than the "plaining" chamber. In this receiving chamber t "metal" undergoes a prolonged "plaining" process, a flows continuously from the lower portion of this tank chamber into a working tank, from which it is work See U.S. Pat. 756,409, April 5, 1904; this J., 1904, 489.
—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

English Patents.

Kilns; Continuous —— for Burning Blue and S Glazed and Vitrified Bricks, Tiles, Pipes, and Te Cotta and like Goods. F. Fidler, Wigan. Eng. I 12,201, May 30, 1904.

Inside flues are constructed down the sides and alo the front firing face of the kilns, to carry the heat fr burning and cooling chambers through those in wh "blueing," &c. is in progress to chambers ahead with t ffecting the proceedings named. The flues are provided ith perforated covered tops to serve as "fire-benches," e passage of gases through the flues and holes being ontrolled by fireclay slabs over the holes.—W. C. H.

iln; Improved Vertical ——, to which the Heat is Supplied by the Aid of Furnaces or Combustion Chambers and by Aid of a Blast. C. R. Gostling, Mitcheldean, Gloucester. Eng. Pat. 14,075, June 22, 1904.

HE heat from the furnaces, which are exterior, but ljacent to the vertical kiln, and which may be fed with lid, liquid or gaseous fuel, is forced into the kiln by eans of a fan or other blast. The material to be calcined fed in at the top and continuously withdrawn, when urnt, from a suitable cooling chamber below the kiln.
—W. H. C.

ilns for Burning Fireproofing Tile and other Clay Products: Continuous ——. D. F. Henry, jun., Port Murry, N.J., U.S.A. Eng. Pat. 14,374, June 25, 1904.

E Fr. Pat. 338,561 of 1903; this J., 1904, 663.—T. F. B.

ilns for Burning Cement, Lime, and the like. N. Perpignani, Tchoudowo, Russia, and E. Candlot, Paris. Eng. Pat. 22,769, Oct. 21, 1903.

E Fr. Pat. 335,377 of 1903; this J., 1904, 188.—W. C. H.

gglutinant or Cement, and Method of Manufacturing the same. F. J. M. M. Ducastel, Paris. Eng. Pat. 9944, April 30, 1904.

RIED and powdered lime or cement is mixed with a rtain quantity of silica, silicates, or carbonates, also in wder, in a furnace consisting of a rotary horizontal iron linder, lined with flint masonry, in which mixture is ected by the action of rounded flint rollers, whilst heating ses are passed through, derived from the combustion of s, from an independent generator, in a chamber concted to the rotary furnace. The gas thus introduced, ntaining much carbon dioxide, is stated to produce ctions in the materials treated, inducing formation of ither acid silicates or bicarbonates." The heated gases ss from the furnace to apparatus for drying the materials ed.—E. S.

United States Patents.

Fireproofing Wood; Process of ——. J. L. Ferrell, Philadelphia. U.S. Pat. 767,514, Aug. 16, 1904.

E Fr. Pat. 319,123 of 1902; this J., 1902, 1455.—T. F. B.

ment or Cementitious Products; Machine for Making ——. W. E. Jaques, Assignor to A. O. Crozier, Grand Rapids, Mich. U.S. Pat. 766,260, Aug. 2, 1904.

E apparatus consists of a horizontal chamber to which terial is supplied through a tapered mouth. One end the chamber develops into a comparatively long narrowing e. Longitudinally through the chamber is arranged a ew which extends into the die. The pitch of the threads this screw is greater in the narrow portion of the die n in the chamber, so that material is carried through re rapidly than it is fed in.—W. C. H.

French Patent.

rnace for Burning a Raw Mixture of Cement, and for other Purposes. G. Gröndal. Fr. Pat. 341,382, March 16, 1904.

E apparatus consists of a hollow rotary drum, slightly lined, at the upper and lower ends of which are vertical naces; an orifice for the gas to enter the drum, and one charging the material to be burned in the upper furce. The lower vertical furnace is constructed so that gas and air can pass through horizontal channels in it the burner, the gas thus becoming heated by contact h the burnt material passing down the furnace. The per furnace is similarly constructed, so that the products combustion and any material in the form of powder are ried off to the chimney and cooled by imparting sensible t to, and thus pre-heating, raw material fed in.
—W. C. H.

X.—METALLURGY.

Steel; Strength of —— at High Temperatures. C. Bach. Z. Ver deutsch. Ing., 1903, 762. Proc. Inst. Civil Eng., 1904, **156**, 56—57.

SPECIMENS of steel were tested at the ordinary temperature and at 200°, 300°, 400°, 500°, and 550° C. The tensile strength increased up to 300° C., and then decreased. For example, the tensile strength of one specimen was 4267 kilos. per sq. cm. (27 tons per sq. in.) at the ordinary temperature; about 4767 kilos. per sq. cm. (30·17 tons per sq. in.) at 300° C.; and 2070 kilos. per sq. cm. (13·1 tons per sq. in.) at 550° C. The ultimate extension decreased from 25·5 per cent. at ordinary temperatures to 7·7 per cent. at 200° C., from which point it rose again to 39·5 per cent. at 550° C. The contraction of area was also less at 200° C. than at ordinary temperatures, but did not commence to rise again until the temperature was above 300° C. Increased duration of the action of the load during the tests had no effect on the tensile strength at ordinary temperatures, but caused a slight decrease at 300° C., and a still greater decrease at 400° and 500° C. By prolonging the action of the load, extension and contraction of area were increased between 300° and 400° C., but then again decreased until, at 500° C., they were lower by 20—25 per cent. than with the ordinary duration of test. The results show that steel for steam boilers, piping, &c. should be tested at higher as well as at ordinary temperatures.
—A. S.

Chromium Steels; Properties and Constitution of ——. L. Guillet. Comptes rend., 1904, **139**, 426—428.

THE results of the micrographic study of two series of chromium steels, with 0·200 and 0·800 of carbon respectively, are summarised in the following table:—

Class.	Microstructure.	Chromium-content in Steels containing:	
		0·2 per Cent. of Carbon.	0·8 per Cent. of Carbon.
		Per Cent.	Per Cent.
1	Pearlite	0—7	0—5
2	Martensite or troostite	7—15	5—10
3	Martensite and carbide	15—20	10—18
4	Carbide	Above 20	Above 18

The term "carbide" is applied to a special constituent, appearing as white globules after attack by picric acid, which the author has not yet isolated. The table shows that the higher the carbon-content, the less the proportion of chromium needed to pass from one structure to another. Mechanically, the same classes are distinguishable, save that classes 2 and 3 tend to run into one another. In the pearlitic steels, with constant carbon, increase of chromium raises the breaking stress, the elastic limit, and the hardness; the elongation, the diminution of cross section, and the brittleness are not greater than in ordinary steels with the same carbon-content. The martensite and troostite steels have an exceedingly high breaking stress, elastic limit, and hardness; very low elongation and contraction of area; medium resistance to shock. The "carbide" steels have medium breaking stress, elastic limit, and hardness; high elongation; considerable contraction of area; but are very brittle. Re-heating softens all these chromium steels. Tempering modifies the pearlitic steels as it does ordinary steels, but acts with greater intensity; it slightly softens the martensite steels, producing some γ-iron; whilst with the "carbide" steels it produces no effect, mechanical or micrographic, between 850° and 1150° C.; but at 1200° C. sharply defined white regions are produced, apparently of γ-iron, and the carbide disappears more or less completely, according to the speed of cooling and the content of chromium. Only the pearlitic chrome steels possess industrial interest.—J. T. D.

Vanadium Steels. L. Guillet. Comptes rend., 1904, **139**, 407—408.

Continuing his researches (this J., 1904, 255), the author finds that the pearlitic vanadium steels are very sensitive to thermal and mechanical treatment, and that when reheated to 900° C. and slowly cooled, they are not more brittle than ordinary steels with the same carbon-content. High vanadium steels, the carbon of which is entirely as carbide, are completely heterogeneous, probably because the vanadium carbide existing in the melted metal tends to rise to the surface. The only vanadium steels of industrial interest are those containing less than 0·7 per cent. of vanadium. A table of the results of mechanical tests is given in the paper.—J. T. D.

Zinc and Magnesium: Alloys of ——. O. Boudouard. Comptes rend., 1904, **139**, 424—426.

The curve of melting-points of these alloys shows a maximum (570° C.) at a point corresponding with the alloy Zn_2Mg. 84 per cent. of zinc; and two minima (355° and 332° C.). The alloys are all more or less brilliantly white in colour. That with 10 per cent. of zinc can be filed or sawn, but as the proportion of zinc increases, the alloys become more and more brittle; their fracture is conchoidal, or in some cases very finely granular. Micrographically, the 90 per cent. zinc alloy shows alternate white and black regions, the black portions being themselves heterogeneous and exhibiting a sort of perlitic structure; the 50 per cent. zinc alloy shows fine arborescent crystals ($ZnMg_4$). Two definite compounds have been isolated from these alloys—Zn_2Mg from the 80 per cent. zinc alloy by treatment with 0·3 per cent. hydrochloric acid, and $ZnMg_4$ from the 30 per cent. zinc alloy by treatment with 5 per cent. ammonium chloride solution.—J. T. D.

Copper; Physical Properties of —— [Crusher Gauges for Recording Powder Pressures]. P. Galy-Aché. Ann. Chim. Phys., 1903, 326. Proc. Inst. Civil Eng., 1904, **156**, 59.

The experiments were made with a view of interpreting the deformations of copper crusher gauges which are used for recording powder pressures. It was found that the "breakdown point" for compression is always raised to the level of the stress applied previously, which can therefore readily be ascertained by testing a used crusher gauge and noting its breakdown point. The amount of compression was greater under the drop test than in the testing machine, owing to the lowering of the breakdown point due to the raising of the temperature by a blow. The breakdown point decreased from 10 tons per sq. in. at − 58° F. (− 50° C.) to 8·5 tons at 392° F. (200° C.). It was also considerably effected by annealing, being, for example, 9·3 tons per sq. in. for an unannealed specimen, but only "0·64 ton" for a sample annealed at 1832° F. (1000° C.). For equal elongations, the acquired breakdown point in tensile test pieces was greater with rapid (drop) testing than with slow testing. As the temperature of annealing was increased, the crystalline structure of the copper became coarser.
—A. S.

"Crystallitic" Forms; Permanence of —— in Crystals [Metals]. F. Osmond and G. Cartaud. Comptes rend., 1904, **139**, 404—406.

Charpy and others have noticed in the structure of the surfaces of bronze, cut, etched, and polished, crystallitic forms the axes of which have a constant direction in the same crystalline granule. These have usually been attributed to lack of homogeneity in the metal, the proportion of copper diminishing with the distance from the crystallitic axes, the points of first solidification. The authors find, however, that these appearances are largely due to mechanical causes—chiefly the different degrees of hardness of the eutectic and the crystalline granules and the varying extents to which the surface is removed by the etching and polishing operations; and it is possible to eliminate or considerably diminish them by lessening the thickness of material removed during these operations. This is best effected, with soft metals like copper (or even lead), by alternating several etching and polishing operations, using materials which shall act as gently as possible. The etching solutions for copper and its alloys should be picric acid and quinone in alcohol or acetone, or aqueous ferric chloride solution slightly acidified; and the polishing should be done by hand with a cloth dusted over with chromic oxide and wetted with weak ammonia.—J. T. D.

Metals; Evolution of Structure in ——. G. Cartaud Comptes rend., 1904, **139**, 428—430.

The author finds that the cellular structure described by him as existing on the cooled surface of metals poured ou in the melted state in a thin layer over a polished surface (this J., 1901, 811), also exists in the interior of an ingot The progress of micrographic art has rendered it possible to polish and etch the surfaces of sections of soft metals like zinc, tin, or lead; and microscopic examination of these surfaces shows the existence of a cellular structure the boundary lines of which are followed and cut by the boundary lines of the larger crystalline structure much as the delineation of the course of a river on a map would be followed and cut by a line indicating its average direction He suggests that the cellular structure forms a stage—a temporary state of equilibrium—in the evolution of the final stable crystallino state. Traces of this earlier stage still exist in the final state, but when the final state has been, so to speak, confirmed by treatment, such as deformation and subsequent reheating, the crystalline boundary lines alone remain, and no sign of the cellular structure is left.—J. T. D.

English Patents.

Furnaces for Baking Briquettes made of Ore, Concentrate or other Material. W. Simpkin, London. Eng. Pat 21,183, Oct. 2, 1903.

The furnace is of the tunnel type, with a central combustion chamber and rails entirely occupied by linked car loaded with the briquettes to be baked, both ends of th furnace being closed ordinarily by sliding doors. The wall are built with expansion pockets. A sand lute extends on both sides of the rails, into which sand an apron, carried by each car, projects, to prevent the passage of heating gase from the upper to the under side of the car. Air admitted by vertical ducts near the entrance end of the furnace passes beneath the cars, and at the opposite (exit) end rises through other ducts to the upper part of the furnace meeting a supply of air under forced draught, and passe over the tops of the cars, cooling them preparatory fo discharge, whilst the air on reaching the combustion chamber becomes heated, and heats the cars near to the entrance end, near to which is the escape for the gases of combustion to the stack. The combustion chamber is supplied with finely-powdered coal, or with gaseous fuel under pressure For each car drawn out, another loaded car is admitted a the entrance end.—E. S.

Cupola. T. Holland, Delphos, Ohio. Eng. Pat. 7694 March 31, 1904. Under Internat. Conv., April 3, 1903.

The object of the invention is to introduce into a cupola for melting metals, &c., hot-air blasts in such a manner as to raise quickly and maintain uniformly a very high temperature. For this purpose, an air receiver, having air-baffling partitions extending transversely one above another, and opening alternately at opposite ends, is arranged in the upper portion of the cupola, with a cold-air pipe leading into the receiver, around which latter a portion of the pipe is coiled. Pipes leading from the receiver and from an air jacket convey the highly-heated air to the lower portions of the cupola.—E. S.

Ferruginous Ore; Process of and Apparatus for Treating —— for the Manufacture of Iron and Steel therefrom. M. Moore, Melbourne, and T. J. Heskett, Brunswick, Victoria. Eng. Pat. 4975, Feb. 29, 1904.

See Fr. Pat. 341,169 of 1904; this J., 1904, 827.—T. F. B.

United States Patents.

oaration [of Metalliferous Ore from Gangue]; Process of ——. A. Schwarz, Assignor to C. N. Lindley, New York. U.S. Pat. 766,289, Aug. 2, 1904.

E materials to be separated, such as the metalliferous tions of ore from the gangue, are moistened, in the nular or pulverulent state, with water, and are then roduced, without agitation, into a bath containing two nids of different specific gravity, insoluble in each other, h as oil floating on water or on a solution of salt in ter.—E. S.

es; Recovering Values [Copper, &c.] from —— by Dissolving in Molten Baths. R. Baggaley, Pittsburg, Pa., and C. M. Allen, Lolo, Mont. U.S. Pat. 766,654, Aug. 2, 1904.

BATH of low-grade copper matte is formed in a converter ough which air is blown, and successive additions are de, first, of ore containing a high proportion of silicious tter, in order to flux the iron present, and lastly, of er molten matte, to replenish the bath as its volume is reased by enrichment. Compare U.S. Pat. 746,260 of 03, this J., 1904, 23.—E. S.

opper] Ore; Method of Smelting ——, and Cleaning Converter Slag. R. Baggaley, Pittsburg, Pa., and C. M. Allen, Lolo, Mont. U.S. Pat. 766,655, Aug. 2, 1904.

AG from a Bessemer converter is poured upon the charge "sulphide ore" which is being smelted in a copper-ore elting furnace, contributing heat thereto, and facilitating smelting process. Or, the smelted product of "sulide ore" is charged directly into a converter, into which cious ore is also charged, and the slag is withdrawn m time to time, while molten, and poured upon the ore ilst it is being smelted. See also the preceding abstract. —E. S.

atte [Copper]; Method of Producing ——. R. Baggaley, Pittsburg, Pa., and C. M. Allen, Lolo, Mont. U.S. Pat. 766,656, Aug. 2, 1904.

R is blown into a molten bath of copper matte, to which added successive small quantities of a highly silicious tal-bearing ore, whereby the iron present is fluxed. The th is then replenished with molten ore, and with "molten terial high in fuel value." See also the two preceding stracts.—E. S.

agnetic Materials [Alloys]; Method of Making ——. R. A. Hadfield, Sheffield, England. U.S. Pat. 767,110, Aug. 9, 1904.

produce a magnetic material of high permeability and hysteresis, a magnetic substance is alloyed with silicon, d the alloy, reduced to a "thin body," is heated to a mperature below its melting point, then quickly cooled, heated to a temperature higher than that first employed, d allowed to cool slowly. Compare U.S. Pat. 745,829 d Eng. Pat. 4981, both of 1903; this J., 1904, 23 and 0.—E. S.

urnace for Burning Materials [Treating Ores, &c.] C. W. Stanton, Mobile, Ala. U.S. Pat. 767,180, Aug. 9, 1904.

EE Eng. Pat. 4806 of 1903; this J., 1903, 1090.—T. F. B.

urnace; Regenerative Gas Reheating ——. F. Siemens, Dresden. U.S. Pat. 767,840, Aug. 16, 1904.

EE Eng. Pat. 25,057 of 1902; this J., 1903, 1197.—T. F. B.

ead; Process of Manufacturing Spongy ——. J. H. Mercadier, Louvres, France. U.S. Pat. 767,906, Aug. 16, 1904.

EE Fr. Pat. 331,006 of 1903; this J., 1903, 1092.—T. F. B.

French Patent.

Steel and Armour Plates; Process for Treating ——. E. W. Engels. Fr. Pat. 341,593, March 21, 1904.

SEE Eng. Pat. 1812 of 1904; this J., 1904, 374.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Diaphragm for Electrolytic Cells; New Form of ——. F. M. Perkin. Electro-Chemist and Met., 1904, **4**, 2—4.

THE diaphragm is constructed of two concentric perforated cells, the space between them being filled with some material which forms the diaphragm proper. This may be asbestos, parchment, or filter paper, or may be made *in situ* from a pulp of asbestos, or from powdered glass or sand, which is poured into the annular space between the cells. The perforations in the cells are about the diameter of an ordinary pin.—R. S. H.

Alkali Chlorides; Electrolysis of ——. *Theory of Diaphragm Electrolysis.* P. A. Guye. Arch. Sc. phys. nat., Genève, 1903, **15**, 612—622; **16**, 393—416, 652—668. Science Abstracts, 1904, **7**, A, 198—199.

IT is shown that the apparently complex character of the electrolysis of alkali chlorides under the ordinary conditions of working becomes very much simplified by accepting the fundamental principle of Hittorf, *viz.*, that the alkali chloride and alkali participate simultaneously in the electrolysis. At any particular temperature, the instantaneous current yield, r, is practically only a function of the alkali concentration, c, and may be expressed very approximately by the equation: $r = 1 - nx$, where n is the "transport number" of the hydroxyl ions, and x the amount of alkali taking part in the electrolysis. If the concentration of the alkali chloride in the cathode liquid be kept constant, the relation is: $r = 1/(1 + ac)^{\frac{1}{3}}$; whilst if the chloride in the cathode liquid is not replaced as it is gradually decomposed, the relation becomes: $r = 1/(1 + ac)$. In either case the value of a is influenced but slightly by variations in the concentration or temperature of the electrolyte. Two methods of working are in vogue in diaphragm electrolysis, *viz.*: (1) The electrolysis is continued until the alkalinity of the cathode solution reaches a certain value, when the liquid is replaced by fresh solution. (2) The concentration of the cathode solution is kept approximately constant by continuous feeding with chloride solution. The first of these methods is the more economical with regard to the consumption of electrical energy. When the second method of procedure is followed, two cases may arise: (*a*) When the added solution does not mix with the remainder; this is approximately so in practice when the cathode compartment is large and the current density small, and in such a case the yield is the same as with the first method of working. (*b*) When instantaneous and complete mixture takes place; this condition is closely realised when the cathode compartment is small, and the current density high. Experimental results obtained in tests on a large scale agreed well with those calculated by the author.—A. S.

Electrolysis of Alkali Chlorides; Physico-Chemical Studies on the ——. A. Tardy and P. A. Guye. J. de Chim. Phys., 1904, **2**, 79—123. Chem. Centr. 1904, **2**, 292—293.

Mode of Action of Diaphragms.—In a diaphragm apparatus for the electrolysis of alkali chlorides the following processes take place:—(1) Physical diffusion of the alkali from the cathode liquid into the anode compartment. (2) Migration of hydroxyl ions into the anode compartment. (3) Depression of the level of the anode liquid in consequence of electrical osmose towards the cathode compartment. (4) Diffusion of cathode liquid to the anode compartment induced by (3). It has been shown that the migration of ions mentioned under (2) is the chief cause of the transference of alkali to the anode compartment. The counteracting influences (3) and (4) produce after some time a condition of equilibrium, the depression of the level of the anode liquid finally established being proportional to the strength of the current and the thickness of the diaphragm, and inversely proportional to the superficial area of the diaphragm. The equation given previously (see preceding abstract) for the instantaneous current-yield must be modified by the introduction of two subtractive terms, and should read: $r = f(c) - k_1c - k_2c$. The coefficient k_1 depends upon the diffusion and electrical osmose, and k_2 upon the permeability of the diaphragm. In an examination of the efficacy of a diaphragm, diffusion, electrical endosmose and the "overflowing" of the anode liquid have alone to be considered. The authors examined a number of different diaphragms and found that it is possible to fix certain characteristic constants for each one, which are of value in judging its efficiency. (1) Ratio, r_1, of the hollow spaces of the diaphragm to its apparent volume. (2) Absolute coefficient of permeability k. This is determined by ascertaining the amount of water which is forced through 1 sq. dcm. of the diaphragm at a definite temperature in 1 hour by a pressure of 1 cm. of water, and referring the result to a liquid having a viscosity of 1. The viscosity of water at different temperatures was found to be as follows:—0° C., 0·01778; 5°, 0·015095; 10°, 0·013025; 15°, 0·011335; 20°, 0·010015; 25°, 0·00891; and 30° C., 0·007974. The coefficient of permeability k is also proportional to the loss of salt by electrical endosmose. (3) Specific coefficient of electrical resistance $= e/r_1$ (e = thickness of the diaphragm). (4) Coefficient of loss by diffusion. The actual diffusion is always less than the calculated, owing to the peculiar nature of the capillary channels forming the diaphragm. For the last constant (5) the virtual thickness of the diaphragm calculated from the diffusion is substituted for the actual thickness. The following conclusions are drawn with regard to the technical electrolysis of alkali chloride solutions with the aid of diaphragms:—The level of the anode liquid should always be kept as high as that of the cathode liquid. The current-density should be tolerably high in order that the endosmotic flow from anode to cathode may in some measure compensate diffusion in the opposite direction: the permeability of the diaphragm may also be somewhat diminished. Under these favourable conditions the yield attains the normal value fixed in the earlier investigation (see preceding abstract).—A. S.

Magnetite Arc-Lamp. C. P. Steinmetz. II., page 859.

English Patents.

Sterilising Water by Means of Ozone; Apparatus for ——. R. F. Wood-Smith. Eng. Pat. 18,193, Aug. 22, 1903. XVIII. B., page 879.

Gaseous Germicide and Insecticide: [Electrical] Process and Apparatus for producing a ——. R. Marot. Eng. Pat. 14,372, June 25, 1904. XVIII. C., page 879.

United States Patents.

Battery; Primary ——. T. A. Edison, Llewellyn Park, N.J., Assignor to Edison Manufacturing Co., Orange, N.J. U.S. Pat. 766,815, Aug. 9, 1904.

This invention consists of a negative electrode for primary batteries, comprising a porous compressed mass of black oxide of copper in an extremely finely-divided condition, and carrying a film of finely-divided red oxide of copper applied to the porous surface.—B. N.

Accumulator. J. A. Lyons and E. C. Broadwell, Chicago. U.S. Pat. 766,958, Aug. 9, 1904.

The accumulator consists of a retaining-cell of metal, lined with a porous non-conducting material such as "a fabric," and an anode element, comprising an inert conducting core of carbon surrounded by a mixture of finely-divided carbon, and an oxide or hydroxide of a metal capable of more than one degree of oxidation. The electrolyte, always neutral or weakly basic, consists of a solution of a basic haloid, or oxy-salt of a metal, which, by electrolysis, deposits in a reguline condition at the cathode.—B. N.

Storage-Battery Gases; Method of Rendering —— Non explosive. T. A. Edison, Llewellyn Park, N.J. Assignor to Edison Storage Battery Co., Orange, N.J U.S. Pat. 767,554, Aug. 16, 1904.

The gases, generated within the electrolyte of a storag battery, are passed through a contracted vent, then spread diffused, and attenuated, and finally passed through cooling medium, such as wire gauze.—B. N.

Electrolytic Apparatus. W. J. Schweitzer, Whiteplain N.Y. U.S. Pat. 767,964, Aug. 16, 1904.

The teeth of the positive and negative comb-like electrode are formed like truncated pyramids in lateral cross-sectio the electrodes being arranged alternately in series and wit the narrower faces of the teeth in the direction from whic the electrolyte flows. The teeth of the alternating coml in the series are relatively "staggered," so as to affor tortuous passages for the electrolyte without retarding th flow.—B. N.

French Patents.

Bichromates and Chlorates [Electrolytic]; Process Manufacturing ——. A. G. Gibbs. Fr. Pat. 341,32 March 12, 1904. VII, page 866.

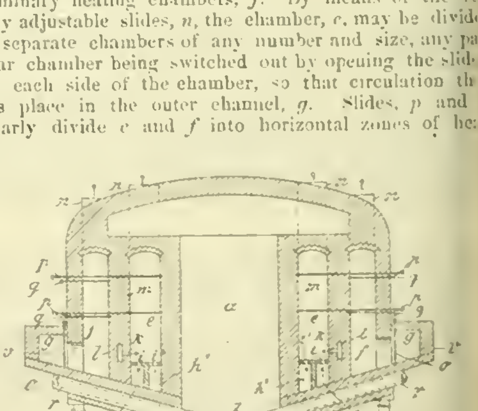
Wines and Spirits; Improvement [Electrical] of —— and Sterilisation Liquids. V. Dorn. Fr. Pat. 341,67 March 26, 1904. XVII., page 878.

(B.)—ELECTRO-METALLURGY.

English Patents.

Electric Furnaces; Method of and Apparatus for Heatin the Charge of ——. A. Neuburger, Berlin, and A. Minc Paris. Eng. Pat. 9468, April 25, 1904.

The shaft, *a*, and crucible hearth, *b*, are enclosed in annular series of main preliminary heating chambers, which in turn are surrounded by an annular series preliminary heating chambers, *f*. By means of the ve tically adjustable slides, *n*, the chamber, *e*, may be divid into separate chambers of any number and size, any pa ticular chamber being switched out by opening the slid *o*, on each side of the chamber, so that circulation th takes place in the outer channel, *g*. Slides, *p* and similarly divide *e* and *f* into horizontal zones of he



The chambers, *e* and *f*, communicate with each other channels, *h*, and openings, *i*. The interchangeable el trodes, *r*, are hollow, in order to allow of direct admissi of gas to the hearth, *b*. Hot combustible gases are pass through one or both chambers, *e* and *f*, but if combusti of the gases is required in *e*, air is heated by passing through the passage, *l*, and openings, *k*, in the wall, *m*, outer series, *f*, being then used for the discharge of combustion gases for the purpose of utilising their heat. —B. N

Scale from Iron and Similar Metals: Removal of — C. C. Garrard, and Messrs. Ferranti, Ltd., Hollinwo Lancashire. Eng. Pat. 21,299, Oct. 3, 1903.

The iron or steel article is constituted the cathode in electrolytic cell, charged, for instance, with dilute s phuric acid, an indifferent insoluble substance, such bon, being used as the anode. A current of sufficient tage (say 8 volts) to render the metal electronegative the solution is used, whereby the dissolving action of acid is counteracted. The scale is stated to be thus noved, leaving the iron or steel clean.—E. S.

United States Patent.

tals; Apparatus for Vacuously Depositing ——. . A. Edison, Llewellyn Park, N.J., Assignor to New ersey Patent Co., Orange, N.J. U.S. Pat. 767,216, Aug. 9, 1904.

an exhausted chamber are arranged a pair of metallic electrodes, which are supported at the upper ends and ghted at the lower ends, and between the electrodes is a tical shaft carrying a sleeve capable of rotation, a disc the sleeve supporting the objects to be coated. The eve also carries a removable armature, which is attracted rotated by a magnet mounted outside the chamber. A r of chambers may be used, with means for connecting a rce of high tension current alternately and automati- y with the electrodes of the respective chambers; or a nber of supports for the objects and a corresponding nber of pairs of electrodes in a single vacuous chamber y be used, with means for alternately and regularly necting the source of the current with the electrodes in rs.—B. N.

French Patents.

st Iron; Process and Apparatus for the Electrical Production of ——, chiefly for the Manufacture of Steel. Soc. Électro-Métallurgique Française. Fr. Pat. 341,611, March 25, 1904.

e lower part of the furnace consists of a water jacketed phite crucible, lined at the bottom with an iron plate, nmunicating with one pole of the source of electricity, ilst the other pole communicates with a hollow carbon ctrode, vertically suspended within the furnace, the tric action being on a combination of the arc and istance systems. The crucible is extended upwards by k walls, the space enclosed being kept charged with the , slag, and charcoal, but a portion of the charcoal, ferably as briquettes, is fed in through the hollow tical electrode. The carbon monoxide generated in the e of fusion, burns to carbon dioxide at the expense of oxygen in the ore, as it ascends, so that the ore is eady partially reduced on reaching the base of the nace. Separate openings are provided at different ghts for running off the slag, and the molten metal. npare Fr. Pat. 336,705 of 1903; this J., 1904, 376.
—E. S.

loy, or Ternary Metallic Composition. Soc. Anon. la Néo-Métallurgie. Fr. Pat. 341,630, March 18, 1904.

alloy, containing manganese, silicon, and aluminium, is pared by heating with carbon in an electric furnace, the responding artificial or natural oxides or silicates, in h proportions that the alloy may contain, say, from ·50 to 40 per cent. of manganese; from 27 to 40·50 per it. of silicon; and from 6·50 to 19·50 per cent of alumi- m. The alloy is especially recommended for use in ining molten iron or steel, forming a fusible slag of nganese and aluminium silicates when added to the bath molten metal. Compare Fr. Pat. 326,140 of 1902, and . Pat. 331,276 of 1903; this J., 1903, 805 and 1136.
—E. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

t of the Wild Strawberry, Fragaria Vesca; Nature of the ——. J. Aparin. J. russ. phys.-chem. Ges., 1904, **36**, 581—596. Chem. Centr., 1904, **2**, 459.

ie fruits lose in the air, at the ordinary temperature, ·28 per cent., and at 100° C., 92·04 per cent. of water. e air-dried fruits contain 5·53 per cent. of ash. The its dried at 100° C., yield, by extraction with light petro- m spirit, 11·64 per cent., the seeds, 20·85 per cent. of a own oil of sp. gr. at 15° C. 4° C., 0·9345; $[n]_D^{25} = 1·4790$; it is easily soluble in ether, chloroform, benzene, and light petroleum spirit, and slightly soluble in alcohol. The oil is of a drying character; it has the iodine value (Hübl), 192·5. The insoluble fatty acids (88·20 per cent.) contain about 81 per cent. of linoleic acid and 10·5 per cent. of linolenic and oleic acids.—A. S.

English Patents.

Garbage or Offal; Apparatus for Cooking —— and Removing the Oil therefrom. C. S. Wheelwright and J. T. Fiske, jun. Eng. Pats. 14,482 and 14,483, June 27, 1904. XVIII. B., page 879.

Removing Oil or Grease from Garbage or Offal; Apparatus for ——. C. S. Wheelwright and J. T. Fiske, jun. Eng. Pat. 14,709, June 30, 1904. XVIII. B., page 879.

Butyrometers; Impts. in ——. E. E. O. Roewer. Eng. Pat. 20,630, Sept. 25, 1903. XXIII., page 882.

Soap: Floating ——, and a Process for the Manufacture of same. F. W. Zimmermann and A. A. Stohr, Chemnitz Germany. Eng. Pat. 13,551, June 14, 1904.

Resin, wax, or the like is melted, and stirred continuously with caustic soda lye (density 42° B.) at about 14° F. until a crumbly, granular mass is produced. This latter is stirred into hot soap paste, to form a floating cake, which is afterwards mixed with ordinary soap liquor.—C. S.

United States Patents.

Fatty Substances; Process of Separating Fluid Portions from Solid Portions of ——. W. B. Kerr, Medford, Mass. U.S. Pat. 766,628, Aug. 2, 1904.

To separate the comparatively solid and liquid portions of fatty substances, the material is boiled with water, then cooled to about 120° F.; an aqueous solution of a vegetable digestive ferment (papaïn) is added, the mixture again boiled, the water drawn off, and the solid and liquid fatty matters are then separated by cooling and pressing.—H. B.

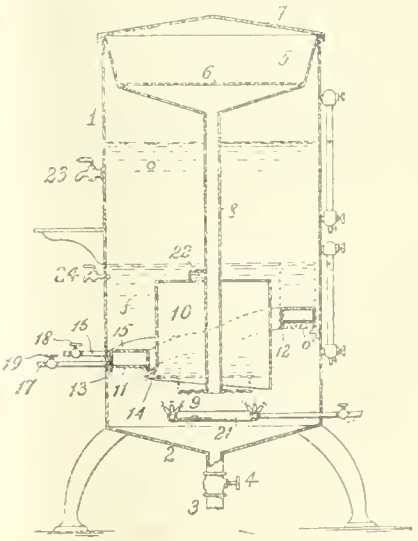
Drying Oil. W. N. Blakeman, jun. U.S. Pat. 767,682. Aug. 16, 1904. XIII. A., page 873.

French Patents.

Tar from Water-Gas; Process for Utilising the —— [Solvent for Fats.] L. Scholvien. Fr. Pat. 340,995, March 7, 1904. III., page 861.

Oils; Apparatus for Purifying ——. D. H. McClelland and F. Risk. Fr. Pat. 341,400, March 17, 1904.

The apparatus consists of a cylindrical vessel 1, having a funnel-shaped bottom 2, in which the impurities and the



washing liquid collect, and from which they are drawn off by the valve 4. The oil to be treated is contained in the vessel 5, situated at the top of the cylinder. After passing through the strainer 6, and down the pipe 8, it escapes under the spreader plate 9, in a thin film, and rises through the washing liquid (the coarser impurities settling to the bottom) and collects in the bell 10. Any air escapes through the valve 22 and the pipe 8. The partly purified oil flows out of the bell 10, by the lip 14, to the under surface of the heating arrangement 11. This consists of a coiled tube of rectangular section, set obliquely as shown, and having the sides projecting downwards as at 12 and 13, in order to cause the particles of oil to follow the course of its under surface. The heating is effected by a current of steam or hot air which enters at 16, passes round the tube, and leaves at 17. The oil is thus heated and washed by the liquid *f*, and collects at *o′*, and then rises through the liquid, finally collecting in the upper part of the cylinder at *o*, from which the purified oil is drawn off by the tap 23. The warming and thorough mixing of oil and washing liquid, which enters thorongh the pipe 21, are said to effectually purify the oil.—W. H. C.

Fats; Apparatus for Extracting Glycerin from ——. G. Col. Fr. Pat. 340, 521, Feb. 17, 1904.

The material is introduced into the top of a closed conical vessel *a*, which is heated by means of the perforated steam coil *g*, *g*, *g*. Having passed through the holes in the diaphragm *d*, it falls in a finely divided state upon the plates *e*, *e*, *e*, *e*, and comes in contact with the steam. It next passes into the cylinder *h*, where it is beaten by the revolving paddles *k*, before passing through the tubes *m*, *m*, into the lower cylinder *l*. Here it is subjected to further beating in the presence of a regulated supply of distilled water from the tank *o*. Finally, the mixture passes into the separator *p*, which is provided with two outlet tubes, the upper *s*, for the residual fatty material and the lower *t*, for the aqueous solution of glycerin.—C. A. M.

Soap [Containing Benzene]; Manufacture of ——. J. F. G. de Roussy de Sales. Fr. Pat. 341,568, March 24, 1904.

Benzene or other hydrocarbon, is emulsified with the soap by means of a suitable mucilage, such as gum arabic, quince gum, fish glue, linseed meal, and the like.—W. P. S.

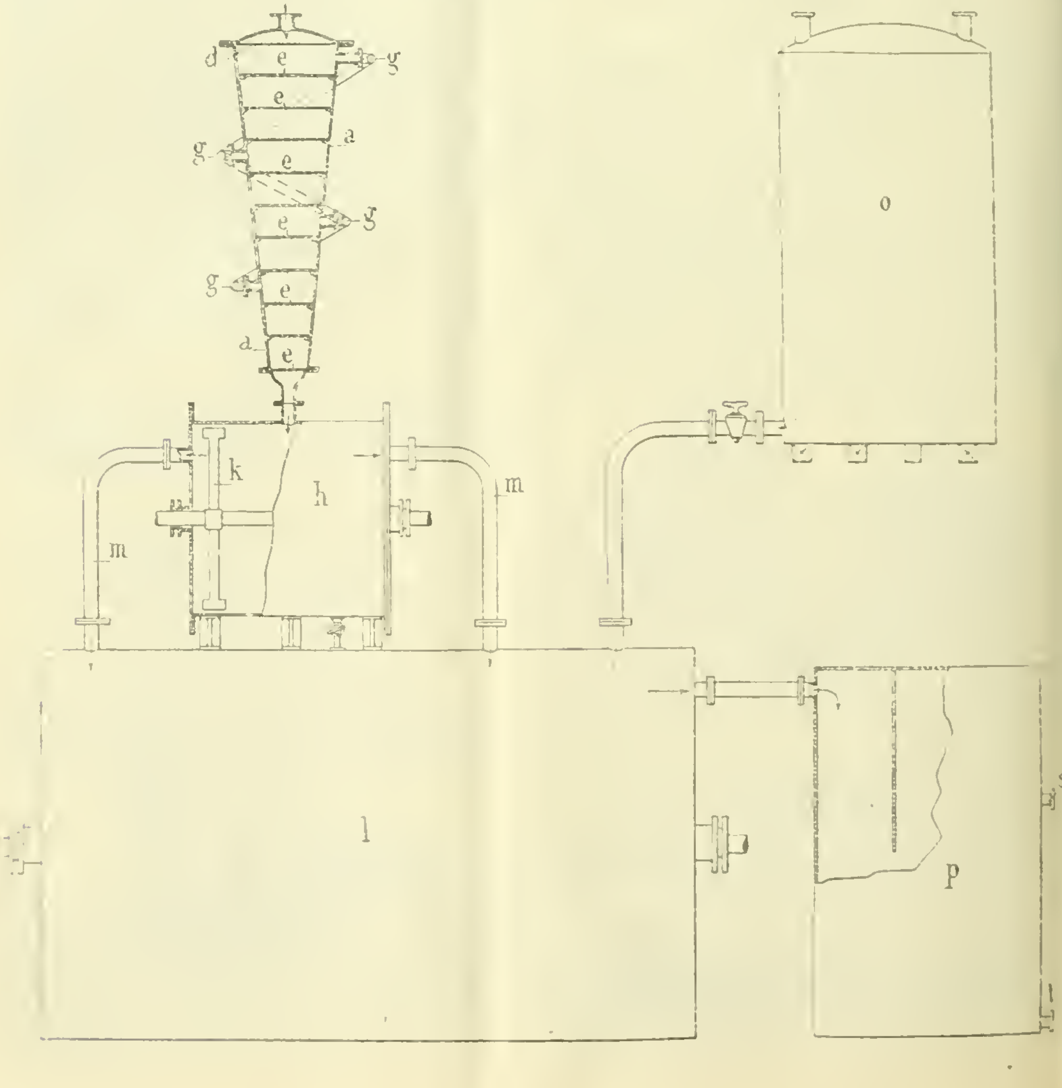
XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

English Patent.

Antimony; Production of Oxysulphide of —— [Pigment]. G. G. M. Hardingham, London. From the Soc. Miniere e Fonderie d'Antimonio, Genoa. Eng. Pat. 19,505 Sept. 10, 1903.

Antimony oxysulphide is produced as "fume" by heating antimony sulphide with a slight excess of coal, coke, or



other reducing agent, in a current of air which is regulated so as to avoid the ultimate reduction of the metal. (Compare Fr. Pat. 330,224 of 1903; this J., 1903, 1096.)—E. S.

United States Patents.

Drying Oil. W. N. Blakeman, jun., New York. U.S. Pat. 767,682, Aug. 16, 1904.

A non-drying fatty oil (85 parts) such as cotton-seed oil, and tung oil (15 parts) are mixed with a drier.—T. F. B.

Paint Composition or Mixture. W. N. Blakeman, jun., New York. U.S. Pat. 767,683, Aug. 16, 1904.

The drying oil described in the previous specification is incorporated with a pigment.—T. F. B.

French Patents.

Lakes from Sulphide Dyestuffs; Process for Making ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 341,246, March 14, 1904.

Lakes are precipitated from solutions of sulphide dyestuffs containing sodium sulphide by oxidising the solution in presence of a suitable metallic salt, a lake-base being added if necessary. For example, a solution of 20 parts of "Sulphur Black T extra," 15 parts of sodium sulphide, and 25 parts of barium chloride is oxidised by blowing air through it. The resulting lake is filtered off, washed, and dried. Manganese dioxide, or other oxidising agent may be used, instead of passing the current of air through the solution.—T. F. B.

Pigment; White ——. J. Gibaud and O. Bang. Fr. Pat. 341,539, March 25, 1904.

The addition of calcium sulphate or carbonate, or of magnesium oxide or carbonate is found not to diminish the covering power of zinc sulphide, and even to increase that of lithopone. As an example of the preparation of a pigment of the above composition, a solution of zinc sulphate is added to a solution of calcium chloride, a solution of an alkali sulphide (or barium sulphide) is added, and the precipitate is calcined.—T. F. B.

(*B.*)—RESINS, VARNISHES.

French Patent.

Tar from Water-Gas; Process for Utilising the —— [Solvent for Resins]. L. Scholvien. Fr. Pat. 340,995, March 7, 1904. III., page 861.

(*C.*)—INDIA-RUBBER, &c.

French Patent.

Gutta-Percha-like Substance; Preparation of a ——. E. H. Fayolle. Fr. Pat. 341,013, March 7, 1904.

Phenol, cresol, or other similar substances (1 kilo), concentrated sulphuric acid (500 grms.), and glycerin (400 grms.) are heated together and allowed to cool. Water (400 grms.) is added and then formaldehyde (400 grms. of 40 per cent. strength) is gradually stirred in. After some hours the mixture is heated and the resulting oil is decanted off and washed, first with water and then with sodium carbonate solution. 1 kilo of this oil is then added to 2 kilos. of melted rosin and the mixture thoroughly incorporated, cooled slowly, and exposed to the air for some days until it acquires the desired consistency.—R. L. J.

XIV.—TANNING; LEATHER, GLUE, SIZE.

French Patent.

Dyeing Skins for Gloves and other Purposes. P. Sorel. Fr. Pat. 341,450, March 19, 1904. VI., page 864.

XV.—MANURES, Etc.

English Patent.

Fertilisers and Cattle Foods; Manufacture of ——. E. Meusel, Leignitz, Germany. Eng. Pat. 13,842, June 18, 1904.

Bone dust, or other bone preparation, is mixed with solutions of ferric chloride, sulphate, or nitrate, for the production of a fertiliser and cattle food.—N. H. J. M.

XVI.—SUGAR, STARCH, GUM, Etc.

Press-Diffusion Process: The Hyros ——. K. Andrlik and V. Stanek. Z. Zuckerind. Böhmen, 1904, **28**, 573—577.

The authors give the results of the working of the Hyros diffusion process (Fr. Pat. 318,451 of 1902; this J., 1902, 1462) with a model apparatus which worked almost the whole season at a Bohemian sugar works. The beetroot chips were fed by hand into the first diffuser at the top, the juice flowed from it continuously, and the exhausted chips left the seventh diffuser automatically. The water pressure varied from 2·4 to 3·4 atmospheres, and the temperature in the battery was 77°—78° C. In six hours eight minutes, 960 kilos. of fresh chips were worked, the quantity of water used was 247·5 litres, and there were obtained 905·6 litres of diffusion juice at 80° C., and 295·6 kilos. of exhausted chips. In the ordinary diffusion the juice drawn off was 119·2 kilos. for 100 of beetroots, in the Hyros only 96·07, and 30·8 of exhausted chips. The density was 18·2° Balling against 15·0° by the ordinary process. The amount of dry solids in the exhausted chips was very high, being 21·94 against 6·79 per cent. by the ordinary diffusion. Although the chips were not exhausted so completely, they could be dried without further pressure and consequent loss of feeding value, whilst the sugar contained would be fully utilised and could not therefore be looked upon as loss. The amount of sugar remaining in the chips was 0·18 per cent. calculated on the beetroots, more than the total loss by the usual diffusion, but this is of no account compared to the economy of the process. The purity of the juice was 90·98 as compared to 90·0 by the diffusion in the 14 ordinary diffusers. The absence of all waste sweet waters and the smaller quantity of water used in working are both obvious advantages (see also this J., 1904, 831).—L. J. de W.

Juice in Raw Sugar Works; Purification of —— by the Lehmkuhl Process. F. Janák. Z. Zuckerind. Böhmen, 1904, **28**, 593—596.

Raw-sugar factories use from 2½ to 3½ per cent. of lime for the purification of the juice, not because such quantities are indispensable for purification, but because the filtration is difficult unless this amount of lime be used. The difficulty in filtration has been variously attributed to the presence of certain organic substances, to saccharates, to gelatinous mineral hydroxides, &c. Lehmkuhl came to the conclusion that it was due to albuminoids dissolved in the juice, and that if these were precipitated by chemical means, 1 per cent. of lime would suffice for purification and the filtration would proceed satisfactorily. Further, he found that it was necessary to heat the juice to 90°—95° C. in the presence of the chemical reagents. The juice is usually heated alone before the addition of lime, but as Classen and Herzfeld have shown, 9/10 of the albuminoids remain in solution under these circumstances. Although these are decomposed by lime into amino-acids, the salts thereby formed remain as molasses formers in the juice. The reagents employed are sulphuric acid and aluminium sulphate, and these are not found to produce any injurious effect at the temperature of 90° C. in the proportions employed during the time they are mixed with the juice, and the small quantity of salts remaining offers no disadvantage and does not appreciably affect the purity compared with the salts of amino acids. The process has been worked with advantage at the factories of Gross-Gerau, Melno, Amongies and Sokolnic. The coagulated albuminoids are not acted on by lime.—L. J. de W.

Water in Molasses; Determination of ——. G. Testoni. XXIII., page 883.

Hexoses; Reactions of ——. R. Ofner. XXIII., page 883.

English Patent.

Sugar; Manufacture of ——. G. Harrison, London. From F. Hlavati and Co., Genoa. Eng. Pat. 16,750, July 30, 1903.

To the saccharine materials during the diffusion process there are added substances which precipitate or prevent the extraction of the organic non-sugar bodies. Suitable substances are: gypsum, sulphates of metals of the magnesium or aluminium group, permanganates of the alkaline earths, peroxides of the alkaline earths or their equivalents, sulphides of hydrogen, nitrous oxide, carbon dioxide, and sulphurous acid. After saturation and carbonation, the slightly alkaline juice is treated in the vacuum-pan with a silicate of the aluminium or magnesium group which has previously been converted by an acid into a poly-silicate, and which combines with the alkali salts of the juice. A final decolorisation may be effected with zinc dust and subsequent carbonation. The use of silicon lead fluoride, supersaturated with lead, is also claimed for the purification of sugar solutions.—J. F. B.

French Patents.

Starch; Rotatory Apparatus for Catching and Automatically Grading ——. L. A. Morel. Second Addition, dated March 17, 1904, to Fr. Pat. 300,237, May 11, 1900.

In this addition the application of a receiver for the preparatory grading of starches before centrifugalising is claimed, together with the arrangement of a circular trough round the basket of the centrifugal apparatus so as to collect the water and carry it into the succeeding centrifugal vessel.—T. H. P.

Tar from Water-Gas; Process for Utilising the ——. [*Solvent for Gums.*] L. Scholvien. Fr. Pat. 340,995. March 7, 1904. III., page 861.

XVII.—BREWING, WINES, SPIRITS, Etc.

Barley; The Tannin of ——. H. Seyffert. Woch. f. Brau., 1904, **21**, 483—485.

The tannin of barley has a far lower affinity for albuminoids than the tannin of hops. Barley-tannin is only precipitated in combination with the readily coagulable albumins, whereas the precipitating action of hop-tannin extends to albuminoids, such as glutin, &c., which are non-coagulable in the ordinary sense. This is illustrated when one portion of a malt-wort made by infusion is boiled for two hours with a small proportion of hops, whilst another portion is boiled for half an hour without hops, and then for 1½ hours with the same quantity of hops. The total quantity of coagulated albumin in the first case is considerably less than in the second case and the former wort has a harsh flavour. When hop-tannin and barley-tannin occur simultaneously, as in the first case, in presence of readily coagulable albumins, the whole of the more powerful hop-tannin is precipitated in combination chiefly with the latter, leaving the barley-tannin and most of the soluble albumins dissolved in the wort. In the second case, the barley-tannin is precipitated in combination with the coagulable albumins during the preliminary boiling, thereby permitting the whole of the hop-tannin to be utilised subsequently for the precipitation of the glutin and similar undesirable albuminoid constituents of the wort. Barley-tannin can be extracted from the grain by means of 75 per cent. methyl or ethyl alcohol, and is precipitated from its solutions by lead hydroxide. The author has isolated the tannin in a crude state, and has studied its relations towards certain constituents of wort. The alcoholic solution of barley-tannin when added to an aqueous solution of barley-albumin [leucosin] causes a heavy turbidity which coagulates on heating. In a saline solution of barley-globulin [edestin], the tannin solution causes a precipitate which dissolves on heating and re-appears on cooling. In an alcoholic solution of hordein it produces a turbidity which clears on heating to 60° C., but re-appears on cooling. Barley-tannin produces a precipitate in a solution of diastase, and the precipitate coagulates on heating. In a solution of Lintner's soluble starch the tannin solution produces a voluminous slimy precipitate, soluble on heating, but re-appearing when cold. When added in excess to unhopped wort, the tannin solution produces a turbidity which coagulates on boiling, but the wort becomes turbid when cold. In unhopped wort which has been coagulated by boiling, the tannin solution produces a heavy turbidity which clears on heating, but re-appears on cooling. Thus, apart from its astringent taste, it appears that the barley-tannin requires consideration as a possible cause of "beer-hazes;" it also probably has an injurious effect upon the yeast.—J. F. B.

Malt; Prior's Method of Determining the Degree of Friability of Cured ——. G. Bode. Woch. f. Brau., 1904, **21**, 495—497.

Prior recently proposed (Bayer. Brauer. J., 1903, **13**, 97—98) to determine the degree of friability in malt by sifting the grist and weighing the meal, a Seck mill and a Vogel sieve being used. The classification is as follows: very tender malt, containing at least 40 per cent. of meal: tender, with 35—40 per cent.; hard, with 30—35 per cent.; and very hard, with less than 30 per cent. of meal. These limits, however, are so narrow as to easily give rise to discordant results, more especially since the author's experiments with artificially moistened samples have shown that an alteration in the percentage of moisture is sufficient to displace one and the same malt from one category into another. In view of the results obtained he therefore proposes to adopt 5 per cent. of moisture as the standard, and where less than this quantity is present to deduct the difference from the percentage of meal found, the converse procedure being adopted when the moisture exceeds this mean. As an example of the effect of this precaution, one sample of malt yielded 38·8 per cent. of meal when the moisture content was 3·5 per cent., but only 29·6 per cent. when containing 11·4 per cent. of water. Under the Prior classification it would be considered in the former case as friable, but in the latter as very hard; whereas after the proposed adjustment, the percentages of meal become respectively 36·3 and 36·0 per cent. *i.e.*, the sample is properly classed as friable.—C. S.

Concentrated Malt Extract; Sugars of ——. A. R. Ling and T. Rendle. Analyst, 1904, **29**, 243—247.

From analyses of nine samples of malt extract, Korn (Ber. deut. Pharm. Ges., 1896, **6**, 319) found their mean carbohydrate composition to be: maltose, 41·43—60·43; dextrose, 0·47—6·21; cane sugar, 0·33—3·60; and dextrin, 11·70—22·70. In their analyses, the results of which are given in the following table, the authors have determined the dextrose as dextrosazone (Chem. Soc., 1904, **84**, 24), whilst the maltose was calculated from the reducing power

—	1.	2.	3.	4.	5.	6.	7.	8.	9.
Sp. gr. at 15·5/15·5 C.	1395·70	1395·12	..	..	..	..	1408·43	1377·82	..
Maltose (apparent)	31·1	30·9	24·8	27·4	23·0	25·9	34·2	25·2	33·0
Dextrose	17·2	18·2	22·0	19·1	19·4	16·5	12·5	20·0	16·9
Dextrin (apparent)	9·8	8·6	10·0	9·8	13·5	12·3	9·9	6·7	7·8
Unfermentable matter (expressed as dextrin)	4·5	3·5	8·9	5·8	4·1	..	..	..	..
Ash	1·45	1·49	1·58	1·64	1·68	2·21	1·34	1·64	1·33
Water	24·30	24·67	27·36	24·84	24·82	25·20	24·58	29·52	24·29
Diastatic power (Lintner)	30·8	27·2	32·3	25·6	32·2	28·0	39·2	46·5	61·7
Specific rotation, α_D	91·8°	90·5°	84·2°	85·8°	88·0°	89·6°	94·5°	81·1°	90·7°

less that due to dextrose and the dextrin from the rotatory power after deducting that of the dextrose and maltose: the small amount of cane-sugar, stated by Korn to be present, was neglected.

Of these samples the first two were not submitted to a higher temperature than 145° F. at any time during the mashing process, whilst Nos. 3—6 were mashed at a slightly lower temperature; these six were prepared from low-dried English malt.

As regards the presence of dextrose, it has been shown (this J., 1903, 1058, 1059, and 1204) that when any of the products of the incomplete hydrolysis of starch by diastase are isolated, and submitted to the further action of the enzyme, even at a temperature of 131° F., glucose is invariably formed. It is suggested that the dextrose of malt extracts may be due to the action, during the evaporation, of the diastase in the extract on the incompletely hydrolysed starch products formed during the mashing.
—T. H. P.

Starch; Note on the Hydrolysis of —— by Diastase. J. S. Ford. Chem. Soc. Trans., 1904, **85**, 980—983.

Ling (this J., 1902, 983) has stated that Kjeldahl's law of proportionality does not hold for the diastase of air-dried malt. The author found, on the other hand, that two different preparations of Lintner's soluble starch gave similar results as regards "proportionality" with extracts from various barleys and air-dried (at 17—40° C.) and kiln-dried malts. These results show that Kjeldahl's law is true for the diastase (amylase) in extracts of barley and air-dried malt as well as for that in kiln-dried malt. Having regard to the influence of slight traces of impurities on amylolytic action (see this J., 1904, 414), it is suggested that the discrepant results obtained by Ling and by the author are due to the use of starches of different degrees of purification.—A. S.

Starch; Final Degradation Products of —— by Hydrolysis with Oxalic Acid, with special Reference to Dierssen's (Lintner's) "Isomaltose." F. Grüters. Z. angew. Chem., 1904, **17**, 1169—1179.

The degradation products obtained consisted of achroodextrins I and II, maltodextrin γ, maltose, dextrose, and a small proportion of levulose. These are the same as the products furnished by diastatic action, except that in the latter case maltodextrin γ is replaced by maltodextrin β, which exhibits different constants and behaves differently towards diastase. The author, however, believes that both these dextrins occur simultaneously, but in varying proportions, this view being supported by the fact that the conversion into maltose is sometimes very imperfect, and at others almost complete. The divergent behaviour of various "isomaltose" preparations towards malt extract is also regarded as indicating that the more resistant maltodextrin γ occasionally preponderates as the lowest member of the dextrin series. Like Lintner and Dierssen he failed to isolate maltose in the pure, crystalline state from the syrups; but neither could this be accomplished from mixtures of maltose and dextrin, which, moreover, gave osazones resembling "isomaltosazone." Furthermore, the statement by Ost that he has finally succeeded in crystallising maltose from the syrups seems to have deprived the "isomaltose" theory of its last support.—C. S.

Brewing; Employment of Sugar in ——. C. Moreau. La Bière, 1904, **12**, 98—104.

Commercial glucose is of irregular composition, and contains undesirable ash constituents; its use in brewing gives unsatisfactory fermentations besides entailing extra fining. Saccharose, whilst free from these defects, is not directly fermentable, and if the necessary inversion be left to the action of the pitching yeast, the latter may be overtaxed and caused to degenerate. Again, this sugar increases the temperature of fermentation by about 2° C., the attenuation is greater by about 3 per cent., the wort does not break so well in the copper, nor is the beer so bright when fined, nor are the flavour and aroma so good as when invert sugar is used. Commercial invert sugar, however, lacks uniformity, but this difficulty can be overcome by inverting saccharose with yeast in the brewery, at a temperature (55° C.). The author made trial brews with this invert sugar added to the malt in proportions ranging between 12 and 55 per cent. The best result was obtained with 15—16 per cent., this quantity leaving the beer unchanged in flavour, and the yeast vigorous and free from degeneration; and the beer kept unusually well, showing good condition and a firm "head." With larger proportions of sugar the results were less favourable. No trace of yeasty flavour could be detected from this yeast-inverted sugar, the taste observed in the sugar itself entirely disappearing when the wort was boiled; and the quantity of proteids introduced in the same way is smaller than in the corresponding weight of malt. Over-attenuation can be prevented by mashing so as to produce a wort containing more dextrin and by the use of about 2 per cent. of high dried malt. For priming, this sugar is less suitable, owing to its yeasty taste, and the inversion is preferably effected by boiling the 20 per cent. solution of saccharose with 1 per cent. of tartaric acid for 20—30 minutes. No injury accrues to the beer from the introduction of this small quantity of acid, and even when 12 per cent. of the malt is replaced by sugar inverted in this way, it is stated, the degree of acidity does not rise above the normal limit. The author considers that the use of sugar would improve the cold flavour of North of France beers, which lack palate-fulness owing to the loss of dissolved carbon dioxide during fermentation and fining. At the same time a slight economy would be effected in the cost of production.—C. S.

Culture Yeasts; Studies on the Behaviour of Certain Races of —— at Various Temperatures. W. Henneberg. Woch f. Brau., 1904, **21**, 347—349; 374—376; 400—403; 432—434; 447—451; 457—460; 470—476.

The subjects dealt with in this series of investigations comprise:—*I. Death of the Yeast Cells:* Diagnosis by appearance and staining; appearance according to the manner of death; death with simultaneous liquefaction; death caused by high temperatures and storage. *II. Cell-wall:* Agglutination; racial variations; permanence; rupture. *III. Nucleus.* *IV. Glycogen:* Detection; appearance and disappearance at various temperatures; persistence after death from different causes and in presence of various substances. *V. Fat:* Its secretion in excess probably pathological; persistence after death; racial and hereditary tendencies of cells rich in fat; sparing solubility of the fat in ether. *VI. Peptase:* Detection; racial differences; conditions which influence auto-digestion; comparative resistance of dead cells to proteolysis; microscopic characters of cells during proteolysis; resistance of peptase to high temperatures and storage; distinction between auto-digestion and the gelatin-liquefying power of living yeast. *VII. Catalase:* Detection; occurrence; diffusibility; behaviour towards heat. *VIII. Zymase:* Its early disappearance from liquefied yeast. *IX. Invertase:* Its high powers of resistance; relative abundance in bottom fermentation yeasts. *X. Putrefaction:* Non-occurrence at temperatures above 38° C.; bottom yeasts putrefy more readily than top yeasts; various lactic acid bacteria probably play a part in starting putrefaction; presence of active enzymes in liquefied yeast is probably inimical to putrefaction.—J. F. B.

Wild Yeast Infection. A. C. Chapman. J. Inst. Brewing, 1904, **10**, 382—396.

The chief sources of wild yeast infection in English breweries are said to be direct aerial infection at the refrigerating stage, indirect aerial infection from dust in the refrigerator or fermenting room, and infection due to nests of micro-organisms in defective fermenting tuns or yeast backs. On the other hand, infection due to very impure pitching yeast or to dry hopping is rarely met with. Provided the wort is run off the cooler before the temperature falls below 140° F., there is little risk of infection at that stage; but it is advisable to screen the ventilation openings with fine linen, moistened with water or dilute salicylic acid, and the same method should be adopted in the refrigerator room, or the latter apparatus be itself enclosed in a casing of similar character. Dust infection may be prevented by cleanliness, and that from defective plant by shaving down the tuns to remove all soft places and spongy surfaces, and treating them for several days with a strong solution of calcium bisulphite. This method proved efficacious in two cases of infection by *S. pastorianus I.* The author also mentions an instance of infection by *S. apiculatus,* occurring in the winter months, whereas this yeast is seldom encountered except in summer and autumn. From the attendant circumstances it was concluded that the organism had found its way into the brewery earlier in the year, and lodged in accumulations of dust, being afterwards disturbed by wind.—C. S.

Fermenting Room [*Breweries*]; *Infection in the* ——. E. de Fine-Bunkeflod. Z. ges. Brauw., 1904, **27**, 573—576.

To prevent infection of the beer by micro-organisms it is essential that the vats should be well cleansed with hot water, followed by spraying or brushing over with an antiseptic, preferably one of the fluorine preparations (this J., 1904, 757). Sarcina germs are frequently found on dirty floors, and the latter should therefore be kept clean. The best material for fermenting room floors is asphalt with a little sand, or cement, crevices being thus avoided. The number of germs gaining access to the wort from the air is relatively small, and the authors failed to detect any injurious infection from this source. More importance attaches to the use of uncontaminated pitching yeast. A greater potential source of danger is water falling from the ceiling in drops. The ceiling should be frequently scraped and disinfected, hot lime wash or bleaching powder being cheapest. Sarcinæ have also been found on walls splashed with fermenting wort; and where contamination arises in this way the old plaster should be scraped off before disinfection.—C. S.

[*Beer*] *Sarcina Infection.* N. H. Claussen. Z. ges. Brauw., 1904, **27**, 528–529.

In reply to the criticisms of Will and Braun (this J., 1904, 757) the author states that he is unaware that sarcina grown in ammoniacal yeast-water has ever been found capable of growing in beer; on the other hand, he has isolated *Pediococcus damnosus* and *P. perniciosus* from beers of various origin, and found the cultures produce sarcina sickness in beer but refuse to grow in the above medium. Hence he feels justified in the conclusion that ammoniacal yeast-water is an entirely unsuitable reagent in brewery tests.—C. S.

Fermentation Processes; Review of Recent Improvements in ——. H. Wichmann. Woch. f. Brauw., 1904, **21**, 455—456.

In the use of pure yeast the best results are only obtained when the propagation of the pure yeast is worked as an integral part of the routine fermentations and under identical conditions. In Delbrück's "natural" pure cultivation the conditions are chosen so as to cause the culture yeast to suppress all foreign organisms. In this natural process of selection without the isolation of single cells, attention must be devoted to the choice of a nutrient material in accordance with the enzymatic power of the species of yeast; also to the demands of the yeast for oxygen, its sensibility towards its own excretion products, acids, and antiseptics, and towards unfavourable temperatures. The use of pitching-vats, which is on the increase, is of assistance in obtaining pure yeast. Purity may also be favoured by conducting the fermentations at higher temperatures, whereby wild yeasts are placed at a disadvantage. Octagonal vats constructed of glass plates with embedded wire have been introduced recently as substitutes for wooden fermentation tuns. For very large-sized fermentation vats only iron is available; these large vats are rendered indifferent towards beer by a special internal coating according to Lapp's process.—J. F. B.

Beer; Filtration of ——. Bauer, Jakob, and Riefenstuel. Z. ges. Brauw., 1904, **27**, 601—607.

The experiments made show that filtration makes the beer brighter and removes most of the yeast cells present, thus enabling the brewer to send out beer sooner and also to clarify beer that has been rendered quite turbid by yeast. Filtration improves the keeping properties of the beer, and delays the appearance of sediment or haze. To enable these advantages to be realised, the filtering material must be kept in a sterile condition and replaced at intervals. The used mass should be washed at once, a temperature of 70°—75° C. sufficing to destroy the micro-organisms. Boiling makes the mass lumpy, and is only required previous to the first time of using. The cleansed mass should be at once repacked in the frames and placed in the filter, to obviate risk of infection from exposure to the air. It is inadvisable to use the same mass several days in succession with merely a washing in the filter in the intervals. On no account should beer be left standing in the filter. The latter must be thoroughly cleaned before use, hot water being the most suitable agent to follow the usual methods of cleaning. Owing to the risk of causing metallic haze, it is inadvisable to treat the filter with antiseptics liable to loosen the incrustation.—C. S.

Amyl Alcohol; Origin of —— *in Fermented Liquids.* Windisch. Z. Spiritusind., 1904, **27**, 311.

The author gives an account of the experiments of Rayman and Kruis on the chemistry of fermentation. In 1892 they found that pure cultures of normal saccharomycetes form no other alcohol than ethyl alcohol at the ordinary brewery temperatures; later on, in 1896, they showed that the culture yeasts are capable, under certain conditions, which they could not clearly define, of yielding fusel oil without the help of bacterial action (see this J., 1896, 465). In continuation of this work, these authors inoculated a series of nutrient sugar solutions, both with yeasts rejuvenated by culture through numerous generations and with others which had finished their alcoholic fermentation years before. It was found that neither unfavourable composition of the nutrient medium nor the age and physiological condition of the yeast cells influence the formation of amyl alcohol. On the contrary, it was shown that amyl alcohol is a product of the culture yeast, that it is formed only in presence of certain carbohydrates, and that it is the nature of the nutrient medium on which the formation and yield of amyl alcohol mainly depend. None of the artificial nutrient solutions yields a trace of amyl alcohol with pure distillery yeast, but with a clear, sterile, barley-malt wort, prepared as in the distillery, amyl alcohol always appears. From this it is concluded that the source of this alcohol is not the hexoses, but fermentable sugars formed by the hydrolysis of other polysaccharides occurring in the raw materials used. On oxidising a mixture of sugars containing a large preponderance of one constituent, the course of oxidation of the mixture depends upon the course of oxidation of the sugar in excess. Thus, in presence of a sugar which readily oxidises, dextrose yields no saccharic acid but oxalic acid. Rayman and Kruis suggest that something similar possibly occurs in fermentation.—T. H. P.

Metals; Influence of —— *on Fermenting Liquids.* L. Nathan. Centrabl. f. Bact., 1904, **12**, 93. Biochem. Centrabl., 1904, **2**, 690.

Cider musts offer greater resistance to the action of metals than beer worts, notwithstanding the fact that they dissolve more of the metals. There is considerable difference in the influence of different metals on the fermentation. Thus copper, zinc, brass, bronze, and rough iron have a strong restrictive influence; tin and lead have less effect; whilst the following metals are only slightly injurious: Polished iron, silver, nickel, gold, polished tin, and aluminium.
—C. A. M.

Wine Making; Australian ——, *with some Notes on the Use of Pure Wine Yeasts.* F. Stoward. J. Inst. Brewing, 1904, **10**, 421—447.

Wine Making.—Fermentation is generally conducted in cement-lined brick tanks, holding about 1600 galls. For producing dry red wine, the bottom of the tank is covered with a layer of stalks, to facilitate drainage and impart tannin, a similar layer being placed on the top of the mash of skins and juice. The skins are kept from rising to the surface of the must by means of a false head of light battens, held down by screw jacks, which also serves to support the attemperators. Yeast from a tank in active fermentation is sometimes added, or occasionally pure cultures are used. No aeration of the must is necessary, but attempts are made to maintain uniformity of temperature by means of a circulating pump, better results being, however, now obtained by piercing the cap of skins with a number of short bamboo vents. When fermentation begins, the temperature in the cap is several degrees higher than that of the must above the false head, the difference being due to the low conductivity of the skins, and the difficulty experienced by the carbon dioxide in escaping through them to the surface. In about six days the must is racked into wooden vessels, and left for a couple of months to clarify, an operation that is repeated previous to blending. For dry white wines, the juice is left in contact with the skins for only 24—36 hours, and is then fermented by itself; whilst, for sweet wines, either red or white, the fermentation is arrested at a certain point by the addition of grape spirit.

Acid : Sugar Ratio.—Australian musts contain more sugar in proportion to acid than do those of French or German origin, the relative quantities of acid per 100 parts of sugar being as follow :—Victoria must, 2·80—3·14 ; South Australian, 2·82 ; French, 4·13 ; and German 5·65 parts. This is because the wines being of more robust type need a high sugar content for their manufacture.

Pure Yeast.—The author has experimented with pure cultures of Chateau Lafitte and Richbourg yeasts, the sub-cultures of which were employed to ferment batches of must, a third batch being left to ferment spontaneously. In addition to giving a more regular fermentation, and suppressing the development of *S. apiculatus* infection, the culture yeasts furnished a superior product, the Chateau Lafitte giving a specially fine bouquet after two years' storage, whilst the Richbourg proved better than the control batch, which lacked cleanness of taste. It was noticed in laboratory experiments that the use of pure yeasts lightened the colour of the wine.—C. S.

Alcohol ; Hydration of —— by Calcium and Barium Oxides. L. Crismer. Bull. Soc. Chim. Belg., 1904, **18**, 128—129.

The author tests the degree of hydration of alcohols by a very sensitive method, *viz.*, by determining the lowest temperature at which they mingle completely with a paraffin hydrocarbon ; this he calls the "critical temperature of solution." With a given solvent these temperatures show equal increments for an additional CH_2 group in the alcohol molecule ; thus in kerosene ("huile de paraffine") the temperature is 166° in the case of methyl alcohol, 89·7° with ethyl alcohol, and 13·5° C. with propyl alcohol, the differences being 76·3° and 76·2° respectively. Having prepared a really anhydrous methyl alcohol, which has a critical temperature of 37·5° C. in "gasoline," the author finds that distillation from quicklime freshly prepared from marble actually leads to hydration, raising the critical temperature to 39·6° (first distillate) and even 66° C. (last distillate), corresponding to 0·12 per cent. and 2 per cent. of water respectively. The reaction is presumably expressed by $CaO + 2CH_3OH = Ca(OCH_3)_2 + H_2O$. Hence the familiar process of dehydration with quicklime is illusory. Anhydrous ethyl alcohol is hydrated by barium oxide but not by quicklime.—W. A. C.

Malt Analysis. A. R. Ling. XXIII., page 884.

Copper Sulphate ; Method of Determining the Purity of —— for Use in the Vineyard. C. Montanari. XXIII., page 883.

Boric Acid in Cider, Fruits, &c. ; Determination of ——. A. H. Allen and A. R. Tankard. XXIII., page 883.

Abrastol in Wine ; Detection of ——. E. Gabutti. XXIII., page 884.

Aldehydes in Wine, &c. ; New Method for the Determination of ——. L. Mathieu. XXIII., page 884.

English Patents.

Grain for the Production of Malt ; Treatment of ——. J. Sleeman, Portishead, Somerset. Eng. Pat. 17,975, Aug. 19, 1903.

The apparatus described permits the whole process of malting to be carried out in a combination or series of appliances, the complete plant consisting of a washing and steeping drum or cylinder, two germinating drums, two withering cases, and two drying machines. The washing and steeping drum consists of a perforated cylinder mounted so as to revolve in a tank of water. It is fitted with internal paddles for raising the grain and allowing it to fall again. A perforated tube may be fitted centrally in the drum to supply air to the latter. The washed grain is then passed through a shoot into the germinating drum. A suitable form of this part of the plant is described in Eng. Pats. 18,412, 1898 (this J. 1899, 936), and 2109, 1899. The air used during the germination is previously passed through a moistening apparatus. Withering is carried out in a similar drum, but the grain space is much narrower. The malt then passes either to an ordinary drying kiln, or to drying and curing machines. For curing, the perforated case is preferably enclosed in an impervious casing, to enable the heated air contained therein to permeate the grain, instead of forcing large volumes of air through it. —W. P. S.

Grain for Malting, Distilling, &c. ; Apparatus for Aerating —— during the Steeping Process. C. F. Henry, Dublin. Eng. Pat. 19,472, Sept. 10, 1903.

The apparatus consists of a cylindrical perforated casing of circular or polygonal section, mounted horizontally on pivots projecting from the end walls. The cylinder is divided radially into compartments into which the grain is loaded through longitudinal doors. The casing is partially immersed in the steeping vat in such a manner that the grain in one compartment is aerated, while that in the other compartments is submerged.—J. F. B.

Malting and Drying Drums. T. McKenna, London. From Holst and Fleischer, Christiania. Eng. Pat. 11,752, May 21, 1904.

In malting grain between two concentric perforated drums, the inner drum being utilised for the admission of air, a perfect distribution of the moist air during germination is ensured by maintaining the whole of the perforations of the inner drum freely open. When, however, the malt is to be dried by the admission of dry heated air, which causes a considerable shrinkage of the grain, the upper portion of the inner drum is closed by deflecting plates or dampers, which swing round on pivots and cover the perforations. Thus the hot air is compelled to pass through the denser, lower layers of the grain. For kilning malt with roasted aroma, the deflecting plates are heated by means of steam pipes attached to their lower surfaces and constructed to swing with the dampers.—J. F. B.

Malting Drums. H. Schreier, Sheboygan, Wis., U.S.A. Eng. Pat. 14,517, June 28, 1904.

A rotary malting drum is provided with a discharge opening, covered by a slide, and also with internal spiral conveyors mounted on a shaft so as to move the contents of the drum towards the discharge opening. The discharge opening may be in the longitudinal centre of the drum, and the conveyors arranged so as to deliver the contents from opposite ends to the centre. The driving gear consists of a bevel wheel on the outer end of a conveyor shaft, engaging with a corresponding wheel, which is mounted on a transverse shaft and can be displaced on the same so as to clear the conveyor wheel while the drum is being rotated. —C. S.

French Patents.

Grain ; Process for Drying ——. Brauerei Gross-Crostitz Akt.-Ges. Fr. Pat. 341,709, March 28, 1904.

See Eng. Pat. 6975 of 1904 ; this J., 1904, 618.—T. F. B.

Wines and Spirits; Improvement [Electrical] of ——, and Sterilisation of Liquids. V. Dorn. Fr. Pat. 341,671, March 26, 1904.

This process, which serves equally well for the sterilisation of all kinds of liquids and of substances containing liquids and for the artificial ageing and improvement of the products of alcoholic, acetic or lactic fermentation, consists in introducing oxygen or oxygenated substances into the materials to be sterilised or improved and then subjecting them to static electrical discharges.—T. H. P.

Denaturation of Industrial Alcohol by Carbialine and its Compounds. A. Leoni, A. Pelizza, and E. Stringa. Fr. Pat. 341,617, Feb. 2, 1904.

Claim is made for the use as a denaturing agent, of "carbialine," which is a mixture of readily and moderately volatile oils obtained by the distillation of bituminous matter. —T. H. P.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Boric Acid in Cider, Fruits, &c.; Determination of ——. A. H. Allen and A. R. Tankard. XXIII., page 883.

Butyrometers; Impts. in ——. E. E. O. Roewer. Eng. Pat. 20,630, Sept. 25, 1903. XXIII., page 882.

English Patents.

Centrifugal [Milk] Separators. M. Dall, Copenhagen. Eng. Pat. 12,161, May 28, 1904. Under Internat. Conv., May 28, 1903.

The fittings of the revolving portions of centrifugal separators are constructed of materials such as ebonite, wood, celluloid, &c., having approximately the same specific gravity as the liquid treated. The object is to prevent the deformation of the fittings resulting from the action of centrifugal force.—W. H. C.

Preservative for Food. A. Fölsing, Offenbach-on-the-Maine, Germany. Eng. Pat. 13,689, June 16, 1904.

The food, such as meat, fish, butter, or jams, is sprinkled, covered or mixed with trioxymethylene, in the form of a powder or of an aqueous solution.—W. P. S.

Fertilisers and Cattle Foods; Manufacture of ——. E. Meusel. Eng. Pat. 13,842, June 18, 1904. XV., page 873.

(*B.*)—SANITATION; WATER PURIFICATION.

Mersey and Irwell Joint Committee. Report by R. A. Tatton, Chief Inspector, July 5, 1904.

A review of the progress made towards the purification of the rivers of the watershed during the past 12 years is given. The area under the jurisdiction of the joint committee consists of seven county boroughs, Manchester being the principal one, 14 non-county boroughs, 63 urban districts, and 11 rural districts; with a total population of 2,502,103, and a rateable value of 2,390,446*l*. The watershed comprises five rivers—the Irwell and the Roach, with 286 manufacturers upon their banks; the Irk, with 45 manufacturers; the Medlock, with 15; and the Mersey, with 98—giving a total of 444. The tipping of cinders into the streams, which was a very common practice 12 years ago, has practically ceased. The sludge accumulating in mill lodges is now seldom discharged into the rivers, but pollution still occurs through the running off of lodges in which polluted water is used, the putrescent water carrying mud with it. Fewer complaints are now received of pollution from stone-polishing works. Tables and diagrams are given showing the gradual progress made in works for preventing pollution from liquid sewage. In May 1892 only 27 of the authorities in the watershed had sewage works in operation; in May 1904 there were 80 in operation in urban districts, and 10 in rural districts. In 1892 there were 26 urban authorities which had no scheme of sewage purification; now there are only two, and of those one—Ramsbottom—has its works nearly completed, and the other—Bollington—has received tenders. In the appendix to the report particulars are given of the methods of treatment adopted by each authority with works in operation. The adoption of bacteria beds, in place of land, is largely on the increase, creating a large demand for suitable material. Special attention is directed to the pollution caused by the discharge of untreated storm water through storm overflows, and it is recommended that if the storm water cannot be filtered, it should at least be allowed to pass through settling tanks to remove solid matter. Fairly satisfactory improvement is noted in the treatment of the dry weather flow of sewage. In the section dealing with liquid by-products of a polluting character, tables are given showing the number of manufacturers in each industry where purification works are necessary, and the progress made since 1893. Of the 444 on the rivers, there were, in October 1893, 45 which had efficient works of purification; in May last there were 306. In 1893, 77 works had plant constructed, but not efficient; now there were 133 works in a similar position. At the first date there were 191 manufactories at which no treatment was adopted; now there were only five. Out of 120 dyeworks, 88 had now efficient plants; out of 75 bleachworks 56; of 59 woollen trades, 44; of 48 printworks, 38; of 12 breweries only three were now efficient; and of five factories of fellmongers, only 1. In addition to these, effluents from a large number of factories drain into the sewers. No proceedings have been taken against manufacturers during the last six years, and it is seldom that the suggestions made by the joint committee are rejected. Considerable trouble is caused by the effluent from fellmongers and bleachworks, owing to the large area required for the necessary filtration. A hopeful direction in which progress has been made is in the recovery of waste products. Interesting facts are given to show the improvement which has taken place in the rivers during the last 12 years, but it is stated that much yet remains to be done, some of the rivers, especially the Irk and the Roach, being in a highly polluted condition.—G. J. F.

Chemical Disinfectants; Action of certain ——. Schumburg. Z. f. Hyg., 1903, **45**, 125. Proc. Inst. Civil Eng., 1904, **156**, 66—67.

Schüder has stated that bromine in a solution of 0·06 per 1000 is not invariably fatal to cholera vibrios in drinking-water. This statement is confirmed, but it was found that only in very rare cases are cholera vibrios capable of resisting the action of the disinfectant. The same is the case with a 1 per 1000 solution of mercuric chloride and a 5 per cent. solution of carbolic acid (phenol). The author considers that since the above disinfectants, which are the most powerful it is possible to use, are not certain to destroy all germs within a short time (say in three-quarters of an hour), no chemical mode of disinfection is to be absolutely depended upon, under all circumstances, to prove fatal to bacteria. Disinfection by means of heat is therefore to be preferred to the use of chemicals.—A. S.

Manganese in Drinking Water; Determination of ——. G. Baumert and P. Holdefleiss. XXIII., page 883.

English Patents.

Refuse-consuming and Gas-producing Furnaces. L. Tobiansky, Brussels. Eng. Pat. 12,361, May 31, 1904.

The refuse destructor consists essentially of a retort, in which the waste substances are dried and distilled; it is arranged above a combustion chamber which is fed with the coke produced in the retort. The apparatus is worked with the minimum admission of air, so that the steam, air, and vapours passing down from the retort, and up through the coke in the combustion chamber, give rise to a poor gas free from smoke, containing carbonic oxide and hydrogen. To render the gas suitable for use for motive purposes, it is enriched to a standard calorific value, the apparatus for automatically regulating the enrichment consisting of a small gas motor, burning the gas, and having its governor connected with the supply valve for the carburetting material, a reduction in the speed of the motor causing a corresponding increase in the supply of the carburetting material. The enrichment is effected by feeding tar into the fuel in the furnace, distilling oils in a special retort above the fire, passing the gas through a spray of light hydrocarbon, or mixing it with rich gas from any suitable source.—H. B.

Garbage and Offal; Apparatus for Cooking ——, and Removing the Oil therefrom. C. S. Wheelwright, Bristol, R.I., and J. T. Fiske, jun., Burrillville, R.I. Eng. Pat. 14,482, June 27, 1904.

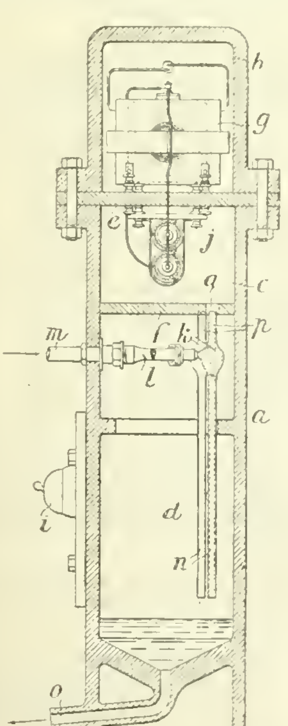
The apparatus consists of a digester in combination with a trapped water and oil receiver placed above the digester. The trap consists of the receiver itself and a stand-pipe opening directly from the digester and extending upwards in the receiver. Taps are provided for drawing off oil and water at different levels from the latter. A strainer is placed at the upper part of the digester. The steam enters through pipes at the lower end of the digester, deflectors being fitted over the end of each pipe. (See also U.S. Pat. 709,836, 1902; this J., 1902, 1285).—W. P. S.

Garbage or Offal; Apparatus for Cooking ——, and Removing the Oil therefrom. C. S. Wheelwright, Bristol, R.I., and J. T. Fiske, jun., Burrillville, R.I. Eng. Pat. 14,483, June 27, 1904.

The steam digester described in the preceding patent is provided with a second chamber apart from the oil and water receiver. The two are connected by a valved circulation pipe and a trapped chamber is placed above the second chamber to receive oil, steam, or water passing through the circulation pipe. A pipe leading from the bottom of the second chamber allows water to be drawn off and injected into the digester to replace the oil and water withdrawn from the latter.—W. P. S.

Sterilising Water by means of Ozone; Apparatus for ——. R. F. Wood-Smith, London. Eng. Pat. 18,193, Aug. 22, 1903.

The outer casing, *a*, of the apparatus is divided into three chambers, *b*, *c*, and *d*, by the horizontal partitions, *e* and *f*. The upper chamber, *b*, contains a step-up transformer, *g*, for raising a low tension alternating current to current of a tension suitable for the ozoniser, *j*, of the Andreoli type, in the middle compartment, *c*. The water to be sterilised is supplied through the pipe, *m*, to three branch pipes, *l*, forming the horizontal side tubes of the three filter pumps, *k*, the upper nozzles, *p*, of which, fit into orifices, *q*, in the partition, *f*. The transformer is controlled by the switch, *i*, and supplies the necessary current to the ozoniser, *j*, which ozonises the air passing into *c* through apertures in *e*. The water, supplied through *m*, draws the ozonised air through the nozzles, *p*, and the water and air being brought into intimate contact in the discharge pipes, *n*, the water leaves the apparatus at *o* in a completely sterilised condition.—B. N.



Removing Oil or Grease from Garbage or Offal; Apparatus for ——. C. S. Wheelwright, Bristol; and J. T. Fiske, jun., Burrillville, R.I., U.S.A. Eng. Pat. 14,709, June 30, 1904.

The garbage, &c. is cooked in the digester by the introduction of water and fresh steam. By mechanical means the solid parts of the garbage are held back, whilst the grease and water pass to an upper chamber, and are separated by gravity.—N. H. J. M.

(C.)—DISINFECTANTS.

English Patent.

Gaseous Germicide and Insecticide; [Electrical] Process and Apparatus for producing a ——. R. Marot, Paris. Eng. Pat. 14,372, June 25, 1904. Under Internat. Conv., Nov. 30, 1903.

A mixture of sulphur dioxide and air is subjected to the silent electric discharge, or is forced through a chamber containing electrodes between which sparks are caused to pass. The gaseous mixture, which now contains some sulphuric anhydride, and is therefore capable of acting as a germicide as well as an insecticide, is mixed with a further quantity of air, and driven by means of a fan into the space to be disinfected.—A. S.

French Patent.

Wines and Spirits; Improvement of ——, and Sterilisation of Liquids. W. Dorn. Fr. Pat. 341,671, March 26, 1904. XVII., page 878.

XIX.—PAPER, PASTEBOARD, Etc.

Kollergang and Pulping Machine. U. Wochenbl. f. Papierfabr., 1904, **35**, 2530—2531.

The author enumerates the relative points of merit of the Kollergang, as compared with the pulping machine of the Würster or Dietrich type.

Advantages of the Kollergang.—The Kollergang, in combination with a strainer, is almost indispensable for pulping up unsorted waste paper and trimmings containing string, binding thread, and other hard and elastic impurities; the stuff can be prepared either "free" or "wet," according to the density of the charge, moisture, and length of treatment; on this account a better felting and, consequently, a tougher paper and better retention of clay and fine fibres can be ensured. The Kollergang, moreover, is the only satisfactory means for pulping up hard papers, such as imitation parchment and strong glazed papers, since it has a kneading and rubbing action.

Disadvantages of the Kollergang.—The Kollergang necessitates a small and intermittent production; the period of treatment cannot be controlled; a certain amount of injury to the fibre cannot be avoided; the treatment is a lengthy one; the service is somewhat dangerous, and the up-keep is costly; any foreign bodies, such as wood or coal, are ground up with the pulp, which also becomes contaminated with sand from the stones.

Advantages of the Pulping Machine.—For "machine-broke" and clean-sorted waste paper, and for all sorts of dry wood-pulp, the pulping machine is vastly superior to the Kollergang. The work is continuous and the output is large; the operation is rapid and cheap; the machine having been adjusted, the condition of the prepared stuff is always constant; the fibre is improved; the service is perfectly safe; space is economised; foreign impurities are discharged intact.

Disadvantages of the Pulping Machine. — Unsorted waste papers may cause clogging and, ultimately, a breakdown of the machine: the treatment is not sufficiently drastic for certain kinds of hard paper; the machines cannot be used for the preparation of "wet" stuff.

—J. F. B.

Paper Dyeing. J. Nonnenmühlen. VI., page 864.

English Patent.

Paper; Manufacture of Waterproof —— and the like. G. Harrison, London. From The Vellumoid Paper Co., Worcester, W. Va., U.S.A. Eng. Pat. 19,541, Sept. 10, 1903.

See U.S. Pat. 740,006 of 1903; this J., 1903, 1145.—T. F. B.

United States Patents.

Paper Stuff Water Circulating Apparatus for Paper Mills. R. Dietrich, Mühlberg, Germany. U.S. Pat. 767,210, Aug. 9, 1904.

See Eng. Pat. 4378 of 1903; this J., 1904, 382.—T. F. B.

Cellulose: Production of Amorphous ——. I. Kitsee, Philadelphia. U.S. Pat. 767,822, Aug. 16, 1904.

Amorphous cellulose is produced "by applying an oil or fatty substance to a portion of the surface of a fibrous material, and then subjecting the material to nitration, whereby only the parts which are not protected with the oily substance are nitrated."—T. F. B.

Nitrated Cellulose: Process of Dissolving ——. I. Kitsee, Philadelphia. U.S. Pats. 767,943 and 767,944, Aug. 16, 1904.

Moist nitrated cellulose is dissolved by treating with a suitable solvent, such as acetic acid fumes. According to the second specification, "cellulose in previous nitrated condition" is subjected to the fumes of a suitable solvent.

—T. F. B.

Celluloid [Utilising Waste ——]. I. Kitsee, Philadelphia. U.S. Pat. 767,646, Aug. 16, 1904.

Waste pieces of celluloid are subjected, in wire baskets enclosed in a suitable vessel, to the action of the vapour of a solvent until they are sufficiently plastic to be worked up again. The vapours of the solvent are then drawn off to a cooled condenser.—T. F. B.

Viscose; Apparatus for Extracting Air and Carbon Bisulphide contained in ——. L. Naudin, Assignor to La Soc. Franç. de la Viscose, Paris. U.S. Pat. 767,421, Aug. 16, 1904.

See Fr. Pat. 340,690 of 1904; this J., 1904, 834.—T. F. B.

French Patents.

Gypsum for Loading Paper; Manufacture of Crystallised ——. W. Brothers. Fr. Pat. 340,952, March 4, 1904.

Natural or artificial calcium sulphate is heated in water or in an aqueous solution to a temperature of from 80° to 130° C. under pressure, the mixture being agitated during cooling to allow of the formation of separate and complete crystals, which are afterwards taken out and dried.

—W. C. H.

Celluloid; Process for Making Products Resembling ——. Chem. Fabr. vorm. Weiler-ter Meer. Fr. Pat. 341,556, March 23, 1904.

Instead of using camphor in the manufacture of celluloid, the following classes of compounds may be employed:—Mono- or poly-halogen derivatives of primary aromatic amino compounds; acidyl derivatives of halogenised aromatic amines (*e.g.*, chloroacetanilide); acidyl (formyl-, acetyl-, benzoyl-) derivatives of secondary aromatic amines such as methylaniline or alkylnaphthylamines.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Veronal [Diethylmalonylurea]. B. Molle and Kleist. Arch. Pharm., 1904, **242**, 401—406.

Veronal, prepared by the condensation of urea and diethylmalonic ester, forms a white crystalline powder of bitter taste, melting at 191° C., and dissolving in 145 parts of water at 20° C., in 12 parts at 100° C. It dissolves readily in ether, acetone, acetic ester, or warm alcohol, less readily in cold alcohol, chloroform, carbon tetrachloride, acetic acid, ligroïn, or amyl alcohol, still less in petroleum spirit or aniline, and very slightly in warm benzene. It also dissolves, apparently unaltered, in concentrated sulphuric acid, and in cold alkali hydroxide or carbonate solutions. When these alkaline solutions are heated for some time, or when the dry substance is fused with sodium hydroxide, ammonia, carbon dioxide, and di-ethylacetic acid are formed:—$(C_2H_5)_2C(CO.NH)_2CO + 5 NaOH = (C_2H_5)_2CH.COONa + 2Na_2CO_3 + 2NH_3$; no doubt sodium diethylmalonate is formed intermediately. A characteristic reaction of veronal was discovered, as follows:—To 1—2 c.c. of the solution, as nearly saturated as possible, add two drops of nitric acid, then Millon's reagent drop by drop; a white gelatinous precipitate falls. Excess of the reagent must be avoided, as it dissolves the precipitate. From the precipitate the veronal can be recovered in the pure state. This, together with Denigès' reaction with mercuric sulphate, with the determination of the melting-point, and with the appearance of the crystalline needles of the sublimate of the substance, afford satisfactory criteria for identifying veronal. Veronal, when taken into the system, is excreted unaltered in the urine.—J. T. D.

Euporphrine [Apomorphine Bromomethylate]. Bergell and Pschorr. Apoth. Zeit., 1904, 423. J. Pharm. Chim., 1904, **20**, 173—174.

Euporphrine, and other quaternary ammonium compounds derived from apomorphine, have, like apomorphine, powerful emetic action, showing that this is not due to the presence of a tertiary amino-group, but to the two phenolic hydroxyl groups, since the dialkyl ethers of apomorphine exhibit no such action.—T. F. B.

Alkaloid Content of Cultivated Cinchonas. O. Hesse. Apoth. Zeit., 1904, **19**, 315. J. Pharm. Chim., 1904, **20**, 160.

The subjoined table shows the mean results obtained by the analysis of certain specimens of cinchona.

Variety.	Total Alkaloids.	Quinine Sulphate.
	Per Cent.	Per Cent.
Cinchona paludiana	0·7	0·2
„ calisaya v. jap.	3·7	1·05
„ hasskarliana	3·4	1·45
„ lancifolia	3·9	0·9
„ coloptera	3·6	0·5
„ officinalis	4·8	4·7
„ succirubra	8·1	2·45
„ calisaya ledgeriana	8·0	8·8
Hybrid of succirubra and ledgeriana.	8·0	5·2

It appears that the most suitable for cultivation are *officinalis*, *succirubra*, and *calisaya ledgeriana*; in Java the latter is largely cultivated, as also are its hybrids with *succirubra*.—T. F. B.

Essential Oil of Rose [Otto of Rose]; Analytical Characters of ——. P. Jeancard and C. Satie. Bull. Soc. Chim., 1904, **31**, 934.

Essential Oil of the non-petaloid parts of Rose Flowers.—1000 kilos of the calices, stamens and pistils, or the rose flowers deprived of petals, gave 50 grms. of a green essential oil with the following characters:—Solidifying point, + 8° C.; stearoptene, 54·13 per cent.; sp. gr. at 15° C., 0·8704; αD at 15° C., − 41°; acid value 6·12; saponification alue, 22·4 ; total alcohols, 13·99 per cent. ; citronellol, 3·56 per cent. The bulk of the stearoptene is composed f a body having the m. pt. 14° C. The high lævo-rotation f the oil indicates that practically all the alcohol present s citronellol.

Essential Oil of Entire Rose Flowers grown at Cannes.—The oil obtained by cohobation and distillation of the entire oses of the Cannes district had the following characters :—olidifying point, 25·5° C. ; stearoptene, 33·20 per cent. he oil freed from stearoptene had the sp. gr. 0·8790 at 50° C. ; α_D — 3° at 15° C. ; solubility in 70 per cent. alcohol, :2 ; total alcohols, 88·55 per cent. ; citronellol, 22·40 per ent. By merely distilling, without cohobation, so as to btain a weight of distillate [rose-water] equal to that of he flowers, only a very small yield of essential oil was btained. This had the following characters :—Solidifying oint, 25·9° C. ; stearoptene, 58·88 per cent. ; acid value, ·2 ; saponification value, 14·7 ; total alcohols, 32 per ent.

Essential Oil of Tea Rose distilled at Cannes had a istinctive odour ; it contained 72—74 per cent. of stear-ptene, although it congealed as high as 23·5° C. This tearoptene consists of two bodies, one solidifying at 14° C. he other at 40° C. In this it resembles the stearoptene f the oil from the nonpetaloid portions of the flower. hese results indicate the fallacy of the application of the olidification test to the valuation of otto of rose. The mount of stearoptene should be determined gravimetrically nd the percentage of citronellol determined after its removal.

Determination of Stearoptene.—10 grms. of the oil are reated with 50 c.c. of acetone, and cooled, without tirring, to – 10° C. The separated stearoptene is collected n a tared filter surrounded by freezing mixture, washed ith cooled acetone, dried *in vacuo* over sulphuric acid and eighed. The acetone is distilled off from the filtrate *n vacuo* and the residue employed for the determination f the citronellol.

Bulgarian Rose Oil of good quality shows but little ariation from the following characters :—Solidifying point, 9—21° C. ; stearoptene, 18—23 per cent. The oil, de-rived of stearoptene, has the sp. gr. 0·886—0·888 at 5° C. ; α_D from – 1° to 3° C. ; solubility in 70 per cent. lcohol, 1 : 1·5 ; acid value, 1—2 ; saponification value, 10—2 ; total alcohols, 84—88 per cent. ; citronellol, 30—40 er cent.

Standards.—Provence rose oil should contain from 30 to 5 per cent. of stearoptene and from 20—23 per cent. of itronellol in the oil freed from stearoptene ; whilst for Bulgarian otto the figures should be 18—23 and 30—40 espectively.—J. O. B.

Lemon Oil ; Adulteration of ——. E. Bertè. Boll. Chim. Farm., 1904, **43**, 349—357. Chem. Centr., 1904, **2**, 358—359.

As an addition to an earlier paper on the analysis of lemon il (see Soldiani and Bertè, this J., 1897, 266), the author ives the results of analyses of oils of the years 1898—1902 inclusive). In 1898 and 1899, adulteration was limited to he addition of French turpentine, but since that time, dulteration with American turpentine, limonene, stear-ptene—easily recognised by the dark colour of the residue—nd, in one case, with turpentine resin has been detected. Contrary to the opinion of Child and Burgess (this J., 1901, 176) the author states that the nature of the adulterant an be ascertained by chemical examination of the frac-ionated distillate, and comparison of the refractive indices f the different fractions, and of the residue, with the refrac-ve index of the original oil. In presence of small uantities of American or French turpentine or limonene, he optical rotation of the residue and of the distillate was he same or somewhat lower than that of the original oil. —A. S.

English Patent.

obacco and its By-products : Process and Apparatus for Treating ——. E. Turpin, Pontoise, France. Eng. Pat. 16,613, July 28, 1903.

OBACCO is freed from nicotine by moistening it with nmonia or other alkali, and then extracting with a suitable solvent, *e.g.*, water, alcohols, ethers, carbon bisulphide, benzene, &c. The solvent is recovered by distillation, and the nicotine is precipitated from the extract by means of salicylic or phthalic acid or picric acid or other nitrophenols. The tobacco thus freed from nicotine may be treated with aromatic perfumes, &c., as substitutes for the nicotine. Several modifications of apparatus for carrying out the extraction of the nicotine are claimed, as also the use of nitrophenols (especially picric acid) and salicylic and phthalic acids as reagents for the detection of nicotine, for the purpose of controlling the process.—A. S.

United States Patents.

Odoriferous Compound ; Process of Making ——. E. Knoevenagel, Heidelberg. U.S. Pat. 767,291, Aug. 9, 1904.

See Fr. Pat. 335,380 of 1903 ; this J., 1904, 204.—T. F. B.

Xanthine Derivative [Theobromine Carboxylic Acid], and Process of Making same. M. C. Massie, Washington, Administrator of F. Ach, Assignor to C. F. Boehringer und Soehne, Mannheim-Waldhof, Germany. U.S. Pat. 767,352, Aug. 9, 1904.

8-Trichloromethyltheobromine is converted into theobromine-8-carboxylic ester by heating with alcohol. The ester is saponified by means of alkali, and the alkali salt precipitated by acidifying the solution. The salt is then filtered off, and its aqueous solution is decomposed by addition of acid. Theobromine 8-carboxylic acid is thus obtained in the form of small white needle-shaped crystals, of m. pt. 345° C., sparingly soluble in water, and almost insoluble in alcohol, chloroform, or acetic ester.—T. F. B.

Xanthine ; Art of Making ——. M. C. Massie, Washington, D.C., Administrator to F. Ach, Assignor to C. F. Boehringer und Soehne, Mannheim-Waldhof, Germany. U.S. Pats. 767,353, 767,354, and 767,355, Aug. 9, 1904.

See Fr. Pat. 326,267 of 1902 ; this J., 1903, 819.—T. F. B.

French Patent.

Camphor from Isoborneol ; Process for Preparing ——. Chem. Fabr. auf Actien, vorm. E. Schering. Fr. Pat. 341,513, March 21, 1904.

Isoborneol is converted into camphor to the extent of 95 to 100 per cent. by oxidation with a neutral solution of a permanganate. 1 kilo. of isoborneol, powdered, or dissolved in 1 kilo. of benzene, is agitated with a solution of 1 kilo. of potassium permanganate in 100 litres of water until the solution is colourless ; pure camphor is obtained by distilling the product in steam, and crystallising the crude camphor from any suitable solvent.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Sensitisers ; Supplementary ——. A. Miethe. Z. Wiss. Phot. Brit. J. Phot., 1904, **51**, 708—709.

The Eosines, Quinoline Red, and a few other dyestuffs, which do not by themselves increase the colour sensitiveness of emulsions, have considerable value as auxiliary sensitisers when used in conjunction with the cyanines or isocyanines. For instance, a plate stained with Methyl Red nitrate (nitrate of the isocyanine from quinoline methyl iodide and quinaldine methyl iodide) always exhibits a certain amount of fog, whereas, if Quinoline Red be added to the staining bath (*e.g.*, 1 part of Methyl Red nitrate and 4 parts of Quinoline Red) the plates obtained are of good colour and sensitiveness, free from fog, and keep well, whilst the curve of colour sensitiveness will be remarkably even, the separate maxima being much less pronounced. Ethyl Red nitrate may be substituted for Methyl Red nitrate with equally good results. The use of certain other cyanines which give great sensitiveness for red (*e.g.*, ethyl cyanine) is also rendered possible by addition of Quinoline Red, the plates obtained exhibiting perfect freedom from fog and good general sensitiveness.—T. F. B.

Cyanine Dyestuffs; Constitution of ——. A. Miethe and G. Book. IV., page 862.

English Patent.

Centrifugal Spreader [*Photographic Films*]; *Improved* ——. A. W. Penrose, London. From G. W. Hinton, St. Joseph, Mo., U.S.A. Eng. Pat. 14,498, June 27, 1904.

The spreader, which is used for spreading the sensitive film on metal plates for photo-etching processes, consists of an inverted cone in which the plate is placed. Means are provided for rotating the cone, for supplying air heated by a lamp held in position below the apparatus, and for preventing the access of actinic light, and dust to the interior of the cone. There is also a suitable brake and means for collecting the excess of emulsion.—W. H. C.

United States Patent.

Photographic Developer [*Glycocoll*]. B. Homolka, Frankfort, and N. Schwan, Soden, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine. U.S. Pat. 767,815, Aug. 15, 1904.

See Eng. Pat. 20,377 of 1902; this J., 1903, 380.—T. F. B.

French Patent.

Photographs having the Appearance of Engravings or Sepia Prints; Process for Producing ——. Van Meurs et Cie. Fr. Pat. 340,974, March 5, 1904.

Photographs resembling black or sepia engravings are obtained by toning the ordinary gelatino-chloride paper, with a bath containing platinum or gold, to the desired tone, fixing in the usual manner, and then again toning in a solution which tints the high lights yellowish or pale brown; this latter bath may consist of a solution of a platinum salt with sodium thiosulphate, and may be prepared by adding platinum sulphate to a solution of sodium thiosulphate, boiling, and filtering. Other methods of preparing the bath are also claimed.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

Copper; Physical Properties of ——. [*Crusher Gauges for Recording Powder Pressures.*] P. Galy-Aché. X., page 868.

English Patents.

Guncotton Blocks; Pressing of ——, *and Apparatus therefor.* G. W. Bell, Ipswich. Eng. Pat. 17,414, Aug. 11, 1903.

See Fr. Pat. 340,473 of 1904; this J., 1904, 837.—T. F. B.

Guncotton; Method of and Apparatus for the Formation of Blocks of ——. G. W. Bell, Ipswich. Eng. Pat. 17,415, Aug. 11, 1903.

Guncotton pulp, composed preferably of one part of nitrocellulose to 10 or 15 parts of water, is introduced into an exhausted chamber which is connected with a vacuum pump. When the block so formed is practically free from air, water is introduced into the chamber, and the block is compressed from each end by means of pistons. A suitable apparatus consists of a mould with perforated walls, fixed in a vertical airtight cylindrical chamber, the lower end of which is connected with a vacuum pump. Pistons are provided in each end of the chamber, working snugly in the mould, and the guncotton pulp is introduced into the upper end of the mould from a receptacle provided with stirrers and a gauge-glass. This receptacle is preferably adapted to be made airtight, if necessary, so as to enable pressure o be applied to force the pulp into the mould. A distributor, for distributing the pulp evenly in the mould, is also described.—T. F. B.

Nitroglycerin; Manufacture of ——. R. Möller, Hamburg. Eng. Pat. 13,562, June 15, 1904.

The separation of the crude nitroglycerin from the nitrated mass is facilitated by adding to the acid mixture or to the glycerin, before nitration, a small quantity of a fatty hydrocarbon or acid, or ester of the latter, or a compound of the aromatic series which is not decomposed by the acids present. For example, 0·5 to 2 parts of paraffin oil is mixed with the acid necessary for the nitration of 1000 parts of glycerin.—T. F. B.

French Patent.

Explosives of the Ammonium Nitrate Group; Process fo Manufacturing ——. J. Führer. Fr. Pat. 341,633. March 7, 1904. Under Internat. Conv., Feb. 19, 1904.

This process is applicable to all explosives containing ammonium nitrate mixed with other compounds, the points of fusion of which are lower than the decomposition point o ammonium nitrate. The materials are intimately mixe and compressed into cylinders by a pressure of 1000 t 5000 kilos. per sq. cm. The cylinders are then immerse in a bath of liquid at a temperature somewhat lower tha the melting point of the fusible constituents of the mixture until the temperature of the whole mass is uniform, whe they are transferred to a bath consisting of the same con stituents in a molten state. The cylinders are now drie and placed in a current of cold air. This treatment ha the effect of producing a more or less porous mixture o high detonating power and in a compressed state.—T. F. B

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

English Patent.

Butyrometers; Impts. in ——. E. E. O. Roewer, Stützer bach, Germany. Eng. Pat. 20,630, Sept. 25, 1903.

The instrument consists of an ordinary shaped (Gerber tube, having the graduated part of the neck flatten instead of round.—W. P. S.

INORGANIC—QUANTITATIVE.

Potassium; Determination of ——. N. Tarugi. Gaz. chim. ital., 1903, **34**, 324—341. Chem. Centr., 1904, **2**, 36

After destroying any organic matter present, the sa (about 1 grm.) is treated with concentrated sulphuric aci and then ignited in order to remove hydrochloric and su phuric acids and ammonium salts. It is then dissolved in definite volume of water, and 10 c.c. of the solution a treated with 10 c.c. of a 15 per cent. solution of sodiu persulphate of known purity. (The persulphate conte of the sodium salt is determined by titrating hot with N sodium hydroxide solution, and the acidity by titrating i the cold; see this J., 1903, 493.) The mixture is agitate for three hours, at 0° C. in the case of dilute solutions, an the separation of the potassium persulphate is induced b introducing a small crystal of the salt. The unused pe sulphate in a known volume of the solution is then dete mined by titration with N/10 sodium hydroxide solutio The author finds that the solubility of potassium persulpha in water at temperatures from 0° to 40° C. is not influence by the addition of sodium, calcium, and magnesium su phates, di- and tri-sodium phosphate and sodium persulpha The solubility of potassium persulphate expressed in pe centages is: From 0° to 9° C. (0·0376) t + 0·564; 9°—10° (0·00278) t + 0·8773; 10°—15° C. (0·0376) t + 0·52 and 15°—40° C. (0·094) t + 0·3164. That potassium pe sulphate gives four distinct solubility curves is consider to be due to the formation of hydrates. Test analys carried out by the above method gave at 21° C. instead 4·32 per cent., 4·34, 4·31, and 4·28 per cent. of potassi oxide; and at 0° C. instead of 1·35 per cent., 1·36, 1· and 1·36 per cent. of potassium oxide.—A. S.

Persulphates; Quantitative Determination of ——. E. Pa nain. Gaz. chim. ital., 1904, **34**, 500—504. Che Centr., 1904, **2**, 563.

Hydrazine set free from its salts by means of concentrat potassium hydroxide solution, reacts vigorously with pe sulphates, according to the equation—

$$2K_2S_2O_8 + N_2H_4.H_2SO_4 + 6KOH = 5K_2SO_4 + N_2 + 6H_2O.$$

he determination of persulphates by this method can be arried out in a Lunge's nitrometer, solutions of the per- ilphate and of a hydrazine salt being placed in the outer essel, and concentrated potassium hydroxide solution n ie inner one.—A. S.

ulphur, Commercial; Valuation of —— [by Means of Aniline]. J. Ceruti. Boll. chim. farm., 1904, 421; Rép. de Pharm., 1904, **16**, 364.

NILINE, b.pt. 180°—185° C., is used as the solvent to extract ilphur from the crude commercial product. From 1 to 2 rms. of the sample are extracted on a tared filter with 0 c.c. of aniline heated to 120°—130° C. The filter is then ashed with alcohol, dried, and weighed. The filtrate may e neutralised with hydrochloric acid and cooled, when the ure sulphur is precipitated; this may be collected, washed, ried over sulphuric acid, and weighed.—J. O. B.

Vater in Molasses; Determination of ——. G. Testoni. Staz. sperim. agrar. ital., **37**, 366—369. Chem. Centr., 1904, **2**, 562—563.

IFTY grms. of the molasses are distilled with 200 c.c. of irpentine, which has been previously saturated with water. istillation begins at 90°—95° C., and the temperature then radually rises to 155°—160° C. Towards the end of the stillation, the condenser should be gently warmed, to rive over any small quantity of water therein. The distil- te is collected in a graduated vessel, and the volume of ie layer of water read off. The author states that this ethod gives more accurate results than the usual one of ying for 7—8 hours at 105°—110° C.—A. S.

opper Sulphate; Method for Determining the Purity of —— for Use in the Vineyard. C. Montanari. Staz. sperim. agrar. ital., 1904, **37**, 227—230. Chem. Centr., 1904, **2**, 367.

HE author proposes the following modification of Zecchini's ethod (this J., 1899, 710), by which the use of an unstable lution of iodine is avoided. 50 c.c. of a solution contain- g 19·878 grms. of pure crystallised sodium thiosulphate, grms. of ammonium thiocyanate, and 0·5 grm. of potas- um iodide are treated with 5 c.c. of a freshly prepared arch solution (1 grm. per 100 c.c.), and a solution of the mple of copper sulphate under examination (20 grms. per re) is run in slowly from a burette, until a faint blue loration appears. The amount of copper contained in ie volume required to produce the blue colour is equivalent 1 grm. of crystallised copper sulphate ($CuSO_4.5H_2O$)

—A. S.

oric Acid; Determination of —— in Cider, Fruits, &c. A. H. Allen and A. R. Tankard. Brit. Pharm. Conf., 1904. Pharm. J., 1904, **73**, 242—244.

ORIC acid is, in traces, a normal constituent of apples, and therefore present also in cider. Apples were found to con- iin from 0·009 to 0·013 per cent., and cider from 0·004 0·017 grm. per 100 c.c., the lower amount being found the Devonshire variety, the higher in the Herefordshire roduct. Boric acid was also found in grapes—0·004 per nt.; in pomegranates, 0·005 per cent.; in quinces, 0·016 er cent.; and in pears, 0·007—0·016 per cent. The resence of phosphates in apples and apple juice renders the eneral processes for the determination of boric acid therein iapplicable. The following methods have been found both ccurate and expeditious for the purpose.

Extraction Method.—About 100 c.c. of cider or other quid are evaporated to dryness with a few c.c. of a 10 per ent. solution of calcium chloride. In the case of fruits bout 50 grms. are cut up into small pieces, and the solution f calcium chloride poured over the mass, which is then vaporated to dryness. The dry residue is well charred, oiled with about 150 c.c. of distilled water, and filtered. he carbonaceous residue is then thoroughly incinerated at moderate temperature, and the resulting ash boiled with nother 150 c.c. of water, and allowed to stand, when cold, or some hours, or, preferably, over-night. A third treat- nent with water, and subsequent standing, may be neces- ary to extract the whole of the borate. The collective queous extracts are filtered and evaporated to 25—30 c.c. After cooling, the concentrated liquid is neutralised with N/10 acid with Methyl Orange as indicator, care being taken that all the borate is in solution before the titration is begun. An equal volume of glycerol (rendered neutral to phenolphthalein just before use) is next added, and the mixture titrated with N/20 sodium hydroxide solution with phenolphthalein as indicator. At the end of the titration another 10 c.c. of glycerol should be added, when the red colour should be permanent. Each c.c. of the N/20 sodium hydroxide solution is equivalent to 0·00175 grm. of boric anhydride, B_2O_3, or 0·0031 grm. of boric acid, H_3BO_3.

Distillation Method.—A suitable quantity of the substance under examination is treated with calcium chloride as described above, well charred, and the main portion of the salts extracted with about 50 c.c. of water. This aqueous extract is transferred to a 100 c.c. distillation flask and evaporated nearly to dryness. Meanwhile the charred residue is incinerated, the ash moistened with 2 c.c. of strong sulphuric acid and warmed. When the evolution of gaseous hydrochloric acid is nearly complete, the acid liquid is transferred to the distilling flask, the last portion being washed in with 10 c.c. of methyl alcohol (ordinary wood spirit of good quality, distilled over caustic potash, is suitable for the purpose). The liquid is distilled nearly to dryness. Another 10 c.c. of methyl alcohol are then introduced, and distilled off. As many as six such treatments are usually requisite, the contents of the flask being allowed to cool between each addition of methyl alcohol. A portion of the residue in the flask should then be tested by the name test for boric acid. If a reaction be obtained, further distillations must be performed. The alcoholic vapours are passed into 25 c.c. of water, the end of the distillation tube dipping into the liquid in the receiver. The distillate is evaporated on the water-bath until free from alcohol, the methyl borate is then hydrolysed and boric acid liberated. The liquid is rendered neutral to Methyl Orange, then treated with glycerol and titrated with N/20 sodium hydroxide solution as described above.

—J. O. B.

Manganese in Drinking Water; Determination of ——. G. Baumert and P. Holdefleiss. Z. Untersuch. Nahr. Genussm., 1904, **8**, 177—181.

THE following method is given for the determination of the small quantities of manganese occurring in some well waters (this J., 1904, 556). From 250 c.c. to 1000 c.c. of the water are acidulated with 1 c.c. of hydrochloric acid and evaporated to a volume of 100 c.c. Towards the end, a little zinc oxide or barium carbonate may be added to precipitate the iron. The solution is filtered and the filtrate collected in a stoppered flask. 5 c.c. of a 10 per cent. sodium hydroxide solution are added and the contents of the flask well shaken for five minutes, the stopper being raised from time to time to admit air. After this, 5 c.c. of a 10 per cent. potassium iodide solution are added and then hydrochloric acid drop by drop until the brown precipitate dissolves. Starch solution is now added and the liberated iodine titrated with sodium thiosulphate solution (0·30 grm. per litre). The latter is standardised on a solution of pure manganous chloride (about 10 mgrms. per litre). The authors also employed Knorre's method (this J., 1903, 1104) in so far that they precipitated the manganese from some of the samples of water with persulphate, and then applied the above method to the precipitate. Evaporation of a large volume of water was thus avoided (see also this J., 1903, 926).—W. P. S.

ORGANIC—QUALITATIVE.

Hexoses; Reactions of ——. R. Ofner. Monatsh. f. Chem., 1904, **25**, 611—620.

THE author has made systematic investigations on the action of hydrochloric acid of various strengths on levulose, dextrose, cane sugar, mannose, maltose, galactose, lactose, isodulcite and arabinose. He finds that Seliwanoff's reaction for detecting levulose in presence of dextrose and other aldoses must be modified as follows: A small quantity of the sugar, and a little resorcinol are dissolved in 3 or 4 c.c. of hydrochloric acid of 12 per cent. strength, and boiled for not longer than 20 seconds. When levulose is present, a deep

red coloration and turbidity immediately appear. If a sugar solution or urine is to be examined, concentrated hydrochloric acid is added to it until the solution contains 12 per cent. of acid, the heating being then carried out as before. No general rule exists for the action of secondary hydrazines on ketoses and aldoses, and in order to detect levulose in presence of dextrose in this way, methylphenylhydrazine must be employed as originally recommended by Neuberg.
—T. H. P.

Abrastol in Wine; Detection of ——. E. Gabutti. Staz. sperim. agrar. ital., 1904, **37**, 234—236. Chem. Centr., 1904, **2**, 370.

100 c.c. of the sample rendered alkaline by the addition of a few drops of ammonia in order to prevent extraction of the natural colouring matter of the wine, are shaken for some minutes with 10—15 c.c. of amyl alcohol. The alcoholic extract is filtered, evaporated to dryness in a small porcelain dish on the water-bath, the residue dissolved in concentrated phosphoric acid (sp. gr. 1·7), heated, treated with 1 or 2 drops of a concentrated solution of formaldehyde, again heated, and filtered. If abrastol be present, even in so small a quantity as 0·1 grm. per litre, the filtrate shows a green fluorescence.—A. S.

ORGANIC—QUANTITATIVE.

Methoxyl; Determination of ——. W. Kropatschek. Monatsh. f. Chem., 1904, **25**, 583—592.

In the determination of alkoxyl groups it is advisable to employ hydriodic acid perfectly free from hydrogen phosphide. If this be done, it is immaterial whether Zeisel's process is used or any modification of it, such as that given by Gregor (this J., 1898, 609). The author recommends the following method, which avoids the use of phosphorus, for the preparation of hydriodic acid. Formic acid and iodine in the relation of I_2 to CH_2O are boiled together in a reflux apparatus, until the greater part of the iodine is used up. Between the boiling flask and the reflux condenser is placed an extraction apparatus provided with a cock (as in the figure), by which it is contrived that the iodine subliming away from the liquid shall be washed into the flask again by the condensed formic acid vapours. The hydriodic acid thus obtained, is distilled several times *in vacuo*.
—T. H. P.

Betaïne Periodide and the Determination of Betaïne. V. Staneк. Z. Zuckerind. Böhmen, 1904, **28**, 578—583.

On adding a solution of iodine in potassium iodide to an aqueous solution of a betaïne salt, a brownish-red precipitate is formed which quickly changes to green crystals with metallic lustre similar to Magenta. If precipitation take place in a hot solution a green oil separates, which on cooling sets as a crystalline mass with a metallic lustre. Free betaïne is not precipitated by a neutral solution of iodine in potassium iodide, but only when acid is added. The tri-iodide is easily soluble in alcohol, hydriodic acid, and in an aqueous solution of potassium iodide. It fuses at 58°—61° C. with disengagement of iodine. The compound is only slightly soluble in water, but on boiling in water it loses iodine, and betaïne hydriodide passes into solution. For the quantitative precipitation of betaïne the author uses a solution of potassium tri-iodide prepared by dissolving 100 grms. of potassium iodide and 153 grms. of iodine (free from iodine cyanide) in 200 c.c. of water. On dilution, iodine separates out from the solution. Sodium chloride or sulphuric acid lessen the solubility of betaïne tri-iodide. Acetic and lactic acids and the constituents of the ash of molasses are without influence on the precipitation, but urea and the substances contained in Liebig's extract of meat are partly precipitated also. An acidified solution of diluted molasses gave a black somewhat crystalline precipitate containing 1·64 per cent. of nitrogen, 65 per cent. of this being due to betaïne.—L. J. de W.

Malt Analysis. A. R. Ling. J. Inst. Brewing, 1904, **10**, 481—491. (See this J., 1902, 983; 1903, 677.)

In the determination of extract it is considered preferable to employ weighed quantities of water than to make up the wort to a definite volume, and to calculate the total volume by means of the formula: $V + v = \frac{100\,(500 + W - 1)}{G - S}$. In this formula, V represents the number of c.c. of solution from 10 grms. of wort; *v* the number of c.c. of water in the wort; W the number of grms. of moisture in 50 grms. of the malt; D the gravity of the wort; S the number of grms. of dissolved matter per 100 c.c. of wort; and G the weight of 100 c.c. of wort. The factor for multiplying the excess gravity of the wort, in order to obtain the yield of extract in lb. per barrel, may be calculated by the formula: $\frac{3\cdot36\,(V + v)}{500}$. The fineness of the grist influences the results obtained in malt analysis; and the author uses a coarse grist ground as uniformly as possible. For attaining this object, the Seck mill is considered advantageous. The mash temperature may vary slightly from the limit of 150° F., but should be kept constant owing to its influence on the character of the wort solids Little definite is yet known of these, but useful statistical data may be obtained from the specific rotatory power and cupric-reducing power of the wort, calculating from these the percentage of apparent maltose and dextrin present. The rotary power, however, varies with the nature of the malt, whilst the percentage of apparent maltose seems, in malts made on identical lines, to have a more definite ratio to the amount of extract present.—C. S.

Aldehydes in Wine, &c.; New Method for the Determination of ——. L. Mathieu. Rev. intern. falsific., 1904, **17**, 43—45. Chem. Centr., 1904, **2**, 180.

One grm. of tartaric acid and 20 c.c. of a solution containing sodium bisulphite equivalent to 30 mgrms. of sulphur dioxide are added to 100 c.c. of the wine, the mixture is shaken, and allowed to stand for four hours in the dark. A few c.c. of starch solution are added, followed by iodine solution till a distinct blue coloration is produced, and then immediately about 10 c.c. of sodium arsenite solution. The combined sulphur dioxide is finally determined by the Has-method. For wines containing more than 10 mgrms. of aldehydes per 100 c.c., relatively more sulphur dioxide is added, whilst of wines containing very small amounts of aldehydes, 200 c.c. are used for the determination. Some brandies contain more than 0·1 grm. of aldehydes per 100 c.c. In such cases, 100 c.c. of the sample are treated with 2 grms. of tartaric acid and about 400 mgrms. of sulphur dioxide in the form of a concentrated solution of sodium bisulphite, the flask containing the mixture is filled up with water, and the method described above followed.
—A. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Radio-active Lead, Radio-tellurium and Polonium. A. Debierne. Comptes rend., 1904, **139**, 281—283.

The author has re-investigated the radio-active substance obtained from pitchblende residues by precipitation with sulphuretted hydrogen in acid solution. A method is described by means of which a body 100,000 times more radio-active than uranium has been extracted. It agrees in properties with each of the three bodies already obtained from pitchblende by rather similar treatment, viz., polonium by the Curies, radio-lead by Hofmann and Strauss, and radio-tellurium by Marckwald (this J., 1903, 49, 657, and 1146). Like these it is sharply distinct from other radio-active substances in its radiation, which consists only of α-rays of feeble penetration and deviated with difficulty by a magnet. It gives no emanation and does not induce radio-activity. The fact that the radiations from these three bodies are identical, proves, in the author's opinion, that ere is only one radio-active substance precipitated from tchblende by sulphuretted hydrogen in acid solution, and is should be called polonium by right of priority.—F. Sdu.

Lead Acetate and Thiosulphate; Crystallised Compound ·——. P. Lemoult. Comptes rend., 1904, **139**, 422—124.

· to a solution of sodium thiosulphate there be added lution of lead acetate, followed by acetic acid, or if the iosulphate solution be added to lead acetate solution eviously acidified with acetic acid, there is deposited, ter a longer or shorter time, according to the concentra- ons of the solutions, a beautifully crystallised substance ıving the composition represented by $2PbS_2O_3.Pb(C_2H_3O_2)_2$. ıe substance is but slightly soluble in cold water, less so water acidified with acetic acid; it is much more soluble hot water, and is deposited again from the solution on oling. Barium acetate behaves similarly to lead acetate so far as in its presence acetic acid does not decompose dium thiosulphate with separation of sulphur, but the lution does not, like the lead solution, deposit crystals.

—J. T. D.

ydrogen Sulphide in Mineral Springs; Condition of——. F. Auerbach. Z. physik. Chem., 1904 **49**, 217—223.

ɪᴇ dissociation constant of hydrogen sulphide was found be $0.91.10^{-7}$. By means of the "avidity formula"—

$$\frac{[HS']}{[HCO_3']} = \frac{k_s}{k_c} \cdot \frac{[H_2S]}{[H_2CO_3]}$$

which k_s is the dissociation constant of hydrogen sulphide d k_c that of carbonic acid, the relative amounts of free and mbined hydrogen sulphide and carbonic acid in sulphur rings may be calculated. In mineral waters containing y considerable quantity of free carbonic acid, boric, silicic, d titanic acids will be present practically entirely in the e and undissociated condition, whilst the amount of rbonate ions (CO_3'') will be negligible.—A. S.

p-Phenylenediamine; Oxidation-Products of ——. E. Erdmann. Ber., 1904, **37**, 2776—2780.

ı oxidising *p*-phenylenediamine with potassium perman- nate in aqueous solution, the main products are carbon oxide and ammonia, but both hydrocyanic and oxalic ids are also formed. Under favourable conditions 2 per nt. of the theoretically possible amount of hydrocyanic d can be obtained. In the animal organism, *p*-pheny- ıediamine is also oxidised with plentiful formation of ımonia. It is therefore possible that in this case also drocyanic acid is formed by a by-reaction, and contributes the toxic effect.—E. F.

Dimethylpyroarsenic Acid. E. Baud. Comptes rend., 1904, **139**, 411—413.

ʜᴇɴ monomethylarsenic acid is heated in an oil-bath at 0°—140° C. in a stream of dry hydrogen, it loses water, d forms dimethylpyroarsenic acid, $2\ (OH)_2.AsO.CH_3 =$ O + $(OH)_2.As_2O_3(CH_3)_2$. Monosodiummonomethyl- ɪenate, when heated, and disodiummonomethylarsenate, ated at 140° C. in a stream of carbon dioxide, undergo rresponding transformations. In each case the product, ıen dissolved in water, regenerates the original substance. ıe new acid, when heated above 170°—180° C., decom- ses, forming arsenic trioxide and methyl alcohol.

—J. T. D.

French Patent.

hers, Alcohols, Benzols, Collodion, &c.; Process for Rendering —— Incombustible. J. P. Ducruet. Fr. Pat. 341,158, Feb. 23, 1904.

ʀʙᴏɴ tetrachloride is added to inflammable liquids to luce their combustibility; in the case of benzol, for tance, it is claimed that the addition of 25 to 30 per cent. carbon tetrachloride renders it absolutely incombustible. rbon tetrachloride is also claimed as a fire-extinguishing ent.—T. F. B.

New Book.

Carborundum (Monographien über angewandte Elektrochemie). Bd. XIII. Von Francis A. J. Fitz-Gerald, Chemiker der Internat. Graphite Co., Niagara-Falls, N.Y. Ins Deutsche übertragen von Dr. Max Huth. Wilhelm Knapp's Verlag, Halle a. S. 1904. Price M. 2.

8vo volume, in style of pamphlet, containing 42 pages of subject-matter with nine illustrations and three tables. There then follows a bibliography, and index of authors. The leading subjects treated of are as follows:—I. Historical chapter, with description of the researches of Despretz, Marsden, Cowles, Schützenberger, Moissan, and Acheson. II. Carborundum Furnace by Acheson. III. Purification, Properties, and Analysis of Carborundum. IV. Applications of Carborundum. V. Simultaneous Preparation of Zinc and Carborundum. VI. Production of Carborundum.

Trade Report.

I.—GENERAL.

Government Laboratory. Report of the Principal Chemist for the year ended 31st March, 1904, with Appendices.

[*Cd.* 2,144.] *Price* 3*d.*

The work of the Government Laboratory during the financial year 1903-4, involved 59,986 tests in the Customs Laboratory, as compared with 61,442 in the preceding year, of samples of goods in regard to their liability to spirit duty, the sugar and tobacco duties, &c., and 85,305 analyses (against 83,370) in the Excise Branch of the Laboratory for the Inland Revenue and other Government Departments. 918 samples of flavouring essences, essential oils, and perfumery were tested during the year for liability to spirit duty. In addition, a large number of samples were examined of preparations such as chloroform, acetic ether, and ethyl bromide, in the manufacture of which spirit is used. A quantity of pure alcohol, equivalent to 2,272 proof gallons, was issued duty-free, with the sanction of the Treasury, to schools and colleges for research purposes, whilst the quantity of duty-free spirit issued to manufacturers under the Finance Act, 1902, was equivalent to 206,451 proof gallons. The majority of applications for permission to take advantage of this concession are said to have been made in cases in which the use of ordinary methylated spirit could not be regarded as unsuitable or detrimental; and in several cases the applicants seemed to be quite unaware that it was possible to obtain permission to use duty-free spirit in the form of methylated spirit in their manufacturing operations. In connection with the same subject there have also been examined a number of samples of denaturing agents—camphor, toluene, benzene, petroleum ether, nitrotoluene, nitrobenzene, animal oil, pyridine bases, &c.—and also samples of the denatured spirit before use, and after recovery by distillation. 160 samples of spirit entered as methyl alcohol, or wood oil, were examined, and of these eleven were found to be pure methyl alcohol and fifteen denatured ethyl alcohol. These were accordingly charged with duty, being potable. A note is given that among the imports were many instances of goods described as "extract of malt." This liquid, in these cases, having the density, alcoholic strength, and general character of ordinary beer, was charged the usual beer duty.

The exportation of medicinal tinctures, flavouring essences, and perfumes on drawback shows a continuous increase. In the past year 13,371 samples, representing 121,137 galls., of proof spirit have been examined, as compared with 12,878 and 118,557 galls. in the previous year. "The regulations in connection with the export of these preparations work very satisfactorily, and inaccuracies found in the traders' declarations are less frequent than formerly." The quantity of wood naphtha approved in the year ending March 31, 1904, is slightly less than in the previous year; this does not, however, involve any real reduction in the use of spirit in manufacturing operations. During the last two years a number of manufacturers have erected apparatus for recovering the methylated spirit formerly wasted in their manufacturing operations, and in this way a large proportion of this spirit is used again instead of being allowed to escape into the air.

In regard to the sampling of saccharin-containing articles, Dr. Thorpe called the attention of the Board of Customs to the importation of chemicals related to saccharin, and requiring only very simple treatment for conversion into this compound, and it was decided that such substances are liable to saccharin duty. Goods suspected to be of this nature, as *o*-toluene-sulphonamide, are now sampled and sent for test to decide this point.

Arsenic was found in 34 out of 1,218 samples of beer in a sufficient quantity to render it necessary to notify the brewers that their materials were contaminated. Herb-beers were examined for alcohol in excess of 2 per cent. Of 852 samples, 269 contained excess of spirit, the amount ranging up 9·1 per cent.

There is a note on rosin size used at a paper mill, which, being discharged into a trout stream, killed a number of fish by blocking up the gills. A dilute solution of copper sulphate, used at Kew as a parasiticide for cucumbers and tomatoes, was found to answer well and not to affect the fruit injuriously. No trace of copper could be detected in either the cucumbers or tomatoes.

RUSSIA; FOREIGN TRADE OF —— IN 1903.

Foreign Office Annual Series, No. 3253.

The first of the subjoined tables shows the quantity and value of certain articles exported from Russia during the years 1902-3, whilst the second gives details of some of Russia's exports to the United Kingdom :—

Exports from European Russia during the Year 1903, *as compared with* 1902.

Articles.		1902.		1903.	
		Quantity	Value.	Quantity.	Value.
			£		£
Linseed	Tons	99,645	1,031,239	94,435	875,500
Hemp seed	,,	17,742	200,600	15,532	116,025
Rape seed	,,	31,290	195,393	59,725	317,900
Sunflower and poppy seeds	,,	19,742	209,812	14,193	127,181
Other seeds	,,	2,161	25,181	2,500	23,800
Oil-cake	,,	379,516	1,819,212	456,774	2,084,518
Hides, raw	,,	13,726	843,731	14,290	1,149,879
Bones and bone-meal	,,	27,858	129,518	29,000	132,706
Tallow	,,	240	36,656	677	24,862
Naphtha and products	,,	1,477,838	4,431,787	1,726,726	5,485,793
Tar and pitch	,,	18,111	82,981	21,774	122,081
Manganese ore	,,	443,532	642,918	451,677	618,906
Sugar	,,	69,119	690,305	176,387	1,539,243
Spirits	Galls.	1,445,561	110,398	1,071,000	79,900

Statement of Certain Articles Exported from Russia to the United Kingdom during the Year 1903, *as compared with* 1902.

Articles.		1902.		1903.	
		Quantity.	Value.	Quantity.	Value.
			£		£
Sugar, raw	Tons	1,016	10,200	4,580	37,931
Linseed	,,	38,936	398,904	45,800	428,187
Rape seed	,,	14,000	..	27,032	129,200
Oil-cake	,,	30,032	183,706	27,371	159,906
Hides and skins	,,	1,548	85,212	1,193	91,633
Manganese ore	,,	133,806	192,418	106,322	148,006
Platinum	Lb.	1,193	97,537	936	34,106
Naphtha and products	Tons	385,016	777,962	526,274	1,387,200

NORWAY; TRADE OF —— IN 1903.

Foreign Office Annual Series, No. 3252.

The following tables show the quantity and value of imports and exports into and from Norway during the years 1902-3:—

Imports.

Articles.		Quantity.		Value.	
		1902.	1903.	1902.	1903.
				£	£
Malt	Tons.	3,773	3,399	45,253	44,290
Sugar	,,	37,553	37,835	402,485	420,213
Brandy and spirits	,,	1,336	1,214	119,120	119,422
Wine in barrels	,,	4,726	4,006	234,000	198,333
Petroleum and paraffin	,,	44,744	58,888	196,892	199,747
Salt	Bshls.	4,017,358	5,064,324	107,348	86,589
Coal, cinders, coke	,,	55,921,660	57,050 570	1,329,664	1,482,621

Exports.

Articles.		Quantity.		Value.	
		1902.	1903.	1902.	1903.
				£	£
Fish oil	Bshls.	331,172	214,533	379,422	271,276
,, guano	Tons.	6,676	6,596	42,233	41,600
Wood-pulp, dry	,,	18,347	19,682	79,818	74,572
,, wet	,,	342,313	333,071	649,603	561,639
Cellulose, dry	,,	100,434	117,654	734,746	760,208
,, wet	,,	18,712	19,445	45,253	59,554
Matches	,,	3,029	2,833	61,656	57,667
Pyrites	,,	105,979	118,148	81,611	91,441
Copper ore	,,	4,847	3,447	12,497	9,747
Condensed milk	,,	9,690	10,241	342,106	360,549
Packing paper	,,	21,821	27,382	204,048	271,111
Worked granite and Labrador	,,	144,282	165,279	134,917	150,005

III.—TAR PRODUCTS, PETROLEUM, Etc.

PETROLEUM PRODUCTS; COUNTERVAILING DUTY ON ——. U.S. CUSTOMS DECISION, AUG. 1904.

Bd. of Trade J., Aug. 25, 1904.

Petroleum is on the "free list" of the United States Tariff, but its free admission is subject to the proviso that the crude article itself and all petroleum products produced in a country which imposes a duty on like articles exported from the United States are to be subject to a duty equal to the duty imposed by such country. It has now been decided that, for the purposes of this proviso, petroleum products manufactured in one country from crude petroleum produced in another country are to be assessed with duty at the rate imposed by the country of origin of the crude petroleum upon *similar products* imported into that country from the United States, and not at the rate levied upon crude petroleum imported into such country from the United States.

X.—METALLURGY.

LEAD; BOUNTIES ON —— IN CANADA.

Bd. of Trade J., Aug. 25, 1904.

The present Act amends the previous Act (No. 31 of 1903) providing for the payment of bounties on lead contained in lead-bearing ores mined in Canada, in so far as it relates to section 5, which reads as follows :—

"5. The said bounties shall cease and determine on the thirtieth day of June, one thousand nine hundred and eight."

The following section is hereby substituted :—

"5. Payment of the said bounty may be made on all such lead-bearing ores mined in Canada, and delivered at smelter in Canada on or after the first day of July, one thousand nine hundred and three; and the said bounties shall cease and determine on the thirtieth day of June, one thousand nine hundred and eight."

BROKEN HILL MINING INDUSTRY IN 1903.

Eng. and Mining J., Aug. 11, 1904.

In the Broken Hill district in New South Wales there were 12 mines in operation during the year 1903, which raised 1,078,442 long tons of sulphide ore, removed 195,969 cub. yds. of material from open cuts, and filled 270,254 cub. yds. into depleted slopes. They used 13,364,399 superficial feet of timber, 330,385 lb. of explosives, 433,089 detonators, and 57,030 coils of fuse, the total value of explosives, including fuse and detonators, being 21,926*l.* The consumption of coal was 70,644 tons. The aggregate of engines was 10,456 h. p., and of boilers 9,300 h. p. The total value of plant on the mines was 620,487*l.* The consumption of explosives per ton of ore raised was about 0·3 lb.; of timber, about 12·5 ft.; of coal, about 0·07 ton. The total number of men employed at the end of the year was 5,626.

From 1,100,514 tons of ore raised there were obtained he following profitable products:—

Galena concentrates, 203,416 tons, containing 5,438,498 z. of silver, 2,135 oz. of gold, 117,078 tons of lead, and 7,063 tons of zinc. Average grade = 26·7 oz. of silver per on, 57·5 per cent. of lead, and 8·4 per cent. of zinc.

Oxidised ore, 22,072 tons, containing 895,681 oz. of ilver and 4,065 tons of lead.

Slimes, 61,498 tons, containing 1,103,350 oz. of silver, 1,654 tons of lead, and 10,035 tons of zinc.

Zinc concentrates, 21,634 tons, containing 295,416 oz. of ilver, 2,606 tons of lead, and 8,385 tons of zinc. Average: 3·7 oz. of silver per ton, 12 per cent. of lead, and 38·8 er cent. of zinc.

The total amount of the profitable products was 308,681 ons, while 826,497 tons of slimes, middlings, and tailings, ontaining 5,029,466 oz. of silver, 52,075 tons of lead, and 48,516 tons of zinc were either dumped on the surface, ith a view to possible future treatment, or were returned the mine as filling.

The 1,100,514 tons of ore raised comprised 22,072 tons f oxidised and 1,078,442 tons of sulphide. The latter ontained 11,867,157 oz. of silver, 183,416 tons of lead, and 84,011 tons of zinc. The average grade of the sulphide re was therefore about 11 oz. of silver, 17 per cent. of ead, and 17 per cent. of zinc.

BOHEMIA; MINING INDUSTRY IN ——.

Foreign Office Annual Series, No. 3255.

In Bohemia there are 21 undertakings for silver mining, f which three were being worked in 1903. The mines are orked by the Imperial Government, and in 1903 produced 1,958 tons of ore, giving 86,000 lb. of silver, worth 38,160*l.*

There are six copper mines in Bohemia, of which one as being worked on a small scale in 1903, and 10 tons of re were produced. In the whole of Austria there were nly 11 being worked, producing 12,688 tons of ore, which ielded 961 tons of copper worth 57,542. There were 10 tons of copper sulphate produced, an increase on 1902 f 62 tons.

Bohemia is particularly rich in iron ore deposits, and ey are to be met with in all parts of the Kingdom. The chest deposits are in the strata of silurian formation nning south-west to north-east from Bischofteinity rough Pilsen, Beraun, and Prague, as far as the River lbe at Celakowitz, for a distance of over 20 miles. It tains its greatest breadth (10 miles) in the neighbourhood Pilsen, whilst towards the Elbe it gradually narrows own to 4 miles. This silurian basin contains an almost exhaustible quantity of iron ore. The iron ore beds etween Prague and Beraun are now being worked, and oduce more than one-third of the total output in Austria. eside the underlying beds with fine-grained hæmatite, ontaining over 50 per cent. of iron, two hanging beds are eing worked, containing some reddish-brown oolitic ematite of great purity, yielding as high as 52 per cent. iron, but more frequently red clay iron ore with a yield from 30 to 40 per cent. of iron. This ore forms the chief chness of the silurian beds of Bohemia. In the year 1903, 3,435 tons of iron ore were produced from 20 mines, out of a total of 78 in Bohemia. In the whole of Austria 37 mines were being worked last year, producing 1,715,984 tons of iron ore, at an average price of 7*s.* 2*d.* per ton. The production was 28,312 tons less than in 1902. The amount of crude iron produced in Bohemia in 1903, in 10 works, was 286,593 tons. The total in Austria was 970,833 tons in 38 works.

NORWAY; MINING INDUSTRY OF ——.

Foreign Office Annual Series, No. 3252.

The copper and pyrites mines at Trondhjem have been worked with good results during 1903, and one mine, which had not been worked for 200 years, has been restarted, and is very rich. The existence is reported of iron veins of some importance at Larvik and Sandefjord. The molybdenite mines at Hekkefjord are reported as not being a success. About 30 tons, valued at from 150*l.* to 200*l.* per ton, were exported last year. These prices did not pay, so that the company are now turning their attention to ferromolybdenum, which it is anticipated will yield better results. A large quantity of copper, iron and copper pyrites, amounting in all to 63,446 tons, and valued at 139,500*l.*, were exported from Bodö in 1903.

The total number of mining works of all kinds in operation at the close of 1902 is stated to be 37, employing 3,550 workpeople, and yielding produce of the total value of about 310,000*l.*

GOLD AND PLATINUM INDUSTRY IN RUSSIA.

Foreign Office Annual Series, No. 3253.

Taking the production of gold for 1903 at 1,134,000 oz., the Russian Empire comes fourth on the list of gold producing regions, and produces 7 per cent. of the whole world's supply. A large tract in Northern Manchuria was being prospected and worked under Australian management when war broke out. In the Ural district great efforts are being made to develop the industry.

In the valley of the river Ivalo, at Kultana, about halfway between the Arctic Ocean and the Gulf of Bothnia, work has been carried on since 1870, but, though the ore is described as being rich (1·96 to 3·25 grms. per cb. m.), the yield from that date to 1899 is valued at only 55,000*l.* The Finnish gold-bearing district is a tableland about 30 miles long by 10 miles broad; the richest finds have been made near Haugasoja, on a southern affluent of the Ivalo: veins of quartz yielding 67·7, 78·7, 217·4, and even 289·6 grms. per ton, are alleged to have been crushed, but the financial results do not appear to have been great so far. The quantity of platinum mined in 1903 was a little under 6 tons (366 poods against 374 poods in 1902). Only a trifling quantity was worked up into articles in Russia, the rest being sent abroad in its natural or refined state, exactly one-half of it to the United Kingdom, against four-fifths in 1901. There is a continually increasing demand for platinum for the making of jewellery, chemical and assaying apparatus.

XII.—FATS, FATTY OILS, Etc.

COD FISHERIES IN NORWAY.

Foreign Office Annual Series, No. 3252.

The winter fisheries of cod yielded 44,600,000 fish against 41,000,000 in 1902 and 40,000,000 in 1901. The average for the preceding 35 years was 53,000,000. The fish were, however, very light in weight. The production of cod-liver oil was the smallest for many years, owing to the poor quality of the fish—amounting to only 3,000 barrels. Prices opened at 9*l.* per barrel, but later rose to 24*l.* per barrel. The total quantity exported was about 25,000 barrels against 34,500 barrels in 1902. For other sorts of fish oil 7,000 barrels of liver were obtained against 21,900 barrels in 1902.

XIII. C.—INDIA-RUBBER, Etc.

INDIARUBBER EXPORT FROM THE AMAZON.

Bd. of Trade J., Aug. 25, 1904.

The following table, showing the quantity of indiarubber exported from the river Amazon during the year 1903–04, including direct shipments from Iquitos (Peru) and Serpa (State of Amazonas) and rubber in transit from Bolivia, has been compiled from figures furnished by H.M. Consul at Pará:—

To Europe.

	Manaos.	Para.	Iquitos.	Serpa.
	Kilos.	Kilos.	Kilos.	Kilos.
Fine	3,636,085	4,012,093	621,703	3,790
Medium	556,158	434,520	160,769	..
Coarse	801,589	1,695,314	249,254	1,143
Caucho	1,665,521	638,869	1,033,283	..
Total	6,659,353	6,780,796	2,005,009	4,933

To United States of America.

	Manaos.	Pará.	Iquitos.	Serpa.
	Kilos.	Kilos.	Kilos.	Kilos.
Fine	5,262,373	2,114,249	2,999	..
Medium	1,131,216	389,200	179	..
Coarse	1,207,758	3,764,577	1,050	..
Caucho	1,137,003	65,410	7,386	..
Total	8,738,350	6,333,436	11,614	..

The total quantity of rubber exported to Europe during the year 1903–4 was 15,450,091 kilos., as compared with 15,260,651 kilos. during the previous year; 15,083,400 kilos. was exported to the United States of America, as compared with 14,565,816 during the previous year; while the total export figures are 30,533,491 kilos. for 1903–4, and 29,826,467 for 1902–3.

XVI.—SUGAR, STARCH, Etc.

SUGAR FACTORY IN TURKESTAN.

Foreign Office Annual Series, No. 3253.

A well-equipped sugar factory, worked by hydraulic power on the turbine system, has been built at Kauf mannskaya station, 30 versts (about 20 miles) from Tashkent, being the first establishment of the kind in Turkestan; it is to begin working in the autumn of 1904, when the first crop of beetroot is harvested; it cost 60,000*l*.. and is to turn out 5,000 tons of sugar annually. Over 3,000 acres of beetroot are being planted, and in 1905 the area is to be increased to 10,000 acres of irrigated land; the white beet yields 24 cwt. of sugar per acre, the red beet less.

XVII.—BREWING, WINES, SPIRITS, Etc.

ALCOHOL FOR INDUSTRIAL PURPOSES; DUTY-FREE ——.

The Times, Sept 3, 1904.

The Chancellor of the Exchequer has appointed the following gentlemen to serve as members of a committee to inquire into the use of duty-free alcohol for industrial purposes:—Sir Henry Primrose, K.C.B., C.S.I., chairman; Prof. Sir William Crookes, F.R.S.; Sir W. H. Holland, M.P.; the Hon. J. Scott-Montagu, M.P.; Lothian D. Nicholson, Esq.; Dr. W. Somerville; Dr. T. E. Thorpe, C.B., F.R.S.; Thomas Tyrer, Esq.

The terms of reference are:—"To inquire into the existing facilities for the use, without payment of duty, of spirits in arts and manufactures, and, in particular, into the operation of section 8 of the Finance Act, 1902; and to report whether the powers conferred upon the Commissioners of Inland Revenue by this section permit of adequate facilities being given for the use of spirits in manufactures, and in the production of motive power, or whether further facilities are required; and, if it should appear to the committee that the present facilities are inadequate, to advise what further measures could be adopted without prejudice to the safety of the revenue derived from spirits and with due regard to the interests of the producers of spirits in the United Kingdom."

All communications should be directed to Sir Henry Primrose, K.C.B., at Somerset House, Strand, W.C.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 17,772. Forbes. Filtering apparatus.* Aug. 16.
„ 17,795. Marshall. Filters or gas purifiers. Aug. 16.
„ 17,816. Elmore. Processes and apparatus for separating certain constituents of finely divided material by causing them to rise or float in a liquid. Aug. 16.
„ 17,854. Sharratt and Sharratt. Kilns, ovens, furnaces and the like. Aug. 17.
„ 17,957. Tobler, and Rhein. Webstuhl and Appreturmaschinenfabr. Drying apparatus.* Aug. 18.
„ 18,094. Marlow and E. Allen and Co. Drying apparatus. Aug. 20.
„ 18,305. James. Apparatus for ascertaining the specific gravity of liquid or semi-liquid material. Aug. 24.
„ 18,382. Féry, and Cie. pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. Pyrometers.* Aug. 24.
„ 18,488. Lennox. Evaporators for evaporating the liquid in brewers' wash, sewage, waste or spent dyes, &c. Aug. 26.
„ 18,512. Lake (Dessoliers and Regnier). Apparatus for treating solids with liquid, fluid, or gaseous agents.* Aug. 26.
„ 18,531. Zeal. Thermometers. Aug. 26.
„ 18,539. Helm. Cooling apparatus. Aug. 26.
[C.S.] 23,183 (1903). Sellenscheidt. Method of and apparatus for decanting fluids under pressure. Aug. 24.
„ 11,839 (1904). Cautley. Centrifugal hydro-extractors. Aug. 31.
„ 14,434 (1904). Reese. Whisking, agitating, and mixing machines. Aug. 24.
„ 15,713 (1904). Paradis. Funnels. Aug. 24.
„ 15,875 (1904). Waldbaur. Apparatus for heating liquids. Aug. 31.

II.—FUEL, GAS, AND LIGHT.

[A.] 17,712. Nash. Gas producers.* Aug. 15.
„ 17,795. Marshall. *See under* I.
„ 17,906. Zuiderhoek. Process for the manufacture of coke briquettes. Aug. 17.
„ 18,047. Haber. Process of and means for controlling the composition of gaseous mixtures. Aug. 20.
„ 18,214. Hatton. Operating gas producers. Aug. 23.
„ 18,262. Koppers. Coke ovens.* Aug. 23.
„ 18,364. Verdier and Teuton. Gas retorts. [Fr. Appl., Sept. 2, 1903.]* Aug. 24.
„ 18,456. Shiels. Production of combustible vapour or gas. Aug. 25.
„ 18,487. Junkers. Method of and apparatus for determining the heating value of fuel. [Ger. Appl., Sept. 1, 1903.]* Aug. 26.

[C.S.] 21,149 (1903). Crossley and Rigby. Gas producers. Aug. 24.

„ 2240 (1904). Capitaine. Method of and means for purifying the gas of gas producers. Aug. 31.

„ 5333 (1904). Dewey. Mantles for incandescent gas burners. Aug. 24.

„ 11,948 (1904). Guilbaud. Apparatus for generating gas. Aug. 24.

„ 12,221 (1904). Deschamps. Gas producers. Aug. 31.

„ 14,007 (1904). Diehl, Showalter, Grube, and Showalter. Apparatus for producing air-gas. Aug. 24.

„ 16,067 (1904). Grice. Gas producers. Aug. 31.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 18,301. Schnell. Means for rendering petroleum or petroleum spirit non-inflammable until heated or vapourised. Aug. 24.

IV.—COLOURING MATTERS AND DYESTUFFS.

[C.S.] 17,982 (1903). Johnson (Badische Anilin und Soda Fabrik). Oxidation of methyl groups of aromatic hydrocarbons. Aug. 24.

„ 22,289 (1903). Raosford (Cassella and Co.). Manufacture of *p*-acetylamino-*o*-aminopheuol and dyestuffs therefrom. Aug. 24.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 17,775. Hunter, Moser, and Burrows. Retting and preparing fibrous stems or straws, especially flax, preparatory to scutching. Aug. 16.

„ 17,822. Carstanjen. Mordanting and loading silk and other textile fabrics. Aug. 16.

„ 18,056. Rhodes. Apparatus for dyeing and otherwise treating with liquids wool, yarn, and other fibrous material. Aug. 20.

„ 18,069. Dawson. Wool washing and scouring machinery. Aug. 20.

„ 18,084. Sherman. Treatment of rhea, grass, wood fibre, and the like. Aug. 20.

„ 18,194. Brossard. Apparatus for dyeing, cleaning washing, and the like. Aug. 22.

„ 18,488. Lenuox. *See under* I.

[C.S.] 22,189 (1903). Thompson (Wyser). Apparatus for mercerising yarn. Aug. 24.

„ 22,869 (1903). Beutner. Dyeing apparatus. Aug. 24.

„ 6728 (1904). Knnp. Process for dyeing silk a blue-black colour after it is weighted. Aug. 24.

„ 13,090 (1904). Haddan (Elosegui). Fulling of woollen fabrics or other fibres or materials adapted to be felted. Aug. 24.

„ 15,978 (1904). Bauersachs and Brückner. Processes of dyeing cops. Aug. 31.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

[A.] 18,096. Abel (Act.-Ges. f. Anilinfabr.). Process of dyeing leather. Aug. 20.

„ 18,303. Dean and Co., Ltd., and Possnett. Method of and means for dyeing skins in the manufacture of leather. Aug. 24.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 17,794. Lake (Soc. Anon. Ing. L. Vogel per. la Fabr. di Concimi Chimici). The manufacture of sulphuric acid. Aug. 16.

„ 17,888. Wilton. Treatment of leucite or other alkali aluminium silicates for the obtainment of useful products. Aug. 17.

„ 17,985. Lake (Soc. Romana Solfati). Treatment of leucite and similar aluminious silicates. Aug. 18.

[A.] 18,049. Le Sueur. Liquefying air. Aug. 20.

„ 18,239. Brindley. Treatment of spent acid from galvanisers' liquors and the like, and the manufacture of the pigment oxide of iron. Aug. 23.

„ 18,283. Carter. Manufacture of sulphate of ammonia. Aug. 23.

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I.—PLANT, APPARATUS, AND MACHINERY.

ENGLISH PATENTS.

Evaporating or Concentrating Apparatus. J. and C. McNeil, Govan, Scotland. Eng. Pat. 20,777, Sept. 28, 1903.

A HOLLOW shaft, divided internally into steam and water spaces, is provided with projecting radial pipes, also divided internally into steam and water spaces, which latter communicate with the steam and water spaces of the shaft. The whole is arranged in a vacuum pan. Means are provided for rotating the shaft, for introducing the steam, and for allowing the condensed water to escape.
—W. H. C.

Roasting Chemicals and the like; Apparatus for ——. T. P. Thomas, J. L. Richardson, and P. Davies, Swansea. Eng. Pat. 21,896, Oct. 12, 1903.

THE apparatus, which is specially suitable for the manufacture of oxalic acid, consists of a shallow circular pan which can be rotated above a furnace. Above the pan are girders from which depend suitable, adjustable, stationary stirrers. A cover luted in sand encloses the pan and stirrers in such a way as to prevent the escape of the gases except by the proper exit.—W. H. C.

Decanting Fluids under Pressure; Method of and Apparatus for ——. C. Sellenscheidt, and Filter u. Brautechn. Maschinen Fabr., A.-G., vorm. L. A. Enzinger, Berlin. Eng. Pat. 23,183, Oct. 26, 1903.

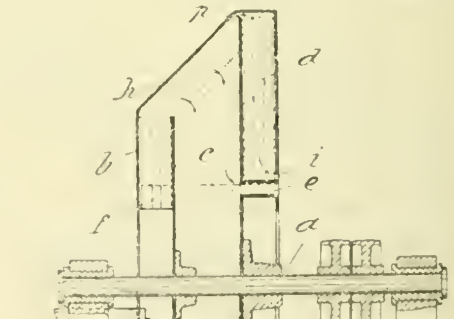
SEE Fr. Pat. 338,188 of 1903; this J., 1904, 600.—T. F. B.

Casks or Vessels from which Liquid is Discharged under Pressure; Impts. in ——. O. Imray, London. From Deutsche Steinzeugwaaren Fabrik für Canalisation und Chem. Ind., Friedrichsfeld, Germany. Eng. Pat. 14,752, June 30, 1904.

THE air inlet and discharge-valves are operated by separate floats, in such a manner that the air supply is cut off before the vessel is quite emptied of liquid. The expansion of the compressed air completes the emptying.—W. H. C.

Purifying Liquids by Centrifugal Force; Apparatus for ——. G. Sagasser, Zwickau, Germany. Eng. Pat. 8181, April 13, 1904.

THE conical drum *b* and the distributing plate *c* are keyed upon the horizontal shaft *a*, which is mounted above a trench, and can be rotated. From the edge of *c* a perforated metal sheet *h* is arranged parallel to the conical wall of the drum, and attached to one side of the mud-collecting chamber *d*. The liquid to be purified, *e.g.*, muddy water, enters by the pipe *g*, which projects into the drum *b* through a central circular opening. The mud, along with a little water, is thrown by centrifugal force against the conical wall of the drum, and passes into the mud collector *d* through the circular channel *p*, whilst the clear water, it is stated, passes through the perforated plate *h*, and flows away through *e*, *e*. At first a small stream of clear water also flows out of the opening *i* in the mud chamber, but when the latter is full, this becomes muddy, and the apparatus is stopped and cleaned out. The clear water and muddy liquid flow away by the two channels *m*



and *n*, either of which can be shut off by the trap *o*. When the apparatus is running, the clear-water channel is left open; when muddy liquid begins to come out of *i*, this is closed and the muddy-water channel is opened.—W. H. C.

Whisking, Agitating, and Mixing Machines. L. C. Reese, London. Eng. Pat. 14,434, June 27, 1904.

Two sets of beaters, revolving the one within the other and in opposite directions, are carried upon a frame. The whole fits into slots arranged in the vertical sides of the pan, and can be removed if required. Suitable means for driving the beaters are provided.—W. H. C.

United States Patents.

Drying Oven. M. M. Suppes and O. Phelps, Elyria, Ohio. U.S. Pat. 768,203, Aug. 23, 1904.

On a suitable perforated base is arranged a movable sheet metal cover, forming the top and side walls of the oven. Means are provided for heating and circulating the air, and for luting the cover with sand.—W. H. C.

Crystallising Apparatus. E. von Seemen and E. Rühle, Rheinfelden, and O. Faller, Basel, Switzerland. U.S. Pat. 768,314, Aug. 23, 1904.

See Eng. Pat. 19,034 of 1902; this J., 1902, 1386.—T. F. B.

French Patents.

Radioactive Substances; Apparatus for Utilising and Storing ——. E. Armet de Lisle. Fr. Pat. 341,833, April 1, 1904.

The radium salt is contained in a glass cup covered by a plate of ebonite which is screwed down to the top of the ebonite cup in which the glass cup stands. The ebonite cup is placed in a leaden vessel with a screw lid, india-rubber rings being used to make tight joints.—L. F. G.

Centrifugal Separator. Aktiebolaget Separator. Fr. Pat. 342,115, Feb. 9, 1904.

Inside the drum of the apparatus, which is provided with a screw cover, two short vertical shafts are placed midway between the centre and the circumference. Each shaft carries a set of curved blades, and a toothed wheel, which engages with another toothed wheel fixed to the central shaft, and is thus rotated in the reverse sense to the drum. The curved blades or rakes remove the solid material deposited on the pervious wall of the drum, and carry it towards the centre, where it falls through an aperture into an annular space below, from which it is expelled by the action of centrifugal force through suitable holes to the outside of the apparatus. The cover of the drum is provided with an inlet pipe and a suitable distributor, and with holes for the escape of the separated liquid.—L. F. G.

II.—FUEL, GAS, AND LIGHT.

Combustion; Retardation of —— by Oxygen. H. E. Armstrong. Proc. Roy. Soc., 1904, **74**, 85—89.

According to H. B. Dixon, carbon monoxide, rather than the dioxide, is the initial product of the combustion of carbon and its gaseous compounds; and the same author has shown that water plays a peculiar and all-important part in the combustion of the monoxide; and, further, that in a number of cases oxygen is by far the most effective diluent in retarding combustion. As an explanation of these results and also of later ones by Bone and Wheeler (Chem. Soc. Trans., 1902, **81**, 536; 1903, **83**, 1074) and Bone and Stockings (this J., 1904, 601), the author puts forward the following views as to the mechanism of combustion:—(1) In the combustion of hydrocarbons, the latter initially merely undergo hydroxylation. (2) At a certain stage in the hydroxylation, thermoschisms begin to take place. Thus dihydroxymethane breaks up as soon as it is formed, into water and formaldehyde, which latter is, in turn, easily resolved into hydrogen and carbon monoxide, $CH_2(OH)_2 \rightarrow CH_2O + OH_2 \rightarrow CO + H_2 + OH_2$. In like manner, dihydroxyethane gives rise to acetaldehyde, which, under some conditions, breaks up into methane and and carbon monoxide, $C_2H_4(OH)_2 \rightarrow CH_3.COH + OH_2 \rightarrow CH_4 + CO + OH_2$. (3) In the case of more complex hydrocarbons, these are to a large extent resolved into thermoschisms prior to oxidation, *e.g.*, $C_6H_{14} \rightarrow C_3H_8 + C_3H_6$; $C_2H_6 \rightarrow C_2H_4 + H_2$. The change may extend even to the formation of carbon when a relatively small proportion of oxygen is present. It is probable that such thermoschisms play an all-important part in high temperature changes (explosions). (4) The reaction by which the oxygen is introduced into the hydrocarbon molecule is regarded as being electrolytic in character, the electrolyte, *i.e.*, conducting water, being the immediate source of the oxygen, whilst the oxygen molecule plays the part of depolariser; it is probable that the water molecules contribute hydroxyl rather than oxygen. The process may be formulated as involving the conjugation of hydrocarbon with water (acting primarily as the catalyst or associating agent) and oxygen, thus:—

$$\begin{array}{c} H_3C \\ \dot{H} \end{array} + \begin{array}{c} OHH \\ OHH \end{array} + \begin{array}{c} O \\ \ddot{O} \end{array} \longleftrightarrow \begin{array}{c} CH_3.OH \\ HOH \end{array} + \begin{array}{c} HO \\ \dot{H}O \end{array}$$

(5) Carbon dioxide is the final product of the change, and in its formation from the monoxide the latter is first converted into formic acid. This affords an explanation of why the presence of so large a proportion of water is required in order that the explosive wave may attain to its greatest velocity, the affinity of water for carbon monoxide being relatively slight, and the reversible change one which takes place mainly in the direction $HCO(OH) \rightarrow CO + OH_2$. (6) Oxygen has a marked influence in retarding the combustion of electrolytic gas, whilst hydrogen has the opposite effect, and nitrogen retards the explosion less than does an excess of oxygen. In seeking for an explanation of these facts, the author points out that the stability of hydrogen peroxide is at a maximum at a high temperature, and that probably water is readily oxidised at temperatures such as prevail in explosions. Then, if the formation of water be regarded as involving the changes—

$$\begin{array}{c} H \\ \dot{H} \end{array} + \begin{array}{c} OHH \\ OHH \end{array} + \begin{array}{c} O \\ \ddot{O} \end{array} \longleftrightarrow \begin{array}{c} HOH \\ HOH \end{array} + \begin{array}{c} HO \\ \dot{H}O \end{array}$$

$$2H_2O_2 \longleftrightarrow 2H_2O + O_2,$$

it follows that water and oxygen will mutually hold each other in check, owing to formation of hydrogen peroxide, which may be looked upon as relatively, if not entirely, inoperative as an oxidising agent at high temperatures in presence of oxygen. The influence of hydrogen in accelerating the combustion is also explicable by the above view, the hydrogen serving to promote the dissociation of the hydrogen peroxide, by diminishing the proportion of active oxygen present.—A. S.

Pentane Lamp; Investigations on the ——. C. C. Paterson. Brit. Assoc., 1904. J. Gas Lighting, 1904, **87**, 606.

Investigations have been carried out at the National Physical Laboratory in order to determine the influence on the Harcourt 10-candle pentane lamp of variations in: (1) the barometric pressure, and (2) the amount of water-vapour present in the air. Photometric comparisons were made against two large-bulb Fleming-Ediswan electric standard glow lamps. The double-comparison method was employed, the electric lamps being used to standardise a comparison glow lamp anew for each experiment, so that it was only necessary to burn the standards for 5 or 10 minutes at a time. From the results of upwards of 60 observations under different conditions, such as are obtained in ordinary practice, the following formula has been deduced for correcting the candle-power of the lamp to the standard atmospheric conditions of 760 mm. of mercury and 10 litres of water vapour per cb. m. of pure dry air:—Candle-power $= 10 + 0{\cdot}066\ (10 - \epsilon) - 0{\cdot}008\ (760 - b)$, where ϵ is the humidity, and b the height of the barometer in mm. The humidity ϵ represents the number of litres of water vapour per cb. m. of pure dry air at the barometric pressure existing at the time so that if b = height of barometer in

mm., e = aqueous pressure, e_1 = vapour pressure of carbon dioxide present in the atmosphere, then $\epsilon = \frac{e}{b - e - e_1} \times 1000$. The standard humidity of 10 litres per 1000, is the mean value for three years found at the Kew Observatory. From the formula given above it follows that a variation of 1 litre per cb. m. in the moisture causes a variation in candle-power of about 0·7 per cent., and that a change of 10 mm. in barometric pressure brings about an alteration of 0·8 per cent. in the illuminating power of the lamp.
—A. S.

English Patents.

Briquets; Process for Producing Pit-Coal and Coke ——. C. Plate, Bonn, and J. Lieb, Cologne, Germany. Eng. Pat. 17,074, Aug. 5, 1903.

See Fr. Pat. 334,257 of 1903; this J., 1904, 15.—T. F. B.

Fuel; Agglomerant for Use in the Manufacture of Compressed ——, *and a Process of Preparing the same.* R. Middleton, Leeds. Eng. Pat. 17,471, Aug. 12, 1903.

See Fr. Pat. 339,370 of 1904; this J., 1904, 709.—T. F. B.

Coke Ovens. H. Koppers, Essen, Germany. Eng. Pat. 17,283, Aug. 8, 1903.

See U.S. Pat. 753,146 of 1904; this J., 1904, 365.—T. F. B.

Peat and Materials evolving Volatile Products; Apparatus for Treating ——. E. K. Carmichael. Eng. Pat. 17,096, Aug. 16, 1903. III., page 897.

Burning Liquid Fuel; Apparatus for ——. P. Davies, Southfields, Surrey, and The Hydroleum Co., Ltd., London. Eng. Pat. 20,059, Sept. 17, 1903.

The invention relates more particularly to the combustion chambers of apparatus of the type described in Eng. Pat. 14,791 of 1898 (this J., 1899, 745). The combustion chamber claimed comprises a casing, preferably of metal, lined or not with refractory material, into which the fuel-supply-pipe projects; and a laminated structure of refractory material constituting the firing plate; the two communicating with each other at adjacent ends, and being situated and supported respectively at the exterior and the interior of the heating chamber, furnace, fire-box, or the like. The laminated structure consists of angular members spaced apart, the outer members being rectangular or polygonal and the inner ones more or less L-shaped.—A. S.

Gas Producers. W. J. Crossley and T. Rigby, Manchester. Eng. Pat. 21,149, Oct. 2, 1903.

See Fr. Pat. 341,970 of 1904, following these.—T. F. B.

Gas-Plant, comprising Generator Base, Gas Washer, Gas Chamber, Cooling Water Reservoir, and Motor Cylinder Casing: One-Part Foundation Frame for a Complete Suction ——. J. Hillenbrand, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 11,853, May 24, 1904. Under Internat. Conv., Jan. 25, 1904.

A combined frame and base for a complete gas plant and motor is formed so as to receive the different parts, as indicated by the title, and combine them into a compact unit, the frame and base being cast in one piece, or consisting of several castings bolted together.—H. B.

Gas; Apparatus for Generating ——. F. E. Guilbaud, Levallois-Perret, France. Eng. Pat. 11,948, May 25, 1904.

A generator for the production of low-grade gas is charged continuously from below by means of Archimedean screws, which convey the fuel into the lower part of the combustion shaft of the generator. A water-sealed trough receives the cinders, which fall from an outlet arranged a short distance above the fire-grate. A superincumbent body of incandescent fuel prevents the escape of smoke in the gas produced. The Archimedean screws may be arranged horizontally, to feed the fuel through a conduit curving upwards into the vertical combustion shaft; or they may work in straight, inclined conduits, arranged almost tangentially to the inner circumference of the shaft, so that a slight rotary movement is imparted to the stack of fuel in the shaft.—H. B.

Air-Gas; Apparatus for Producing ——. G. C. Diehl, H. M. Showalter, W. H. Grube, and J. W. Showalter, Butler, Ind., U.S.A. Eng. Pat. 14,007, June 21, 1904.

Gasoline is fed under pressure from a closed reservoir into a vaporising retort, which is heated by means of a burner supplied with gas from the retort. The main body of gas produced is injected, along with air, into a pipe which rises through the reservoir itself and thence to the place of consumption, this pipe, from its lower end to the part which comes out of the top of the reservoir, being surrounded by a wider pipe, serving as a jacket through which a stream of warm air rises and prevents the condensation of the gas by the cold gasoline. The reservoir is provided at the top with a safety valve, consisting of an upright pipe leading to the outer air and having a diaphragm or valve adapted to give way if the internal pressure becomes excessive, a by-pass pipe permitting the escape of air while the reservoir is being refilled with gasoline.—H. B.

Gasification of Coal or other Materials in the Production of Illuminating or Heating Gas; Apparatus for Use in the ——. C. C. Carpenter, London. Eng. Pat. 14,718, June 30, 1904.

A vertical retort opens at its lower end into a horizontal chamber, in which coke or other residual material collects. In the horizontal chamber is a "pusher," for the removal of the coke. The pusher consists of a cutter, which cuts through the pile of coke at the intersection of the vertical retort and the horizontal chamber, and a shield behind the cutter, which prevents the contents of the vertical retort falling behind the head of the pusher.—W. C. H.

United States Patents.

Peat Blocks; Manufacture of ——. F. W. Gaertner, St. Petersburg. U.S. Pat. 768,445, Aug. 23, 1904.

A cold, dry mixture of peat, powdered rosin, and powdered sulphur is subjected to pressure and slight heating.
—W. H. C.

Hydrocarbon Burner. A. M. Hunt and T. Mirk, San Francisco. U.S. Pat. 768,367, Aug. 23, 1904.

The burner comprises a rectangular frame; a horizontal partition wall in the same, having a series of openings at the sides; air flues extending longitudinally below and communicating with the openings; a longitudinal vaporising flue upon the partition, between the openings, provided with slits alternately upon the sides and top, and with a feeding arrangement for the hydrocarbon, and a body of broken refractory material within the frame, covering the top and sides of the vaporising flue and partition wall.—H. B.

Hydrocarbon Burner [Furnace]. A. M. Hunt and T. Mirk, San Francisco. U.S. Pat. 768,368, Aug. 23, 1904.

The furnace consists, as shown in the diagram, of a closed outer wall, with an opening in the lower part of one end to admit air; the combustion chamber is formed by two horizontal partitions, extending nearly the entire length of the outer casing, the upper partition having an opening, 9, to admit the air; the side walls of the outer casing also form the side walls of the combustion chamber. The hydrocarbon is introduced through the nozzle 4, fixed at a point immediately below the opening 9.—T. F. B.

Gas-Generator. J. H. Eustace, Assignor to J. Williamson, Chicago. U.S. Pat. 767,217, Aug. 9, 1904.

The generator consists of a furnace for heating fuel and superheating steam. Above the furnace, and communicating with it, is a carburetter, by the side of which is a superheater, each of these being filled with chequer brickwork. At one end the carburetter and superheater communicate, and at the other end they are closed to each other. Communicating with the furnace is a chamber in which the superheated steam and "carbonaceous oil" mix, and pass into the carburetter, and thence into the superheater, where the fixed gas is formed.—W. C. H.

Waste Gases; Process of Utilising ——. A. Schütt, Charlottenburg, Germany. U.S. Pat. 768,404, Aug. 23, 1904.

Hot waste gases are brought into contact with water in a finely-divided condition travelling in an opposite direction, the water being thus heated to the boiling point. The amount of water supplied is greater than can be converted into steam; the portion remaining liquid absorbs impurities from the gases. The vapour and the purified gases are utilised in heating a liquid of low boiling point.—E. S.

Gas-washing Mechanism. A. M. Hunt and W. S. Dole, San Francisco. U.S. Pat. 768,369, Aug. 23, 1904.

Between the gas-producer and scrubber are arranged a number of washers, comprising a series of compartments containing the washing liquid, through which the gas has to bubble on its way to the scrubber, means being provided for closing the passage through any of the washers at will.—H. B.

Electrical Apparatus for Clearing Gas. C. G. Hardie. U.S. Pat. 768,450, Aug. 23, 1904. XI. A., page 904.

Incandescent Filaments and Mantles; Manufacture of ——. A. M. Plaissetty, Paris. U.S. Pat. 768,073, Aug. 23, 1904.

See Fr. Pat. 321,803 of 1902; this J., 1903, 291.—T. F. B.

French Patents.

Fuel Briquettes and their Manufacture. M. G. Larondie. Fr. Pat. 338,863, June 15, 1903.

The fuel consists of 91·8 parts of coal, 8 parts of cellulose, and 0·2 part of dry sodium nitrate. The cellulose, in the form of rags, is treated in an autoclave with a dilute soda-lye, and warmed till a clear pulp results. This pulp is then mixed with crushed coal treated with a solution of sodium nitrate, and the mixture thoroughly heated and stirred. The mass is then heated in an autoclave under a pressure of eight atmospheres, and, when dry, compressed into blocks by a hydraulic press.—L. F. G.

Agglomerating Finely-divided Materials [Fuel Briquettes, &c.]; Process for ——. Soc. Anon. des Mines de Houille de Montrelais, Mouzeil et Languin. Fr. Pat. 341,751, April 1, 1901.

Coal, anthracite, lignites, peat, sawdust, leather waste, or other similar material is treated with a solution of a colloid, such as gelatin, gum, or rosin, to which a suitable oxidising agent, such as formol, potassium permanganate, potassium bichromate, or iron perchloride has been added, and the mass formed into blocks and dried. For instance, 92 parts of sawdust are mixed with 8 parts of a solution containing 5 per cent. of gelatin and 2 per cent. of formol. The block, after drying, is stated to possess all the properties of wood, and can be worked and cut.—L. F. G.

Agglutinant for Agglomerating Finely-divided Materials, which becomes Insoluble after Drying, [Fuel Briquettes, &c.] Soc. Anon. des Mines de Houille de Montrelais, Mouzeil et Languin. Fr. Pat. 341,752, April 1, 1904.

The agglutinant is used for the materials specified in Fr. Pat. 341,751 (see preceding abstract), and consists of 1 part of gelatin, to which one-twentieth part of potassium bichromate has been added, dissolved in 4 parts of water. This is then mixed with 99 parts of anthracite powder, the mass formed into balls, and dried for four to five hours at a temperature of 100°—150° C.—L. F. G.

Fuel; Manufacture of Artificial ——. Graigola Merthyr Co., Ltd. Fr. Pat. 341,771, March 30, 1904. Under Internat. Conv., April 6, 1903.

See Eng. Pat. 7871 of 1903; this J., 1904, 539.—T. F. B.

Gas Producers; Apparatus for Regulating the Supply of Steam to ——. P. M. V. Guignard. Fr. Pat. 341,791, March 31, 1904.

In this apparatus the pressure in the exhaust of the motor, which is fed by the producer, is utilised for regulating automatically the supply of steam to the producer, in accordance with the gas consumption. A branch pipe from the exhaust enters the upper end of a closed box containing water, and, at each explosion of the motor, the pressure created temporarily within the box forces some of the water up a pipe into a tank above. This tank has an outlet so adjusted that, as the speed of the motor increases (the amount of water forced up into the tank increasing accordingly), the level of the water in the tank rises, and *vice versa.* The water flowing out of the tank passes down into the box again, through a non-return valve; there is thus an almost continuous circulation of the water in the box and tank. A float inside the tank is connected to the steam-supply valve of the producer, and hence, as the float rises or falls with the level of the water, the steam supply is regulated.—H. B.

Gas Producers. W. J. Crossley and T. Rigby. Fr. Pat. 341,970, April 7, 1904.

A gas producer, the lower end of which rests within a hydraulic seal, is provided with a rotary conical grate, mounted on ball bearings carried by a central cylinder into which the air, or air and steam, is led on its way through the grate. The mechanism for rotating the grate is protected from excessive heating by being situated in one of the conduits through which the air, or air and steam, is led to the central cylinder. The conical grate is of such size as to support only a part of the superincumbent fuel, so that the rotation may be effected easily.—H. B.

Barytic Ores; Preparation of —— *for the Production of a Double Carbide of Barium and Calcium.* J. Cartier. Fr. Pat. 342,036, April 11, 1904. VII., page 901.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

English Patents.

Peat and Materials Evolving Volatile Products; Apparatus for Treating ——. E. K. Carmichael, Edinburgh. Eng. Pat. 17,096, Aug. 6, 1903.

Peat powder, obtained by drying and separating the fibre from peat in an apparatus which forms a part of this patent, is fed through a hopper into a horizontal cylinder provided with a rotating rod, on which are fixed blades to convey the material along the cylinder to an outlet at the further end. There are several of such cylinders arranged one above the other in a furnace, the material being conveyed from one to the other by similar rotating rods. The furnace is so arranged that the lower tubes are more strongly heated. The volatile products are removed from each cylinder by means of outlet pipes, and the hot carbonised material from the lowest cylinder is led through a pipe which passes through a boiler containing water, the steam thus generated being led back to the lowest carbonising cylinder, thereby generating water-gas.—T. F. B.

Filtering and Washing [Lubricating] Oils; Apparatus for ——. C. W. Brown. From W. F. Warden. Eng. Pat. 14,216, June 23, 1904. XII., page 905.

French Patent.

Benzene, Alcohol, Oil of Turpentine, and Petroleum; Process for Rendering —— Uninflammable. G. H. Dilette and J. Talabot. Fr. Pat. 341,927, Feb. 10, 1904.

Carbon tetrachloride is added to the following substances in the proportions given to produce non-inflammable products: benzene or mineral oils, about 15 per cent.; alcohol or oil of turpentine, about 50 per cent. (See also Fr. Pat. 341,158 of 1904; this J., 1904, 885.)—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

English Patents.

p-Acetylamido o-amidophenol, and [Azo] Dyestuffs therefrom; Manufacture of ——. R. B. Ransford, Upper Norwood. From L. Cassella and Co., Frankfort-on-Maine, Germany. Eng. Pat. 22,289, Oct. 15, 1903.

p-Acetylaminophenol is nitrated at a low temperature and the nitro compound reduced, *p*-acetamino-*o*-aminophenol being obtained. On coupling the diazo compound of this substance with amines, phenols, or their derivatives, azo dyestuffs dyeing various shades are produced. Thus, the dyestuff obtained by coupling with 1.8-aminonaphthol-5-sulphonic acid gives bluish-violet shades on wool, converted into blackish-blue on chroming; whilst that obtained from 2.5-aminonaphthol 7-sulphonic acid gives red shades, converted into blackish-violet on chroming. The dyestuffs obtained by coupling with the following compounds are also described: aminonaphtholmonosulphonic acids 2.3.6 and 2.6.8; aminonaphtholdisulphonic acids 1.8.3.6 and 1.8.2.4; dihydroxynaphthalenemonosulphonic acid 1.8.4; and dihydroxynaphthalenedisulphonic acid 1.8.3.6.
—T. F. B.

Sulphur Dyes [Sulphide Dyestuffs]; Manufacture of Colouring Matters of the Class known as ——, and of an Intermediate Product of the said Manufacture. H. C. Cosway and the United Alkali Co., Ltd., Liverpool. Eng. Pat. 22,966, Oct. 23, 1903.

Dinitrobenzene and sulphanilic acid are heated together in alkaline solution, and the solution acidified; the product obtained thus is salted out of the solution, and heated with an equal weight of *p*-aminophenol, six times its weight of sodium sulphide, and one half its weight of sulphur, until the melt becomes dry. The resulting product dyes green shades, fast to light, acids, and alkalis.—T. F. B.

Anthracene Series; Production of Colouring Matters of the ——, and of Intermediate Products relating thereto. [Anthracene Dyestuffs.] J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 23,179, Oct. 26, 1903.

See Addition, of Oct. 26, 1903, to Fr. Pat. 319,618 of 1902; this J., 1904, 368.—T. F. B.

Sulphurised [Sulphide] Dyestuffs; Manufacture of ——. O. Imray, London. From Soc. Chem. Ind. in Basle. Eng. Pat. 23,188, Oct. 26, 1903.

See Fr. Pat. 337,316 of 1903; this J., 1904, 186.—T. F. B.

Glucosides possessing Colouring or Tanning Properties; Processes for Extracting from Vegetable Matters ——, and the Products resulting from such Processes. F. J. Oakes, New York. Eng. Pat. 9932, April 30, 1904.

See U.S. Pat. 759,008 of 1904; this J., 1904, 604.—T. F. B.

United States Patent.

Glycollic Acid Anilide Orthocarboxylic Acid and Process of Making Indigo. B. Homolka, Frankfort, and F. von Bolzano, Assignors to Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine, Germany. U.S. Pat. 768,455, Aug. 23, 1904.

See Eng. Pat. 4538 of 1903; this J., 1904, 16.—T. F. B.

French Patents.

Basic Dyestuffs; Production of Soluble Salts of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 338,857, June 11, 1903.

See Eng. Pat. 12,681 of 1903; this J., 1904, 485.—T. F. B.

Anthracene Series; Production of Dyestuffs of the ——. Badische Anilin und Soda Fabrik. Second Addition, dated March 2, 1904, to Fr. Pat. 338,529, March 30, 1903. Under Internat. Conv., Feb. 12, 1904.

See U.S. Pat. 763,233 of 1904; this J., 1904, 747.—T. F. B.

Sulphide Dyestuffs; Process of Making Yellow ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 341,798, March 31, 1904.

Sulphide dyestuffs, dyeing clear yellow shades from sodium sulphide solution, are obtained by heating equimolecular quantities of *m*-toluylenediamine and diformyl-*p*-phenylenediamine with sulphur to 220°–230° C. By raising the temperature of the reaction, or by reducing the quantity of diformyl-*p*-phenylenediamine, dyestuffs giving more orange shades are produced.—T. F. B.

Lakes [from Azo Dyestuffs]; Process for Preparing ——. Soc. Anon. Prod. F. Bayer et Cie. Fr. Pat. 341,867, April 2, 1904. XIII. A., page 906.

Anthraquinone Derivatives [Anthracene Dyestuffs]; Production of ——. Soc. Anon. Prod. F. Bayer et Cie. Fr. Pat. 342,195, April 11, 1904. Under Internat. Conv., Nov. 26, 1903.

On treating alizarin with fuming sulphuric acid or with a mixture of anhydrous sulphuric acid and boric acid, and saponifying the resulting sulphuric ether, the hitherto unknown 1.2.5-trihydroxyanthraquinone is obtained. It dyes cotton mordanted with alum pure bluish-red shades, and gives violet-blue shades on chrome-mordanted cotton.
—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Silk Mordanting. C. Knapstein. Färber-Zeit., 1904, **15**, 248–250.

The paper is a polemical one, and adduces sundry cases in which P. Heermann's work on the various theories of the mordanting process (see this J., 1904, 820) does not agree with facts observed in actual dyeing practice.—T. F. B.

Tannic and Gallic Acids; Determination of ——. W. P. Dreaper. XXIII., page 913.

English Patents.

Dressing Material; Method of Producing a Consistent Dust-free Surgical ——. E. M. Sello, London. Eng. Pat. 15,276, July 8, 1904.

The "fleecy" material is passed, directly it comes from the carding machine, between heated rollers, the stearic acid adhering to the material being thereby melted, and imparting a gloss to the material.—T. F. B.

Woollen Fabrics and other Fibres or Materials adapted to be Felted; Fulling of ——. H. J. Haddan, London. From A. Elosegui, Tolosa, Spain. Eng. Pat. 13,090, June 9, 1904.

Woollen fabrics or other materials suitable for felting are exposed to the mechanical action of compression, either by passing between cylinders or by stamping, the fabric being heated at the same time by hot water or steam. The usual treatment with alkali, acid, soap, &c., is omitted.—T. F. B.

Mercerising Yarn; Apparatus for ——. W. P. Thompson, London. From A. Wyser, Aarau, Switzerland. Eng. Pat. 22,189, Oct. 14, 1903.

A stand is fixed on the edge of the mercerising tank on which the reel is placed after mercerising, to allow it to

lrain. Two washing tanks are provided for each mercer-
ising tank; these have perforated tubes arranged inside
hem, which project a spray of washing liquid on to the
abric. The yarn reels are driven by an adjustable change-
gear, so that the reels may be rotated alternately in opposite
lirections, thus preventing tangling of the under threads of
he yarn.—T. F. B.

Dyeing Apparatus. E. W. Beutner, Neukirchen, Germany. Eng. Pat. 22,869, Oct. 22, 1903.

Two vertical cylindrical tanks, communicating with one
nother by means of a short pipe fixed near the top of
ach, are divided horizontally into compartments by means
of perforated plates or sieves, on which the goods to be
lyed rest. The dyeing liquid is introduced into the bottoms
of the tanks through branch pipes leading from a main pipe,
which latter is provided with a three-way cock and a rotary
ump, so that the liquid can be introduced into each of the
anks alternately. By this means, as the liquid comes in
ontact with the goods on the sieves alternately from above
nd below, more even dyeing results.—T. F. B.

Dyeing Silk a Blue-Black Colour after the same is Weighted; Process for ——. J. A. Knup, Paterson, N.J., U.S.A. Eng. Pat. 6728, March 19, 1904.

ilk is weighted by successive immersions in solutions of
tannic chloride, alkali phosphate, and alkali silicate; the
arious strengths of solution and methods of working for
weighting to definite degrees are specified. The silk is then
mmersed in a solution of "Iron liquor" (iron dissolved in
rude acetic acid) of 40° B. at 60° F. for one hour, and then
n a solution of 100 lb. of gambier, 20 lb. of logwood extract,
nd 10 lb. of fustic extract (for each 100 lb. of silk) at
60° F. for two hours. After washing, the silk is finally
reated with a solution containing 20 lb. of logwood extract
nd 50 lb. of soap per 100 lb. of silk, the temperature being
aised from 110° F. at the start to about 150° F., the treat-
ment being continued until the desired shade is produced,
fter which the material is finished as usual.—T. F. B.

Vaterproofing Fabrics; Apparatus for ——. T. F. Wiley, Harrogate, Yorks. Eng. Pat. 7172, March 25, 1904.

he apparatus is of the type in which the waterproofing
gent is applied to the fabric in the form of spray. In order
o ensure a uniform discharge of liquid, a hollow float is
ounted in a tank or vessel containing the waterproofing
quid, the tubes which convey the liquid to the fabric
assing diametrically through this float. Air outlets are
rovided behind or below the fabric, to prevent uneven air
urrents in the waterproofing chamber.—T. F. B.

UNITED STATES PATENTS.

mpregnating Fabrics with Fluid Substances; Machine for ——. H. A. Mann, Albany, N.Y. U.S. Pat. 768,059, Aug. 23, 1904.

Two cylinders, between which the fabric passes, are provided
ith rubber coatings which extend beyond the ends of the
ylinders, and are mounted on a suitable framework, the axis
f the upper cylinder being rearward of that of the lower
ne. Side walls of glass abut against the projecting rubber
acings without touching the ends of the cylinders. The
ylinders are rotated by suitable mechanism, the journal
nds of one of the shafts being supported in stationary
earings, and the journal ends of the other in adjustable
earings. The fluid substance is contained in a receptacle
bove the upper cylinder, and is delivered by a suitable
evice on to the surface of the upper cylinder.—B. N.

yeing and Washing; Machine for ——. C. Corron, Lyons, France. U.S. Pat. 768,425, Aug. 23, 1904.

ee Fr. Pat. 319,049 of 1902; this J., 1902, 1533.—T. F. B.

FRENCH PATENTS.

Fibre from Gelatin; Production of an Artificial ——. L. E. Jannin. Fr. Pat. 342,112, April 1, 1904.

concentrated solution of gelatin (1 kilo.) in water
1 kilo.) and glycerin (100 grms.), containing, if desired, a
mall proportion (1—2 grms. per litre) of formaldehyde and colouring matters, is forced, at a temperature of 80°—100° C., through spinnerets, as in the manufacture of artificial silk. The fibres thus produced are passed either into the air or into a solution of formaldehyde in alcohol or acetone, in order to harden them. They are then treated in a closed chamber with gaseous formaldehyde, to render the gelatin completely insoluble.—E. B.

Artificial Silk, Hair, and Straw; Manufacture of ——. L. Crespin. Fr. Pat. 342,077, April 11, 1904.

Nitrocellulose is dissolved in a mixture of methyl and ethyl alcohols and ether, to which is added some castor or palm oil or glycerin. The collodion is forced through a capillary tube, the threads issuing from which being passed into a tube containing water, which dissolves nearly all the solvent from the collodion; this bath is constantly renewed, so that it always contains about 10 per cent. of alcohol. On distilling the wash water, the alcohol and nearly all the ether are recovered and can be used again.—A. B. S.

Woollen Fabrics in General; Manufacture [Fulling] of ——. Soc. Reynes et Michel. Fr. Pat. 341,943, March 1, 1904.

In order to avoid the loss in weight of woollen fabrics during fulling, the operations of scouring and fulling are performed simultaneously by immersing the fabric in a solution containing alkali and ammonia, "of suitable concentration and temperature," and then rapidly passing it between rollers, to cause the liquid to thoroughly impregnate the fibres.—T. F. B.

Removing Fatty Matters from Tissues [Wool Scouring]; Application of Electrolysis in ——. J. M. J. Baudot. Fr. Pat. 342,108, April 1, 1904.

Woollen tissues are taken from a scouring machine without being washed, and are passed at full width through a tank in which positive and negative plates are fixed, a bath of sodium or potassium carbonate serving as electrolyte at starting. The fatty matters present in the tissues are, it is stated, readily saponified and removed. The soapy liquors obtained are run off into a separate tank and are electrolysed for the recovery of the fatty acids contained in them. The apparatus in which these operations are accomplished is especially intended for use in connection with the wool washing machine described in Fr. Pat. 331,956 (this J., 1903, 1192).—E. B.

Cop-tubes for Use in Dyeing, Bleaching, &c.; Improved ——. J. Brandwood. Fr. Pat. 342,109, April 1, 1904.

The cop-tubes in question are composed of woven or knitted materials.—E. B.

Blue and Blue-black Shades [on Wool] Fast to Light and Fulling; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 342,026, April 8, 1904. Under Internat. Conv., March 11 and 18, 1904.

By dyeing chromed wool with substituted Acid Fuchsines mixed with certain azo dyestuffs susceptible to chroming, blue to blue-black shades are obtained, perfectly fast to light, fulling, washing, and acids. Suitable azo dyestuffs are those obtained by coupling diazotised di-o-diaminophenolsulphonic acid with 2 mols. of β-naphthol, or by coupling diazotised 1.2.4-naphthylaminedisulphonic acid with β-naphthol. (See Fr. Pat. 338,819 of 1903; this J., 1904, 820.)—T. F. B.

Dyeing Silk a Blue-Black Colour after the same is Weighted; Process for ——. J. A. Knup. Fr. Pat. 341,482, March 19, 1904.

See Eng. Pat. 6728 of 1904; preceding these.—T. F. B.

Stannic Oxide contained in the Wash Waters of Silk Dyeworks; Plant for the Automatic Recovery of the ——. R. Schmitz. Fr. Pat. 341,769, March 30, 1904. Under Internat. Conv., March 22, 1904.

The washings containing stannic oxide are collected in a tank placed below the silk-washing apparatus, and are then pumped up into the separator, the rate of flow being controlled by means of a perforated nozzle fixed on the end of the discharge tube. The separator consists of an upright cylindrical vessel with conical bottom: the upper part of this vessel is divided into two compartments by a plate extending about halfway down the vessel, whilst at the bottom of the cone (*i.e.*, at the apex) is provided a conical cap, resting on feet fixed to the vessel. The stannic oxide falls to the bottom of the vessel, and is prevented by the cap from rising again in the vessel. When a sufficient deposit has collected, it is drawn off, and filtered through a press. The water, freed from the stannic oxide, overflows from the separating vessel by means of a pipe provided in the compartment not containing the inlet pipe.—T. F. B.

Fabrics printed with Metallic Powders; Process of Compression for ——. O. Ostersetzer. Fr. Pat. 341,899, April 6, 1904.

To remove the metallic glitter, the materials are compressed with heated plates or cylinders the surfaces of which are finely engraved either with lines or dots.—A. B. S.

Printing of Fabrics. Soc. Anon. l'Art Industriel. Fr. Pat. 341,875, April 8, 1904.

The dry colouring matters are made into a thick paste with boiled linseed oil, and this is thinned, according to the material to be printed, with a mixture of equal parts of heavy petroleum and ammonia. To this mixture is added some silicate of potassium solution containing about 80 grms. of sugar per litre. The colouring matter is fixed by the silicate which also combines with the sugar; the latter prevents the colour from being too brittle. The ammonia counteracts the smell of the linseed oil and petroleum and accelerates the drying of the colours.
—A. B. S.

VII.—ACIDS, ALKALIS, AND SALTS.

Carbon Dioxide and Soluble Nitrites; Reaction between ——. R. B. Moore. J. Amer. Chem. Soc., 1904, **26**, 959—961.

In order to obtain conclusive evidence as to whether carbon dioxide does or does not liberate nitrous acid from a solution of potassium or sodium nitrite, the following experiments were made:—Three small bottles were filled with (*a*) distilled water, (*b*) and (*c*) concentrated potassium nitrite solution. Carbon dioxide was passed into (*a*) and (*b*), but not into (*c*) until the liquids were saturated, and a strip of iodised starch paper was suspended in each bottle $\frac{1}{4}$ in. above the liquid. After six minutes the paper in bottle (*b*) was quite blue, whilst the papers in the other two bottles remained unchanged, even after several hours. Similar experiments, using papers dipped in a solution of *m*-phenylenediamine hydrochloride and also others dipped in a solution of ferrous sulphate, gave confirmative results. On repeating the experiment with solutions of sodium nitrite and silver nitrite, instead of a solution of the potassium salt, similar results were obtained, proving that nitrous acid is also liberated from these nitrites by the action of carbon dioxide.—W. P. S.

Ferrous Salt Solutions; Oxidation of ——. E. Jordis and H. Vierling. Z. Elektrochem., 1904, **10**, 679—682.

The differences in behaviour of solutions of ferrous ammonium sulphate, according to the method used to purify the salt, are ascribed in large measure to the slight variations in constitution of the salts obtained. The small electrical conductivity of a solution of the salt precipitated with alcohol is, however, chiefly due to the presence of alcohol which has adhered to the crystals. The oxidation of dilute solutions (1/1000 mol.) by means of oxygen was chiefly studied. Platinum was found to accelerate the oxidation, as also did an elevation of temperature. The precipitates obtained with and without platinum differed considerably in constitution and appearance. In the former case the precipitate was fine grained, bright yellow and insoluble in dilute acids, whereas in the latter it was coarser, of a red colour, and easily soluble. These observations agree with and extend those of Graham (Phil. Trans., 1861, **151**, 208—210).—R. S. H.

English Patent.

Lead Dithionate; Making ——. A. G. Betts, Troy, N.Y., U.S.A., Eng. Pat. 15,308, July 8, 1904.

Sulphur dioxide gas is passed through water in which native manganese dioxide, in fine powder, is suspended. The necessary amount of lead dithionate is added to decompose any manganese sulphate which may have formed, and the solution of manganese dithionate is then treated with lead peroxide, to obtain lead dithionate in solution, and a precipitate of manganese dioxide.—E. S.

United States Patents.

Sulphuric Acid Plant. A. Zanner, Brussels, Belgium. U.S. Pat. 768,108, Aug. 23, 1904.

The plant includes a roasting furnace, Glover tower, and heating flue through which the gases pass to the tower within which flue removable concentrating pans are set These pans have an inlet supply pipe traversing the flue wall at the end near the tower, and are fed from without A discharge pipe also extends through the wall at the enc near the furnace. Vapour exit openings discharge into the flues. See also U.S. Pat. 693,635 of 1902; this J., 1902 476.—E. S.

Carbonic Acid Gas; Manufacture of ——. W. J. Knox Assignor to G. Westinghouse, both of Pittsburg, Pa U.S. Pat. 768,230, Aug. 23, 1904.

The process consists in heating carbon dioxide gas, anc passing it through carbonates or "carbonic-acid-containin substances," which then yield a further portion of the gas A portion about equivalent to the portion thus added i withdrawn, and the remainder is reheated, and is passe continuously through the carbonates, &c., the evolution o the gas being increased by circulation of steam through th system.—E. S.

French Patents.

Lead Chambers [Sulphuric Acid]; Pulverisation of Wate in ——, *by aid of the Gases of the Pyrites Furnac* R. Delplace. Fr. Pat. 342,117, Feb. 15, 1904.

The furnace gases, after being cooled, and before enterin the Glover tower, are passed through a column in whic they are washed with strong sulphuric acid, in order t absorb any sulphuric anhydride present. The gases a then compressed, and admitted to a reservoir, whence the are supplied to the injectors. The injectors consist J-shaped tubes into the long limbs of which the current water enters. The mouths of the shorter limbs are covere by circular plates of greater diameter than the tubes, th plates being surmounted by small cones against the apic of which the gases are directed, through small orifices i the ends of vertical tubes arranged above the cone Compare Fr. Pat. 333,285 of 1903; this J., 1903, 1292.
—E. S.

Gas; Apparatus for the Absorption of Liquids by —— *and especially for the Absorption of Hydrochloric Ac by Water.* Vereinigte Thonwaarenwerke Akt.-Ges. F Pat. 342,008, March 18, 1904.

The apparatus consists of a shallow rectangular clos box, the double bottom of which is separated as to t greater part of its length by a partition, which causes t water or liquid entering at one side aperture to traverse t length of the box before returning to emerge at a cor sponding outflow aperture. A thin layer of liquid is th presented to the gas which enters the top of the box by vertical pipe at one end, and leaves by a corresponding p at the opposite end. A number of such boxes are co nected in series, with arrangements for the circulation fr box to box of both the absorbing liquid and the gas. T apparatus may be provided with cooling tubes.—E. S.

Hydrosulphites; Production of —— *Dry and quite Stab* Soc. Badische Anilin und Soda Fabrik. Fr. Pat. 341,71 March 28, 1904.

A hydrosulphite, such as sodium or potassium hyd sulphite, or a hydrosulphite of zinc, or of zinc and sodiu or of potassium and ammonium, is heated in a reflux ap

tus with a volatile liquid capable of absorbing water, such
 ethyl or methyl alcohol. The receiver in which the
istillate collects is charged with lime or other desiccating
ibstance, which absorbs moisture from the distillate before
 returns to the retort. The final product is dried in a
acuum at about 60° C., and lastly over sulphuric acid.
e Eng. Pat. 2204, of 1903; this J., 1903, 1347.—E. S.

ithopone; Manufacture of —— by Electrolysis of Sodium Sulphate or Chloride, with Simultaneous Production of Sodium Hydroxide. J. B. and A. Caudau. Fr. Pat. 341,827, April 5, 1904. XI. A., page 904.

arytic Ores; Preparation of ——, for the Production of a Double Carbide of Barium and Calcium. J. Cartier. Fr. Pat. 342,036, April 11, 1904.

ITHERITE (barium carbonate) mixed with minerals con-
ining both barium carbonate and calcium carbonate, is
ated in a reverberatory furnace to expel carbon dioxide.
e oxides of barium and calcium obtained are then mixed
th carbon and strongly heated in an electric furnace.
—E. S.

rbon from Pulverised Carbonaceous Substances; Process for Separating ——. J. D. Darling. Fr. Pat. 341,736, March 29, 1904.

E U.S. Pat. 763,859 of 1904; this J., 1904, 780.—T. F. B.

VIII.—GLASS, POTTERY, ENAMELS.

ttery Clay; Influence of Magnesia on ——. A. E. Hottinger. Thonind. Zeit., 1904, **28**, 806; Chem.-Zeit., 1904, **28**, Rep. 240.

 test the extent to which magnesia could be substituted
 chalk or dolomite as a sintering agent, porcelain body—
mposed of 55 parts of clay substance, 21·5 of felspar,
d 23·5 of quartz—was mixed with 5 and 10 per cent. of
ch of the above ingredients in turn, and baked at the
ing temperature of Seger cones 1 and 5 respectively, with
 following results:—

Porcelain Body.	Baked at—	
	Seger Cone 1.	Seger Cone 5.
centage of moisture absorbed by:—	Per Cent.	Per Cent.
ody unmixed	22·5	14·4
„ with 10 per cent. of chalk	26·2	24·9
„ „ 5 „ „	22·0	11·8
„ „ 10 „ dolomite	20·2	12·4
„ „ 5 „ „	19·1	10·8
„ „ 10 „ magnesite	8·8	9·9
„ „ 5 „ „	13·2	6·0

The last sherd was so hard as to resist scratching with
steel point. In further experiments with clay shale, the
lition of 10·5 per cent. of magnesite caused the body to
ter at cone 1.—C. S.

English Patent.

ment [for Porcelain, &c.]; Manufacture of a Material Designed for the Production of ——. P. Steenbock, Berlin. Eng. Pat. 15,181, July 7, 1904.

RYLLIUM compounds soluble with difficulty in water, but
cting with phosphoric acids, or their acid salts, are
xed with similar compounds of other light metals, includ-
 zinc, and a solution of phosphoric acid or an acid phos-
ate is added to the mixture. For example, a solution of
yllium nitrate may be precipitated with sodium silicate
ution, and eight parts of the beryllium silicate obtained,
er washing and slightly calcining, mixed with five parts
 a mixture obtained by melting together one part of lime,
 part of alumina, and two parts of silica. The whole
then mixed with a 50 per cent. solution of ortho-phos-
oric acid, which is almost saturated with aluminium
osphate, and also contains a small quantity of zinc
osphate. The mass hardens in a short time. Colouring matters may be added to it. The cement produced is adapted for filling teeth, cementing porcelain, &c.—A. G. L.

United States Patent.

Glass Furnace. J. E. Berry, Monongahela, Pa. U.S. Pat. 767,373, Aug. 16, 1904.

THE furnace consists of a melting chamber, from which a central channel passes to a gathering or drawing chamber, which, together with the central channel, is surrounded by double heating chambers provided with means for introducing gas, and a communicating flue formed near the furnace proper.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Lime in Cement; Rapid Method for the Determination of ——. B. Enright. XXIII., page 912.

United States Patent.

Brick; Process of Making ——. O. G. Diefendorf, Waterton, N.Y. U.S. Pat. 766,938, Aug. 9, 1904.

THE ingredients, including cement, a friable earth, and colouring matter, are first mixed with a small quantity of water, and formed into bricks in suitable moulds and subjected to a pressure of about 2,000 lb. per sq. inch, whereby the small quantity of moisture is brought to the surface of the moulds. The bricks are then removed from the moulds, exposed to the air till a thin crust forms on the surfaces, and then wetted and allowed to stand and harden.—W. C. H.

French Patents.

Marble; Process for Rendering —— Antiseptic and at the same time increasing its Insulating Power. Chem. Techn. Fabr. Dr. Alb. R. W. Brand and Co., G. m. b. H. Fr. Pat. 338,886, June 22, 1903.

THE marble is impregnated with substances such as asphalt, paraffin, caoutchouc, linseed oil, &c., to which disinfectants such as boric acid and thymol may be added, by placing it in a benzene or other solution of these bodies in a vessel from which the air is exhausted. On admitting air again, the solution is forced into the pores of the marble, the solvent being then removed by heating or other suitable means, leaving the dissolved non-volatile body in the marble.
—A. G. L.

Colouring Natural Stones, especially Marble; Process for ——. Chem. Techn. Fabr. Dr. Alb. R. W. Brand and Co., G. m. b. H. Fr. Pat. 338,887, June 22, 1903.

THE stone is first impregnated with a volatile liquid, *e.g.*, ether, benzene, or alcohol, and is then placed in the solution containing the colouring matter, which solution must have a much higher boiling point than the first liquid. The whole is then heated until the volatile liquid has been driven off.—A. G. L.

Peaty Packing and Coating Material; Manufacture of —— for Walls, Ceilings, &c. W. Klinger. Fr. Pat. 341,929, Feb. 13, 1904.

MOIST peat is well mixed with about 10 per cent. of cork waste and with a milk of mixed lime and magnesia (4 per cent. of lime to 1 per cent. of magnesia), and the plastic mass is moulded to any desired form. For coating such surfaces as ceilings, dry peat is mixed with about 20 per cent. of asphalt and tar, to which plaster is added, with sometimes, magnesia also. It is stated that the mixture may be rolled into thin plates, which can be used, for example, for covering ice-houses.—E. S.

Nickel; Utilisation of the Waste produced in the Manufacture of —— [Bricks, &c.]. M. Molon. Fr. Pat. 342,000, March 11, 1904.

THE nickel waste is ground, sifted, and sorted, to form a "sand," which is utilised alone or mixed with river sand, chalk or the like, in the manufacture of bricks, in masonry, and otherwise.—E. S.

Cement Composition containing Magnesia, and Process for Making Artificial Stone therefrom. E. Bidtel, G. J. Bidtel, and G. K. N. Nutz. Fr. 341,989, March 7, 1904.

See U.S. Pat. 757,252 of 1904; this J., 1904, 491.—T. F. B.

X.—METALLURGY.

Gold-Copper and Gold-Silver Alloys; Specific Gravity of ——. C. Hoitsema. Z. anorg. Chem., 1904, **41**, 63—67.

The author determined the specific gravity, at 15° C., of cast gold-copper and gold-silver alloys, in order to supplement the figures previously given by Matthiessen and Roberts-Austen. The results are given in the following tables:—

Gold-Silver Alloys.

Gold Content. Parts per 1000.	Specific Gravity.	Specific Volume.	
		Found.	Calculated.
(1000)	(19·26)	(0·05192)	..
917	18·08	0·05531	0·05555
*916	*18·041	0·05543	0·05560
*879	*17·54	0·05701	0·05722
843	16·96	0·05896	0·05922
*784	*16·354	0·06115	0·06137
750	16·03	0·06238	0·06286
667	15·07	0·06636	0·06651
*646	*14·87	0·06725	0·06741
583	14·24	0·07023	0·07017
500	13·60	0·07353	0·07381
*477	*13·432	0·07445	0·07481
417	13·09	0·07692	0·07744
333	12·38	0·08070	0·08112
*313	*12·257	0·08158	0·08199
250	11·78	0·08489	0·08475
*186	*11·760 ?	0·08504	0·08755
167	11·28	0·08861	0·08831
0	(10·4)	(0·09569)	..

* By Matthiessen. The figures for the alloy containing 186 parts of gold per 1000 are probably incorrect, perhaps owing to a printer's error.

Gold-Copper Alloys.

Gold Content. Parts per 1000.	Specific Gravity.	Specific Volume.	
		Found.	Calculated.
(1000)	(19·26)	(0·05192)	..
†980·1	18·84	..	..
†968·8	18·58	..	..
†958·8	18·36	..	..
†948·4	18·12	..	..
†938·5	17·93	..	..
†932·0	17·79	..	..
†922·8	17·57	..	..
917·0	17·35	0·05764	0·05715
†900·5	17·17	..	..
†880·5	16·81	..	..
†861·4	16·48	..	..
833·0	15·86	0·06305	0·06244
750·0	14·74	0·06784	0·06768
583·0	12·69	0·07880	0·07820
250·0	10·035	0·09965	0·09819
0·0	(8·7)	(0·11494)	..

† By Roberts-Austen.

—A. S.

Silver; Simple Method for the Preparation of Metallic ——. J. Thallwitz. Z. phys.-chem. Unterr., 1904, **17**, 224. Chem. Centr., 1904, **2**, 634.

For the rapid preparation of metallic silver from silver chloride, the author recommends the use of a mixture of powdered charcoal and sodium peroxide. A mixture of powdered wood charcoal and sodium peroxide is placed in an earthenware crucible, and is covered with a layer of the dry silver chloride. The whole is then carefully and intimately mixed. After a short time the mixture ignites spontaneously, and metallic silver separates in a reguline condition. The proportions of the substances taken are calculated from the equation:

$$2AgCl + Na_2O_2 + 2C = 2CO + 2NaCl + 2Ag.$$

—A. S.

Purple of Cassius Test for Use in Cyanide Works [Determination of Gold]. A. Prister. XXIII., page 912.

Lead, Iron, Lime, Sulphur, Cadmium and Copper in Commercial Zinc Ores; Determination of ——. W. S Waring. XXIII., page 912.

English Patents.

Cupola Furnaces for Melting Iron. J. Higham, Manchester. Eng. Pat. 22,308, Oct. 16, 1903.

The invention relates to means for heating the blast of ai introduced into the furnace. An air-belt in the form o an annular cylindrical chamber is arranged near the to of the furnace, in communication with a fan and with th tuyères by means of one annular passage or several longitudinal passages in the brickwork surrounding the furnace A coiled pipe communicating with the fan and with the ai belt may also be arranged in the chimney of the furnace.

—A. S.

Case Hardening; Process for ——. G. C. Marks, London. From C. Lamargese, Rome. Eng. Pat. 25,98 Nov. 27, 1903.

See Fr. Pat. 332,199 of 1903; this J., 1904, 610.—T. F. B

Furnaces especially adapted for the Separation of Gold an other Precious Metals from the Sweepings of Jewellers Warehouses, Photographers' Waste, and the like. S. W Price, London. Eng. Pat. 19,984, Sept. 16, 1903.

The melting chamber, lined with refractory material, ha its bottom inclined downwards from the front to the back "the longitudinal centre line of the bottom being straigh from end to end, but curving gradually up and round at th side and the lower part of the end, so as to be more or les elliptical in cross section, the roof being a continuation u and round, in similar elliptical form, of the bottom, the roo at the back end being curved gradually down, to receiv and reflect back and down the flame from a burning jet o mineral oil, vapour or spray, injected through the openin in the front of the furnace." There are three exit opening for the products of combustion to the chimney; one fro the furnace front, near the jet, another from the side of th curved top of the furnace near its back end, and the thir from the same side as the second opening, but close to th front and as high up as possible. There is also an opening having two branches at different heights, through the bac wall of the furnace, for running off slag and metal separatel

—E. S.

Cadmium Alloy. G. Chaudoir, jun., Vienna. Eng. Pat. 21,854, Oct. 10, 1903.

See Fr. Pat. 335,838 of 1903; this J., 1904, 325.—T. F.

Metallic Alloy. F. W. Green, Wakefield, and T. Prescot Hudders-field, Yorks. Eng. Pat. 22,073, Oct. 13, 1903.

The alloy is prepared by melting from 70 to 90 parts weight of aluminium, and adding successively 18 to 5 part of magnesium and 12 to 2 parts of cadmium. The allo is stated to be suited for ornamental work, bells, gong &c., and as a substitute for electro-plated ware.—E. S.

Metals, Alloys, Metallic Oxides and High Temperatures Process for the Production of ——. P. Weiller, Vienn and A. Weiller, Triest, Austria. Eng. Pat. 24,14 Nov. 6, 1903.

See Fr. Pat. 336,989 of 1903; this J., 1904, 445.—T. F.

Minerals; Concentration of ——, from Ores. A. Cattermole, H. L. Sulman, and H. F. Kirkpatrick-Picar London. Eng. Pat. 17,109, Aug. 6, 1903.

The pulped ore is agitated with a soap solution and mineral acid; the mineral particles become coated with t liberated fatty or resinous acid, and are separated from t ncoated granules in a suitable classifying apparatus. The eparation of such coated mineral particles may be facilitated y generating a gas, such as carbon dioxide, in the solution, y addition of an acid, and, if necessary, of a carbonate. he particles coated with fat, after separation, are washed ith an alkaline solution, and the soap thus recovered is gain used. Compare Eng. Pats. 26,295 and 26,296 of 902, and 18,589 of 1903; this J., 1904, 118 and 256.—E. S.

ead Ores; Process for Effecting the Desulphurisation of ——. A. Savelsberg, Ramsbeck, Germany. Eng. Pat. 24,493, Nov. 11, 1903.

ee Fr. Pat. 336,540 of 1903; this J., 1904, 376.—T. F. B.

inc and Lead, and generally all Metals whose Affinity for Sulphur is Inferior to that of Copper; Process for Extracting from their Sulphides ——. A. H. Imbert, Grand Montrouge, France. Eng. Pat. 24,825, Nov. 14, 1903.

e Fr. Pat. 336,660 of 1903; this J., 1904, 376.—T. F. B.

re Pulverising Apparatus. E. H. Benjamin, Oakland, Cal., U.S.A. Eng. Pat. 13,743, June 17, 1904.

he gyratory central vertical driving shaft of the apparatus tates inside a guide pillar, arranged within an outer casing. he lower end of the shaft works on a ball-bearing, whilst tween the upper portion and the guide pillar a "floating aring" is interposed, controlled by a series of spring-held nsion devices. Within the upper portion of the casing, d around the shaft a die ring is fixed. Within the space closed by the die ring the driving shaft carries two discs, to the lower one of which the ore is fed, whilst the upper e prevents the ore being thrown back into the feeding amber when the shaft is rotated. A series of guide oes is interlocked to and between the discs, each shoe ving a part radial groove terminating in an involute rve on its wearing face, and provided with a bore such at when the face of the shoe has become worn to a predetermined depth, an inrush of air occurs, resulting in a histling sound, which calls the attention of the operator the need for a new shoe.—E. S.

United States Patents.

pen-Hearth Steel; Method of Producing ——. H. Carlsson, Assignor to J. H. Le Fevre, both of Sydney, Canada. U.S. Pat. 768,265, Aug. 23, 1904.

he character of the slag produced in the basic open-hearth ocess is controlled by the addition of titaniferous ore to e materials employed.—E. S.

on and Steel and their Alloys; Manufacture of ——. J. B. de Alzugaray, Bromley, Kent. U.S. Pats. 768,551, 768,552, and 768,553, Aug. 23, 1904.

e Fr. Pat. 333,382 of 1903; this J., 1903, 1353.—T. F. B.

inc and other Sulphides from their Ores; Extracting ——. G. D. Delprat, Broken Hill, N.S.W. U.S. Pat. 768,035, Aug. 23, 1904.

ee Eng. Pat. 26,279 of 1902; this J., 1903, 912.—T. F. B.

etal from Ores; Extraction of ——. C. H. Webb, Dorking, Assignor to the Rapid Cyanide Treatment, Ltd., London. U.S. Pat. 768,319, Aug. 23, 1904.

ee Fr. Pat. 340,238 of 1904; this J., 1904, 792.—T. F. B.

French Patents.

Blast Furnace Tuyère. E. Bertrand and E. Vorbach. Fr. Pat. 341,997, March 10, 1904.

ee Eng. Pat. 26,037 of 1903; this J., 1904, 325.—T. F. B.

ertical Furnace; Process and —— for the Direct and Continuous Extraction of Metals, and especially for the Direct Production of Iron. O. Simmersbach. Fr. Pat. 341,788, March 31, 1904.

he iron ore to be reduced is contained in a covered vertical rnace in the walls of which channels are cut from the bottom up to a certain height, these channels being connected annularly and heated by gas burners at their bases. An exit for the products of combustion is provided at the top of the channels. The furnace, while thus heated entirely from its walls, without access of air or of fuel to its body, is traversed by carbon dioxide admitted into the mass of the charge near the bottom by suitable tubes, and aspirated from a discharge opening at the top. The gases discharged from the body of the furnace may be led away to feed the burners within the furnace walls. The reduced ore is withdrawn from the water-cooled iron base of the furnace, and may be then treated to obtain iron or steel in, for instance, a Martin's furnace.—E. S.

Steel Articles; Protecting certain portions of —— during Cementation. A. De Dion and G. Bouton. Fr. Pat. 342,061, April 9, 1904.

The parts of the piece of steel to be guarded against cementation are coated with a metallic deposit or with a salt which is not attacked by carbon.—E. S.

Nickel; Utilisation of the Waste produced in the Manufacture of ——. M. Molon. Fr. Pat. 342,000, March 11, 1904. IX., page 901.

Metals; Process for the Extraction of ——, the Formation of Alloys and Metallic Oxides, and the Production of High Temperatures. P. and A. Weiller. Addition, dated April 7, 1904, to Fr. Pat. 336,989, Nov. 9, 1903. See this J. 1904, 145.

The powdered ore, freed as far as possible from gangue, is mixed with iron filings and saltpetre, with addition, in some cases, of a chlorate. The mixture is ignited in a small furnace, and the reduced and molten metal which sinks to the bottom is drawn off in the usual way.—E. S.

Metallic Alloy; Manufacture of a ——. A. Jacobsen. Fr. Pat. 342,054, April 9, 1904.

Two atomic proportions each of copper and of iron are fused with one atomic proportion each of aluminium and of nickel. The alloy is said to be suitable for the manufacture of cannon, of machines, ships, &c. A bronze is obtained by fusing together 6 parts by weight of the above-described alloy with 54 parts of copper and 40 parts of zinc. See Fr. Pat. 338,415 of 1903; this J., 1904, 610.—E. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

English Patents.

Batteries; Galvanic ——. L. Fiedler and F. J. Gerard, London. Eng. Pat. 18,010, Aug. 20, 1903.

The active portion of the cathode consists of an alloy of zinc and antimony, together with or without an amalgam of mercury and with or without other metals, such as manganese. The alloy may conveniently be in the form of a powder saturated with mercury, and contained in a tray, the electrolyte being in the form of a jelly.—B. N.

[*Electric Furnace*] *Processes for Heating Carbonaceous Material applicable for Chemical and other similar Processes.* Soc. Anon. l'Industrie Verrière et ses dérivés, Brussels. Eng. Pat. 5094, March 1, 1904. Under Internat. Conv., March 2, 1903.

See Fr. Pat. 340,846 of 1904; this J., 1904, 828.—T. F. B.

United States Patents.

Furnace; Electric ——. C. G. P. de Laval, Stockholm, Sweden. U.S. Pat. 768,054, Aug. 23, 1904.

The furnace is cubical in form with a flat hearth, and has a horizontal feed opening in one wall extending inwardly. The electrodes pass through opposite walls, terminating in front of the feed opening, and between the latter and the electrodes is an escape opening in the roof of the chamber. —B. N.

Connector for Electro-Chemical Apparatus. O. P. Fritchle, Denver, Colo. U.S. Pat. 768,175, Aug. 23, 1904.

This invention comprises a cup containing mercury, the cup being grooved externally, and furnished with a lower stem coated with tin and surrounded by a lug of cast lead, and a coupler of copper wire with a tinned body portion covered with a lead sheath cast on the copper. The end of the wire projects from the sheath, and is supported within, but out of contact with the cup, both cup and coupler end being coated with nickel. Near the end of the lead sheath is an annular groove, forming a bulb at the end, and an elastic sleeve of rubber encloses both cup and bulbed end, so that when the coupler end is withdrawn, the perforated diaphragm in the elastic sleeve closes.—B. N.

Electrical Apparatus for Cleaning Gas. C. G. Hardie, Hamburg, N.Y. U.S. Pat. 768,450, Aug. 23, 1904.

The gas is passed through an inclined casing, containing an electrode insulated throughout its length so as to prevent disruptive discharges between it and the casing. The electrode is connected to one of the secondary terminals of a high-potential transformer, the other terminal being connected to the bottom of the casing. Water is caused to flow uniformly over the bottom of the casing, to wash away the impurities deposited thereon under the influence of the electrical condenser.—H. B.

French Patents.

Electric Melting Furnace. Soc. Anon. l'Industrie Verrière et ses dérivés. Fr. Pat. 342,134, March 19, 1904. Under Internat. Conv., March 21, 1903.

See Eng. Pat. 5921 of 1904; this J., 1904, 550.—T. F. B.

Removing Fatty Matters from Tissues; Application of Electrolysis in ——. J. M. J. Baudot. Fr. Pat. 312,108, April 1, 1904. V., page 899.

Lithopone; Manufacture of —— by Electrolysis of Sodium Sulphate or Chloride with Simultaneous Production of Sodium Hydroxide. J. B. and A. Candau. Fr. Pat. 341,827, April 5, 1904.

Sodium sulphate solution is electrolysed with zinc anodes in cells having porous partitions, the products in the anode and cathode compartments being respectively zinc sulphate and sodium hydroxide. The zinc sulphate solution is treated with solution of barium sulphide to obtain lithopone, a white precipitate composed of zinc sulphide and barium sulphate. If sodium sulphate be replaced by sodium chloride in the process, the zinc chloride obtained is mixed with a solution of sodium sulphate before precipitation by barium sulphide. Compare Fr. Pat. 338,322 of 1903; this J., 1904, 606.—E. S.

(B.)—ELECTRO-METALLURGY.

Iron and Iron Alloys; Electro-thermal Production of ——. B. Neumann. Stahl u. Eisen, 1904, **24**, 682—688; 761—769; 821—826; 883—888; 944—950. See also this J., 1904, 258.

The author reviews the different methods for the electrical production of iron and iron alloys. The subject-matter of the paper is given under the following headings and sub-headings:—*I. Processes and Apparatus.*—Processes of Ruthenberg, Stassano, Conley, Héroult, Keller, Harmet, Kjellin, and Gin; Girod's crucible furnace. *II. Nature of the Products.*—Examination of castings; examination of forged electro-steel. *III. Power Consumption and Thermal Efficiency.*—Production of pig-iron; conversion of pig-iron into steel. *IV. Costs. V. Comparison of the Electrical Production of Iron and Steel with the ordinary Metallurgical Processes.*—The author considers that in countries such as Germany, England, and the United States, which have large supplies of coal and have only impure iron ores to work with, electric processes cannot compete with the blast-furnace process in the production of pig-iron. In countries such as South America and New Zealand, however, which are deficient in mineral fuel, but in which pure iron ores and sufficient cheap water-power are obtainable, the production of iron in the electric furnace can be carried out economically. With cheap electric energy, the production of iron alloys containing high percentages of silicon, chromium, tungsten, &c., may be made remunerative. The electric process for the manufacture of steel from pig-iron can also compete with the costly crucible process for the production of the finer kinds of steel.—A. S.

Electro-plating; Baths for ——. A. Grésil. Monit. Scient., 1904, **18**, 675—676.

The nickel-plating bath recommended by Namias (this J., 1904, 754) is considered to contain too little nickel; a very suitable bath contains 60 grms. of "ammoniacal nickel sulphate" and 40 grms. of crystallised nickel sulphate per litre. In silver-plating, the baths corresponding to the simple formula AgCN, 2KCN are not invariably the best; thus experience shows that, for silver-plating copper and its alloys, the most suitable bath contains 20 grms. of silver cyanide and 30 grms. of potassium cyanide per litre; whilst for tin and its alloys, 50 grms. of silver cyanide and 150 grms. of potassium cyanide per litre constitutes the best bath. As regards copper-plating, the formula given (*loc. cit.*) is considered too complex; excellent results are obtained with a bath consisting of copper sulphite, 20 grms.; potassium cyanide, 30 grms.; water, 1 litre.—T. F. B.

English Patents.

Alkali Metals; Production of ——. E. A. Ashcroft, Runcorn, Cheshire. Eng. Pat. 17,640, Aug. 14, 1903.

A solution of an alkali chloride is electrolysed ove mercury, the latter forming an amalgam with the alkali metal. The amalgam is then used as the anode in a electrolytic cell containing an electrolyte capable of fusing and yielding alkali metal at a temperature below th volatilising point of mercury. A mixture of sodium an potassium hydroxides in about molecular proportions, whic fuses at about 200° C., may be used, or other mixtures o the alkalis or alkaline earths, or organic compounds of th alkali metals, such as sodium amide, may be used.—B. N.

Electro-deposition of Metals upon Aluminium. J. Creswic and H. Shaw, Sheffield. Eng. Pat. 21,609, Oct. 8, 1903.

Metallic tin is first deposited upon the article by im mersing it in a solution of stannous chloride and ammoniu alum, prepared by dissolving 2 oz. of the former and 5 lb of the latter in water. The plating is afterwards carried ou in the usual way.—B. N.

French Patent.

Electric Furnace intended for the Transformation of Ca Iron into Steel. G. H. Gin. Fr. Pat. 342,101, March 3 1904.

The furnace has a horizontal hearth of refractory materi and is supported on wheels running on rails within a thic casing of non-conducting and heat-resisting material. T hearth is indented by a gutter extending from near the fr to near the back, and repeatedly curved upon itself so as form a series of connected parallel depressions, the two en of which terminate opposite to one another at the front the furnace. Each of the two termini to the gutter formed within a massive block of steel, hollowed in i lower part and cooled by a current of water, and the bloc are constituted the poles to a source of electricity. funnel of refractory material is set in the roof of the casi of the furnace, immediately above each terminus, throu which molten cast iron is introduced so as to flow throu out the entire length of the gutter, giving the resistance the current necessary for obtaining the temperature requir for effecting the purification of the metal and its conversi into steel. Channels are provided at the exit end of t furnace converging from the end loops of the gutter towa a receptacle for receiving the outflow of metal. Scrap ir may be added to the charge, and means are described f making other additions, and for rabbling, &c. Compa Fr. Pat. 340,413 of 1904; this J., 1904, 792.—E. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

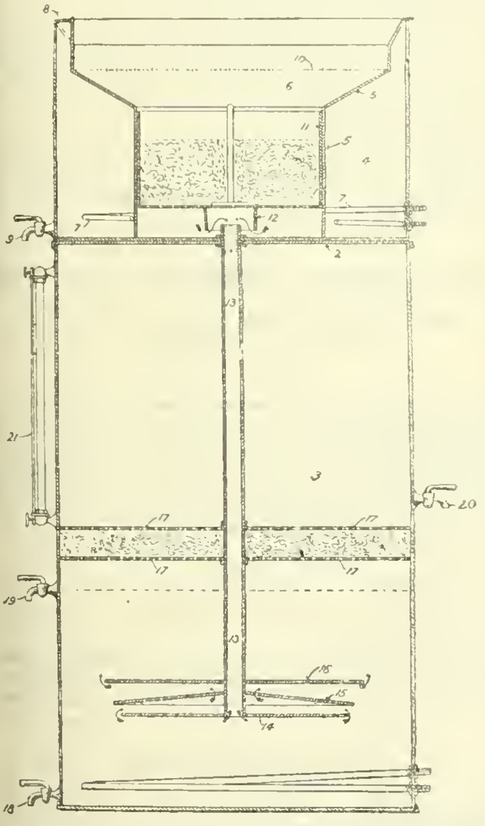
aponification Process; Theory of the ——. L. Balbiano. Gaz. chim. ital., 1901, **34**, 55—56. Chem. Centr., 1904, **2**, 674.

he facts that: (1) oleic acid when heated in the air is xidised and then gives an acetyl value; (2) the esters of e fatty acids of linseed oil readily oxidise and give acetyl alues; (3) the oxidised oils yield triglycerides of fatty cids; and (4) in the residue after the partial saponification f the triglyceride of benzoic acid, only the triglyceride is resent, lead the author to believe that the increased acetyl alue of the residue after the partial saponification of fatty cids observed by Lewkowitsch, is due to the formation of iglycerides of hydroxy acids and not, as the latter conders, to the formation of di- and mono-glycerides. (Compare Lewkowitsch, this J., 1898, 1107; 1899, 1031; 1900, , 254.)—A. S.

English Patents.

iltering and Washing [Lubricating] Oils; Apparatus for ——. C. W. Brown, London. From W. F. Warden, Akron, Ohio, U.S.A. Eng. Pat. 14,216, June 23, 1904.

tank (see figure) is divided by a partition, 2, into two mpartments, 3 and 4, the upper one containing an inner amber, 6, into which is fitted a vessel, 11, containing tton waste. Water is circulated through the compartent, 4, and heated by the coil, 7. The oil, which is pplied to the chamber, 6, passes first through the wire auze, 10, then through the cotton waste and perforated ottom of vessel, 11, and overflows through the pipe, 13, nto the lower compartment, 3. The deflecting plates, 14, 5, and 16, cause the oil to travel as indicated by the rrows, the conical plate, 15, being perforated near its entre, and every particle of oil is thus subjected to the ashing action of the water, which is contained in 3 up to the level of the tap, 19. Before being withdrawn through the tap, 20, the oil finally passes through more cotton waste between the perforated plates, 17.—B. N.



Garbage or Offal; Process of Cooking —— and Removing the Oil or Melted Grease therefrom. C. S. Wheelwright and J. T. Fiske, jun. Eng. Pat. 15,235, July 7, 1904. XVIII. B., page 909.

Detergent and other Preparations for Toilet Use [Soap with Lemon Juice]; Manufacture of ——. G. Giraudet, Paris, and A. Neuberger, London. Eng. Pat. 18,247, Aug. 24, 1903.

See Fr. Pat. 334,916 of 1903; this J., 1904, 121.—T. F. B.

French Patents.

Removing Fatty Matters from Tissues; Application of Electrolysis in ——. J. M. J. Baudot. Fr. Pat. 342,108, April 1, 1904. V., page 899.

Fatty Materials of any kind; Apparatus for the Deglycerination of ——. G. Col. First Addition, dated March 28, 1904, to Fr. Pat. 340,521, Feb. 17, 1904 (see this J., 1904, 872).

A form of apparatus is described which can be worked both continuously and intermittently. The fatty material is fed into a conical drum in which it traverses successively a series of plates and then runs through a series of superposed horizontal cylinders. In its passage over the plates in the conical vessel, it is mixed with steam under pressure, and steam is also supplied to the horizontal cylinders, which are furnished with rapidly moving stirring arms. This apparatus discharges the material to one of two cylindrical "saturating collectors," which are likewise provided with slowly moving stirring arms and steam under pressure. Whilst one collector is being filled, the other is being discharged, and the operation is thus made continuous.
—J. F. B.

Cellulose from Green Alfa [Esparto]; Preparation of —— [and Manufacture of Soap from By-Product]. P. Boutry and A. Deiss. Fr. Pat. 341,930, Feb. 16, 1904. XIX., page 909.

Soap; Apparatus for Rapidly Cooling Liquid ——. R. Roth. Fr. Pat. 341,731, March 29, 1904.

The hot liquid soap is filled into a closed reservoir or tank. Below the latter are a number of vertical tubes surrounded by cold water. The liquid soap fills the tubes, where it is cooled and solidified. The solid bars are removed from the tubes by forcing air into the closed tank, a fresh supply of liquid soap being caused to pass into the tubes. At the commencement of the operation the lower ends of the tubes are closed by a sliding plate.—W. P. S.

Rosin Soap for Sizing Paper and Millboard; Manufacture of ——. A. Sauvage. Fr. Pat. 341,844, April 6, 1904. XIX., page 910.

Soap [containing Benzene]; Manufacture of a Liquid Sanitary ——. L. Jodoche. Fr. Pat. 342,033, April 8, 1904.

19 kilos. of rosin are dissolved in 57 kilos. of warm benzene, 24 kilos. of potassium hydroxide solution (sp. gr. 1·10) are then added, and the mixture is stirred for 15 minutes. The quantities of rosin and potassium hydroxide may be varied, and the benzene may be replaced by another solvent, such as "essence."—W. P. S.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

English Patents.

Paint; Preparation of Zinc for use as ——, and Apparatus therefor. M. Malzac, Paris. Eng. Pat. 17,895, Aug. 18, 1903.

See Addition, of June 29, 1903, to Fr. Pat. 329,079 of 1903; this J., 1903, 1357.—T. F. B.

Colour Lakes [from Azo Dyestuffs]; Manufacture of ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 22,856, Oct. 22, 1903.

SEE Fr. Pat. 336,433 of 1903; this J., 1904, 368.—T. F. B.

FRENCH PATENTS.

Lakes [from Azo Dyestuffs]; Process for Preparing ——. Soc. Anon. Prod. F. Bayer et Cie. Fr Pat. 341,867, April 2, 1904.

RED lakes, fast to light, are obtained by precipitating, on a suitable substratum, the dyestuff obtained by coupling the diazo compound of 1-naphthylamine-3.8-disulphonic acid with β-naphthol.—T. F. B.

White Lead; Non-poisonous ——. H. and L. Dodé. Fr. Pat. 341,870, April 2, 1904.

LEAD oxide is heated with about 25 per cent. of its weight of kaolin, sand, or other siliceous substance, to 700° or 800° C. When cold, the mass is pulverised and made into pigments in the same way as white lead. Such pigments are non-poisonous, and do not blacken on exposure to bad air.—T. F. B.

Lithopone Manufacture of ——, *by Electrolysis of Sodium Sulphate or Chloride, with Simultaneous Production of Sodium Hydroxide.* J. B. and A. Candau. Fr. Pat. 341,827, April 5, 1904. XI. A., page 904.

(B.)—RESINS, VARNISHES.

Turpentine: Technical Analysis of Spirits of ——, *with a New Method for the Detection of Petroleum Adulterations and Wood Spirits of Turpentine.* J. M. McCandless. XXIII., page 913.

ENGLISH PATENTS.

Linoleum of Multiple Layers; Manufacture of ——, *and Apparatus therefor.* W. P. Thompson, London. From Bremer Linoleumwerke Delmenhorst, Delmenhorst, Germany. Eng. Pat. 17,780, Aug. 17, 1903.

SEE Fr. Pat. 334,635 of 1903; this J., 1904, 69.—T. F. B.

Linoleum or the like; Manufacture of ——. L. W. Seeser, Raguhn, Germany. Eng. Pat. 17,971, Aug. 19, 1903.

THE linoleum mass is passed between rollers, together with two layers of fabric instead of only one. The stretching of the whole under the rollers, and the consequent irregularities due to shrinkage, are thus much diminished. The additional layer of fabric, the use of which forms the main feature of the patent, may be applied to the same side as the usual layer and afterwards stripped off, leaving the inner layer firmly imbedded, or to the opposite side in a subsequent operation, when by reversing the whole and removing the first layer, inlaid linoleum can be produced on the rolls themselves.—R. L. J.

(C.)—INDIA-RUBBER, &c.

Castilloa: its Description, Yield, and a Method of Preparing Rubber from its Latex. C. O. Weber. India-Rubber J., 1904, **28**, 228—230.

THERE are at least three varieties of Castilloa:—*C. alba*, the hardiest, which yields a large quantity of rubber and suffers little from the tapping operation; *C. negra*, yielding good rubber, but which easily bleeds to death; and *C. rubra*, which produces a good rubber, but in very small quantities. Cultivation of the Castilloa in Colombia should prove very remunerative, since land, at any rate in territories adjoining the isthmus, is to be had for practically nothing, and labour is cheap. In fact, the cost of clearing the land and attending to the plantation for seven years does not exceed 25*l.* per 1,000 trees. If the trees are tapped at the end of the seventh year and yield only ½ lb. per tree, then, after deducting all expenses, a return of about 100 per cent. would be made in the eighth year, and with careful management this would increase for some years. The trees should not be tapped until they are at least eight years old, as the rubber from young trees contains a large percentage of resin, as is shown by the following figures:—Two years old, 42·33; three years old, 35·02; four years old, 26·47; five years old, 18·18; seven years old, 11·59; eight years old, 7·21 per cent. By the following process it is stated that a purer and stronger product can be obtained from the Castilloa than the finest brands of commercial Para:—The crude latex is diluted with five times its volume of water (in some cases boiling water being preferable), strained through cotton gauze, and formaldehyde added in the proportion of about 8 oz. to a barrel of the diluted latex; the whole is then well stirred and allowed to stand for 24 hours. The formaldehyde prevents coagulation of the albumin, and the rubber collects on the surface of the liquid in the form of a snow-white cake, which can be lifted out in one mass. Every trace of albuminous matter can then be removed in an ordinary washing machine. The analysis of a sample sheet of rubber so prepared, gave the following figures:—Resinous matter, 2·61; ash, 0·44 per cent.; nitrogenous constituents, nil; insoluble matter, nil.
—J. K. B.

ENGLISH PATENT.

Rubber Solutions or Compounds. Isidor Frankenburg, Ltd., R. J. Frankenburg, and F. H. Betteridge, Salford, Lancs. Eng. Pat. 17,156, Aug. 7, 1903.

MORE or less uninflammable solutions are obtained by dissolving rubber in one or more of the following solvents:—Carbon tetrachloride, dichloromethane, trichloro-ethane, tetrachloro-ethane, or trichlorobenzene. The rubber may also be softened with coal-tar naphtha or other ordinary solvent, and then one of the above solvents added until the desired consistency is obtained.—T. F. B.

UNITED STATES PATENT.

Wurtzilite [Rubber Substitute]; Process of Treating and Dissolving ——. F. M. Whitall, Assignor to S. R. Whitall and J. R. Edson, Washington, D.C. U.S. Pat. 768,101, Aug. 23, 1904.

WURTZILITE (see this J., 1903, 1139) in a finely-divided or pulverised condition is dissolved in "dead-oil" by the aid of heat; the solvent is then removed until the mass becomes consistent.—J. F. B.

XIV.—TANNING; LEATHER, GLUE, SIZE.

Tannic and Gallic Acids; Determination of ——. W. P. Dreaper. XXIII., page 913.

ENGLISH PATENT.

Leather; Artificial —— *and its Method of Manufacture.* R. Piesbergen, Berlin. Eng. Pat. 15,629, July 13, 1904.

A PLASTIC compound which sets hard when cold, composed of tanned animal albumin, glycerin, fatty oils, india-rubber solution and filling material is enclosed in a collodion film and gently pressed or rolled to the desired shape.—R. L. J.

UNITED STATES PATENT.

Skins or Hides; Process of Treating Pickled or Tanned ——. O. P. Amend, New York. U.S. Pat. 768,259. Aug. 23, 1904.

PICKLED skins and leather are de-acidified and oxidised by treatment in a neutral or slightly alkaline solution of a nitrite of an alkali or alkaline earth, such as sodium nitrite.
—J. F. B.

XV.—MANURES, Etc.

Phosphates: Action of Water and Saline Solutions upon certain Slightly Soluble ——. F. K. Cameron and L. A. Hurst. J. Amer. Chem. Soc., 1904, **26**, 885—913.

THE phosphates of iron, aluminium, and calcium are all hydrolysed by water, and the solutions always contain free phosphoric acid. It is therefore more correct to speak of the resulting solutions as solutions of the decomposition products, the phosphates themselves being, in many cases, present in negligible quantities only. The reaction follows the law of mass to some extent, is a slow one, and is markedly affected by the temperature. The conclusions arrived at after a considerable number of experiments are as follows:—Whilst the free acid tends to increase the solubility of the phosphate, the base, though in solution in smaller amount, exerts a greater effect in decreasing it. Successive additions of water, therefore, cause relatively less solution and decomposition of the phosphate. Potassium chloride decreases the amount of phosphoric acid entering into solution from iron, aluminium, or calcium phosphate, but increases the amount of base. Potassium sulphate increases the amount of soluble acidity in the case of iron phosphate, but decreases the amount entering into solution from aluminium phosphate. The presence of sodium nitrite decreases the acidity obtained from iron or aluminium phosphate, but appears to slightly increase the amount yielded by calcium phosphate. No correlation of the acidity with the amounts of iron in the solution seems possible. A rise of temperature accelerates the decomposition of the solid phosphates in either water or saline solutions.—W. P. S.

English Patent.

Manure; New and Useful Process of Manufacturing an Artificial ——. W. Mathesius, Berlin. Eng. Pat. 13,361, June 13, 1904. Under Internat. Conv., June 13, 1903.

Mineral phosphates, such as phosphorites, &c., are mixed with lime to form a "tetrabasic phosphate of calcium," if sufficient lime is not already present, and are melted in, for instance, a cupola furnace. The molten slag is treated with steam under pressure, or, in case an adequate excess of lime is present, with exhaust steam, in a closed vessel, until the product crumbles to a dry powder.—E. S.

XVI.—SUGAR, STARCH, GUM, Etc.

United States Patent.

Syrup; Process for Purifying ——. H. Kowalski, Warsaw. U.S. Pat. 768,130, Aug. 23, 1904.

See Addition, of May 23, 1902, to Fr. Pat. 315,737 of 1901; this J., 1903, 221.—T. F. B.

French Patent.

Saccharine Juices; Process of Defecation of ——. Vve. H. Breyer (*née* Muterbacher) and A. J. de Wehrstedt. Fr. Pat. 342,159, April 2, 1904.

Pulverulent, inert materials, such as pounded brick, are mixed with lime and employed for the defecation of saccharine juices. It is stated that such materials permit of a considerable economy in the quantity of lime required and that they absorb colouring matters and impurities from the juice and assist filtration.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Malt Analysis; Fermentation Experiments as an Aid to ——. A. Schifferer. Z. ges. Brauw., 1904, **27**, 585—587.

To obtain evidence of the behaviour of a malt in the brewery, the mixed wort which has been employed for extract determinations by mashing the coarse and fine grist is boiled for a short time in an Erlenmeyer flask, cooled to 17·5° C., and its specific gravity determined. Three clean, dry, white beer bottles, 340—360 c.c. capacity, are one-third filled with the wort, closed, and kept in the steriliser for half an hour at 55°—58° C. After cooling, two of the bottles are each pitched in the sterile chamber with 1 grm. of the freshly-washed, dry-pressed brewery yeast, and, after closing with a sterile cotton-wool plug, placed in a thermostat at 25° C. The third bottle, which is also kept in the thermostat until the fermentation in the other two bottles is at an end, serves as a control. In the author's experiments these blanks gave either zero or negligible results, so that no corrections were needful. Of the two bottles pitched with yeast, one is removed from the thermostat after 72 hours, and the specific gravity of the beer determined at 17·5° C., after removal of the carbon dioxide and filtration. The other fermented wort is treated in the same way after a further 24 hours, by which time the fermentation is complete. The relation between the results thus obtained and those of the tun beers are shown in the following table:—

	Apparent Final Attenuation.	
	Experimental Wort.	Tun Beer.
	Per Cent.	Per Cent.
Pilsen malt	82·0	78·4
Pale lager beer malt, No. I.	77·0	73·5
" " " No. II.	76·3	72·0
Dark " " No. I.	72·5	64·5
" " " No. II.	70·5	63·1

The higher percentage of matter fermented in the laboratory experiments as compared with the brewery mashes is explained by the more favourable conditions for starch degradation obtaining in the former case, the decoction process of mashing involving much destruction of diastase.
—T. H. P.

Yeast Oxydase. W. Issajew and S. Kalliski. Z. physiol. Chem., 1904, **42**, 132—140; Chem. Centr., 1904, **2**, 663.

The authors have detected an oxidising enzyme in extracts of yeast prepared with water and glycerin. The action of the enzyme is frequently masked by that of a reductase, but the latter can be rendered inactive by previous oxidation with atmospheric oxygen. The oxidising action of the enzyme can be proved both on the normal constituents of the yeast and on added polyphenols (quinol, pyrogallol). Top-fermentation yeast is appreciably richer in this oxidising enzyme than is bottom-fermentation yeast.—A. S.

Invertase of Yeast. B. Hafner. Z. physiol. Chem., 1904, **42**, 1—34. Chem. Centr., 1904, **2**, 603.

By dialysis of different specimens of invertase, the author found that the ash-content could be considerably reduced, but could never be brought quite to zero; this is especially the case with regard to the phosphorus, which, as Salkowski (Z. physiol. Chem., **31**, 321) has stated, is in organic combination. All attempts to obtain invertase free from carbohydrates failed. (Compare Wróblewski, this J., 1898, 682.) Invertase is not an albuminoid body, as it is not acted upon by proteolytic enzymes, and does not give the biuret reaction. It, however, contains nitrogen, and is possibly a complex phosphoric acid derivative, in which hydroxyl groups have been replaced by carbohydrates and nitrogenous substances. Invertase prepared from brewers' yeast is, in general, more active than that prepared from pressed yeast, but the latter preparations are of more constant composition.—A. S.

English Beer Types; Preparation of ——. H. Seyffert. Woch. f. Brau., 1904, **21**, 519—520.

With reference to the discovery by Claussen (this J., 1904, 721) of the so-called Brettanomyces, torulæ which produce the characteristic flavour of English beers, the author describes his own experience in a Russian brewery, preparing top-fermentation ales and porters with single-cell yeast. It was found that genuine English porter always contained a large proportion of wild yeasts and bacteria, whereas the Russian porter was free from infection, but lacked the typical "English" flavour. Experiments showed that when the Russian porter was infected with some of the cask-sediment from the English, the desired aroma was readily developed in it. The constituent organisms of this cask-sediment, some of them closely resembling Claussen's Brettanomyces, were isolated and cultivated in the pure state. Amongst them was a peculiar yeast which was capable of conducting the entire fermentation of the porter-wort, with the production of an "English" aroma. But difficulties were encountered in separating the yeast from the beer, and after a few fermentations the yeast had changed its character and had lost its property of developing the "English" aroma. None of the isolated organisms were capable of giving such a good flavour as the original mixed cask-sediment, but here again, when it was attempted to transfer the sediment from one brewing to the next, alteration or degeneration gradually took place, and the desired effect was lost. Similar results, successful at first, but failing after continued use, attended all attempts to obtain the "English" flavour by means of imported organisms, whether pure or mixed. The author suggests that the property claimed by Claussen for his Brettanomyces may also not be of a specific character, but merely a temporary property, which will disappear under different conditions of sub-cultivation, in the same manner as in the cases cited above.—J. F. B.

Beer; Sulphur Dioxide in ——. G. Graf. Z. ges. Brauw., 1904, **27**, 617—620.

The author's experiments confirm the assumption of Pfeifer (this J., 1889, 995) that the formation of sulphur dioxide in fermenting liquids is the result of a physiological process based on racial peculiarities of the yeast, and depending on the environment. The chief practical inference is that sulphur dioxide is a normal constituent of beer, and that its presence in excess of the usual limit (57 mgrms. per litre) should not be regarded as conclusive evidence of the use of sulphites or the like.—C. S.

Wine; Manufacture of —— by Sulphuring and Fermenting the Grapes. A. Lacassagne. J. d'Agric. Pract., 1903, 412—416; through Bied. Centralbl., 1904, **33**, 639—640.

Experiments were made on the large scale by exposing the grapes to the vapours of sulphurous acid in order to kill the foreign organisms whilst acclimatising the yeast to sulphurous acid. In addition to this treatment, "potassium persulphate" was added to the juice to the extent of 40 grms. per hectolitre. The fermenting must showed a preponderance of *S. ellipsoideus*, whilst *S. apiculatus* was absent. The above treatment, when applied to sound grapes, had a slight but distinct favourable influence on the course and the final result of fermentation; the last residues of sugar were fermented in a shorter time. The treatment had no appreciable effect upon the chemical composition of the wine, nor upon its colour, flavour, &c. The value of the wine was in no way impaired. The sulphured wine was decidedly more resistant towards the attacks of foreign micro-organisms, and kept better when exposed to the air than wine prepared in the ordinary way.—J. F. B.

Spirit from Dried Potatoes; Manufacture of ——. G. Heinzelmann. Z. Spiritusind., 1904, **27**, 358.

Owing to poor harvests, the use of potatoes preserved by drying as raw material for the manufacture of spirit has not made much progress in the last two years, since the cost of the potatoes has been too high. Dried potatoes require the same treatment during steaming as maize, *i.e.* the Henze steaming apparatus should be provided with stirrers; otherwise the potatoes clog together and form a mass impenetrable to the action of the steam, and gelatinisation is incomplete. If a stirrer be not available it is necessary to employ rather more water for the steaming, in order to ensure the necessary mobility. For the reason just mentioned, it has not been found practicable to steam a mixture of fresh and dried potatoes simultaneously, with the object of increasing the concentration of the mash. In thick-mash distilleries 100 kilos. of dried potatoes have yielded 33—35 litres of absolute alcohol, according to their richness in starch. Dried potatoes occur in the market in two forms: dried slices, which are prepared by drying slices of raw potatoes in a current of hot air; and flaked potatoes, which are made by passing boiled potatoes between hot rollers. The slices require steaming under pressure in the Henze apparatus. The flakes, manufactured originally for food purposes, are much dearer than the slices; they do not require steaming, but are mashed with water and malt at 60 C. If potatoes at harvest time show any signs of disease or any indications that they will not keep well over the winter, it is strongly recommended that, wherever practicable, they should be dried.—J. F. B.

French Patents.

"Lecithinated Beer": Incorporation of the Active Constituents of Lecithin with Acid, Alcoholic, and other Beverages. A. Fournier. Fr. Pat. 342,007, March 17, 1904.

The active constituents of lecithin, *viz.* choline and glycerophosphoric acid, may be isolated for the purpose of mixing with beverages in two ways: (1) by the hydrolysis of lecithin with hydrochloric acid and neutralisation of the solution with sodium bicarbonate, and (2) by boiling the alcoholic solution of lecithin with glycerophosphoric acid. In the first case the solution ultimately isolated for use contains choline hydrochloride and sodium glycerophosphate, and in the second case the product is a solution of choline glycerophosphate. In either case the final solution is brought to a standard concentration, and adjusted to the same degree of acidity and alcoholic strength as the beverage with which it is to be incorporated.

—J. F. B.

Distillery; System of —— adapted for Agricultural Use L. P. Bazin. Fr. Pat. 341,983, Feb. 25, 1904.

In order to continue the working of the distillery all th year round, a sufficient number of cylindrical silos ar constructed of masonry below the level of the ground The roots, &c. are washed and sliced, and the slices ar stored in the silo-pits, in regular horizontal layers, car being taken to pack them closely, with exclusion of ai spaces. When required for use, the slices are remove layer by layer, and extracted systematically by boilin water. The wort is acidified, and fermented by yeast.

—J. F. B.

Brandies and Liquors; Use of Roasted Wood for Improving and Ageing ——. J. L. Rouméguère. Fr. Pat 342,123, March 10, 1904.

The wood is first roasted in order to render the principles which play a part in the improvement and ageing of brandy immediately soluble in the liquor.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Flour; Preservation of —— by Cold. Balland. Compt rend., 1904, **139**, 473—475.

Samples of flour were stored for three years in a receptacl at the ordinary temperature, and in an apparatus kept a temperature between + 2° and − 2° C. The flo preserved at ordinary temperatures was slightly bleache after storing, and was bitter, and useless for food, whil the gluten obtainable from it was in clots, inelastic, an contained 64·5 per cent. of water; the amount obtained b extraction with ether was from 3 to 6 per cent. less tha that obtained from the original flour; the acidity had als increased. The sample preserved in the cold was rath damp and tasteless, but this was due to the presence moisture in the apparatus; the amount of gluten obtainab was slightly greater than that from the original sampl whilst, as regards quality, it was homogeneous, sweet, an contained 71 per cent. of water; the fatty matter and aci were present in the same quantities as in the original flou

—T. F. B.

English Patent.

Albumen from Fish; Manufacture of ——. A. Foelsin Offenbach a Main, Germany. Eng. Pat. 19,017, Sept. 1903.

The fish, after the removal of the head and bones, is fre from grease by a suitable solvent, such as acetone, and th repeatedly extracted with a 1½ per cent. solution of sodiu or potassium hydroxide, until all the albuminous matter dissolved. The liquors are filtered, deodorised by additi of hydrogen peroxide (2 per 1000), and precipitated b sulphurous acid solution. The flocculent matter is wash till neutral, dried, and pulverised.—R. L. J.

French Patent.

Milk Powder; Manufacture of a ——. J. Maggi. Fr. Pat. 341,840, April 1, 1904.

The milk is intimately mixed and rendered homogeneous under pressure, then dried by the hot-roller system, and powdered.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Nitrogen in Water; Determination of Ammoniacal and Proteid ——. J. Effront. XXIII., page 912.

Iron; Colorimetric Determination of Small Amounts of —— *by Acetylacetone* [*especially applicable to Water Analysis*]. H. B. Pulsifer. XXIII., page 913.

English Patents.

Wash and other Waste Waters or Residues; Treatment of ——. A. J. Boult, London. From A. E. Vasseux, Hal, Belgium. Eng. Pat. 17,661, Aug. 14, 1903.

See Fr. Pat. 330,423 of 1903; this J., 1903, 1099.—T. F. B.

Trade Effluents; Treatment of ——. J. Turner, Sowerby Bridge, Yorkshire. Eng. Pat. 20,021, Sept. 17, 1903.

Any common soap, such as rosin soap, or fats and alkali, are added, preferably in solution, to the trade effluent. After agitating the mixture, sulphuric acid, aluminium sulphate, or any suitable metallic salt, is added to "curd or crack the sud," after which the whole is allowed to stand for some time. The clear water may then be run off, the solid matters being precipitated. If necessary, the effluent may also be oxidised before or during the treatment by blowing air through it.—A. G. L.

Garbage; Apparatus for Removing Liquids from Solids, applicable for the Treatment of —— *and for other Purposes.* C. S. Wheelwright, Bristol, R.I., and J. T. Fiske, jun., Burrillville, R.I. Eng. Pat. 14,484, June 27, 1904.

The apparatus consists of a cylinder placed at the lower end, and in connection with, a digester in which the material is previously treated with water. The cylinder is provided with a revolving screw fitting its internal periphery. Perforated plates are placed in the sides of the cylinder with suction boxes below them, and a pump is arranged in connection with the latter to return the water to the cylinder. Fins or plates are let into the cylinder, which vibrate to and from the interstices between the threads of the screw. One end of the cylinder projects beyond the screw, and is provided with an outlet and a head fitted with a valve on the axis of the screw at various distances from the latter, to direct the material from the screw to the outlet. (See also U.S. Pat. 719,541 of 1903; this J., 1903, 288.)—W. P. S.

Garbage or Offal; Process of Cooking —— *and Removing the Oil or Melted Grease therefrom.* C. S. Wheelwright, Bristol, R.I., and J. T. Fiske, jun., Burrillville, R.I., U.S.A. Eng. Pat. 15,235, July 7, 1904.

Steam is introduced under pressure directly into the mass of garbage or offal, together with sufficient fresh water to float the oil or grease extracted from the garbage. The water and extracted oil or grease are continuously trapped, whilst the solid parts of the garbage or offal are held back, and the water is finally separated from the oil or grease extracted.—A. G. L.

French Patent.

Water Filter. N. A. Hélous, L. Mauclaire, and E. Meyer. Fr. Pat. 341,908, April 6, 1904.

The filter consists of a vertical cylindrical vessel having a tubulure at the top and bottom. A tube passes through the lower tubulure, the upper end of the tube being surrounded by a hollow block of compressed carbon which has previously been "stoved," soaked in a solution of ferric chloride containing 1 per cent. of vanadic chloride, and then in a solution of sodium hydroxide (4° B.) to which has been added 10 per cent. of hydrogen peroxide. This block of carbon has around and above it a layer of granulated wood-charcoal also previously treated with ferri-vanadic chloride and sodium hydroxide. A packing of oxycellulose is placed above this layer, and the remaining space in the filter is filled with a mixture of powdered iron, containing 1 per cent. of vanadium, and corundum. Above this mixture is a second packing of oxycellulose. The water to be filtered enters through the upper tubulure.—W. P. S.

(*C.*)—DISINFECTANTS.

United States Patents.

Antiseptic Compound. A. M. Clover, Ann Arbor, Mich. U.S. Pats. 768,561 and 768,563, Aug. 23, 1904.

See Eng. Pat. 8415 of 1904; this J., 1904, 834.—T. F. B.

Peroxide Acids; Process of Forming Organic ——. [*Disinfectants*] A. M. Clover, Ann Arbor, Mich. U.S. Pat. 768,562, Aug. 23, 1904.

See Eng. Pat. 8415 of 1904; this J., 1904, 834.—T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

English Patent.

Celluloid and like Substances; Apparatus for the Treatment [*Softening*] *of* ——. H. W. Cave-Browne-Cave, London. Eng. Pat. 22,299, Oct. 16, 1903.

An air-tight box is fitted with a loose perforated bottom, beneath which wool or other absorbent material, moistened with a volatile solvent of celluloid, *e.g.*, methylated spirit and camphor, amyl acetate, or methylated ether, is packed. The articles to be softened are placed in trays above the false bottom and exposed to the vapours for the necessary space of time.—R. L. J.

United States Patents.

Paper-making Machine. E. Waite, Franklin, Mass. U.S. Pat. 768,353, Aug. 23, 1904.

In a paper machine, the web of paper, after passing from the suction rolls on to the long felt, comes in contact with an upper apron travelling in unison with the long felt. The surface of the apron which is in contact with the web of paper is composed of a coarsely woven fabric, such as jute, which, passing through the press-rolls with the paper, imparts to the latter a roughened surface on the side with which it is in contact. The other side of the apron, which is reversible, may be employed when desired for giving a smoother surface.—J. F. B.

Paper; Process of Making ——. R. S. Case, Unionville, Conn. U.S. Pat. 768,422, Aug. 23, 1904.

A series of disconnected and bevel-edged webs of paper of uniform character are formed upon a single travelling apron by gathering pulp from the vat by a cylinder and forming it into a number of independent webs or plies, which are transferred to the blanket. The same operation is repeated a certain number of times in succession, each fresh ply being couched upon the previous one, and each successive ply being slightly wider than the last. The resulting bevel-edged webs are then pressed and trimmed, colour is applied to the edges if desired, and the whole series is dried simultaneously. (See also U.S. Pat. 759,862; this J., 1904, 677.)—J. F. B.

French Patents.

Cellulose from Green Alfa [*Esparto*]; *Preparation of* ——. P. Bouby and A. Deiss. Fr. Pat. 341,930, Feb. 16, 1904.

The esparto, in the perfectly fresh green state, is sorted and subjected to a preliminary mechanical breaking treatment; the plant is then treated in open vessels with five times its weight of an alkaline solution, either hot or cold. After sufficient steeping the cellulose is separated, washed, and bleached. The sediment deposited from the used alkaline baths serves for the manufacture of a green-coloured soap.—J. F. B.

Rosin Soap for Sizing Paper and Millboard; Manufacture of ——. A. Sauvage. Fr. Pat. 341,844, April 6, 1904.

The soap is prepared at high temperatures by introducing very hot, molten rosin gradually into a boiling solution of the alkali concentrated to its saturation point. Boiling water is added from time to time, to replace that lost by evaporation, and to prevent crystallisation of the alkali. —J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Cerite Earths; Preparation of —— *in the Pure State by the Aid of their Alkali Double Carbonates.* R. J. Meyer. Z. anorg. Chem., 1904, **41**, 97—125.

The following alkali double carbonates were prepared and analysed:—*Potassium Salts*: Potassium lanthanum carbonate, $K_2La_2(CO_3)_4.12H_2O$; potassium cerium carbonate, $K_2Ce_2(CO_3)_4.12H_2O$; potassium praseodymium carbonate, $K_2Pr_2(CO_3)_4.12H_2O$; and potassium neodymium carbonate, $K_2Nd_2(CO_3)_4.12H_2O$. *Ammonium Salts*: Ammonium lanthanum carbonate, $(NH_4)_2La_2(CO_3)_4.4H_2O$; ammonium cerium carbonate, $(NH_4)_2Ce_2(CO_3)_4.6H_2O$; ammonium praseodymium carbonate, $(NH_4)_2Pr_2(CO_3)_4.4H_2O$; and ammonium neodymium carbonate, $(NH_4)_2Nd_2(CO_3)_4.4H_2O$. *Sodium Salts*: Sodium lanthanum carbonate, $Na_6La_4(CO_3)_9.20H_2O$; sodium cerium carbonate, $Na_6Ce_4(CO_3)_9.24H_2O$; sodium praseodymium carbonate, $Na_6Pr_4(CO_3)_9.22H_2O$; and sodium neodymium carbonate, $Na_6Nd_4(CO_3)_9.22H_2O$. The sodium salts were all amorphous unstable compounds, and were possibly contaminated with adherent sodium carbonate. The ammonium and sodium double salts are only very slightly soluble in the corresponding alkali carbonate solutions. The potassium salts, on the other hand, are easily soluble in a concentrated solution of potassium carbonate, but the degrees of solubility of the several salts examined differed considerably one from another. If the concentrated solutions be diluted with water, the potassium double carbonates separate in the following order: lanthanum, praseodymium, cerium, neodymium. A crude lanthanum salt can be almost completely freed from cerium and didymium by three precipitations as potassium double carbonate, whilst at the same time the didymium splits up to a considerable extent into praseodymium and neodymium. Praseodymium oxide contaminated with small quantities of cerium, neodymium and lanthanum can be completely freed from cerium and neodymium by three precipitations as potassium double carbonate. The lanthanum can be almost completely removed by systematic fractional crystallisation of the praseodymium oxalate from nitric acid solution. The praseodymium oxide obtained by ignition of the oxalate invariably has the composition Pr_6O_{11} or $4PrO_2.Pr_2O_3$; the formula Pr_4O_7 or $2PrO_2.Pr_2O_3$, accepted by Auer von Welsbach and by Jones, is incorrect.—A. S.

Mercuric Chloride in Corrosive Sublimate Pastilles; Volumetric Determination of ——. R. Corradi. XXIII., page 913.

Methyl Alcohol; Determination of —— *in Formaldehyde.* H. Bamberger. XXIII., page 914.

Quinine Sulphate; Testing of ——. B. H. Paul. XXIII., page 914.

Quinine Sulphate; Testing of ——. D. Howard. XXIII., page 914.

Volatile Oil of Mustard; Determination of ——. Vuillemin. XXIII., page 914.

English Patents.

Methyl Groups of Aromatic Hydrocarbons; Oxidation of ——. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 17,982, Aug. 19, 1903.

The methyl groups of aromatic hydrocarbons are oxidised in acid solution to aldehyde groups by means of the sulphate of manganese dioxide obtained by the action of electrolytic oxygen on a solution of manganous sulphate in sulphuric acid (see Eng. Pat. 17,981 of 1903; this J., 1904, 749). For example, a solution of the sulphate of manganese peroxide obtained from six parts of manganous sulphate is added slowly to five parts of *o*-nitrotoluene at a temperature of 50° to 60° C., with constant stirring; the mixture is heated to 100° or 110° C. until decolorised, and the product distilled with steam, the distillate consisting of *o*-nitrobenzaldehyde and unchanged *o*-nitrotoluene; the solution is oxidised electrolytically and used for a further operation. Toluene is oxidised to benzaldehyde similarly, and also to benzoic acid if sufficient oxidising agent and high enough temperature be employed.—T. F. B.

Roasting Chemicals and the like; Apparatus for ——. T. P. Thomas, J. L. Richardson, and P. Davies. Eng. Pat. 21,896, Oct. 12, 1903. I., page 894.

Suprarenal Glands; Manufacture of Compounds of the Active Substance of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine, Germany. Eng. Pat. 24,723, Nov. 13, 1903.

Adrenalin, the active principle of the suprarenal gland, may be dissolved in a solution of boric acid or of one of its derivatives (*e.g.*, phenylboric acid). The resulting solutions are not precipitated by the addition of alkali. The compound of adrenalin and boric acid may be obtained in the dry state by evaporating the solution (preferably *in vacuo*) or by precipitation with absolute alcohol from a concentrated solution.—T. F. B.

Protocatechuic Aldehyde and its Derivatives [*Vanillin*]; *Manufacture of* ——. A. Verley, Paris-Neuilly. Eng. Pat. 25,546, Nov. 23, 1903. Under Internat. Conv., Nov. 27, 1902.

See Fr. Pat. 326,775 of 1902; this J., 1903, 819.—T. F. B.

United States Patents.

Cyclogeraniolidene Acetone and Process of Making same G. Merling, Frankfort, and H. Eichwede, Hoechst-on-the-Maine, Assignors to Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine, Germany. U.S. Pat. 768,389, Aug. 23, 1904.

See Eng. Pat. 3173 of 1903; this J., 1904, 203.—T. F. B.

Pyrazolone Compound [*with Butylchloral Hydrate*], *an Process of Making same.* M. Overlach, Greiz, Assigno to Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine, Germany. U.S. Pat. 768,398 Aug. 23, 1904.

See Eng. Pat. 15,782 of 1903; this J., 1904, 679.—T. F. B

Theophylline; Process of Making ——. M. C. Massie Washington, Administrator of F. Ach, Assignor to C. F Boehringer und Soehne, Mannheim-Waldhof, Germany U.S. Pat. 768,533, Aug. 23, 1904.

See Eng. Pat. 5901 of 1903; this J., 1903, 648.—T. F. B.

Extracting Essence; Apparatus for ——. E. E. Hand, New York. U.S. Pat. 768,575, Aug. 23, 1904.

The material to be extracted is placed in a horizontal perforated, cylindrical cage, mounted on a horizontal shaf projecting from each end, by means of which it is supporte in an outer, horizontal, cylindrical vessel or "still." Mean are provided for rotating and for withdrawing the inne cage, one end of the still being removable, and the end o the shaft passing through this removable head of the stil being connected with the rotating mechanism, which i mounted on a truck running on rails.—W. H. C.

French Patents.

Halohydrins of the Aromatic Series, and Amino Alcohol derived therefrom; Process for Obtaining —— Poulenc Frères and E. Fourneau. Fr. Pat. 338,38 June 23, 1903.

Epichlorhydrin reacts with phenyl (or other aromati derivative of) magnesium halides, forming two classes c products, *viz.*, substituted chloropropenes, and substituted chloropropanols, which can be separated by fractionation. Using phenyl magnesium bromide, for instance, phenylchloropropene and phenylchloropropanol are produced. On heating the arylchloropropanols with fatty amines, amino-alcohols derived from propane are obtained. Thus, from phenylchloropropanol and dimethylamine, dimethylaminophenylpropanol results. The following compounds are also described :—Phenylpropenol, phenylchlorobutanol, anisylchloropropanol, phenyldi- and trimethylaminopropanol. All these compounds have agreeable odours, and are applicable to perfumery.—T. F. B.

Alcohols and their Derivatives; Production of New Compounds, and General Method of Preparing Primary ——. L. Bouveault and G. Blanc. Fr. Pat. 338,895, June 27, 1903.

See Eng. Pat. 14,758 of 1903; this J., 1904, 798.—T. F. B.

Formic Acid from Formates; Production of Concentrated ——. M. Hamel. Fr. Pat. 341,764, March 30, 1904.

Concentrated formic acid is obtained by dissolving the formate in some solvent which, on subsequently distilling the solution, will not dilute the formic acid, and then decomposing the formate with concentrated sulphuric acid or an acid sulphate. Suitable solvents are formic or acetic acids, formic acid being preferable. The sodium formate may be dissolved in an equal weight of concentrated formic acid, and sulphuric acid and sodium formate added alternately, until the retort is sufficiently full, when the contents are distilled.—T. F. B.

Formates; Process for Making ——. R. Koepp and Co. Fr. Pat. 342,168, April 6, 1904.

Carbon monoxide reacts more rapidly on alkali hydroxides in presence of water than in the dry state, and the reaction is also more rapid with rise of temperature, owing to the increasing solubility of carbon monoxide. Sodium formate can be produced by running a solution of sodium hydroxide of 40° B. on to a mass of coke heated to 220° C. in a closed vessel, and blowing heated carbon monoxide through the liquid for three-quarters of an hour. In place of alkali hydroxides, the oxides or carbonates of the alkaline earth metals or alkali carbonates may be employed.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

English Patents.

Photographic Emulsions; Sensitising —— with the Aid of Dyestuffs. H. E. Newton, London. From Farbenfabr. vorm. F.Bayer and Co., Elberfeld, Germany. Eng. Pat. 23,722, Nov. 2, 1903.

See Fr. Pat. 336,298 of 1903; this J., 1904, 337.—T. F. B.

Furnaces especially adapted for the Separation of Godl and other Precious Metals from the Sweepings of Jewellers' Warehouses, Photographers' Waste, and the like. S. W. Price. Eng. Pat. 19,984, Sept. 16, 1903. X., page 902.

French Patent.

Photography of Colours. J. Hero. Fr. Pat. 342,037, April 12, 1904.

Photographs in natural colours are obtained by the following process :—An ordinary dry plate is immersed for about six minutes in a solution prepared by dissolving 50 grms. of gelatin in a litre of water, and then adding solutions containing alum, 5 grms.; ferrous sulphate, 15 grms.; Judea bitumen, 10 grms.; potassium ferricyanide, 7 grms.; potassium ferrocyanide, 6 grms.; uranium nitrate, 5 grms.; "paraffin," 5 grms.; white gum, 10 grms. The plate is dried, exposed in the usual way, developed by means of diaminophenol, and fixed as usual. A print is made on gelatino-chloride paper in the usual way, and toned and fixed in a bath containing gold chloride, lead acetate, alum, and sodium thiosulphate in stated proportions. The print is finally immersed for about one minute in a bath similar to that used for preparing the dry plate, with the exception that barium sulphate is used and the gelatin is omitted, the proportions being also slightly modified.

—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

United States Patent.

Explosive Compound. N. Ceipek, Vienna. U.S. Pat. 768,512, Aug. 23, 1904.

See Fr. Pat. 341,021 of 1904; this J., 1904, 837.—T. F. B.

French Patents.

Explosive Materials and Powders; Method of Manufacture of ——. A. Mikolajczek. Fr. Pat. 341,911, April 6, 1904.

Glycerol dinitrate is prepared by adding nitric acid of sp. gr. 1·5 (33 parts) to glycerin (10 parts) under continuous stirring and cooling. The mixture is allowed to stand for several hours at 10° C., diluted with 10 parts of water, and then neutralised with calcium carbonate. After a further period of standing, the greater part of the glycerol dinitrate rises to the surface, and can be separated, the remainder being extracted from the liquid by means of ether. Glycerol dinitrate is a colourless oil soluble in water and nitroglycerin (glycerol trinitrate), and dissolves and gelatinises collodion cotton, &c. It does not solidify at low temperatures, and its admixture with the trinitrate lowers the freezing point of the latter. The following are mentioned as examples of explosives containing this body :—glycerol dinitrate (61 per cent.), collodion cotton (1·8 per cent.), saltpetre (30 per cent.), and wood meal (7·2 per cent.), and also glycerol dinitrate (45 per cent.), glycerol trinitrate (30 per cent.), chalk (2 per cent.), kisselguhr (23 per cent.).—G. W. McD.

Matches; Method of Manufacture of Phosphorus-free Paste for ——. J. D. Riedel. Fr. Pat. 342,010, April 9, 1904.

Barium-copper poly(di-, tri-, tetra-, penta-)thionate (10 parts) is mixed with sulphur (3 parts). Under the action of pressure or heating a sulpho-polythionate is produced. The paste has the following composition :—Barium-copper sulpho-polythionate (20 per cent.), powdered pumice (27·2 per cent.), potassium chlorate (44·8 per cent.), and gum (8 per cent.).—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUANTITATIVE.

Oxidising Substances; Use of Hydrazine Sulphate in the Determination of ——. U. Roberto and F. Roncali. L'Ind. Chimica, 1904, **6**, 178—179; Chem. Centr., 1904, **2**, 616.

Substances capable of evolving oxygen react with hydrazine sulphate according to the equation, $H_2SO_4.N_2H_4 + O_2 = H_2SO_4 + 2H_2O + N_2$. For example, if potassium permanganate be heated gently with hydrazine sulphate, the solution is decolorised and nitrogen is evolved: $4KMnO_4 + 6H_2SO_4 + 5H_2SO_4.N_2H_4 = 2K_2SO_4 + 4MnSO_4 + 5H_2SO_4 + 16H_2O + 5N_2$. Then, from the volume of nitrogen evolved, the amount of permanganate can be ascertained in a manner similar to that previously described for bleaching powder (this J., 1904, 623). Bichromates, peroxides, chlorates, and other compounds of a similar character can also be determined in this manner.—A. S.

Magnesium; Colorimetric Determination of ——. O. Schreiner and W. S. Ferris. J. Amer. Chem. Soc., 1904, **26**, 961—967.

The following solutions are required: (1) fifty grms. of ammonium molybdate in 1 litre of water; (2) nitric acid, sp. gr. 1·07; (3) 0·5045 grm. of crystallised sodium phosphate, $Na_2HPO_4.12H_2O$, and 100 c.c. of nitric acid of sp. gr.

1·07 in 1 litre; (4) a standard colorimetric solution prepared by diluting 10 c.c. of the sodium phosphate solution (3) to about 80 c.c., then adding 9 c.c. of nitric acid (2) and 8 c.c. of the ammonium molybdate solution (1) and making up to 100 c.c.; (5) phosphate reagent, prepared by dissolving 17·4 grms. of potassium hydrogen phosphate, K_2HPO_4, and 100 grms. of ammonium chloride in about 900 c.c. of water, adding 50 c.c. of ammonia (sp. gr. 0·9) and diluting to 1 litre. Fifty c.c. of the solution to be examined are evaporated in a basin to dryness after adding one drop of ammonia and two or three drops of saturated ammonium oxalate solution. The residue is treated with 1 c.c. of the phosphate reagent (5), well stirred and allowed to stand two hours, when 5 c.c. of dilute ammonia (1 : 9) are added, and the precipitate is collected on a filter. The precipitate is washed with the dilute ammonia five times by decantation, and then on the filter until the filtrate measures 50 c.c. The basin is washed once with 5 c.c. of water, which is poured on the filter. 5 c.c. of nitric acid (2) are added to the basin, poured on the filter, after removing the vessel containing the ammoniacal washings and substituting another, and both basin and filter are washed with hot water until about 45 c.c. of filtrate have been obtained. To the cooled liquid 4 c.c. of the ammonium molybdate solution (1) are added, and after 20 minutes, the coloration is compared with that produced by known quantities of the colorimetric phosphate solution (4). 1 c.c. of the latter is equivalent to 0·00001 grm. of phosphoric anhydride or 0·00000342 grm. of magnesium. Any silica present is completely removed during the washing process.—W. P. S.

Lime in Cement; Rapid Method for the Determination of ——. B. Enright. J. Amer. Chem. Soc., 1904, **26**, 1003—1005.

THE powdered cement is agitated with hot dilute hydrochloric acid, a few drops of bromine-water are added, and the solution is boiled, rendered alkaline with ammonia, and filtered. The residue is treated with hydrochloric acid, and the solution diluted. After once more adding ammonia in slight excess, boiling, filtering, and washing, the united filtrates are slightly acidified with hydrochloric acid and boiled. Ammonium oxalate solution and ammonia are added to the boiling solution, the precipitate is washed with hot water, and dissolved in sulphuric acid, and the solution immediately titrated with potassium permanganate solution.—W. P. S.

Gold Determination by means of the Purple of Cassius Test, for Cyanide Works. A. Prister. J. Chem., Met. and Min. Soc. of S. Africa, 1904, **4**, 455.

THE process is a modification of the one previously described (this J., 1904, 207). Potassium cyanide is added to the cyanide solution to be tested, until the proportion of free cyanide reaches about 1 per cent. 1 grm. of zinc dust is added to each 200 c.c. of the solution, and, after boiling, the solution is filtered, and the zinc dust remaining is dissolved by warming with dilute sulphuric acid. The zinc sulphate solution is passed through the same filter. The residual metals are dissolved in 10 c.c. of dilute *aqua regia*, and the boiling solution is passed repeatedly through the same filter. To the gold solution collected in a test tube, and cooled, a few drops of stannous chloride solution are added, and, if the proportion of gold is small, time is allowed for formation of the coloration.—E. S.

Lead, Iron, Lime, Sulphur, Cadmium, and Copper in Commercial Zinc Ores; Determination of ——. W. G. Waring. Eng. and Mining J., 1904, **78**, 298—299.

THE author from a long practical experience finds the following methods give accurate results with the least expenditure of time:—

Lead.—From 0·5 to 3 grms. of the ore are decomposed with nitric acid, 2 or 3 c.c. of strong sulphuric acid are added, the mixture is evaporated till white fumes appear, cooled, diluted, and then boiled until the soluble sulphates are dissolved. The insoluble residue containing the lead as sulphate is filtered off, washed with water containing 2 or 3 c.c. of sulphuric acid per litre, and digested with 15 or 20 c.c. of a hot solution of ammonium carbonate, the lead carbonate dissolved by means of 5 or 6 c.c. of glacial acetic acid or 15—20 c.c. of hot 30 per cent. acid, and the solution titrated with standardised potassium ferrocyanide solution, using uranium acetate or nitrate as indicator. The solution must not contain more than 0·2 grm. of lead per 100 c.c. If the amount of lead sulphate separated at first correspond to only 50 mgrms. or less of lead, more accurate results are obtained by dissolving the lead sulphate by repeated boiling with ammonium acetate solution, washing the residue with 15—25 c.c. of hydrochloric acid of sp. gr. 1·4, heating the solution with a pellet of pure zinc, and weighing the separated lead.

Iron.—For the determination of iron, the ferric hydroxide separated in the ordinary zinc assay is reduced by sulphuric acid and zinc, or by means of stannous chloride, and the solution titrated with permanganate solution.

Lime.—Iron and manganese are separated by precipitation with excess of ammonia in presence of ammonium chloride, and the calcium is precipitated as oxalate. If the ore contain a large proportion of lead, the calcium oxalate should be redissolved and again precipitated.

Sulphur.—0·25 grm. of a blende ore, or a larger amount in the case of an oxidised ore or roasted blende, is ground with 0·5 grm. of dry sodium carbonate, 0·25 grm. of potassium chlorate, and 1·2 grms. of pure manganese dioxide, and the mixture transferred to a platinum or porcelain crucible lined with magnesia. The mixture is covered with a little magnesia, and the crucible is then heated, gently at first, and finally to full redness for 15—20 minutes. After cooling, the contents of the crucible are emptied into water and the sulphur determined as in Eschka's method, except that no addition of bromine is required. For more exact results, the insoluble residue should be dissolved in hydrochloric acid, and any sulphur present determined. A blank test must always be made with the manganese dioxide.

Cadmium and Copper.—The ore is decomposed with hydrochloric acid or *aqua regia*, the excess of acid expelled, the solution diluted and filtered, and sufficient acid added to the filtrate to bring its acidity up to the equivalent of 10 c.c. of hydrochloric acid of sp. gr. 1·10 per 250 c.c. Hydrogen sulphide is then passed through the solution, the precipitated sulphides are treated with dilute sulphuric acid to dissolve the cadmium and zinc, and acid or alkali is added to the solution to make its acidity equivalent to about 6·5 per cent. by weight of sulphuric acid. The solution is then heated to 70° C. and the cadmium precipitated by hydrogen sulphide.

Other Elements.—Gold and silver, antimony, arsenic, selenium, tellurium, thallium, iridium, bismuth, manganese, cobalt, and nickel may also be present in zinc ores. For the determination of gold and silver by the crucible or scorification method, the ore must first be decomposed by hydrochloric acid and the zinc removed by treatment with water. Skinner and Hawley's method (this J., 1902, 1156) has been found to be the best for the determination of arsenic and antimony. Thallium, iridium, tin, and bismuth are precipitated together with silver, cadmium, copper, and part of the antimony, tellurium, &c., by means of aluminium from acid solution, as a preliminary step to the separation of zinc by hydrogen sulphide in the presence of formic acid. In the metallic residue, the elements named are determined by the usual methods.—A. S.

Nitrogen Determinations [Kjeldahl]; Influence of the Alkalinity of Glass on the Accuracy of ——. K. Barelt and R. Schönewald. Woch. f. Brau., 1904, **21**, 523.

PARALLEL blank distillations made in an apparatus which had been in use for a considerable time, and in a similar but perfectly new apparatus, showed that with the new apparatus the errors due to the glass were considerably greater than with the old one. It is therefore advisable to "age" a new apparatus before use by boiling water in it. (See also this J., 1904, 269.)—J. F. B.

Nitrogen in Water; Method for the Determination of Ammoniacal and Proteid ——. J. Elfront. Monit. Scient., 1904, **18**, 669—674.

THE method is based on the reduction of alkali hypochlorite to chloride by ammonia and albuminoid substances. 1 litre of the water is allowed to stand for two hours with 20 c.c. of N/1 sodium carbonate solution and 20 c.c. of a standardised hypochlorite solution (prepared by digesting 50 grms. of bleaching powder with 1 litre of water). Excess of a standard solution of arsenious acid (containing 4·586 grms. of arsenious acid and 15 grms. of sodium carbonate per litre) is then added, and the excess determined by titration with a solution of iodine in potassium iodide, corresponding to the arsenious acid solution. 1 c.c. of this iodine solution corresponds to 0·5 mgrm. of ammonia. Proteid nitrogen is determined by evaporating 1 litre of the water with 0·5 to 1 grm. of sodium carbonate to a volume of 150 c.c., diluting to 1 litre, and then treating as in the determination of ammonia, with the exception that the solution must stand for 14 to 16 hours instead of for 2 hours only. 1 c.c. of iodine solution corresponds to 0·215 mgrm. of proteid nitrogen. By this method it is stated that 0·5 mgrm. of nitrogen can be determined in 1 litre of water.—T. F. B.

Iron; Colorimetric Determination of Small Amounts of —— by Acetylacetone [especially applicable to Water Analysis]. H. B. Pulsifer. J. Amer. Chem. Soc., 1904, **26**, 967—975.

The method is based upon the fact that acetylacetone, $CH_3.CO.CH_2.CO.CH_3$, gives an intense red coloration with ferric salts. For the determination of iron in water, 100 c.c. or more of the latter are evaporated to dryness and all organic matter removed by treating with sulphuric and nitric acids. The residue is warmed with a few drops of dilute sulphuric acid and a drop of hydrochloric acid, filtered, and the filtrate oxidised by a trace of nitric acid. If the amount of iron present be very small, the solution must be evaporated almost to dryness to expel excess of acid. If larger amounts be present the solution may be diluted to 500 c.c. or 1000 c.c. without removing the acid. A definite portion of the solution is then transferred to a Nessler tube, 2 c.c. of a 0·5 per cent. aqueous solution of acetylacetone is added, and the tube filled up to the mark with water. The contents must be well mixed. The coloration produced is compared with that yielded by a known amount of iron. In no case should the colour be matched by pouring out one or other of the solutions until the tints are equal, but a number of standard tubes should be used. The colour is very permanent, and there are practically no substances which interfere with the reaction. The test is more sensitive than the potassium thiocyanate one, the limit being 0·000003 grm. of iron.—W. P. S.

Mercuric Chloride in Corrosive Sublimate Pastilles; Volumetric Determination of ——. R. Corradi. Boll. Chim. Farm., 1904, **43**, 424—427. Chem. Centr., 1904, **2**, 617.

The method is based upon the reaction: $HgCl_2 + 2KI = HgI_2 + 2KCl$. The mercuric iodide produced dissolves in the excess of potassium iodide, with formation of a double salt, $KI.HgI_2$. A 2 per cent. solution of potassium iodide is added, drop by drop, to 10 c.c. of a 1 per cent. solution of mercuric chloride, till the exact amount required to just re-dissolve the precipitate produced is determined. A corresponding determination is then made with, for example, an aqueous solution of five corrosive sublimate pastilles. Sodium chloride, vaseline oil, and colouring matters (Eosine, Erythrosin) are stated to have no influence on the results. —A. S.

ORGANIC—QUALITATIVE.

Turpentine; Technical Analysis of Spirits of ——, with a New Method for the Detection of Petroleum Adulterations and Wood Spirits of Turpentine. J. M. McCandless. J. Amer. Chem. Soc., 1904, **26**, 981—985.

For the detection of petroleum and wood turpentine in turpentine, determinations of the flashing point and specific gravity were found to be useless, the iodine value also giving no decisive evidence (see this J., 1904, 302) when only small quantities of the adulterants were present. Polymerisation with sulphuric acid, followed by steam distillation and a determination of the refractive index of the distillate, however, afforded a reliable means of detecting 5 per cent. or less of petroleum in turpentine. 100 c.c. of the turpentine were cautiously treated with 50 c.c. of concentrated sulphuric acid, with constant agitation and cooling. After adding 25 c.c. of water, the mixture was steam-distilled until 100 c.c. of distillate, consisting of oil and water, were collected. The oily layer was separated and treated with its own volume of fuming sulphuric acid. The resulting mixture was poured into water, the oil separated and steam-distilled. The distilled oil was again treated with fuming sulphuric acid and re-distilled. The refraction of the oil obtained was then determined at 25° C. by means of a Zeiss butyro-refractometer. In no case with a genuine sample of turpentine or wood turpentine, did the reading fall below 30 (scale degrees), but with adulterated oils, containing even as little as 1 per cent. of petroleum, the reading fell as low as 25, and could be reduced to 22 by further treatment with sulphuric acid. The final volume of the oil obtained roughly represented the quantity of petroleum present. Petroleum having been proved to be absent, the following method was employed for the detection of the wood turpentine:—100 c.c. of the sample are slowly distilled and the refraction of the first 0·5 c.c. of distillate determined. At 25° C., genuine turpentines gave readings from 60 to 63, and wood turpentine from 57 to 59. If no indication of adulteration was detected by this initial reading, the distillation was continued, and the refraction of the 97th and 98th c.c. observed. Genuine turpentine did not give a higher reading than 77, usually much less, whilst with wood turpentine, the reading exceeded 77, and even reached 90. A further distinction was noticed during the distillation. In the case of the genuine turpentines 95 c.c. distilled over below 165° C., but if admixed with any wood turpentine, when 95 per cent. had come over, the temperature would be found to be much higher than 165° C.—W. P. S.

ORGANIC—QUANTITATIVE.

Tannic and Gallic Acids; Determination of ——. W. P. Dreaper. Chem. News, 1904, **90**, 111—112.

The author considers that until further evidence is brought forward, the use of collin as a precipitant for tannin, as recommended by Parker and Payne (this J., 1904, 648), must be regarded with suspicion. In a test with a solution containing equal parts of tannic and gallic acids, it is stated that about 60 per cent. of the gallic acid was separated with the tannin-collin compound. The author recommends the following modification of his earlier process (this J., 1893, 412), and claims that it enables one to differentiate between tannic and gallic acids, and also between tannin acids soluble and insoluble respectively in ammonium carbonate solution. Three solutions are required: (1) Standard copper sulphate solution of a strength equivalent to 0·05 grm. of copper oxide per c.c.; (2) solution containing 50 grms. of ammonium carbonate and 50 grms. of sodium sulphite per litre; (3) solution containing 20 grms. of lead acetate and 60 c.c. of glacial acetic acid per litre.

Total Tannic and Gallic Acids.—50 c.c. of the tannin solution containing 10—15 grms. of tannin material per litre are heated with excess of calcium carbonate, cooled, and titrated with the copper solution, with ferrocyanide indicator, as previously described (*loc. cit.*). The result, expressed as copper oxide, represents the total tannic and gallic acids, and, from the dyers' point of view, the "mordant value" of the tannin extract.

Tannic Acid Insoluble in Ammonium Carbonate Solution.—50 c.c. of the tannin solution are treated with 25 c.c. of No. 2 solution, and titrated with the copper solution; the reaction proceeds slowly towards the end, and the final colour test with the ferrocyanide, which must be rendered strongly acid with acetic acid, should be made after the lapse of three minutes. The copper tannate produced is free from gallate. In the case of an unknown extract, the precipitate may be filtered off, and weighed at 105° C., and the amount of tannic acid present calculated, the weight of copper oxide being known.

Total Tannic Acid.—50 c.c. of the tannin solution are treated with 10 c.c. of No. 3 solution and some barium sulphate, and the mixture well shaken. The solution is filtered through a dry paper, lead is precipitated in the filtrate by adding a little anhydrous sodium sulphate, and after five minutes the solution is again filtered through a dry paper. 40 c.c. of the filtrate are heated with calcium carbonate, and titrated with the copper solution. The result obtained gives the amount of gallic acid, and, by difference, that of the total tannic acid.—A. S.

Methyl Alcohol; Determination of —— in Formaldehyde. H. Bamberger. Z. angew. Chem., 1904, **17**, 1246—1248.

It is alleged that the method of Gnehm and Kaufler (this J., 1904, 626) gives too low results owing to the presence of aldehyde in the distillate (caused by the partial decomposition of the aldehyde and sodium sulphanilate condensation product). More accurate results (3—4 per cent. higher) were obtained by "fixing" the aldehyde with sodium bisulphite. 50 c.c. of formaldehyde (about 38 per cent.) are treated with 140 c.c. of a bisulphite solution containing 1 grm.-mol. in 200 c.c. of water, and the liquid then neutralised with caustic soda. The neutrality of the liquid must be tested by transferring a drop on to Brilliant Yellow or phenolphthalein paper. If too much alkali has been taken, dilute sulphuric acid or bisulphite solution is added. The flask is then fitted with a fractionating column containing glass beads and joined to a long condenser and heated in an oil-bath at 135°—145° C. until about 75 c.c of distillate have been collected. After washing the condenser with water and making up the volume of the distillate to 100 c.c., the sp. gr. at 15° C. is determined to four places of decimals with a Mohr's balance. By this method the amount of aldehyde which gets into the distillate is negligible.

—E. H. T.

Quinine Sulphate; Testing of ——. B. H. Paul. Chem. and Druggist, 1904, **65**, 428—430.

The solubility of cinchonidine in ether has been variously given as 1 in 76, 1 in 143, and 1 in 188 parts by weight. The author finds that the normal solubility of cinchonidine in ether, determined by extracting the alkaloid with ether from an aqueous solution of one of its salts, after the addition of sufficient ammonia solution, is 0·004 grm. per c.c. Cinchonidine can, however, form supersaturated ethereal solutions, from which, on allowing to stand, the alkaloid gradually deposits in crystals. The solubility is also considerably influenced by the presence of quinine. The author criticises the B.P. ether-test for quinine sulphate, and states that a far greater degree of precision may be secured more conveniently, by proceeding in the following manner:—1 grm. of the quinine sulphate is dissolved in 100 c.c. of boiling distilled water, and the solution, after cooling, is filtered from the crystallised quinine salt. The filtrate is concentrated to 30 c.c., cooled, filtered through a loose plug of cotton-wool, and the volume made up to 30 c.c., if necessary, by washing the separated crystals with a little water. 5 c.c. of the solution are treated with five drops of ammonia solution and shaken with 1 c.c. of ether in a corked tube, and then allowed to stand in a cool place for one hour. If no crystals are formed at the end of this period, the 5 c.c. of solution contain less than 0·004 grm. of cinchonidine. If crystals are formed, different volumes of the solution, less than 5 c.c., are shaken each with 1 c.c. of ether, the operation being repeated until with two portions of the solution differing in volume by 0·5 c.c., after treating with ammonia solution and shaking with 1 c.c. of ether, and then allowing to stand for 12 hours, a slight formation of crystals takes place in one case, but not in the other. The mean volume of the two portions of solution contains 0·004 grm. of cinchonidine or 0·0054 (0·004 × 1·35) grm. of cinchonidine sulphate.—A. S.

Quinine Sulphate; Testing of ——. D. Howard. Chem. and Druggist, 1904, **65**, 475.

The varying statements as to the solubility of cinchonidine in ether mentioned by Paul (see preceding abstract) may probably be explained by differences in the purity of the ether used. A small proportion of alcohol greatly increases the solubility of cinchonidine; ether of the B.P. will dissolve nearly twice as much cinchonidine as *æther purificatus*. Paul's modification of the B.P. ether-test is considered to be in the wrong direction, since the whole of the cinchonidine will not be contained in the mother liquor of a single recrystallisation. If a solution of commercial quinine sulphate be concentrated and allowed to crystallise, then, specially below 50° C., the cinchonidine sulphate persistently crystallises with quinine sulphate in varying proportions far in excess of those which might be deduced from the relative solubilities of the two salts. For ascertaining the purity of quinine sulphate, the author recommends the test now adopted in the Codex Français:—2 grms. of the sample and 20 c.c. of water are maintained at 60° C., with frequent agitation, for half an hour. The mixture is then allowed to cool, and is kept at 15° C. for half an hour, with frequent agitation. 5 c.c. of the solution mixed with 7 c.c. of *liquor ammoniæ* must remain clear.—A. S.

Volatile Oil of Mustard; Determination of ——. Vuillemin. Apoth.-Zeit., **19**, 607. Pharm. J., 1904, **73**, 218.

Five grms. of the powdered seeds are treated in a closed flask with 100 c.c. of water at 25°—30° C., and the mixture is maintained at that temperature for one hour, during which period it is frequently shaken. 20 c.c. of alcohol are then added, and half of the liquid is distilled off, and collected in 30 c.c. of ammonia solution and 3—4 c.c. of 10 per cent. silver nitrate solution, the delivery tube of the condenser dipping below the surface of the liquid. The receiver is connected to a second vessel also containing ammoniacal silver solution. After the distillation, the ammoniacal solution is gently warmed, the silver sulphide filtered off, washed with water, alcohol, and ether, dried at 80° C., and weighed. The weight, multiplied by 8·602, gives the percentage of mustard oil in the powder. Seeds of *Brassica nigra* yielded from 0·815 to 1·19 per cent. of volatile oil. The volatile oil in mustard plasters and papers may also be determined in the above manner, but the maceration with water must be prolonged to 90 mins., whilst, to avoid troublesome foaming, it is advisable to add a further 20 c.c. of alcohol during the distillation and to use a larger distillation flask.—A. S.

Tobacco; Analysis of ——. R. Kissling. Chem.-Zeit., 1904, **28**, 775—776.

Determination of the Moisture.—The stripped tobacco is first dried over sulphuric acid in an exsiccator, and is then ground and sifted. The powder obtained, forms the raw material for the analysis. The moisture is determined by drying to constant weight 2—3 grms. of the powder in the exsiccator at the ordinary temperature. In 20 samples of different tobaccos, the amount of water determined in this manner varied only from 3·25 to 6·37 per cent.

Determinations of Ash and its Alkalinity are carried out with 2—3 grms. of the tobacco powder in the usual way, except that luteol is used as indicator.

Determination of Nicotine.—Ten grms. of the tobacco powder are mixed with 10 grms. of powdered pumice stone and 10 grms. of a solution of caustic soda containing about 50 grms. per litre. The moist mass is extracted with ether in a Soxhlet or other apparatus, the ether is distilled off from the extract, the residue dissolved in water containing some caustic potash, and the solution distilled in a current of steam. Each 100 c.c. of distillate are titrated with sulphuric acid in presence of luteol as indicator; the fifth fraction should be free from nicotine. 1 mol. of sulphuric acid corresponds to 2 mols. of nicotine.

Determination of Resins.—See this J., 1900, 696.

Determination of the Non-Volatile (Citric, Malic, and Oxalic) Acids.—See this J., 1902, 1104.—A. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Solubilities; Influences causing Alterations of ——. G. Geffcken. Z. physik. Chem., 1904, **49**, 257—302.

The author has studied the effect of the presence of dissolved electrolytes, chiefly acids and bases, upon the solubility of the gases, hydrogen, oxygen, nitrous oxide, and carbon dioxide, in water at 25° C. and at 15° C. In all the cases examined, the relative depression of the solubility was greater at the lower temperature than at the higher. The gree of relative depression of solubility depends very uch upon the nature of the gas, although the order is most the same for all gases; the alterations are especially fferent in the case of the otherwise very similar gases, rbon dioxide and nitrous oxide. The alteration of the lubility due to the electrolytes is probably connected with e alteration of the internal pressure caused by their lution in water. In other experiments, on the influence the presence of dissolved electrolytes upon the solubility other electrolytes, the observed divergences from the law mass-action are probably attributable to the same causes. olloids in solution have practically no influence on the lvent capacity of water; a notable exception to this rule as found in the case of the solubility of carbon dioxide in ferric hydroxide "sol," which absorbed about 12 per cent. ore of this gas than pure water—a result due probably the acid and basic nature of the two bodies. Nitrous ide in aqueous solution was found to be practically different; it cannot therefore be regarded as behaving as e anhydride of hyponitrous acid.—J. F. B.

mmonia; Decomposition of —— by Heat. E. P. Perman and G. A. S. Atkinson. Proc. Roy. Soc., 1904, **74**, 110–117.

HE authors examined the rate of decomposition of nmonia by heating in a vessel of porcelain at tempe- tures between 677° and 1111° C. The results are given two tables and two curve-diagrams. The rate of de- omposition was found to be much influenced by the state the porcelain globe; it invariably increased after the obe had been used once or twice, owing probably to the tion of ammonia or hydrogen upon the porcelain. The sults show that the reaction is essentially monomolecular, oceeding according to the equation $NH_3 = N + 3H$. he rate of decomposition is much quickened by the esence of traces of some of the metals, *e.g.*, mercury, on, platinum. No confirmation of Ostwald's view that e decomposition of ammonia by heat is a reversible action, equilibrium being established when 98 per cent. of e ammonia is decomposed, was afforded by the authors' sults.—A. S.

otassium Ferrocyanide; A Reaction of ——. A. Gutbier. Z. anorg. Chem., 1904, **41**, 61–62.

SOLUTION of potassium ferrocyanide, when warmed with a eshly prepared solution of phenylhydrazine hydrochloride, quired a brownish-red colour, changing to bright red d then to deep red, and finally became suddenly colour- ss, with separation of a yellowish-green precipitate and ith vigorous evolution of hydrocyanic acid and nitrogen. he mixture was now distilled with steam; a dark-coloured l, insoluble in caustic soda solution, distilled over, whilst greenish-blue residue was left, below a layer of a violet- loured liquid. The volatile oil, after purification, solidified, hen cooled by a freezing mixture, to a bright red mass, om which, on an earthenware plate, a yellow oil ran off, hilst a bright red mass, melting at about 45° C., remained hind. The yellow oil, when treated with strong sulphuric id, was coloured first green and then brown, with separation a solid, apparently crystalline mass.—A. S.

Trade Report.

I.—GENERAL.

MEXICO; CHEMICAL INDUSTRY AND TRADE OF ——.

Foreign Office Annual Series, No. 3262.

The following table shows the quantity and value of rtain Mexican exports during the last three years. The orld's production of silver in 1903 was, approximately, 65,800,000 troy oz. Of this Mexico, which now holds r the first time the leading position, mining more than e United States, produced 60,000,000 oz. as compared ith 58,000,000 oz. in 1902. In 1881 Mexico produced but 23,000,000 oz.; in 1891, 33,000,000 oz.; and in 1901, 57,500,000 oz.

	1900-01.		1901-02.		1902-03.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.	£	Tons.	£	Tons.	£
Gold	..	1,800,000	..	1,900,000	..	2,800,000
Silver	..	7,000,000	..	5,500,000	..	6,800,000
Copper	33,000	800,000	61,000	1,500,000	62,000	1,600,000
Lead	85,000	450,000	98,000	520,000	99,000	550,000
Chicle	1,100	83,395	1,750	99,000	1,832	119,700
Dyewoods	41,500	130,218	38,600	107,397	31,895	80,331
Rubber	189	37,000	180	32,600	142	28,000
Vanilla	..	..	22	44,557	57	98,388

The average annual export of Mexican silver dollars is 15,000,000. 10 per cent. are melted down, and the balance reaches India, the Straits Settlements, China and the Philippines, where it circulates as currency. Those which reach India are also ultimately melted.

The imports of certain goods into Mexico from the United Kingdom were as follows:—

	1900-01.		1901-02.		1902-03.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.	£	Tons.	£	Tons.	£
Cement	12,224	17,841	5,597	8,568	3,848	6,301
Chemicals:						
Alkali	5,790	51,442	5,714	51,916	5,821	52,341
Copper sulphate	80	1,952	171	3,677	220	3,917
Other kinds	..	37,358	..	25,543	..	23,868
Earthen- and china-ware	..	8,821	..	10,983	..	21,513
Linseed oil	94	3,005	91	3,095	122	4,141
Painters' colours and materials	..	7,683	..	7,354	..	9,013
Perfumery	..	325	..	1,516	..	1,212
	Proof galls.		Proof galls.		Proof galls.	
Spirits	11,111	5,128	9,327	4,334	16,127	7,502
			Tons.		Tons.	
Wax, paraffin	..	..	36	878	329	7,910

There are over 1,200 sugar mills in Mexico, of which 300 may be considered as important producers, and cane growing and sugar refining are becoming of considerable consequence. The mills, equipped with British or American machinery, are general, and the number is increasing.

The sugar exported, about 20,000 tons annually, now goes almost entirely to the United Kingdom, and the reduction of the duty on imported sugar, which came into effect on May 1, 1904, aims solely at securing for Mexican exported sugar the privileges of the Brussels Convention. Common and refined sugar of all kinds, including the so-called sugar-candy, formerly paid per gross kilo. 15 c. Mexican currency, while the new rate is 2 dols. 50 c. per 100 kilos. gross. Molasses from sugar cane or fecula, as well as preparations for colouring wines, liquors, &c., and for grading up sugar, have hitherto paid duty per gross kilo. 5 c., while the new rate is 2 dols. 25 c. per 100 kilos. gross. The total product of molasses in 1903 was 77,000 tons. The total produce of sugar during the last few years was, during 1900, 78,000 tons; 1901, 95,000 tons; 1902, 103,000 tons; 1903, 112,000 tons; and the 1904 crop is estimated at 126,000 tons.

III.—TAR PRODUCTS, PETROLEUM, Etc.

PETROLEUM; BOUNTIES ON CRUDE ——.

Bd. of Trade J., Sept. 8, 1904.

A supplement to the *Canada Gazette* contains the text of an Act, assented to on the 10th August, to provide for the payment of bounties on crude petroleum produced from Canadian wells. The Act is to take effect as from the 8th June 1904.

By this Act the Governor in Council may authorise the payment, out of the Consolidated Revenue Fund, of a bounty of one and one-half cent per imperial gallon on all crude petroleum produced from wells in Canada on and after the 8th June 1904, the said bounty to be paid to the producer of the petroleum.

The Governor in Council may further authorise the payment, out of the Consolidated Revenue Fund, of a bounty of one and one-half cent per imperial gallon on all crude petroleum produced from wells in Canada and held in storage tanks or other storage receptacles on the 8th June 1904, the said bounty to be paid to the actual owner of the petroleum on that day.

Asphalt Production in the United States.

Eng. and Mining J., Aug. 25, 1904.

The Geological Survey gives the production of asphalt and bituminous rock in the United States in 1903 as follows, in short tons:—

Bituminous sandstone	38,633
Bituminous limestone	2,520
Mastic	961
Refined asphalt and gilsonite	12,896
Liquid asphalt, or maltha	58
Asphalt from petroleum	44,849
Total	99,917

The largest increase shown last year was in manufactured asphalt—that is, the asphaltic material produced by the distillation of petroleum. Exports of asphalt from the United States in 1903 were valued at 104,586 dols.; imports were 181,579 long tons, of which about two-thirds came from the island of Trinidad. Considerable quantities were also imported from Cuba, Venezuela, and Italy, while some small lots came from Turkey, France, Mexico, and Colombia.

VII.—*ACIDS, ALKALIS, Etc.*

Phosphate Rock Output in the United States.

Eng. and Mining J., Sept. 1, 1904.

1,581,576 long tons of phosphate rock were mined in the United States in 1903. Of this quantity Florida contributed 860,336 tons; South Carolina, 258,540 tons; Tennessee, 460,530 tons; Arkansas, 2125 tons; and North Carolina, 45 tons. Florida showed a decrease in hard rock phosphates, but a large increase in pebble. The greatest gain last year was in the Tennessee district.

Lithium Minerals in the United States in 1903.

Eng. and Mining J., Sept. 1, 1904.

The output of lithium minerals in the United States in 1903 amounted to 1155 short tons, valued at 23,425 dols., as compared with 1245 short tons, valued at 25,750 dols. in 1902. The production includes lepidolite, spodumene and amblygonite, and was obtained entirely from the deposits at Pala, California, and in the Black Hills, South Dakota.

Fluorspar Output of the United States.

Eng. and Mining J., Sept. 1, 1904.

The output of fluorspar in 1903 amounted to 42,523 short tons, valued at 213,617 dols., against 48,018 short tons, valued at 271,832 dols., in the previous year. The falling off, as shown by these figures, was due partly to the depression in the iron and steel industries, and partly to the fact that considerable stocks of fluorspar were left over from the previous year. Kentucky was the largest producer, followed by Illinois, Tennessee, and Arizona.

IX.—*BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.*

Monazite Production of United States.

Eng. and Mining J., Aug. 25, 1904.

The Geological Survey reports that the total production of monazite in the United States in 1903 was 862,000 lb., an increase of 60,000 lb. over the preceding year. All of last year's output came from placer workings in North and South Carolina.

Asbestos Production.

Eng. and Mining J., Sept. 1, 1904.

The production of asbestos in the United States in 1903 was only 874 short tons, which compares with 1005 short tons in 1902. Most of the asbestos reported in 1903 came from Sall mountain in Georgia, but small quantities were mined at Dalton, Mass., and near New Hartford, Conn. Some deposits near Lowell, Vermont, are being explored.

Talc and Soapstone.

Eng. and Mining J., Aug. 25, 1904.

The production of talc and soapstone of all varieties in the United States last year was 58,901 short tons. This is a decrease of 39,053 tons from the preceding year. The falling off was chiefly due to the reduction in the quantity of fibrous talc in New York. The demand for this mineral decreased, owing to a diminution in a production of paper in which talc is used. In other States there was little change.

X.—*METALLURGY.*

Tasmania; Mineral Production of ——.

Bd. of Trade J., Sept. 8, 1904.

The following table, showing the quantity and value of the minerals produced in, and exported from, Tasmania during the year 1903, has been compiled from the quarterly statements issued by the Government geologist:—

——		Twelve months ended 31st Dec. 1903.		Three months ended 31st March 1904.	
		Quantity.	Value.	Quantity.	Value.
		Oz.	£	Oz.	£
Gold, won		59,887	254,403	14,235	341,29
		Tons.		Tons.	
Gold quartz and pyrites	Exported	410	11,304	41	
Silver ore	"	16,013	167,282	4,098	
Silver-lead bullion	"	7,020	255,776	1,694	
Copper, blister	"	5,812	383,187	1,705	
" ore	"	13	77	27	
" matte	"	3,727	83,624	..	
Tin ore	"	305	10,822	49	
" metallic	"	2,376	300,098	529	
Zinc ore	"	1,357	4,247	..	
Iron ore	"	5,323	4,646	3,150	
Other ores	"	373	4,871	..	
Coal	Raised	49,069	42,147	11,873	

Canada; Pig Iron Production of ——.

Eng. and Mining J., Sept. 1, 1904.

The American Iron and Steel Association has received direct from the manufacturers, the statistics of the production of pig iron in Canada in the first six months of 1904. The figures show a decrease as compared with either of the two halves of 1903, as will be seen by the following table which gives the production by fuels, in gross tons, in half yearly periods:—

——	1903.		1904.
	First Half.	Second Half.	First Half.
Coke	123,500	124,405	111,840
Charcoal	9,430	8,083	8,803
Totals	132,930	132,488	120,643

Of the total production in the first half of 1904, 35,29 tons were basic pig iron, against 69,325 tons in the fir f of 1903 and 57,567 tons in the second half of that r. A small quantity of Bessemer pig iron was produced the second half of 1903, but none was made in the t half of 1903 or in the first half of 1904. The unsold iron held by Canadian manufacturers on June 30, 4—none of which was intended for their own consump- ı—amounted to 36,868 gross tons, as compared with 168 tons on December 31, 1903, and 13,585 tons on e 30, 1903. Of the unsold stocks on June 30, 1904, a e less than 4,000 tons were made with charcoal, the ainder being coke iron. On June 30, 1904, Canada 15 completed blast furnaces, of which six were in blast nine were idle. Of this total, 11 were equipped to use e and four to use charcoal. In addition, one coke fur- e was being built on June 30, 1904, and one coke and charcoal furnace were partly erected, but work was pended. During the first half of 1904, the total number urnaces in Canada actually in blast for the whole or a t of the period was 10, of which seven used coke and e used charcoal. The number of furnaces idle during whole period was five, of which four used coke when in blast, and one used charcoal.

Tin Exports of the Federated Malay States.

Bd. of Trade J., Sept. 1, 1904.

he following statement, showing the weight of tin and ore (tin exported in the form of ore being taken at per cent. of the gross weight of the ore) exported from Federated Malay States during the first six months of 4, with corresponding figures for the corresponding od of the previous year, is taken from the *Selangor ernment Gazette* of 22nd July :—

——	First Half of 1903.		
	Tin.	Tin exported in the Form of Ore.	Total.
	Piculs.	Piculs.	Piculs.
k	80,060·25	128,282·54	208,342·79
ngor..............	60,576·00	75,279·26	135,855·26
i Sembilan.......	18,581·26	20,248·91	38,830·17
ng...............	3,103·15	8,723·46	11,826·61
Totals	162,320·66	232,534·17	394,854·83

——	First Half of 1904.		
	Tin.	Tin exported in the Form of Ore.	Total.
	Piculs.	Piculs.	Piculs.
k	72,182·58	136,718·24	208,900·82
ngor..............	57,467·22	82,706·59	140,173·81
i Sembilan.......	22,474·07	16,014·98	38,489·05
ng...............	2,556·12	8,358·78	10,914·90
Totals	154,679·99	243,798·59	398,478·58

NOTE.—Picul = 133⅓ lb.

Zinc Industry in Poland.

Eng. and Mining J., Aug. 25, 1904.

1903 there were in operation three mines in the asz district, in Poland, of which the Joseph and Ulyss es are owned by the Crown and are leased to the nce-Russian Company, and the Boleslaw mine is owned he Sosnowice Company, by which it is operated. Work carried on through 47 shafts and adits, the number of loyees being 1108, of whom 614 were engaged underund. The production of the mines was 4,570,000 poods alamine and 43,317 poods of lead ore. Each of the e mines has dressing works.

he ores are smelted at the Pauline works of the owice Company and the Konstantin and Bendin works, ed by the Crown and leased to the Franco-Russian pany. All of these works are situated in the vicinity of Bendin. They had in operation in 1903 an average of 47 gas-fired furnaces, with about 1818 muffles, and produced 604,031 poods of spelter, of which 248,747 came from the Pauline works, 150,747 from the Konstantin, and 204,528 from the Bendin. In addition to the spelter production, there were produced 31,037 poods of zinc dust. Of the spelter production, 36·26 per cent. was rolled into sheets at the works where smelted.

U.S. Iron Ore Production in 1903.

Bd. of Trade J., Sept. 1, 1904.

An advance abstract of the annual report of the United States Geological Survey upon the production of iron ore in 1903, states that in the year ending December 31st, 1903, the quantity of iron ore produced in the United States was 35,019,308 long tons. This is a decrease of 534,827 tons, or about 1½ per cent., from the maximum of 35,554,135 tons in 1902; but the quantity mined in 1903 is the second largest recorded.

The production of iron ore in the United States during each of the last three years was as follows:—1901, 28,887,479 tons; 1902, 34,554,135 tons; 1903, 35,019,308 tons.

In 1903 the quantity of red hematite mined in the United States was 30,328,654 tons, or 86·6 per cent. of the total for the country, a decrease of 203,495 tons, or about 1 per cent., from the 1902 production of 30,532,149 tons.

The total quantity of brown hematite mined decreased in 1903 to 3,080,399 tons, a loss of 225,085 tons, or 7 per cent.

The production of magnetite in 1903 was 1,575,422 tons, a decline of 113,438 tons, or 7 per cent., from the 1902 total of 1,688,860 tons.

The carbonate ores, the least important class, show an increase, the 1903 total of 34,833 tons being 7,191 tons, or 26 per cent., more than the quantity mined in 1902, 27,642 tons.

The output of concentrated ore in 1903 was 259,469 tons, most of which was magnetically separated, the remainder having been passed through jigs.

In 1903 there were also produced 73,264 tons of zinc residuum for use in the production of spiegeleisen and ferromanganese.

Zircon in the United States.

Eng. and Mining J., Aug. 25, 1904.

3000 lb. of zircon were produced and sold in the United States last year. The mineral is used for the same purposes as monazite. The production all came from two mines at Zirconia, in Henderson county, North Carolina. The zircon occurs in a pegmatite dike, which is about 100 ft. wide and can be traced for nearly 14 miles. This is worked at two places: the Freeman mine, near the south-west end, and the Jones mine, near the north-east end of this dike. Owing to the slight demand there is no systematic working, but the crystals are washed out of the soil largely by women and children.

Sweden; Mining Industry of ——.

Bd. of Trade J., Sept. 1, 1904.

The quantity and value of the minerals extracted during the past year were as follows, corresponding figures for the preceding year being added for comparison :—

——	Quantity.		Value.	
	1902.	1903.	1902.	1903.
	Met. Tons.	Met. Tons.	Kr.	Kr.
Iron ore...............	2,896,616	3,677,841	11,368,806	16,626,3
Silver and lead ore..	9,378	9,792	165,688	191,005
Copper ore...........	30,095	36,687	320,841	331,725
Zinc ore	48,783	62,927	1,712,869	2,233,681
Manganese ore......	2,850	2,244	51,959	36,550
Iron pyrites	..	7,793	..	46,000

The chief iron products show the following results for 1903:—

——	Quantity.	Value.
	Metric Tons.	Kr.
Castings	506,825	34,024,488
Unwelded blooms	192,342	20,718,316
Bessemer metal	84,229	8,012,100
"Martin" metal	232,878	24,966,268
Crucible ingot metal	1,105	354,875
Iron and steel bars	178,538	25,879,451
Iron and steel bands and rods	74,823	11,386,234
Wire rods	31,805	4,652,126
Steel tubes (unfinished)	21,959	4,542,381
Strong sheet iron	14,027	2,157,407

NOTE.—Krona = 1*s*. 1⅓*d*., or 18 to the 1*l*.

The output of coal in 1903 was 320,390 metric tons, as against 304,733 metric tons in the preceding year. The refractory clay deposits, which are worked in connection with the extraction of coal, produced in 1903, 172,718 metric tons of clay, or 11,106 metric tons more than in 1903.

SPAIN; MINERAL EXPORTS OF ——.

Eng. and Mining J., *Sept.* 1, 1904.

Exports of mineral for the half year ended June 30 are reported by the *Revista Minera*, as follows, in metric tons:—

——	1903.	1904.
Iron ore	3,953,909	3,642,594
Copper ore	542,713	538,794
Zinc ore	68,349	66,541
Lead ore	1,151	2,897
Pyrites	292,688	258,518
Salt	177,871	203,784

Exports of metals for the six months were 18,813 tons of pig iron, against 20,745 tons in 1903; 14,534 tons of copper, against 14,991 tons; 936 tons of spelter, against 1,038 tons; 87,943 tons of lead, against 76,935 tons last year.

XI.—ELECTRO-CHEMISTRY, Etc.

COPPER CONDUCTORS; BRITISH STANDARDS FOR ——.

Interim Report by the Engineering Standards Committee, August 1904.

The report, by the Sub-Committee on Cables of the Engineering Standards Committee, commences by defining the standards for copper conductors finally adopted, as follows:—

(1) A wire 1 metre long, weighing 1 grm., and having a resistance of 0·1539 standard ohm at 60° F., to be taken as the Engineering Standards Committee (E.S.C.) standard for hard-drawn, high conductivity commercial copper.

(2) Hard-drawn copper to be defined as that which will not elongate more than 1 per cent. without fracture.

(3) A wire, 1 metre long, weighing 1 grm., and having a resistance of 0·1508 standard ohm at 60° F., to be taken as the E.S.C. standard for annealed, high conductivity commercial copper.

(4) Copper to be taken as weighing 555 lb. per cb. ft. (8·89 grms. per c.c.) at 60° F., which gives a specific gravity of 8·90.

(5) The average temperature coefficient of 0·00238 per 1° F. (0·00428 per 1° C.) to be adopted for commercial purposes.

(6) Two per cent. variation from the adopted standard of resistance to be allowed in all conductors.

(7) Two per cent. variation from the adopted standard of weight to be allowed in all conductors.

(8) An allowance of 1 per cent. increased resistance, as calculated from the diameter, to be allowed on all tinned copper conductors between diameters 0·104 and 0·028 (Nos. 12 and 28 S.W.G.) inclusive.

(9) For the purpose of calculation of tables, a lay involving an increase of 2 per cent. in each wire, excep the centre wire, for the total length of the cable, to be take as the standard.

(10) The legal standard of wire gauge, as fixed by Orde in Council dated Aug. 23, 1883, to be adopted as th standard for all wires.

The remainder of the report is occupied by tables givin British standard sizes of stranded conductors for electri supply; British standard radial thicknesses for jute or pape dielectric, lead and armour, for underground cables, fo working pressures up to 11,000 volts; and British standar radial thicknesses for rubber dielectric, for lead sheathin and armouring.—T. F. B.

XII.—FATTY OILS, FATS, Etc.

ILANG-ILANG OIL IN THE PHILIPPINES.

Bd. of Trade J., *Sept.* 8, 1904.

The *Monthly Summary* of commerce of the Philippir Islands contains a review of the trade of those islan during the year 1903, from which the following extract taken:—

"Among the products of economic value in the Phili pines, ilang-ilung oil as an export amounted to 123,182 dol or about 50 per cent. increase over the trade in 1902, tl shipments to France advancing in about the same propo tion. Some consider the oil as equal in perfume to attar roses, and by the greater yield of essence furnishing a le expensive base, it becomes a strong competitor of the latte the perfumers of the United States (to whom exporti houses in Manila shipped nearly 10,000 dols. worth la year) making it the base of some of their most expensi extracts. The ilang-ilang tree grows best in the Philippin and it takes about 75 lb. of the flowers, worth from 8 15 cents gold per lb., to yield 1 lb. of oil. The cost manufacture is about 4 dols., and it sells readily for fro 40 to 55 dols. in open market, with the supply unequal the demand."

XVII.—BREWING, WINES, SPIRITS, Etc.

SPIRIT FOR TECHNICAL PURPOSES; USE OF —— IN FRANCE DURING 1903.

Z. Spiritusind., 1904, **27**, 359.

The following statistics show the use of spirits domestic and manufacturing purposes in France duri 1903:—Total consumption, 374,598 hectols. (1902, 326,66 divided as follows:—For heating and lighting, *i.e.*, de tured in the ordinary way, 262,036 (1902, 227,253); lacquer, varnish, and polish, 14,447 (1902, 14,188); dyeing, 532 (1902, 41); for collodion, celluloid, &c., 45 (1902, 3963); for drugs, 844 (1902, 742); for chemical a pharmaceutical products, 27,027 (1902, 6071); for et and explosives, 63,879 (1902, 69,996); and for scienti purposes, 519 (1902, 406).

The apparent decrease under the heading of "ether a explosives" is partly accounted for by the inclusion certain articles under the heading of "chemical and ph maceutical products.—J. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

EXPLOSIVES CONTAINING NITROGLYCERIN.

Bd. of Trade J., *Sept.* 8, 1904.

The following notice has been issued to mine-owner the United Kingdom with a view to the prevention of ac dents occurring in metalliferous mines from the use explosives containing nitroglycerin:—

"All cartridges made of dynamite, gelignite, blasti gelatin, and other explosives containing nitroglycer must always be thawed (in a properly-designed warmi pan) before use during the months of December, Janua February and March, and also at any other times if cartridges are not in a soft or pasty condition."

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and .S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an terisk is affixed. The dates given are (i) in the case of Applicaons for Patents, the dates of application, and (ii) in the case of omplete Specifications Accepted, those of the Official Journals which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to spection at the Patent Office immediately, and to opposition ithin two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 18,922. Komata Reefs Gold Mining Co., Ltd. (Brown). Apparatus for mixing or circulating materials in a liquid or semi-liquid state. Sept. 1.

„ 18,978. Huillard. Drying apparatus. Sept. 2.

„ 19,001. Thompson (L'Hospied). *See under* II.

„ 19,002. Rusdell. Fluid heating and cooling apparatus. Sept. 3.

„ 19,174. Hargreaves. Evaporation of solutions, condensation of vapour, and the manufacture of salt. Sept. 6.

„ 19,186. Suzuki. Vacuum evaporating apparatus. Sept. 6.

„ 19,346. Hargreaves. Mixing and agitating solutions, and precipitating and crystallising. Sept. 8.

„ 19,416. Alberger. Condenser system.* Sept. 8.

„ 19,442. Hargreaves. Evaporating solutions and obtaining salts. Sept. 9.

„ 19,497. Turnbull. *See under* X.

„ 19,696. Wurmb and Baumann. Thermometers.* Sept. 13.

„ 20,031. Gaskell and Day. Drying apparatus for distillery refuse and other liquids. Sept. 17.

C.S.] 20,775 (1903). Pochin and Pochin. Breaking, crushing, and grinding machinery. Sept. 7.

„ 20,932 (1903). Rakowski. Grinding mills for gradual and variable pulverisation. Sept. 7.

„ 21,765 (1903). Jouve. Manufacture of distilling, evaporating, or like apparatus. Sept. 14.

„ 28,572 (1903). Lake (Trump). Process of evaporating liquors. Sept. 14.

„ 28,593 (1903). Lake (Trump). Vacuum pans. Sept. 14.

„ 6786 (1904). McAulay. Heating furnaces. Sept. 14

„ 10,157 (1904). Forbes. Distilling and condensing apparatus. Sept. 7.

II.—FUEL, GAS, AND LIGHT.

[A.] 18,721. Tucker and Grundell. Fuel oil burning system. [U.S. Appl., Sept. 19, 1903.]* Aug. 30.

„ 18,858. Grayson. Manufacture of artificial fuel. Sept. 1.

„ 18,975. Roberts and Anstey. Apparatus for the manufacture of generator gas. Sept. 2.

„ 19,001. Thompson (L'Hospied). Gas furnaces. Sept. 3.

„ 19,037. Ibbotson. Ascension pipes of gas producers. Sept. 3.

„ 19,046. The Chalk Power Gas Syndicate, Ltd., and Pearson. Process for the continuous and concurrent production of fuel gas and lime. Sept. 3.

„ 19,183. Brotherhood. Producer gas manufacturing apparatus. Sept. 6.

„ 19,222. Johnston. Apparatus used in the manufacture of coal-gas. Sept. 6.

„ 19,276. Breckon. Method of producing superior coke in connection with gas works and the like. Sept. 7.

[A.] 19,307. Gibbons and Masters. Manufacture of gas. Sept. 7.

„ 19,318. Hepburn. Coking. Sept. 7.

„ 19,319. Hepburn. Coke ovens. Sept. 7.

„ 19,568. Tompkins. Production of acetylene derivatives. Sept. 10.

„ 19,744. Blackmore. Process for making hydrogen carbide, and separating sulphur from sulpho-hydrocarbons or sulphurous petroleum.* Sept. 13.

„ 19,774. Wilson. Manufacture of coal-gas. Sept. 14.

„ 19,827. Cerasoli. Gas producers. Sept. 14.

„ 19,842. Crossley and Rigby. Methods of obtaining power from fuel gases, oils, and other similar combustibles. Sept. 15.

„ 20,075. Cottançin. Method of artificial carbonisation. Sept. 17.

[C.S.] 19,220 (1903). Wesselsky. Apparatus for generating water- or like gas from small and dust coal. Sept. 14.

„ 20,556 (1903). Lake (Ges. f. Flüssige Gase R. Pictet and Co.). Method of increasing the intensity of incandescent gas light. Sept. 14.

„ 21,724 (1903). Bruce. Gasogenes and the like. Sept. 14.

„ 24,068 (1903). Gielis. Gas retorts. Sept. 21.

„ 24,326 (1903). Hanmer. Treating peat or turf to obtain valuable products therefrom. Sept. 14.

„ 24,670 (1903). Allison. Manufacture of coke. Sept. 21.

„ 27,823 (1903). Wilson. Gas producers. Sept. 14.

„ 2696 (1904). Thompson (Rush). Apparatus for utilising liquid hydrocarbons as fuel. Sept. 14.

„ 5911 (1904). Loomis and Pettibone. Manufacturing and mixing gases. Sept. 7.

„ 14,445 (1904). Boult (Lomax). Method of purifying illuminating gas. Sept. 21.

„ 15,048 (1904). Lake (Bucknam). Gas burners. Sept. 7.

„ 15,706 (1904). Thompson (Verein. Maschinenfabr. Augsburg u. Maschinenbauges. Nürnberg, A.-G.). *See under* XXIII.

„ 16,288 (1904). Act.-Ges. f. Selas-Beleuchtung. Apparatus for the production of mixtures of gas and air. Sept. 14.

„ 16,763 (1904). Boutillier. Apparatus for producing poor gas free from tarry matters. Sept. 14.

„ 17,580 (1904). Patterson. Method of treating coal for coking purposes. Sept. 21.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 19,695. Martin and Wynne. Process for purifying petroleum oils and rendering them non-explosive. Sept. 13.

„ 19,744. Blackmore. *See under* II.

[C.S.] 12,696 (1903). Oppenheimer and Kent. Process for treating tar for the elimination of water and recovery of volatile products therefrom. Sept. 14.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 18,985. Johnson (Kalle and Co.). Manufacture of mono-azo dyes. Sept. 2.

„ 19,165. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters and of intermediate products relating thereto. Sept. 5.

„ 19,474. Imray (Basle Chemical Works). Manufacture of indoxyl, its homologues or their derivatives. Sept. 9.

„ 19,660. Johnson (Kalle and Co.). Manufacture of new mono-azo dyes. Sept. 12.

[C.S.] 19,973 (1903). Johnson (Kalle and Co.). Manufacture of colouring matters containing sulphur. Sept. 14.

„ 23,392 (1903). Imray (Meister, Lucius und Brüning). Manufacture of dyestuffs derived from anthracene. Sept. 7.

„ 25,144 (1903). Newton (Bayer and Co.). *See under* XXI.

„ 25,461 (1903). Johnson (Badische Anilin und Soda Fabrik). Manufacture of acid nitriles. Sept. 14.

„ 26,132 (1903). Newton (Bayer and Co.). Manufacture of new azo dyestuffs. Sept. 14.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 18,720. Wilhelm. Method of cleaning oil waste, &c. Aug. 30.

„ 18,797. Nicholson and Shepherd. Compound batching oil for dressing jute, wool, and like fibrous material. Aug. 31.

„ 19,324. Harris. Treatment of rhea grass, wood fibre, and the like. Sept. 7.

„ 19,382. Leachman. Method of finishing and dressing yarns and threads. Sept. 8.

„ 19,385. Bower. Manufacture of substitutes for lithographic stones. Sept. 8.

„ 20,040. Wilkinson. Means or apparatus for gassing or cleansing silk and other fibres. Sept. 17.

[C.S.] 18,897 (1903). Morton. Manufacture of figured fabrics. Sept. 7.

„ 21,667 (1903). Bergmann. Process for the removal of fat extracting solvents from materials. Sept. 21.

„ 21,949 (1903). Gebauer. Apparatus for use in subjecting fabrics, warps, yarns, and the like to the action of fluids or chemical solutions. Sept 7.

„ 23,484 (1903). Scott. Printing, painting, or marking on cloth, and machinery therefor. Sept. 7.

„ 24,222 (1903). Perkin, and Whipp Bros. and Todd, Ltd. Treatment of raw cotton and flax, and cotton and linen goods, to reduce the inflammability thereof. Sept. 21.

„ 27,539 (1903). Calico Printers' Association, Ltd., and Garnett. Calico printing. Sept. 21.

„ 2062 (1904). Heuser. Yarn-dyeing vat, with device for throwing in and out of gear a windlass for lifting the material out of the colouring liquor. Sept. 14.

„ 13,302 (1904). O'Brien (L'Huillier). Dyeing, and apparatus therefor. Sept. 21.

„ 16,594 (1904). Hulse and Co., Ltd., and Shaw. Production of printed fabric, such as calico. Sept. 7.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

[A.] 19,373. Lye and Lye. Dyeing or colouring straw and other materials capable of being similarly treated. Sept. 8.

„ 19,374. Lye and Lye. Apparatus for the dyeing or similar treatment of straw, straw plait, and similar materials. Sept. 8.

„ 19,989. Nusch (Sorel). Dyeing process of skins for glove making and other uses.* Sept. 16.

[C.S.] 20,324 (1903). Ransford (Cassella and Co.). Production of two-coloured effects upon straw, or mixed straw and chip plaits. Sept. 7.

„ 23,563 (1903). Ransford (Cassella and Co.). Dyeing of leather. Sept. 7.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 18,710. Stead. Manufacture of carbon dioxide
Aug. 30.

„ 18,899. Piolunowsky. Manufacture of alkali an
alkaline earth carbonates, and apparatus therefor
Sept. 1.

„ 19,046. The Chalk Power Gas Syndicate, Ltd., an
Pearson. *See under* II.

„ 19,174. Hargreaves. *See under* I.

„ 19,332. Elworthy, Thornett, and Fehr. Processe
and apparatus for manufacturing carbonic aci
and hydrogen. Sept. 7.

„ 19,442. Hargreaves. *See under* I.

„ 19,448. Craig, Brown, and Craig. Method of pro
ducing oxygen from atmospheric air. Sept. 9.

„ 19,571. Bloxam (Soc. Anon. d'Études Electr
Chimiques). Manufacture of lead peroxid
Sept. 10.

„ 19,606. Robinson. Process for the manufacture
sulphates. Sept. 12.

„ 19,921. Cie. des Prod. Chim. d'Alais et de
Camargue. Manufacture of alumina. [Fr. App
Sept. 19, 1903.]* Sept. 15.

„ 20,012. Davis and Davis. Construction of pla
for the manufacture of sulphuric acid. Sept. 1

[C.S.] 17,040 (1903). Heskett. Carbonic anhydride r
frigerating machines. Sept. 14.

„ 24,332 (1903). Donnachie. Appliances for t
manufacture of nitric acid. Sept. 14.

„ 24,619 (1903). Schwab, and H. Greene and So
Ltd. Manufacture of vitriol. Sept. 14.

„ 2739 (1904). Bellot des Minieres. Apparatus f
the manufacture of cupro-ammonium soluti
Sept. 7.

„ 11,172 (1904). Cie. Franç. de l'Acetylene Disso
Manufacture of oxygen. Sept. 7.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 19,067. Baudoux. Glass-melting furnaces.* Sept.

[C.S.] 16,600 (1904). Good. Apparatus for the ma
facture of glassware. Sept. 21.

„ 17,235 (1904). Robin. Composition for the ma
facture of ceramic products. Sept. 12.

IX.—BUILDING MATERIALS, CLAYS, MORTAR AND CEMENTS.

[A.] 18,699. Pryor. Wood-preserving compositi
Aug. 30.

„ 18,804. Brunson. Composition of matter for a
ficial stone.* Aug. 31.

„ 18,837. Saunders. Manufacture of bricks and
like. Aug. 31.

„ 18,920. Lake (Matthey and Co.). Manufacture
electrical insulating and non-heat-conduct
compositions. Sept. 1.

„ 18,930. Sellars. Manufacture of cement or cementitious substances. Sept. 2.

„ 18,939. Müller. *See under* XI.

„ 19,737. Boult (Hülsberg and Co.). Impregnat
of wood and other porous materials. Sept. 13

„ 19,884. Morris and Chalmers. Manufacture
bricks and tiles. Sept. 15.

„ 19,912. Hamblet. Brick kilns and the l
Sept. 15.

„ 20,018. Ridley, Taite, and Williamson. Slag
scoriæ bricks or blocks, and method and apparatus for manufacturing the same.* Sept. 16.

[C.S.] 19,676 (1903). Magens. Treatment of conc
and the like, whereby the setting of the s
after mixture may be arrested. Sept. 7.

[A.] 20,028 (1903). Sadler. Brick kilns. Sept. 21.

„ 11,258 (1904). Stöffler. Fireproof quartz bricks or blocks. Sept. 14.

„ 15,979 (1904). Schmidtgen and König. Process for manufacturing a non-conductor of heat. Sept. 7.

„ 16,987 (1904). Ryser. Building stone. Sept. 14.

X.—METALLURGY.

[A.] 18,658. Bavay. Process for separating by flotation parts of the constituents of ores and other solid bodies from the remainder thereof. Aug. 29.

„ 18,652. Bavay. Apparatus for separating by flotation parts of the constituents of ores and other solid bodies from the remainder thereof. Aug. 29.

„ 18,660. Bavay. Process for separating by flotation zinc blende from ores, tailings, concentrates, and slimes, and for preparing such ores for such separation. Aug. 29.

„ 18,674. Annable, Steinhardt, Vogel, and Tungsten Rare Metals Co., Ltd. Treatment of nickel ores. Aug. 29.

„ 18,746. Goodsell. Method of and apparatus for treating sheet iron and steel.* Aug. 30.

„ 18,977. Vanderlip. Ore concentration. Sept. 2.

„ 19,053. Massenez. Manufacture of steel by the basic Bessemer process. Sept. 3.

„ 19,140. Swyny and Plucknett. Ore separators and classifiers.* Sept. 5.

„ 19,142. Swyny and Plucknett. Process for extracting normally buoyant mineral particles from slimes, tailings, and like metalliferous materials.* Sept. 5.

„ 19,233. Guye. Treatment of lead sulphide, or ores thereof, to obtain volatile products. Sept. 6.

„ 19,251. Thompson (Carlo, Tito, and Pollak and Rothschild). Alloy, and process for manufacturing the same. Sept. 6.

„ 19,269. Rawson and Elmore. Process for extracting gold from solutions. Sept. 7.

„ 19,394. Fyfe. Ore-roasting furnaces, and means for producing and depositing fumes from ores. Sept. 8.

„ 19,464. Reinke. Process for briquetting friable ores. Sept. 9.

„ 19,497. Turnbull. Apparatus for separating water-borne particles of varying density, such as finely divided ore, &c. Sept. 9.

„ 19,555. Abelspies. Ore concentrating and classifying apparatus. Sept. 10.

„ 19,653. Ellis and Highton. Apparatus for extracting gold from slimes, tailings, or the like. Sept. 12.

[C.S.] 12,727 (1903). Auchinachie. Manufacture of metallic vanadium from its ores or any other compounds of vanadium. Sept. 14.

„ 19,226 (1903). Deutsch. Plunger-jig for treating ores. Sept. 14.

„ 19,353 (1903). Lake (Sanfilippo). Ore-roasting and like furnaces. Sept. 21.

„ 26,375 (1903). Michelis, Michelis, Kruse, and Kuhn. Process for hard-soldering aluminium. Sept. 7.

„ 26,376 (1903). Michelis, Michelis, Kruse, and Kuhn. Process for hard-soldering cast iron. Sept. 7.

„ 7309 (1904). Weiller and Weiller. Process for separating from their ores copper, silver, lead, mercury, and all other metals adapted to be precipitated from an acid solution by means of sulphuretted hydrogen. Sept. 21.

„ 8216 (1904). Gin. *See under* XI.

[C.S.] 13,328 (1904). Pelletier and Semprun. Solder for aluminium or aluminium alloys. Sept. 14.

„ 16,419 (1904). Engels. Process for treating steel and armour plates. Sept. 14.

„ 16,449 (1904). Fink-Huguenot. Process and apparatus for granulating or pulverising fused metals and alloys. Sept. 21.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 18,840. British Thomson-Houston Co., Ltd. (Gen. Electric Co.). Processes of electric deposition. Aug. 31.

„ 18,929. Lake (Matthey and Co.). *See under* IX.

„ 18,937. Hargreaves. Operating electrolytic cells. Sept. 2.

„ 18,989. Müller. Insulating substance, and method of making same. Sept. 2.

„ 19,266. Ziegenberg. Galvanic cell.* Sept. 6.

„ 19,571. Bloxam (Soc. Anon. d'Études Electro-Chimiques). *See under* VII.

„ 19,898. Blackburn. Primary batteries. Sept. 15.

„ 20,003. Birkeland and Eyde. Process and furnace for subjecting solid materials to the action of the electric arc. [Appl. in Norway, Sept. 19, 1903.]* Sept. 16.

[C.S.] 14,221 (1903). Dreibholz. Galvanic batteries. Sept. 7.

„ 23,712 (1903). Nehmer. Manufacturing of dry batteries. Sept. 7.

„ 8216 (1904). Gin. Electric furnace for converting pig iron into steel. Sept. 21.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 18,797. Nicholson and Shepherd. *See under* V.

„ 19,043. Le Brocquy. Oils for lubricating gun barrels. Sept. 3.

[C.S.] 25,010 (1903). Harvey. Manufacture of dry soap powders. Sept. 7.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*B.*)—Resins, Varnishes.

[A.] 19,282. Dunnett. Composition for preventing the incrustation and preserving the hulls of ships. Sept. 7.

„ 19,583. Pugh. and Rudge Whitworth, Ltd. Application of varnishes and the like. Sept. 10.

[C.S.] 17,135 (1903). Tixier and Rambaud. Process for the manufacture of varnishes by the direct solution of gums without previous fusion. Sept. 14.

„ 21,020 (1903). Johnson (Foelsing). Apparatus for the treatment of products containing gums and resins, for the separation and obtainment of the gums and resins therefrom. Sept. 21.

(*C.*)—India-Rubber.

[A.] 19,780. Owen and Threlfall. *See under* XIX.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

[A.] 18,691. Jerret, Graham, and Blair. Leather-dressing composition. Aug. 30.*

„ 19,244. Sonoff and Zwerkoff. Curing skins and hides. Sept. 6.

„ 19,323. Petersen. Cleansing and dyeing gloves, skins, leather, and the like. [Appl. in Denmark, Sept. 9, 1903.]* Sept. 7.

„ 19,779. Owen and Threlfall. Manufacture of leather. Sept. 14.

„ 19,780. Owen and Threlfall. Manufacture of leather for use as a substitute for india-rubber and for other purposes. Sept. 14.

[A.] 19,989. Nusch (Sorel). *See under* VI.

[C.S.] 18,677 (1903). Muir. Treatment of skins or hides anterior to and during the process of tanning. Sept. 7.

XVI.—SUGAR, STARCH, GUM, Etc.

[C.S.] 26,799 (1903). Lafeuille. Annular moulds for treating sugar by centrifugal action. Sept. 21.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 19,587. Hunt. Manufacture, purifying, and maturing or flavouring of spirit. Sept. 10.

[C.S.] 19,645 (1903). Monti. Treatment of wine, must, beer, beetroot juice, and the like, and apparatus therefor. Sept. 14.

„ 24,294 (1903). Jensen (Diessler). Process for freeing yeast extracts from bitter principles. Sept. 14.

„ 28,264 (1903). Plischke and Beschorner. Malting apparatus. Sept. 7.

„ 14,028 (1904). Schueible. Art of brewing. Sept. 21.

„ 15,370 (1904). Boult (Pabst Brewing Co.). Pasteurising apparatus. Sept. 7.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—Foods.

[A.] 18,906. Ross. Production of foods for animals.* Sept. 1.

„ 19,082. Cornthwaite. *See under* XXIII.

„ 19,676. Bell. Process for preserving flesh meat and other foodstuffs. Sept. 13.

[C.S.] 9684 (1904). Maggi. Manufacture of milk powder. Sept. 21.

(*B.*)—Sanitation; Water Purification.

[A.] 19,444. Adams. Filter beds for sewage or other purposes. Sept. 9.

„ 20,031. Gaskell and Day. *See under* I.

[C.S.] 19,599 (1903). Adams and Springborn. System for the purification of sewage and other fluids. Sept. 7.

„ 19,644 (1903). Talbot. Means for purifying air. Sept. 21.

„ 17,307 (1904). Walter. Water purifying apparatus. Sept. 14.

(*C.*)—Disinfectants.

[C.S.] 18,678 (1903). Muller. Insecticide. Sept. 7.

„ 19,837 (1903). Kösters. Process for forming solutions of antiseptics which are otherwise insoluble or not easily soluble. Sept. 21.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 18,742. Krais and The Bradford Dyers' Association, Ltd. Manufacture and application of nitrocellulose solutions. Aug. 30.

„ 19,178. Beadle and Stevens. Manufacture of blotting and other water-leaf papers. Sept. 6.

[A.] 19,310. Thiebaut. Manufacture of paper, cardboard, and the like. Sept. 7.

[C.S.] 11,253 (1904). Noyes and Krueger. Machines for coating paper and like materials. Sept. 7.

„ 16,403 (1904). Nebrich. Pulp strainers for paper manufacture. Sept. 7.

„ 17,232 (1904). Homberger. Method of imparting lustre to objects made of celluloid or the like. Sept. 14.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 18,825. Newton (Bayer and Co.). Manufacture of a pharmaceutical compound. Aug. 31.

„ 19,411. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of dialkylated barbituric acids. Sept. 8.

„ 20,071. Wetter (J. D. Riedel). Pharmaceutical compounds having the therapeutic properties of codeine, and processes for the manufacture of the same. Sept. 17.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 18,890. Von Garainow-Trauttenberg and Fabian Method of production of photographic paper an the like. Sept. 1.

„ 19,940. Smith. Photographic plates or films. [Ger Appl., Sept. 17, 1903.]* Sept. 16.

[C.S.] 25,144 (1903). Newton (Bayer and Co.). Manufacture of new sensitising dyestuffs and intermediate products for use therein. Sept. 7.

„ 17,009 (1904). Lake (Jacobsen). Photographi reproductions. Sept. 14.

„ 17,036 (1904). Lake (Jacobsen). Photographi reproductions. Sept. 14.

„ 17,610 (1904). Schmidt. Pigment photographi processes. Sept. 21.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 19,200. Hall. Manufacture of explosives. Sept.

„ 20,106. Evangelidi. Explosives.* Sept. 17.

[C.S.] 23,766 (1903). Unge. Slow-combustion compos tions for fuses, self-propelling explosive proje tiles, and the like. Sept. 7.

„ 11,000 (1904). Steel. Explosive. Sept. 21.

„ 12,627 (1904). Hough. Nitrated carbohydrate Sept. 7.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[A.] 19,082. Cornthwaite. Soxhlet extractors f analysis of milk, cereals, cattle foods, &c. Sept.

„ 19,337. Decker. Goniometers or similar instr ments. Sept. 7.

[C.S.] 15,706 (1904). Thompson (Verein. Maschine fabr. Augsburg und Maschinenbauges. Nürnber A.-G.). Method for the continuous determin tion of the hydrogen contents of gaseous mixtur and apparatus therefor. Sept. 7.

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Ira Remsen

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CHANGE OF ADDRESS REQUIRED.

Moses, Herbert B., l/o National Battery Co., Buffalo, N.Y., U.S.A.

Deaths.

Cook, Wm. Martyn, Cecilhurst, Uplands Park, Enfield, Sept. 27.

Serel, Ernest, 119, Rue Notre Dame de Champs, Paris.

PROCEEDINGS

OF THE

TWENTY-THIRD ANNUAL MEETING.

About 100 members and ladies from Europe, the bulk of whom travelled by the steamships "Baltic," "Campania," "Kaiser Wilhelm der Grosse," and "Majestic," arrived in New York for the Annual General Meeting, and were received on landing by Drs. H. Schweitzer, V. Coblentz, R. W. Moore, E. G. Love, and W. McMurtrie, Prof. E. Hart, Mr. N. J. Lane, and Mr. and Mrs. F. Hemingway, acting on behalf of the Reception Committee, and conveyed to the Society's head quarters, the Hotel Seville, Madison Avenue, in automobiles.

On Wednesday evening (Sept. 7th) a reception was held at the Chemists' Club, West 55th Street, which was attended by a large number of members and ladies

Thursday, September 8th, 1904.

The twenty-third annual meeting of the Society was held in the Gymnasium of Columbia University, New York City, on Thursday, September 8th, 1904. The President, Sir William Ramsay, K.C.B., F.R.S., occupied the chair.

Prof. Charles F. Chandler, in welcoming the Society on behalf of the faculty of Columbia University, said it was eminently proper that the Society of Chemical Industry should hold its first meeting on that side of the Atlantic Ocean in the halls of Columbia University, which was one of their oldest institutions of learning, having been founded by King George II. by Royal Charter in 1754, one hundred and fifty years ago, under the name of King's College. At the close of the War of Independence the college had been opened under its present name of Columbia. Columbia was in the forefront for the study of the sciences; she had been the very first in this country to establish a School of Mines and cognate School of Sciences, founded on a regular prescribed course of four years, with strict requirements of personal preparation, and graded courses specially designed and devised for the education of those men who wished to make the applied sciences their professions for life—mining engineers, metallurgical engineers, mechanical engineers, electrical engineers, chemists, and architects. It was indeed a great pleasure to welcome the distinguished President of the Society. The late Dr. Barnard, President of the University, had provided in his will that once in five years there should be awarded a gold medal to the person who during the previous five years had made the most important contribution to physical science, or who had conferred the greatest benefit upon mankind by the application of the sciences. That medal was to be awarded by the trustees of Columbia University on the nomination of the Nationa Academy of Sciences. At the end of the first period of five years, when the Academy met at Washington to consider who should be named as the first recipient of this medal, it had been decided that the most prominent contribution to physical science during the previous five years had been the discovery of the curious and inert element argon But this great discovery had been due to the joint labours o Lord Rayleigh and Sir William Ramsay. Although the wil of Dr. Barnard had provided but for a single gold medal President Low had risen to the occasion and had said ther should be two medals, and those two medals had been conferred, one upon Lord Rayleigh and the other upon Si William Ramsay. So they claimed Sir William Ramsay a belonging to Columbia. He expressed the hope that thei English guests would enjoy the three weeks' trip which ha been arranged for them.

The President, in the name of the Society, cordiall thanked the Trustees of the University for the use of th magnificent hall in which they then were, and Dr. Chandler for his extremely kind welcome. He said that it had been the greatest possible pleasure to come and visit their brethren of America. The recollection of the War of Independence was not an unpleasant one to most Englishmen, whose feelings had so changed that, if a poll of the country were taken, he doubted whether there would be found an Englishman who would not in that war have fought on the American side.

The General Secretary read the minutes of the last annual general meeting, which were passed, and signed by the President. He then read the list of new members of the Council (see this J., Sept. 15, 850), and stated that two Vice-Presidents had resigned, namely, Prof. Procter and Mr. Carey, who had been elected respectively chairmen of the Yorkshire and the Liverpool Sections, and did not wish to duplicate their offices. In their places Mr. David Howard and Dr. V. Coblentz had been elected.

The President, after announcing that Mr. William H. Nichols, President of the General Chemical Company of New York, had been elected President of the Society for the ensuing year, said, with regard to the Report of the Council (see this J., Sept. 15, 851), the number of members on the register was 4134; at the same time last year it had been 3959. Four hundred new members had been elected, as compared with 380 last year, and the losses had also been fewer—216 as against 224. There had been 29 deaths. The Journal numbered 1378 pages; and 90 original papers, with discussions, had been published, as compared with 81 in the previous year. Since the last meeting a new section had been added to the Society, in Sydney, Australia. Important papers relating to the tariffs and trade regulations with other nations had been furnished from the Board of Trade. These would no doubt prove interesting, not merely in the British Isles, but also in the United States, for the sake of the information contained in them.

Dr. Harvey W. Wiley, of Washington, D.C., U.S.A., moved, and Prof. A. C. Humphreys, of Stevens Institute of Technology, of Hoboken, N.J., U.S.A., seconded the adoption of the report, and the motion was carried.

The President, in answer to a question, said that there were 1250 members in the U.S.A., not including the Canadian members.

The President invited Mr. Thomas Tyrer to read the report of the Honorary Treasurer, Mr. Hall, who was, unfortunately, not able to be present.

Mr. Tyrer expressed his regret at the absence of their highly esteemed Honorary Treasurer, and pointed out the satisfactory character of his Report as regards the balance. In connection with that, however, he had to draw attention to the likelihood, in the near future, of some increase in the cost of printing the Society's Journal. Its bi-monthly issue had, he thought, been fully justified by the results, but it had proved to be more expensive than had been anticipated, and the printers were therefore terminating the present contract as unremunerative to themselves. An important source of income to meet the expenses of the Journal was that of advertisements, to which the Treasurer had called attention in his Report, at the same time pointing out that those who could advertise in the Journal would be assisting the Society's work by so doing. Mr. Tyrer concluded by reading the last three paragraphs of the Treasurer's Report (which has already appeared in full in the Journal for Sept. 15th, p. 852).

Dr. McMurtrie echoed Mr. Tyrer's expressions of regret at the absence of Mr. Hall, and at the cause of that absence. Mr. Hall's very valuable Report was gratifying as showing the real prosperity of the organisation, and he believed that they were all glad to join in congratulations to the Treasurer and those who had supported him. Therefore he moved the adoption of the Report, and expressed the thanks of the Society to the officers who had had it in charge.

Prof. Edward Hart seconded the motion, which was carried unanimously.

The President then read his address. (See J., Sept. 15, pp. 852—857.)

The President-Elect, Mr. W. H. Nichols, stated the appreciation which the members of the New York Section felt of the honour which had been brought to them by holding their meeting on that side of the Atlantic Ocean; the New York Section felt keenly the honour which for the second time had been conferred upon one of its members by electing him to its presidency. Personally, as the one chosen to fill that office, he felt his inadequacy. He knew he had not been selected for anything which he had done, or for anything which he could reasonably expect to do; but he had been selected because so many friends in the New York Section had felt disposed to name him as their candidate; he cordially thanked his friends for putting him forward as representative of what they hoped their President might be. It would be his desire, in carrying out the duties of the office, to do what he could in his humble way to follow in the steps of the gentlemen who had occupied the position. He then moved a vote of thanks to the gentleman who had just finished reading one of the ablest papers which it had been his pleasure to hear on that subject—the subject of the education of the technical chemist. In the New York Section it was a matter that had shown evidence of sharp divergence of opinion, but they had before them the word of the master, which it would be well to consider and to take to their hearts. In moving this vote of thanks he did so not only for the paper, but also for the man himself, who had permitted himself to be used in the office of President during the past year, to bring all that he had been able to bring to the advantage and glory of this Society.

Prof. Charles F. Chandler, in seconding the motion, said he had listened to this address with the greatest interest, and felt sure every teacher of chemistry in the English-speaking world would read it and consider carefully its recommendations. For his own part, he should certainly study it with the greatest care. He was apprehensive, however, how far it would be possible to adopt those radical suggestions in an institution like Columbia University, where there were over 700 students working in the chemical laboratory, where the appropriations were not half sufficient to provide the necessary apparatus and chemicals, where the laboratories were so very crowded that it was almost impossible to find standing room for the young men who were entitled to the required laboratory practice in chemistry, and where the number of instructors was not half sufficient for the number of students. And this condition at Columbia applied, to a greater or less extent, to most of the larger institutions in America; but the presentation of this ideal plan of chemical instruction, and the spreading of it upon the records, where it might be read, not only by the patrons of chemistry, but by the authorities of our institutions, and further, by the liberal citizens of this country, who were so ready to come forward, when the necessity could be brought home to them, to provide the facilities for proper study and instruction, would serve a useful purpose. He took great pleasure in seconding that motion for a vote of thanks.

The motion was put, and carried unanimously by a rising vote, amid much applause.

The President thanked the meeting very heartily for the cordial reception which they had given to his address. In regard to the phase which Prof. Chandler put forward, the only remedy he could suggest would be to erect more laboratories, to subdivide the offices, and give to each of a number of professors of chemistry complete charge over all his particular department. There should not be one department of chemistry in the University, but some eight or nine. It was now his extremely pleasant duty and greatest possible pleasure to give the medal of the Society, which was awarded every two years, to his very old friend Prof. Ira Remsen, President of the Johns Hopkins University. He was known throughout the whole of the United States, throughout the whole Continent, as well as in England, as one of the most eminent and resourceful of chemists: he it was whose work had led to the discovery of that curious substance, saccharin; not only had he promoted chemical industry in that particular way, but he had trained a very large number, perhaps the majority, of the technical chemists in America; he certainly was a focus, a centre of learning, from which learning had spread throughout the whole of the United States. His first acquaintance with Prof. Remsen had been in the year 1871, when he rang the front-door bell of a door which was never opened, he believed, except when the King of Württemberg entered the University of Tübingen. The door was finally opened, after several pulls at the bell, by a man wearing a blue apron, and with rather black hands. He (Sir Wm. Ramsay) put the following question to him:—"Können Sie mir sagen, wo ist das Vorlesungszimmer?" This man was Prof. Remsen, and he said, "You want to find the lecture room, don't you?" Ever since, they had known each other intimately, and had corresponded for upwards of thirty years. In acknowledgment of his conspicuous services to technical chemistry, the Council of the Society, with the concurrence of the whole Society, had directed him, as President, to offer Prof. Remsen this medal, with the hope that he would long live to wear it.

Prof. Ira Remsen said it was scarcely necessary for him to say that he was deeply gratified by that act of the Council of the Society. What more could he say? The subject which the circumstances suggested was not an inspiring one. He could not talk touching himself. Indeed, altogether too much had been said on that subject. He wished he could believe one-half of what Sir William had said; it would be a pleasure to him, as the receipt of that medal was a pleasure. The subject of teaching had been suggested by what had been said. Of course the subject in general was one that he might enlarge upon, but he thought they would hardly care to hear it, nor should he care to take up their time in discussing it. To the study of teaching he had given his life. He could, he thought, enlarge upon that, because his heart was full of it even now, when circumstances had made it necessary for him to give up most of the work in that line in which he had been engaged since the memorable day when he opened the front door for Sir William. It was of course a great pleasure to see so many members of the Society there, and especially to see his "very old friend" again.

[A portrait of Prof. Remsen is enclosed with this issue of the Journal.]

Mr. J. B. F. Herreshoff moved that Messrs. Miall, Wilkins, Randall, and Co. be elected auditors of the Society at a remuneration of 10*l.* 10*s.*

Mr. Maximilian Toch seconded, and the motion was carried.

The President read a letter from the Chairman of the London Section, Mr. Reid, officially and heartily inviting the Society to hold its next annual meeting in London.

Dr. R. Messel moved that the next annual meeting of the Society be held in London. He thanked the New York Section for its kind attention and hospitality, and assured them that the Society would be no less warmly and cordially welcomed by their London brethren.

Dr. J. Lewkowitsch seconded the motion, and assured the members that everything would be done to make their stay in London pleasant.

Mr. Thomas Tyrer supported the motion and endorsed Mr. Reid's letter of invitation.

The motion was unanimously adopted.

Mr. Wm. T. Matheson moved that the thanks of the Society be given to the President and Trustees of Columbia University for the hospitality shown the Society and facilities afforded it.

Mr. Thomas Tyrer seconded the motion, and it was passed by a standing vote. This concluded the business, and the proceedings terminated.

After the meeting, a photograph of the members in a group was taken on the steps of the library of Columbia University.

The Annual Dinner.

The Banquet was held at the Waldorf-Astoria Hotel, Prof. Charles F. Chandler acting as toastmaster.

The Toastmaster proposed the health of the President of the United States, which was drunk standing. He then proposed the health of his Majesty, King Edward, which was also drunk standing.

The Toastmaster in announcing that the next toast, the Society of Chemical Industry, called for a response from the late President of the Society, said he felt that the late President owed an apology to the Society for having brought into the world five of the laziest elements, and he asked if any one had ever heard any good word for argon, neon, krypton, xenon, or even helium. He certainly thought that the late President owed the Society an apology for bringing into the chemical elements a lot of tramps.

Sir William Ramsay, in responding, referred to his address in the morning at the annual meeting, saying it was his hope to bring into closer touch Science and Industry, and that he lived in the hope—and believed that the Society would share his hope—that the present President would look at the other side of the shield in his address at the next annual meeting, and that he would touch upon the relation of Industry to Science. He confessed to the justice of the charge of bringing into the world—although one was in the curious position of having two fathers—a set of lazy tramps, and stated that there was another body which had recently been born—only about two months ago. He went on to relate the circumstances that led to the discovery of that body, and stated that experiments were now in progress to try which of certain suppositions were correct, and it appeared to him that they were on the brink of a discovery of the synthesis of atoms which would themselves decompose, and possibly into the ordinary well-known elements, and in this way prove to be the ultimate sources of these elements. It was a mere hope, he said, but he gave it to the Society for what it was worth. Having effected the introduction of his very latest child, he would like to add just a few words on the subject of the toast, the Society of Chemical Industry. He foresaw that the New York Section of the Society was bound to grow very rapidly, but whatever they did they must not quarrel. They must devise some means of living together in peace and harmony, and it was for his successors to consider this question very carefully. That union had to be preserved; but difficulties would obviously arise when the child outgrew the parent and became much larger. He was not going to prophesy, but it would demand very careful consideration. He thought they might remain in perfect union as one body, with sections not merely in America and England, but also in the English colonies. Indeed, he hoped it would foreshadow a much larger union, for he did not see why the two nations, America and Greater Britain, should not work together in absolute peace and harmony; not, of course, under one government, but in thorough agreement to support each other through thick and thin. Sir William then thanked the Society for the very cordial way in which it had received the toast, the Society of Chemical Industry.

A toast to the Verein Deutscher Chemiker was then drunk amid cheers.

Dr. Erdmann replied in German.

The subject of the next toast was Industrial Corporations.

Prof. Wiley, in responding, quoted statistics in regard to the wealth, population, and voting strength of the United States, and then, referring to the prophecy of Sir William, said there was no danger of a dissolution of the unity of the Society of Chemical Industry. There was a little fact in history which they had possibly forgotten—that they parted from England because they were taxed without representation; but that did not occur in the Society of Chemical Industry. They were taxed, it was true, but they had a large representation. So there would be no Boston Tea Party in the Society of Chemical Industry. They had a perfect community of interests, and that community of interests was not confined to the science of chemistry; it was a community of interests that percolated every feature of their common international life. Further, he believed such meetings as those—meetings that were international in character—did more to draw together already strong ties than any amount of preaching in the public prints could do. They saw their fellow-man face to face; they saw the character of the man, and then began to appreciate that it was the man, for, after all, it was the man—the man as a man. In the great sphere of industry it was the man—the man was measured by his industry, but the man was the thing. Industry was incident to the man and his develop ueur, and it was because industries developed manhood, nd not because they brought dollars, that industries were seful to man.

The Toastmaster then called upon Dr. Wilhelm Ostwald, f Leipzig, to say a few words.

Prof. Ostwald, after expressing regret, as a man who ame from the land of theory to the land of practice, at not aving heard any speeches or discussions on chemical industry at the meeting, and having referred to the fact that there vas no quarter on the surface of the globe where no member f the Society was residing, said that the Society was therefore nternational, and if they would look through all things they vould find nothing more international, nothing more naturally nternational, than science; there existed nothing in the whole vorld that was quite the same thing, whether you considered ngland, Japan, Sweden, or the frontier land in South Africa. cience was indeed the only thing that formed a part of the quipment of every body of men which had reached some legree of civilisation. He then expressed the hope of seeing he day when all people would speak one language, and stated hat science was indeed the tie that held nations together. cience was spreading over all lands. International science vould be the means of uniting all peoples of the world. o this purpose he drank to the furtherance of the idea of nternational brotherhood, beginning with science and ending vith the union of hearts. Science was brotherhood. The oast was drunk by the assembly amid cheers.

The Toastmaster proposed the toast, "American Chemical ndustry," and called upon the new President of the Society o respond.

Mr. Nichols, in replying, stated that chemical industry in he United States was of comparatively recent growth, but vas not altogether without interest. He referred to the ffect of the American tariff on chemical industry, and the act that America had all kinds of raw materials. In eferring to the cost of labour, he stated that it was his xperience that it paid well to pay men well, and cited an nstance where by paying certain labourers double the wages hey received abroad for certain work it cost his firm rather ess to turn out a ton of ore with those identical men than t did their former employers at half the wages. That was he only way in the world that the American manufacturer with high-priced labour was able to compete with the foreign manufacturer at lower cost. In other words, it was perfectly possible in his judgment for the foreign labourer to produce wice his present result if he received twice the pay. In ecalling the names of the men who had been the pioneers n the domain of American chemical industry, Mr. Nichols eferred to Mr. Weightman, of Philadelphia, lately deceased, Martin Kalbfleisch, of Brooklyn, Major Knight, Eugene Kressley, Mr. Gridley, Hugh Cochran, ex-Mayor Tiemann, of New York, Mr. Chappell, and Mr. Bowers, who he said were the originators of what was known as American hemical industry to-day. The future was in the hands of the young men, many of whom were present. It was to them that they looked for the future of chemical industry; the young men had it in their power to make it worthy of the great country in which they lived.

The Toastmaster then called upon the British Vice-Consul, Mr. Clive Bayley, to give some impressions of New York.

After expressing regret at the absence from the city of the Consul-General, Mr. Bayley narrated his impressions and experience since coming to New York, and said, further, he hoped that was not the only time that they would be able to have impressions of New York, and that not only they, but every Englishman, would make it his duty and his object in life to come not only to New York, which was not the United States, but to the whole United States, becoming better acquainted with their own sons, their own relatives.

The Toastmaster then proposed a toast to the English committee which arranged the trip to the United States, and called upon one who had been familiar with the affairs of the Society since its inception—their past president, Mr Thomas Tyrer.

Mr. Tyrer, in calling attention to the American colours —red, white, and blue—which decorated the hall, noticed the fact that the same colours appeared in the British ensign and the tricolour, which were also among the decorations. He warmly advocated the cosmopolitan and international character of the Society. He stated that this meeting with the New York Section differed from meetings held 20 or 21 years ago only in two things: first, in locality, and second, in the peculiarity of the conditions under which hospitality had been extended. Mr. Tyrer then paid a glowing tribute to the ladies' committee of the New York Section, which had looked after the welfare of the wives and daughters of the visitors, and also warmly thanked the committee which had looked after the party from the time of their landing in New York up to that time.

The Toastmaster then said he could not bring that delightful function to a close without calling upon the man who was practically responsible for the Society of Chemical Industry in America—Dr. Hugo Schweitzer.

Dr. Schweitzer, admitting that he was godfather when the New York Section was founded, went into a history of the growth of the Section in New York. Ten years ago there existed the American Chemical Society in New York, which was strictly devoted to science; the industrial chemists had been hardly represented in it, and had no voice in the management of the Society. At that time some kindred spirits had started the Section with about 300 members; to-day they were 1250. He knew his Section, knew the members—knew fully 90 per cent. of the members belonging to it—and they were loyal to the parent Society, and would never depart from it. This was not sentiment, he said, but was absolute materialism. Dr. Schweitzer also referred to the value of the Journal as being the best paper published for chemists. As chairman of the general committee of arrangements for the entertainments and annual meeting, he desired to express his thanks to Drs. Coblentz and Moore, Mr. Zabriskie, and Messrs. Parker and Love, the last two of whom he called the "Gold Dust Twins," they having looked after the financial side of the matter.

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I.—PLANT, APPARATUS AND MACHINERY.

English Patents.

Furnaces; Mill and the like ——. D. G. Davies, Birmingham. Eng. Pat. 19,542, Sept. 10, 1903.

The furnace is constructed with double walls and a double roof, the spaces thus formed communicating with each other and opening into the ash-pit by means of holes formed within the inner walls under the grate bars. Suitable means of access are provided for clearing out the holes. The air-inlet, which opens directly into the double roof, is controlled by a damper.—L. F. G.

Grinding Mills for Gradual and Variable Pulverisation. J. Rakowski, Warsaw, Russia. Eng. Pat. 20,932, Sept. 29, 1903. Under Internat. Conv., Nov. 22, 1902.

The grinding stones, of which there are several and which act successively, have gradually diminishing diameters, and gradually increasing grinding surfaces. The weight of the grinding stones can be varied as desired. For this purpose certain parts of the stones, *e.g.*, the lateral walls or parts, are made of sufficiently heavy material, and are detachable.
—W. H. C.

Distilling and Condensing Apparatus. J. S. Forbes, Philadelphia, Pa. Eng. Pat. 10,157, May 3, 1904.

See U.S. Pat. 760,440 of 1904; this J., 1904, 652.—T. F. B.

Filter Elements. K. Kiefer, Cincinnati, U.S.A. Eng. Pat. 14,381, June 25, 1904.

See Fr. Pat. 325,255 of 1902; this J., 1903, 690.—T. F. B.

Heating Liquids; Apparatus for ——. A. Waldbaur, Stuttgart, Germany. Eng. Pat. 15,875, July 16, 1904.

Hot gases from a combustion chamber are drawn into a separate chamber by means of sprayed jets of liquid, with which they mix, and thus uniformly heat the liquid.
—L. F. G.

United States Patents.

Roasting Furnace. O. Hofmann, Argentine, Kans. U.S. Pat. 768,748. Aug. 30, 1904.

A roasting furnace of the Herreshoff type is constructed with a vertical hollow shaft, provided with adjustable hollow arms to which stirrers are attached. In the centre of the hollow shaft an air pipe is fixed, so as to rotate with it, having branch pipes projecting into the hollow arms. The cooling air is forced through the central pipe into the branch pipes, and returns between the latter and the hollow arms to the hollow vertical shaft.—W. H. C.

Drying Kiln. H. J. Morton, Chicago. U.S. Pat. 768,813, Aug. 30, 1904.

The kiln has a vertical series of air-inlet ports in one wall, so arranged that the air can be admitted at different levels. The air-outlet ports are similarly arranged in the opposite wall.—W. H. C.

Drying Apparatus. M. Bertrand, Grigny, France. U.S. Pat. 769,643, Sept. 6, 1904.

The apparatus consists of a main closed chamber, connected at each end with an auxiliary chamber. Hot air is admitted at one end, and a draught chimney is placed at the other end of the main chamber. One of the auxiliary chambers also contains a draught chimney. Lateral heating pipes are arranged in the main chamber, being separated by lateral partitions from a truck-track. Sliding doors are provided for closing the main and auxiliary chambers.
—L. F. G.

Crucible and Preheater; Combined ——. J. A. Aupperle, Indianapolis, Ind. U.S. Pat. 768,972, Aug. 30, 1904.

A crucible is provided with air inlet and outlet tubes, which are connected with a device for preheating, and a wash-bottle for purifying the air before it passes to the crucible. The crucible is surrounded by a water jacket.
—W. H. C.

Filter. E. Boellinghaus, Hamburg. U.S. Pat. 769,143, Sept. 6, 1903.

See Eng. Pat. 27,287 of 1903; this J., 1904, 708.—T. F. B.

Condenser. O. S. Still, Annette, Cal. U.S. Pat. 770,127, Sept. 13, 1904.

In a vertical casing having a conical bottom, provided with an outlet tap, a determined depth of water is maintained. A vertical pipe, forming the uncondensed-vapour outlet, extends from a slight distance above the surface of the water, through the centre of the casing, to above the top. The vapour inlet is situated near the top of the casing, and above it is a spraying device and means for supplying liquid to form the spray.—W. H. C.

Liquid-cooling Apparatus. A. Siebert, St. Louis, Mo. U.S. Pat. 770,190, Sept. 13, 1904.

A zigzag series of double sloping shelves, down which the liquid to be cooled flows, are held in a frame and so arranged that the liquid from the upper shelf of one set flows on to the lower shelf of the next, and *vice versa*. There is a cooling shelf between the shelves of the lowest set, and means are provided for feeding the liquid on to it.
—W. H. C.

French Patents.

Drying Apparatus for all kinds of Substances. H. Diedrich. Fr. Pat. 342,417, April 18, 1904.

See Eng. Pat. 4173 of 1903; this J., 1904, 315.—T. F. B.

Furnaces. White-Mylin Furnace Co. Fr. Pat. 342,434, April 19, 1904.

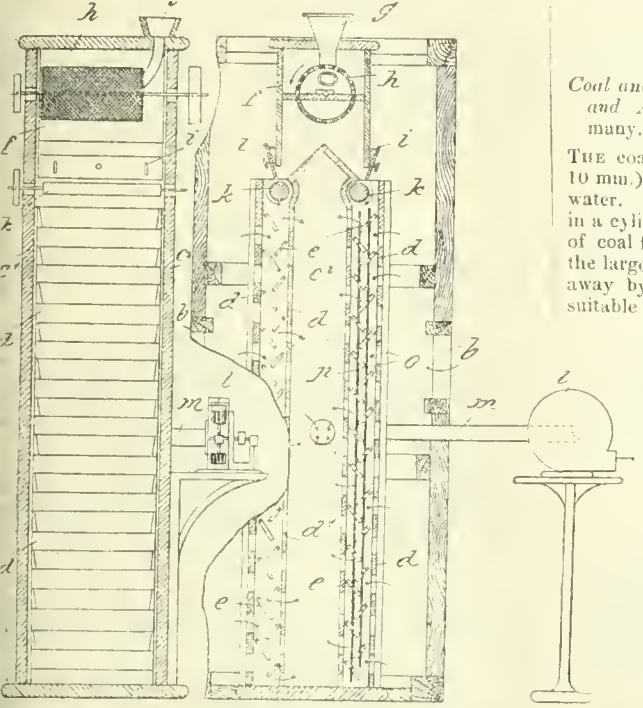
See Eng. Pat. 6855 of 1904; this J., 1904, 600.—T. F. B.

Extraction and Distillation Apparatus. C. Garnier. Fr. Pat. 312,534, April 22, 1904.

A horizontal cylindrical frame, carrying around its periphery a number of smaller cylindrical frames formed of rods, is mounted on an axis, capable of rotation, within an outer casing forming the still. The material to be extracted is contained in cylindrical, perforated, metal cages, which are placed in the frames around the inner cylinder. The apparatus is heated by a steam coil, and filled to about one-quarter of its height with the solvent, means for charging and drawing off which are provided. The outer casing is provided with a still head and condenser for dealing with the products of distillation.—W. H. C.

)esiccating and Cooling Granular Products, such as Crystallised Sugar, &c.; Apparatus for ——. F. Hall. Fr. Pat. 342,619, April 25, 1904.

'he material to be treated is fed through a hopper, g, and he rotary sieve, f, on to the series of sloping shelves, e, y means of the rollers, k. The whole is surrounded by ie casing, c. A current of air, produced by the suction f the fan, l, is drawn through h, and the openings, o and p, cross the shelves. Means are provided for heating the ielves and for adjusting the angle at which they are set.—W. H. C.



II.—FUEL, GAS, AND LIGHT.

'uels; Valuation of Mineral ——. E. Goutal. Ann. Chim. anal. appl., 1904, **9**, 242—246. Chem. Centr., 1904, **2**, 726.

ECENTLY several samples of coal from one and the same oring gave calculated values (this J., 1902, 1267) differing onsiderably from those determined calorimetrically. The ause of the discrepancies was found to be the contamination f the coal with adherent gangue, which latter, in this ase, contained considerable quantities of volatile matter. 'he author also draws attention to the necessity of the xygen used in calorimetric determinations being perfectly ee from hydrogen. Electrolytic oxygen seldom contains ss than 1 per cent., and frequently more than 2 per cent. f hydrogen, and the error caused in this way may amount several hundred calories.—A. S.

'ulphuretted Hydrogen; Bacterial Production of ——. [Pollution of Coal-Gas.] J. G. Taplay. J. Gas Lighting, 1904, **87**, 734.

T one of the testing-stations of a London gas company, was recently found that the gas, when submitted to the 'as Referees' test, gave stains indicating the presence of ydrogen sulphide, whilst in the laboratory immediately ver the testing-station, no such indication could be obtained. he source of the contamination was found to be a slightly ncave portion of the service-pipe, in which a small nount of water had lodged. From this water, bacteria ere isolated which were capable of generating hydrogen sulphide in amount sufficient to stain paper moistened with lead acetate solution. Gas free from hydrogen sulphide became contaminated by the latter by contact with this water.—A. S.

Flue Gases; Rapid Method for Testing ——. H. Le Chatelier. XXIII., page 951.

Phosphorus in Calcium Carbide; Determination of ——. H. Lidholm. XXIII., page 951.

English Patents.

Coal and the like; Apparatus for simultaneously Washing and Assorting ——. C. J. Kremer, Dortmund, Germany. Eng. Pat. 23,259, Oct. 27, 1903.

The coal is fed on to a sieve with large mesh (about 10 mm.) placed in the upper portion of a vessel containing water. The water is kept in motion by a piston working in a cylinder at one side of the vessel. The small pieces of coal fall through the meshes into the water, whilst of the larger pieces left behind, the heavier slate is carried away by the water beneath a horizontal plate fixed at a suitable height, into a channel, from which it is removed, whilst the lighter coal passes over the plate, and is collected separately. The small pieces that have dropped through, are washed in another apparatus with a sieve of finer mesh.—L. F. G.

Gases; Manufacturing and Mixing ——. B. Loomis and H. Pettibone, New York. Eng. Pat. 5911, March 10, 1904.

Two generators are connected together and operated reversibly in series for the making of producer-gas and water gas in succession. Whilst water-gas is being generated, it is drawn off by an exhauster and stored in a holder. During the next period the producer-gas is drawn off into a second holder by means of the same exhauster, and simultaneously a certain proportion of the water-gas is admitted from the first holder by means of an auxiliary exhauster. A mixed gas of definite calorific value, suitable for use in high-power gas engines, is thus obtained.—H. B.

Gas Producers [Down-Draught, Suction]. J. J. Deschamps, Paris. Eng. Pat. 12,221, May 30, 1904.

A down-draught producer, operated by suction, is provided at the top with one or more metal casings, having openings at the bottom, down through which tuyères may be passed, so as to penetrate into the mass of the fuel. The casings are connected to the air supply, and have removable covers to permit of replacing the tuyères; they may also be fitted so as to allow of feeding liquid fuel continuously into the tuyères. The casings may be prolonged downwards so as to form protecting sheaths for the tuyères.—H. B.

Gas Producers [Suction]. H. J. Grice, Acocks Green, Worcestershire. Eng. Pat. 16,067, July, 20, 1904.

An annular reservoir for water, at the upper part of the producer, is connected by means of a pipe with the exhaust pipe of the motor, and at each explosion in the latter, a quantity of water is forced from the reservoir into the steam generator, which consists of a series of horizontal tubes extending across the upper part of the producer. The steam generated is sucked by the motor into the producer, along with air. The fire-grate is formed of rotatable bars, provided with cog-like projections to facilitate the breaking up of clinker. The producer gas is led through a cooler and is then passed with water down through a scrubber packed with coke; at the base of the latter is a separating chamber, containing a series of short vertical pipes, through which the gas escapes, the upper open ends of the pipes being shielded from the falling water by means of conical shields. The under sides of the latter are fitted with fine gauze to arrest solid matter and prevent backfiring.—H. B.

Gas of Gas Producers; Method of and Means for Purifying the ——. E. Capitaine, Frankfort-on-the-Maine, Germany. Eng. Pat. 2240, Jan. 29, 1904.

To remove the mechanical impurities in the gas, a fine spray of water is injected into it by means of compressed air, the air being used in quantities insufficient to form an explosive mixture. The apparatus described consists of a vertical shaft, arranged alongside the producer, and divided internally into three vertical compartments. The gas passes down the first compartment, in which it is cooled by means of water; it then flows up the second, at the bottom of which is a diffuser, which throws up a jet of air and water spray; and finally it passes down the third compartment to the outlet. The compressed air is supplied by a pump actuated by the motor which is fed by the producer, so that the proportion of air is varied automatically according to the amount of gas produced.—H. B.

Hydrogen Contents of Gaseous Mixtures; Method for the Continuous Determination of ——, *and Apparatus therefor.* W. P. Thompson. From Verein Maschinenfabr. Augsburg u. Maschinenbau-Ges. Nürnberg. Eng. Pat. 15,706, July 14, 1904. XXIII., page 951.

UNITED STATES PATENTS.

Coking Coal; Process of ——. C. F. Spaulding, Chicago, Ill. U.S. Pat. 769,241, Sept. 6, 1904.

The coal is fired in an oven, and an upwardly directed blast of air and oxygen is forced into the part of the oven above the coal.—L. F. G.

Coke-Oven. J. H. Bowling, Ozone, Tenn. U.S. Pat. 769,246, Sept. 6, 1904.

In a battery of beehive coke-ovens, a flue leads from the coking chamber of each oven into a horizontal main flue running below the ovens, each oven flue being controlled by a valve. At the other side of the ovens is a similar main gas-flue connected to a chimney, the two main flues being connected across by a number of straight and parallel cross flues of rectangular cross-section.—L. F. G.

Peat; Oven for Coking ——, *with Recovery of By-Products.* E. Bremer, Mariupol, Russia. U.S. Pat. 769,531, Sept. 6, 1904.

A vertical retort with perforated sides carries at its upper end a preliminary drier adapted to discharge peat into the retort, and at its lower end a cooling or condensing box for receiving the coked peat, the discharge from the retort being regulated by a valve. A combustion chamber surrounding the retort receives the evolved gases, these being then mixed with air and burned, the hot products of combustion circulating round the drier, and then passing to the chimney. Several retorts are arranged side by side, and surrounded by a common collecting chamber for the combustible gases.—L. F. G.

Gas Producer. W. J. Crossley and T. Rigby, Manchester. U.S. Pat. 768,655, Aug. 30, 1904.

See Eng. Pats. 13,763 and 13,764 of 1903; this J., 1904, 779, 780.—H. B.

"Hydrogen Carbide"; Process of Producing ——. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 770,214, Sept. 13, 1904.

A metallic carbide (*e.g.*, iron carbide), containing at least 9 per cent. of combined carbon, is heated and exposed to the action of a gaseous or fluid sulphurous hydrocarbon (sulphurous petroleum or so-called Lima oil). The sulphur of the hydrocarbon must have a greater affinity for the metal of the carbide than for the hydrocarbon radical with which it is combined.—H. B.

Gas; Apparatus for Purifying ——. W. Everitt, Ilkley, and T. Redman, Bradford, Yorkshire. U.S. Pat. 768,792, Aug. 30, 1904.

The apparatus comprises "a chamber or conduit having screens, a gas inlet to and outlet from said conduit or chamber, and means independent of said inlet and outlet for abstracting portions of gas from and injecting same into said conduit in intermittent currents at high velocity against and through said screen in alternate directions."
—H. B.

Gas; Apparatus for Purifying ——. J. E. Prégardien, Kalk, Germany. U.S. Pat. 769,713, Sept. 13, 1904.

See Eng. Pat. 13,788 of 1901; this J., 1901, 1101.—T. F. B.

[Coal] Gas; Purifying ——. W. O. Felt, New York. U.S. Pat. 769,860, Sept. 13, 1904.

The gas is cooled out of contact with a liquid, scrubbed, and then "subjected to the action of glycerin and subsequently to the action of an oxide."—H. B.

Electrodes of Arc Lamps; Manufacture of ——. M. Lilienfeld, Berlin. U.S. Pat. 769,003, Aug. 30, 1904.

See Eng. Pat. 2698 of 1903; this J., 1903, 691.—T. F. B.

FRENCH PATENTS.

Generator for Poor Gas, free from Tar. L. Boutillier. Fourth Addition, of April 9, 1904, to Fr. Pat. 331,011, April 7, 1903.

The combustion chamber of the generator is constructed with an inclined bottom, and the fresh bituminous fuel is fed upwards from below, to the lowest part of the bottom, by means of a screw conveyor. The tarry matters are thus liberated beneath an incandescent body of fuel. To prevent the escape of any of the tarry matters with the gas, a vertical partition depends from the top of the producer down into the fuel, at a point between the gas outlet and the inlet for the air and steam. The gas is thus compelled to pass through the upper strata of the fuel, which has already been coked in passing up the inclined bottom.
—H. B.

Gas; Process for Manufacturing ——. J. Bueb and Deutsche Continental Gas-ges. Fr. Pat. 342,299, April 14, 1904.

See Eng. Pat. 15,147 of 1903; this J., 1904, 602.—T. F. B.

Gas; Apparatus for Producing ——, *having the Generator placed beneath the Retorts.* H. Poetter. Fr. Pat. 343,487, April 20, 1904.

See Eng. Pat. 8993 of 1904; this J., 1904, 860.—T. F. B.

Water-Gas; [Double] Generators for ——. F. Thuman. Fr. Pat. 342,578, April 23, 1904.

A "double" generating apparatus (consisting of two generators, connected together in parallel during the blast period, and in series during the make period, the direction of the gas through the fuel being reversed periodically) is provided with air-, steam-, and gas-valves so connected together as to prevent explosions through inadvertence. The air (or water-gas) remaining in the ash-pits and passages at the foot of the generators is expelled by means of steam at the end of each phase. If carburetted gas is being made, the inlet valve for the hydrocarbon is also connected to the air-valves as above.—H. B.

Gas Generators [Suction]. W. J. Crossley and T. Rigby. Fr. Pat. 342,627, April 25, 1904. Under Internat. Conv., June 20, 1903.

See Eng. Pat. 13,763 of 1903; this J., 1904, 779.—T. F. B.

"Mixed-Gas" Generator. A. Vizet. Fr. Pat. 342,820, May 3, 1904.

The generator consists of a vertical tubular boiler, having at its base a combustion chamber for solid fuel, the whole being enclosed in a cylindrical casing provided at the foot with an inlet for compressed air, and at the top with an inlet for water and a device for admitting the fuel. By the combustion of the fuel, steam is generated from the water surrounding the tubes; the hot combustion-gases, issuing from the upper ends of the tubes, impinge upon the incoming water supply, which falls in the form of rain from a distributing plate, thus generating more steam; and the mixed gas, consisting of steam and the gaseous products of combustion, is used for motive purposes in the same way as steam or compressed air.—H. B.

"*Mixed Gas*"; *Apparatus for Making* ——. F. R. Boivinet and Soc. Popineau, Vizet Fils et Cie. Fr. Pat. 342,821, May 3, 1904.

The apparatus, which is designed for generating a mixed gas composed of steam and gaseous products of combustion, consists of a vessel, fitted with suitable inlet and outlet valves, into which gas, air, and water are admitted under pressure, the combustion of the gas and air causing the vaporisation of the water. The water is heated beforehand by circulating in a jacket surrounding the combustion vessel. The gas produced may be used for motive or heating purposes.—H. B.

Candles; Rapid Lighting Wicks for ——. A. Haase. Fr. Pat. 342,527, April 22, 1904.

The wicks, freed from fat or wax, are impregnated with a solution of potassium chlorate or nitrate and dried. To increase their inflammability they are then dipped in a solution of sulphur in carbon bisulphide.—W. H. C.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Benzene and its Homologues from Russian Petroleum; Preparation of ——. W. N. Ogloblin. Z. Farben- u. Textil-Chem., 1904, **3**, 293—294.

The method of preparation depends on the decomposition of the naphthenes by heat, into aromatic hydrocarbons. The petroleum is first heated to 525°—550° C. in iron retorts, which are furnished with iron channels through which the petroleum flows. The outlet of the retort is connected with a receiver which condenses all the substances that boil above 200° C. The lower-boiling portion is condensed in a water condenser, any gas being collected in a gasometer. The portion boiling above 200° C. can be used as fuel or be still further decomposed. The portion boiling below 200° C. is distilled again at a temperature of from 700° to 1200° C. under a pressure of two atmospheres. The distillate is fractionally distilled. The fraction boiling up to 120° C. is called "gray benzol." The fractions from 120° to 200° C. are further decomposed under a pressure of two atmospheres. The portion above 200° C. is used for the preparation of naphthalene, anthracene, &c. The "gray benzol," which amounts to about 12 per cent. of the petroleum, consists of benzene, toluene, and xylene, and can be used at once for nitration, &c.—A. B. S.

Petroleum; Determination of Impurities in Crude ——. R. Nettel. XXIII., page 952.

United States Patents.

Distilling [*under Reduced Pressure*]; *System and Apparatus for* ——. L. Gathmann, Washington, D.C. U.S. Pat. 768,795, Aug. 30, 1904.

This apparatus, which is designed for distilling or evaporating under reduced pressure, consists of a still connected with a rectifier and condenser, means being provided for heating the rectifier. Heated air is introduced into the contents of the still by means of a rotating "tubular rake," nd connections are provided for continuously circulating he air through the entire system; an air-heating device is placed in the tube connecting the condenser to the still, to eheat the air after each circuit.—T. F. B.

Hydrocarbon Oils and Spirits; Process of Distilling or Refining ——. L. Gathmann, Washington, D.C. U.S. Pat. 768,796, Aug. 30, 1904.

Petroleum or other hydrocarbon oils or spirits are distilled in an apparatus similar to that described in the preceding specification, a current of hot air under reduced pressure being passed through the contents of the still, and then through the condenser and air-heating apparatus, before being again passed into the still.—T. F. B.

Pyro-Acetic Spirit; Apparatus for Producing ——. A. Ippendorf, Düsseldorf, Germany. U.S. Pat. 769,164, Sept. 6, 1904.

The apparatus consists of a horizontal cylindrical vessel, "having a frusto-conical end"; a rotating shaft, passing diametrically through the vessel, carries blades in the cylindrical portion of the vessel, and a worm conveyor in the frusto-conical end. The vessel is provided with heating means, and communicates with a rotating retort, which is provided with a shaft on which are mounted inclined blades to agitate the contents of the retort.—T. F. B.

Wood; Apparatus for the Distillation of ——. J. A. Mathieu, Georgetown, S.C. U.S. Pat. 769,177, Sept. 6, 1904.

Each of a series of vertical cylindrical retorts is provided with a removable top, a liquid discharge opening in the bottom, and a discharge pipe for the volatile products. A cylindrical basket, with openwork sides and solid bottom, adapted to contain the wood to be distilled, fits loosely in the retorts; the bottom of the basket contains an opening which is in register with the liquid-discharge opening of the retort. A cover without a bottom is provided, which is lowered over the basket when it is desired to transfer the contents from one retort to another, means being also provided for fastening the cover to the basket, raising the whole, and carrying it along the series of retorts.—T. F. B.

Peat; Oven for Coking ——, *with Recovery of By-Products.* E. Bremer. U.S. Pat. 769,531, Sept. 6, 1904. II., page 930.

Lubricant for Oiling Guns; Alkaline ——. J. G. Wild, Assignor to Winchester Repeating Arms Co., New Haven, Conn. U.S. Pat. 768,835, Aug. 30, 1904.

This lubricant, intended for neutralising the acid residues left by smokeless powder on the surface of guns, consists of a fixed hydrocarbon lubricant mixed with an alcohol or glycerin saturated with ammonia gas.—C. A. M.

Oils; Process of Treating [*Bleaching*] ——. A. C. Calkins, Assignor to H. E. Brett, Los Angeles, Cal. U.S. Pat. 769,681, Sept. 6, 1904.

Oil is treated with sulphuric acid in a closed tank "to precipitate tarry matters within the oil." The air and sulphur dioxide are pumped from the top of the vessel and passed through a pipe which discharges into the tank containing the oil near the bottom; this circulation of gas is continued until the oil is sufficiently bleached.—T. F. B.

French Patent.

Soap; Transformation into ——, *of Mineral Oils in General, and principally Petroleum.* M. Kuess. Fr. Pat. 342,348, April 15, 1904. Under Internat. Conv., Nov. 3, 1903.

See Eng. Pat. 7481 of 1904; this J., 1904, 817.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Aldehydes; Detection of ——, *and the Constitution of Nitrosodimethylaniline.* G. Velardi. XXIII., page 952.

English Patent.

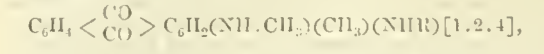
Dyestuffs Derived from Anthracene; Manufacture of ——. [*Anthracene Dyestuffs.*] O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine, Germany. Eng. Pat. 23,392, Oct. 28, 1903.

On condensing the halogen derivatives of 1.5- and 1.8-aminohydroxyanthraquinones with primary aromatic amines, and sulphonating the products, dyestuffs are obtained which give fast blue shades on unmordanted wool. (Compare Fr. Pat. 338,756 of 1903; this J., 1904, 783.)—T. F. B.

United States Patents.

Anthraquinone Dye [*Anthracene Dyestuff*]; *Blue* ——. W. Berchelmann, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 764,837, July 12, 1904.

Dyestuffs having the general formula—



$$C_6H_4 < \substack{CO \\ CO} > C_6H_2(NH.CH_3)(CH_3)(NHR)[1.2.4],$$

R being an alphyl radical, are obtained by first brominating methylamino-β-methylanthraquinone (produced by treating mononitro-β-methylanthraquinone with methylamine), and condensing this compound with an aromatic amine; on sulphonating the resulting product, dyestuffs are obtained which give blue shades on unmordanted wool from acid baths.—T. F. B.

Orange Dye, and Process of Making same. [*Acridine Dyestuff.*] O. Sohst, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 766,540, Aug. 2, 1904.

The leuco-acridineglycin, obtained by treating tetra-aminoditolylmethane with a mineral acid and monochloracetic acid, is alkylated and then oxidised. The resulting dyestuffs give orange shades on leather and cotton mordanted with tannin. By alkylating in presence of concentrated sulphuric acid, the dyestuff gives redder shades than when hydrochloric acid is used, and yellower shades are obtained by ethylation than by methylation.—T. F. B.

Azo-Dye, and Process of Making same. P. Julius, H. Reindel, and F. C. Günther, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany, U.S. Pat. 770,177, Sept. 13, 1904.

See Fr. Pat. 338,819 of 1903; this J., 1904, 820. The diazotised naphthylamine-*o*-sulphonic acid is converted into *o*-hydroxynaphthyldiazonium compounds by treatment with an alkali carbonate and hypochlorite. The dyestuff from 1.2.4-naphthylaminedisulphonic acid is specified.
—T. F. B.

French Patent.

Dyestuffs or Tannin from Dyewoods; Process for Extracting ——. F. J. Oakes. Fr. Pat. 342,748, April 30, 1904.

See U.S. Pat. 759,008 of 1904; this J., 1904, 604.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

Indigo-dyed Tissues [*Calico Printing*]: *Discharging* —— *with Chromic Acid.* A. Bulard. Rev. Gén. Mat. Col., 1904, **8**, 257—261.

With the object of dispensing with the use of oxalic acid in the acid discharge-bath employed in discharging indigo-dyed tissues by the chromic acid method, it has been proposed (this J., 1903, 359) to add potassium oxalate to the alkali chromate printing-mixtures. The author finds that the oxalates of sodium, ammonium, and calcium are more effective in this connection. The last-named salt binds the printing-mixtures well together, and appears likely to be of special value in the production of well-defined, "white" discharges. By its use it may be possible to obtain, with sulphuric acid alone in the discharge bath, results equal to those produced with the mixed sulphuric-oxalic acid bath. Besides the economy, an advantage to be gained by the omission of oxalic acid from the discharging-bath is that the intensity of the indigo dyeings in the unprinted parts of the tissues remains unimpaired, whereas, when the mixed acid bath is employed, this is considerably reduced. Owing to the insolubility of calcium oxalate, it may be advisable, in the case of printing mixtures containing pigments, to use a mixture of this salt and a soluble oxalate, in order to keep as low as possible the proportion of insoluble matters present.—E. B.

English Patents.

Fabrics, Warps, Yarns, and the like; Apparatus for Subjecting —— *to the Action of Fluids or Chemical Solutions.* J. Gebauer, Charlottenburg, Germany. Eng. Pat. 21,949, Oct. 12, 1903.

A series of endless conveyors, composed of wire netting, are arranged one above the other in a closed tank; each one is adapted to rotate in the opposite direction to the one below it; the conveyors which rotate in the same direction are fixed vertically one above the other, with their ends projecting beyond the ends of the conveyors rotating in the opposite direction. The fabric is passed through a folder, hvaing been previously impregnated with the liquid, and deposited in folds on the uppermost conveyor; when it reaches the end of this, it falls on the projecting end of the second conveyor, and so on down the series. Above each conveyor is fixed a system of perforated pipes to spray the liquid on the fabric, and between the conveyors steam pipes are provided. Below the upper conveyors are fixed trays to collect the liquid with which the fabric has been treated. The liquid from the lower conveyors is collected in suitable tanks at the bottom of the main tank, and removed for further use.—T. F. B.

Straw, or Mixed Straw and Chip Plaits; Production of Two-coloured Effects upon ——. R. B. Ransford, Upper Norwood. From L. Cassella and Co., Frankfort-on-Maine, Germany. Eng. Pat. 20,324, Sept. 21, 1903.

Straw, or mixed straw and chip plaits, are treated with cold solutions of sulphide dyestuffs, rinsed, and then cleansed or bleached by means of acid, hydrogen peroxide, &c. This treatment gives dyeings fast to light and washing, the rough inner surface of the straw, and the chip, being coloured, whilst the outer surface of the straw remains colourless.—T. F. B.

Dyeing Cops; Process of ——. E. F. Bauersachs and G. A. H. Brückner, Scheibe, Germany. Eng. Pat. 15,978, July 19, 1904.

The cops, dyed in a single colour and wound on bobbins, are again dyed with another colour, for such a time as to allow the colour to only partially penetrate the material, thus producing variegated effects. This partial dyeing can be repeated with other dyestuffs of different colours to further vary the effects obtained.—T. F. B.

Figured Fabrics; Manufacture of ——. J. Morton, Carlisle. Eng. Pat. 18,897, Sept. 2, 1903.

Fabrics, resembling tapestry, &c., are produced by printing the desired pattern on a fabric made by weaving white, grey, or other light yarns with interspersed lines of warp or weft which have been previously treated with a resist for the printing mixture, and, if desired, dyed in some different colour.—T. F. B.

Patterns on Pile and other Fabrics or Goods; Method of and Means for Producing Ornamental ——. O. St. L. Davies and J. Booth, Castleton, Lancs. Eng. Pat. 21,427, Oct. 6, 1903.

The portions of the fabric which it is desired to produce in relief are printed with a solution of gum or other suitable mixture, and a portion of the unprotected pile are removed by burning with a singeing roller, or by some cutting appliance, the protected parts having been depressed by the printing, thereby producing a variety of effects.
—T. F. B.

Printing, Painting, or Marking Cloth [*Stencil-Printing*]; *Process and Apparatus for* ——. A. A. Scott, Bradford. Eng. Pat. 23,484, Oct. 29, 1903.

The tissue to be printed is drawn in a continuous manner over a table, and is printed, from a portion of a stencil plate or disc, by means of an apparatus travelling in the ame direction above it, whilst the printing is being accomplished, and then returning in the opposite direction, the iate or disc being simultaneously, though partially, turned ound to bring another portion of it, with the same or a lifferent design upon it, into position. The colour-mixtures mployed are applied from a valved receptacle which forms he subject of a special claim.—E. B.

rinting Sarees, Scarves, Shawls, and the like; Machines for ——. The Calico Printers' Association, Ltd., Manchester, and J. Whittaker, Bury. Eng. Pat. 25,088, Nov. 18, 1903.

'his invention relates to a special form of tappet-shaft riving-clutch, which has been devised for the purpose of voiding undue shocks or jars experienced in starting the appet shafts in the apparatus described in Eng. Pat. 22,678 f 1902.—E. B.

rinted Fabric, such as Calico; Production of ——. Hulse and Co., Ltd., Salford, and A. G. Shaw, Pendleton, Lancs. Eng. Pat. 16,594, July 27, 1904.

'issues are "back-filled," *i.e.*, coated on the reverse side to hat which it is desired to print, with filling materials, such s a mixture of starch paste and china clay. After being ried, they are printed with the usual printing mixtures by eans of surface rollers.—E. B.

ydro-Extractors [for Textiles]; Centrifugal ——. N. Cautley, Halifax, Yorks. Eng. Pat. 11,839, May 24, 1904.

'o prevent the tearing and stretching of clothes, yarn, or xtile fabrics in a centrifugal hydro-extractor, the drum is ivided into compartments by means of plain or perforated adial partitions fixed to a central cone fitted over the otating shaft.—L. F. G.

UNITED STATES PATENTS.

ordanting; Process of ——. A. Müller-Jacobs, Richmond Hill, N.Y., Assignor to Cosmos Chemical Co., New York. U.S. Pat. 769,954, Sept. 13, 1904.

'he process consists of mordanting the fabrics with a ixture containing stearamide. (See also U.S. Pat. 767,114 f 1904; this J., 1904, 864.)—T. F. B.

ormaldehyde Hydrosulphites [Discharges], and Process of Making same. L. Descamps, Lille, France. U.S. Pat. 769,593, Sept. 6, 1904.

ee Eng. Pat. 19,446 of 1903; this J., 1903, 1345.—T. F. B.

FRENCH PATENTS.

ollodion and Cellulose Solutions; Apparatus for Filtering and Spinning Filaments from ——. Soc. Desmarais et Morane and M. Denis. Fr. Pat. 342,655, April 26, 1904.

he solution is supplied to two closed reservoirs, one of hich is discharged whilst the other is being charged. The scharge is effected by means of air, compressed by a pump arranged that the pressure is accurately governed by eans of weights and regulating springs which move levers nnected with the electro-motor driving the pump. The lution is thus delivered under pressure to a special pump, ted with several pistons in order to avoid pulsations, and ecially constructed suction-valves which are under control. he pump passes the solution into a regulating cylinder ntaining a piston which acts as the governor for the inning system. This piston is worked by a motor conolled in a manner similar to that working the air pump, d the pressure-accumulator is capable of very delicate ljustment by means of reservoirs of water above the eights.—J. F. B.

aw Wool, Yarn, &c.; Dry Cleaning of ——. L. Bouillant. Fr. Pat. 341,492, March 21, 1904.

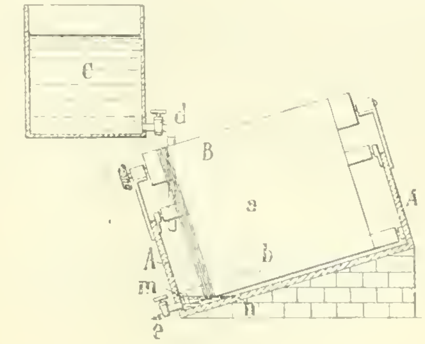
e material is treated in closed vessels with benzol, to ich has been added from ½ to 2 per cent. of the following xture. Oleic acid, 33 to 36 per cent.; methylated alcohol, to 22 per cent.; olive oil, 4 to 6 per cent.; ammonia, 22° B., 18 to 22 per cent.; "green soap," 4 to 6 per cent.; rain water, to make up 100. This mixture is stated to remove the moisture contained in the wool, which would interfere with the extraction of the fatty matters.—A. B. S.

Bleaching Apparatus; Continuous ——. M. Muntadasy Rovira. Second Addition, dated March 23, 1904, to Fr. Pat. 327,931, Nov. 10, 1902. (See this J., 1903, 948, and 1904, 251.)

In the present Addition, arrangements are added for controlling the level of the liquids in the various compartments. The number of compartments is reduced and a new arrangement is used for rolling and unrolling the cloth.—A. B. S.

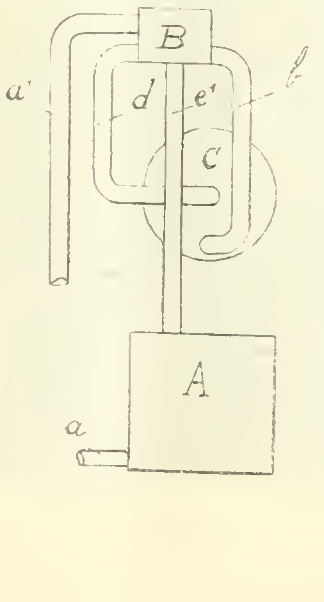
Shaded Dyeings of Textiles; Process for ——. Soc. Hannart Frères. Fr. Pat. 341,950, April 6, 1904.

This process depends on the use of a dye-bath with an inclined bottom (see figure). The material passes over the inclined rollers B and *b*. The dye liquor, at the beginning of the operation, only fills the lower part of the dye-bath, and only a portion of the material passes through the liquor. As the dyeing proceeds, water and the necessary mordants, &c., are allowed to flow in from a tank C, so that the level of the liquid in the dye-bath rises, the dye liquor being at the same time diluted. As the level rises, further portions of the material pass through the liquor and are dyed in gradually lighter shades. As water is introduced, dye liquor may be run out through the pipe *e*, whereby the dye liquor is diluted to a still greater extent. —A. B. S.



Dyeing of Piece Goods wound on Perforated Tubes; Process and Apparatus for the Automatic Treatment and ——, *as well as for all other Textiles.* G. A. Dantan and C. G. Pain. Fr. Pat. 342,340, April 16, 1904.

The material to be dyed is wound on perforated tubes fixed in closed cylindrical vessels, the end of one of which is shown in the diagram at C. Tubes *b* and *d* convey the dye-liquor or other liquid from the reservoir A to the material; *b* enters the cylinder near its outer wall, whilst *d* introduces the liquid into the interior of the perforated tube. A device is provided to cause the liquid to enter C alternately through *b* and *d*, thus giving even dyeings. The tubes *a* and *a'* are connected by a force pump, which causes the liquid to circulate through the apparatus. A replica of



the cylinder C and perforated tube in miniature is connected with the liquor pipes to enable the progress of the dyeing to be judged without interrupting the operation. In case hanks or narrow pieces have to be treated, small cylindrical boxes can be fitted on to the perforated tube at will.—T. F. B.

Dyeing Piece Goods; Machine for ——. C. Gruschwitz and C. Herminghaus. Fr. Pat. 342,345, April 15, 1904.

The vat containing the dye-bath is provided with two short vertical pipes, which project above the surface of the liquid, near the points where the material enters and leaves the liquid. At the top of these pipes are fixed air-blowers, which cause a spray of the liquor to play on the material, the size of the spray being regulated by taps in the blowers. The liquor in the vat is kept in motion by pumping it through a pipe, one end of which enters the side and the other end the bottom of the vat.—T. F. B.

Dyeing, Scouring, Bleaching, or Treatment with Liquids of Threads wound on Spindles or on Bobbins. R. Rawson and E. Lodge. Fr. Pat. 342,694, April 27, 1904. Under Internat. Conv., May 4, 1903.

See Eng. Pat. 10,035 of 1903; this J., 1904, 543.—T. F. B.

Dyeing Hanks; Apparatus for ——. G. Stöhr. Fr. Pat. 342,795, April 30, 1904. Under Internat. Conv., June 12, 1903.

See Eng. Pat. 9311 of 1904; this J., 1904, 820.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

English Patent.

Dyeing Leather. R. B. Ransford, Upper Norwood. From L. Cassella and Co., Frankfort-on-Maine, Germany. Eng. Pat. 23,563, Oct. 30, 1903.

See Addition, of Oct 24, 1903, to Fr. Pat. 322,605 of 1902; this J., 1904, 321.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Chamber Process; Theory of the ——. F. Raschig. Z. angew. Chem., 1904, **17**, 1398—1420.

The author stated his views on the reaction of nitrites with bisulphites, and of nitrous acid on sulphurous acid, 17 years ago (this J., 1887, 819; and 1888, 747). From those views he drew the conclusion that the reactions in the chamber were expressed by the equations—

$$ON.OH + H.SO_2.OH = ON.SO_2.OH + H_2O \quad (1)$$

$$ON.SO_2.OH + ON.OH = SO_2(OH)_2 + 2NO \quad (2)$$

$$2NO + O + OH_2 = 2(ON.OH) \quad (3)$$

It was not possible, however, to isolate either "nitrososulphonic acid," $ON.SO_2.OH$, or the dihydroxylamine-sulphonic acid, $(OH)_2.N.SO_2.OH$, from which it may be supposed to be derived by the loss of a molecule of water. Since that time Divers has closely investigated these reactions, and has found that nitrite and normal sulphite do not react; the author has confirmed this as far as cold solutions are concerned, but finds that at high temperatures reaction occurs, with formation of $N(SO_3Na)_3$, though the sodium hydroxide simultaneously produced, soon limits the reaction. Divers also contends that hydroxylamine-monosulphonic acid, though in acid solution it hydrolyses to sulphuric acid and hydroxylamine, does not do so, as Claus stated and the author believed, in alkaline solution. The author finds that though in presence of aldehydes or ketones the corresponding oximes are formed, yet that alone hydroxylamine is not produced, but, as Divers states, sulphurous acid and hyponitrous acid, which latter and water are products of decomposition of hydroxylamine. Thirdly, Divers states that nitrous acid and bisulphite at once give hydroxylaminedisulphonic acid, and that nitrososulphonic acid does not exist; and he has shown that Fremy's salts, potassium sulphazite and potassium sulphazate, regarded by the author as derivatives of dihydroxylamine-sulphonic acid, are mere double salts of potassium hydroxylamine-disulphonate and potassium nitrite, and can be formed directly by crystallisation from the mixed solutions. The author finds, however, that whilst nitrososulphonic acid cannot be isolated, yet it exists temporarily during the reaction of nitrite on bisulphite; for determination of the acidity and of the sulphur dioxide during the progress of the reaction in very dilute solutions show that they do not steadily diminish in the proportion of 3 mols. of bisulphite (acidity) to 2 mols. of SO_2, as required by the equation $NaNO_2 + 3NaHSO_3 = OH.N.(SO_3Na)_2 + Na_2SO_4 + H_2O$, but at first in the proportion of 1 mol. of bisulphite to 1 mol. of SO_2, and later in that of 2 mols. of bisulphite to 1 mol. of SO_2, as indicated by the successive equations $NaNO_2 + NaHSO_3 = ONa(OH)N.SO_3Na$, and $ONa(OH)N.SO_3Na + 2NaHSO_3 = OH.N.(SO_3Na)_2 + Na_2SO_3 + H_2O$. The extreme instability, in these solutions, of nitrososulphonic acid, is not so marked in acid solutions; and when N/100 nitrous acid is allowed to act on N/10 sulphurous acid, reaction occurs exactly in the proportion $HNO_2:SO_2$. When these proportions are used, however, immediately after mixture, sulphuric acid is found, in amount equivalent to the sulphurous acid taken, and no evidence of the first formation of nitroso-sulphuric acid is forthcoming. But that it is so formed is inferred from the fact that when a large excess of sulphurous acid solution is used, the amount of sulphuric acid formed is lessened, and there appears hydroxylamine disulphonic acid, and, with still greater excess of sulphurous acid, nitrilo-sulphonic acid, $N(SO_3H)_3$. That the second and third stages of the reaction, which occur so readily when nitrite and bisulphite react, should occur so much less readily when the acids themselves react, is of great importance for the chamber-process. Were there, for example, great quantities of $N(SO_3H)_3$ produced, then by its reaction on water much nitrogen would be lost to the process by conversion into ammonia. The hydrolysis of nitrososulphonic acid yields, then, sulphuric acid, and must also yield hyponitrous acid, $OH.N:N.OH$, or nitrous oxide and water, or the substance $O:N.H$, investigated by Angeli, and called by him nitroxyl. The author shows that neither hyponitrous acid nor nitrous oxide is present; but the solution contains a neutral substance, very unstable, readily decomposing into nitrous oxide and water, and oxidised by permanganate to nitric oxide and water—the properties of nitroxyl. The same substance is produced if nitrous acid be allowed to react on stannous chloride instead of sulphurous acid; and in this case sodium nitrite and neutral stannous chloride can be used in fairly concentrated solutions. There is then no evolution of nitrous oxide till the solution is heated. If to the nitroxyl solution nitrous acid be added, nitric oxide instead of nitrous oxide is evolved: $HNO + ON.OH = 2NO + H_2O$. If the liquid contain dissolved oxygen, the nitric oxide reacts to form nitrous acid, $2NO + O + H_2O = 2HNO_2$, which again reacts on any sulphurous acid (or stannous chloride), and the cycle of changes recurs as long as sulphurous acid (or stannous chloride) and oxygen are present. The reaction is slow; but whereas in the case of stannous chloride, addition of sulphuric acid accelerates it only slightly, in the case of sulphurous acid the acceleration is enormous, so that, when the reaction is carried out in sulphuric acid much weaker than chamber acid, a stream of sulphur dioxide can be led into the liquid and continuously converted into sulphuric acid, provided only that sufficient oxygen be supplied by vigorous agitation: we have, in fact, the chamber reaction. Acid of the concentration of chamber acid dissolves so little nitrous acid that the reaction is on this account checked; and with this strength of acid it can only be carried out by bringing the reagents together in the form of gas, "atomised" liquid, or cloud—under the chamber conditions, in fact. The difference in the behaviour of stannous chloride and sulphurous acid, in presence of nitrous acid and sulphuric acid, is attributed by the author to the direct formation, in the case of stannous chloride, of nitroxyl, which reacts but slowly on nitrous acid, whilst in the case o sulphurous acid, nitroso-sulphonic acid is formed, which react very rapidly on nitrous acid. If no sulphuric acid b present, the nitroso-sulphonic acid decomposes into sulphuric acid and nitroxyl; but in presence of sulphuric acid it is much more stable and remains present to react on the nitrous acid. Hydrochloric acid produces the same result as sulphuric acid. Finally, as the result of all these investigations, the author regards the three reactions, given above as those representing the chamber process, as confirmed. Only as to the second is there any uncertainty, not as to its final result, but as to its intermediate progress. Without question, nitrous acid is reduced to nitric oxide; but it is not certain whether the nitroso-sulphonic acid is directly oxidised to sulphuric acid and nitric oxide, or whether intermediately a higher state of oxidation is not produced. The author considers it possible that the reaction $ON.SO_3H + 6\,(OH.NO) = 6\,NO + H_2SO_4 + HNO_4 + 2H_2O$ may occur The evidence for the existence of pernitric acid, HNO_4, is as follows:—When nitrous acid acts in great excess on a little potassium iodide and starch, a blue substance is produced. If it acts on potassium iodide alone, and then starch be added, no blue colour is struck, but a drop or two of thiosulphate renders the solution blue. These two blue substances are identical, but are not iodide of starch; for a few drops of thiosulphate very slowly decolorise them, and then the blue colour, in spite of the presence of nitrous acid, only very slowly returns, whilst the decolorised liquid, if added to fresh potassium iodide and starch solution, at once turns it blue. Moreover, this "nitroso-iodide of starch" is at once decolorised by hydrogen peroxide, which has no action (in the dilute solutions used) on iodide of starch. This formation of "nitroso-iodide of starch" may be regarded as an indication of the presence of nitrous acid. Now if to N 100 nitrous acid solution be added varying quantities of hydrogen peroxide solution, the liquids containing less peroxide than the proportion $HNO_2:2H_2O_2$ still contain nitrous acid; those containing that proportion, or more peroxide, contain a substance which liberates iodine from potassium iodide—not hydrogen peroxide, and not nitric acid, therefore. Since, in the mixture $2HNO_2:3H_2O_2$, all the peroxide has disappeared and yet nitrous acid remains, it is clear that the substance formed contains more oxygen than nitric acid. Further experiments showed that the reaction occurs between one molecule of nitrous acid and two of hydrogen peroxide, and is therefore presumably $HNO_2 + 2H_2O_2 = HNO_4 + 2H_2O$. The substance is very unstable, and readily decomposes, with formation of nitric acid and hydrogen peroxide. No analysis has yet been possible: the only other reaction established is the ability of pernitric acid to decompose potassium bromide, with evolution of bromine, which, at these dilutions, neither nitrous acid nor hydrogen peroxide can accomplish. (Compare Inglis, this J., 1904, 643.)—J. T. D.

Lead Chambers; Effect of Blackening —— on their Radiation and Yield. Bakem. Z. angew. Chem., 1904, **17**, 1447.

The increase of yield per cubic foot of chamber space in the modern vigorous working of the chamber process, is limited by the difficulty of keeping down the temperature. The author filled two small "chambers" of 1 cb. m. capacity, one of plain lead and the other of lead coated with a black paint, with water of 85° C., and timed their rates of cooling. The curve of results shows that in 100 minutes the uncoated chamber cooled from 73° to 56·5°, the coated chamber from 73° to 49° C., ranges of 16·5° and 24° C. respectively.—J. T. D.

Nitric and Sulphuric Acids; Properties of Mixtures of ——. A. Saposchnikoff. J. russ. phys.-chem. Ges., 1904, **36**, 669—671. Chem. Centr., 1904, **2**, 685. (See also this J., 1904, 865.)

The specific gravity and electric conductivity of mixtures of nitric acid of sp. gr. 1·48 and concentrated sulphuric acid were determined. The results are given in curve-diagrams in the original. The specific gravity is at a maximum in a mixture containing about 90 per cent. of sulphuric acid. The increase in the specific gravity caused by additions of sulphuric acid up to 90 per cent. is due to the formation of nitric anhydride, whilst the decrease in specific gravity, when the amount of sulphuric acid added exceeds 90 per cent., may be attributed to reactions between the latter and the oxides of nitrogen present. The results of the determinations of electric conductivity were as follows:—

Percentage of Sulphuric Acid.	Specific Conductivity × 10^{-4}	Percentage of Sulphuric Acid.	Specific Conductivity × 10^{-4}
0	1283	50	899·7
1·25	1267	60·75	874·5
5·14	1201	79·93	911·8
10	1199	89·95	1016
20·32	1068	94·71	1023
30·19	964	100	1067
40·09	930·6		

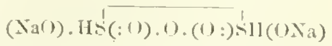
—A. S.

Magnesium Hydroxide; Action of Carbon Dioxide on ——. M. Monhaupt. Chem.-Zeit., 1904, **28**, 868.

When magnesium hydroxide is suspended in water and carbon dioxide passed through to saturation, the clear solution has a variable composition. Alcohol precipitates from it a substance having approximately the composition $MgCO_3.3H_2O$. If excess of solid magnesium hydroxide be used, the residue not dissolved by the carbon dioxide will invariably consist, to the extent of 96·3 per cent., of minute crystals of $MgCO_3.3H_2O$, the remaining 3·7 per cent. being unchanged magnesium hydroxide.—J. T. D.

Hyposulphites (Hydrosulphites). H. Bucherer and A. Schwalbe. Z. angew. Chem., 1904, **17**, 1447—1451.

The authors consider that sodium hyposulphite, as usually obtained by salting out from its aqueous solution, contains at least one molecule of "constitutional water"; is, in fact, an acid salt, $Na_2H_2S_2O_5$—



$$(NaO).HS(:O).O.(O:)SH(ONa)$$

and that the corresponding normal salt is $Na_4S_2O_5$. The acid salt condenses with formaldehyde to an addition-product, analogous in constitution to the oxymethylenesulphonic acids produced from bisulphites and formaldehyde. This product, like the bisulphite derivative, condenses with aromatic amines to form ω-hydrosulphonic acids analogous to the ω-sulphonic acids, with which they share the property of reacting on potassium cyanide to form the nitriles of glycines. These properties are clearly indicated by the constitution, analogous to that of sodium bisulphite, ascribed to sodium hydrosulphite by the authors. Possibly the hydrosulphites of the metals like calcium and zinc are also acid salts ($MH_2S_2O_5$), though salts of the type $M_2S_2O_5$ may also be formed.—J. T. D.

Cuprammonium Sulphates; Composition and Constitution of ——. D. W. Horn and E. E. Taylor. Amer. Chem. J., 1904, **32**, 253—285.

The methods of analysis of these compounds are critically examined and details given of the authors' improvements. Whether prepared by precipitation of ammoniacal copper sulphate solution with alcohol (Berzelius) or by passing ammonia into copper sulphate solution (André, Comptes rend., **100**, 1138), a substance having the composition $CuSO_4 + 4NH_3 + H_2O$ is obtained. It must be dried over lime, after which it is quite odourless in dry air. It decomposes over sulphuric acid and most desiccating agents, and cannot be dried mechanically without loss of ammonia, which probably accounts for Bouzat's formula, $CuSO_4.4NH_3.\frac{2}{3}H_2O$ (this J., 1903, 1045). In the presence of solid potassium hydroxide and concentrated ammonia solution, H_2O is displaced by NH_3, and a substance approximating to the composition $CuSO_4 + 5NH_3$ is obtained, but it is probably a mixture. Heating at 100°, 125°, 149°, 203°, and 260° C. gives rise to no definite products. Water hydrolyses the salt, liberating some ammonia and precipitating basic salts, but it is long before equilibrium is established. The authors conclude that the formula $CuSO_4 + 4NH_3 + H_2O$ does not correctly represent the constitution of the salt, since four equivalents of acid do not neutralise one molecule of the salt, but produce a permanent precipitate.

—F. Sdn.

Chloric Acid; Determination of ——. W. S. Hendrixson. XXIII., page 951.

Alkali Chromates; Action of Nitric and Acetic Acids on —— [*Determination of Chromium*]. A. Leuba. XXIII., page 951.

Copper Sulphate Solutions; Electrolysis of ——. F. Foerster and G. Coffetti. XI. A., page 940.

Iodine; Determination of —— in presence of Bromine and Chlorine. E. Thilo. XXIII., page 951.

Phosphide, Arsenide, and Antimonide of Hydrogen; Reagent for ——. P. Lemoult. XXIII., page 950.

English Patents.

Cupro-ammonium Solution; Apparatus for the Manufacture of ——. A. H. Bellot des Minieres, Leognan, France. Eng. Pat. 2739, Feb. 4, 1904.

See Fr. Pat. 335,207 of 1903; this J., 1904, 186.—T. F. B.

Oxygen; Manufacture of ——. Cie. Franç. de l'Acetylene Dissous, Paris. Eng. Pat. 11,172, May 14, 1904. Under Internat. Conv., May 15, 1903.

See Fr. Pat. 332,098 of 1903; this J., 1903, 1195.—T. F. B.

United States Patents.

Sulphuric Anhydride; Process of Making ——. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 769,585, Sept. 6, 1904.

During the reaction between sulphur dioxide and oxygen, in an "igniting or transforming chamber," a fresh portion of the gaseous mixture is supplied in such volume and at such a rate as to prevent the temperature of reaction rising to the dissociating point of sulphuric anhydride. The same result may be attained by supplying a sufficient volume of an inert gas to the reacting mixture, by refrigerating the mixture of sulphur dioxide and oxygen, or by mixing the residual gases after absorption of the sulphuric anhydride formed, with the reacting mixture, and again passing through the apparatus. The required refrigeration may also be effected by employing sulphur dioxide or oxygen in a compressed or liquid state. The oxidation of the sulphur dioxide in presence of oxygen is effected by supplying heat to the sphere within the reacting chamber with which the gases come into contact, the temperature being kept within proper limits by one or other of the means described. See U.S. Pat. 724,251 of 1903; this J., 1903, 554. —E. S.

Alumina Sulphate, &c.; Process of Calcining [*Drying*] ——. A. E Cummer, Cleveland, Ohio. U.S. Pat. 769,534, Sept. 6, 1904.

See Eng. Pat. 4820 of 1903; this J., 1903, 907.—T. F. B.

French Patents.

Metallic Oxides; Preparation of —— by direct Combustion of the Metal, and Apparatus appropriate to the purpose. L. Fink-Huguenot. Fr. Pat. 342,432, April 19, 1904.

The molten metal to be oxidised is run through a valved side opening into a closed chamber, in which, by pressure of introduced gases, it is forced up a vertical tube of small bore, reaching nearly to the bottom of the chamber and bent above at right angles to pass horizontally outwards from the side of the chamber near the top, the tube being narrowed to a capillary bore and discharging the molten metal as spray into a conical chamber, in which the flame of an oxy-hydrogen burner of special construction plays against the pulverised metal, and effects its oxidation.—E. S.

Iron Pyrites; Process for Preparing —— for Desulphurisation. U. Wedge. Fr. Pat. 342,436, April 19, 1904.

See U.S. Pat. 757,531 of 1904; this J., 1904, 545.—T. F. B.

VIII.—GLASS, POTTERY, ENAMELS.

French Patents.

Glass in Sheets; Process and Apparatus for the Production of ——. E. Rowart and L. Francq. Fr. Pat. 342,310, April 14, 1904. Under Internat. Conv., April 23 and 27, 1903.

See Eng. Pats. 9033 and 9295 of 1904; this J., 1904, 660 and 715.—T. F. B.

Furnace with Rotating Base and Continuous Firing for Burning Ceramic Wares and Vitrifiable Colours. E. Lachaud. Fr. Pat. 342,363, April 15, 1904.

This continuous reverberatory furnace is characterised by a circular rotating base divided into a number of sectors, each of which in turn is brought beneath the firing-chamber proper. These sectors serve for the firing, preliminary heating, cooling, charging, and discharging of the articles to be burnt.—A. G. L.

Calcium Sulphate and Carbonate occurring as Residues in the Manufacture of Caoutchouc Goods, Ceramic Ware, and Cement Blocks, and in other Chemical Industries; Utilisation of ——. A. Monin. Fr. Pat. 342,797, May 2, 1904. IX., page 937.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

English Patents.

Concrete and the like; Treatment of ——, *whereby the Setting of the same after Mixture may be Arrested.* J H. Magens, Hamburg. Eng. Pat. 19,676, Sept. 12, 1903.

See Addition, of Sept. 12, 1903, to Fr. Pat. 330,393 of 1903; this J., 1904, 254.—T. F. B.

Non-Conductor of Heat; Manufacture of a ——. W. Schmidtgen and M. König, Dresden. Eng. Pat. 15,979, July 19, 1904.

Equal quantities of infusorial earth and short-fibred textile waste are intimately mixed, together with sufficient water to make a paste, to which is added alum or other material of similar properties.—W. C. H.

United States Patents.

Stone Plates, Slabs, or Tiles; Process of Manufacturing Imitation ——. L. Hatschek, Vocklabrück, Austria. U.S. Pat. 769,078, Aug. 30, 1904.

See Eng. Pat. 22,139 of 1900; this J., 1902, 118.—T. F. B.

Asbestos Millboards, Slates, Plates, or Tiles; Process of Manufacturing ——. T. H. Ibbotson, East Greenwich, and R. Meldrum, Blackheath, England. U.S. Pat. 769,087, Aug. 30, 1904.

See Eng. Pat. 20,841 of 1902; this J., 1903, 1088.—T. F. B.

Asphalt Paving Cement. F. J. Warren, Newton, Mass. U.S. Pat. 769,123, Aug. 30, 1904.

See Eng. Pat. 9303 of 1902; this J., 1902, 915.—T. F. B.

Bricks; Drying Plant for ——. G. Pagel, Stettin, Germany. U.S. Pat. 770,186, Sept. 13, 1904.

The drying plant consists of a compartment combined with a kiln. A smoke conduit, opening into the kiln, extends lengthwise under the compartment and communicates with similar supplementary conduits parallel to the first. Air-conduits are arranged between the smoke and supplementary conduits, and the latter and the air conduits are provided with grated openings leading into the compartment.
—W. C. H.

Hydraulic Cement; Process of Making ——. F. W. Brown, Portland, Col. U.S. Pat. 769,467, Sept. 6, 1904.

Slag resulting from fusing argillaceous and calcareous materials together is subjected, together with sulphate of calcium, to a high degree of heat in an oxidising furnace. —A. G. L.

Cement Kiln. F. M. Haldeman, Alpena, Mich. U.S. Pat. 769,742, Sept. 13, 1904.

The kiln is of the rotary type, and comprises a drum or kiln portion proper, inclined to the horizontal, and a hood portion, capable of removal from the former, both portions being lined with firebrick materials, and having a gasket of asbestos or similar heat non-conducting material between the linings. Near the lower end of the kiln is a door, worked by gravity, and a channel which retains the cement material and supplies it to the door. At the lower end an annular wall of refractory material projects inwardly from the kiln lining, and separated from this annular wall by a small space is a second annular wall, which does not project inwardly quite as far as the first, these walls forming the channel, above referred to, which conducts the cement to the discharge door. The lower end of the kiln is completely closed, and finely pulverised fuel is fed in through a pipe passing through this closed end. Means are provided for supplying finely divided cement material to the upper end of the kiln, where there is a dead space for the material introduced. To protect the finely divided material from the draught caused by the process and products of combustion, a bridge wall is arranged to close the larger portion of the upper end of the kiln, where the products of combustion escape to the chimney, the finely divided cement material being introduced to the kiln through this bridge wall near ts base.—W. C. H.

French Patents.

Wood; New Treatment of —— with Silicate of Soda (Soluble Glass). A. Boissi. Fr. Pat. 312,321, March 26, 1904.

All the timber entering into the framework of a structure s painted over with a coat of sodium silicate. The planks forming the skirting are also painted in a similar manner, but only on the side nailed to the framework, so as not to destroy the paper or paint on the other side by the efflorescence which is formed after a time.—A. G. L.

Dehydrator or Calciner for Gypsum, Cement, or other similar Materials. V. Ragau and H. Cornette. Fr. Pat. 342,449, April 5, 1904.

Two circular hearths are set stepwise over a furnace, so hat the heat is first utilised under the lower hearth, and hen passes to the next, which is kept at a lower temperaure. The waste gases pass from the second hearth to conomisers formed of vertical chambers with a series of horizontal tubes through which the waste gases pass. The material fed into these economisers around the tubes is dehydrated by the waste heat. Means are provided for eeding, discharging, and for regulating the operations. —W. H. C.

Building Materials; Manufacture of ——. A. Lévy and V. Couti. Fr. Pat. 312,495, April 21, 1904.

Bricks, &c., are made from 10 parts of an agglomerating mixture, consisting of a metallic oxide, chlorine, sulphuric acid, or other materials capable of forming an oxychloride which may unite with magnesium, aluminium, barium, or ther isomorphous sulphates, and 90 parts of an inert ubstance, such as sand or calcareous or silicious waste. The mixture is moulded as usual, and then dried in the air. A suitable composition for the agglomerating mixture is s follows:—Magnesia, 10,000 parts; magnesium chloride n solution, 10,000 parts; magnesium sulphate in solution, 5 parts; aluminium sulphate in solution, 25 parts; "barium ulphate in solution," 25 parts; kieselguhr or other infusorial arth, 5 parts.—A. G. L.

Slate; Hardening of ——, Crude or Worked, by Heating and Enamelling. G. Rovere. Fr. Pat. 342,788, May 2, 1904.

Slate may be hardened by firing in the usual manner, or enamelled in the same way as earthenware or majolica ware.—A. G. L.

Calcium Sulphate and Carbonate occurring as Residues in the Manufacture of Caoutchouc Goods, Colours, Ceramic Ware, and Cement Blocks, and in other Chemical Industries; Utilisation of —— in the same Industries. A. Mouin. Fr. Pat. 342,797, May 2, 1904.

Precipitated calcium sulphate or carbonate, occurring as residues in various works, is heated to from 400° to 1500° C., then ground, sifted, and sorted according to tints, to replace talcs, kaolins, ochres, &c., used in the industries specified.—E. S.

X.—METALLURGY.

Boiler Plates; Effect of Heating on the Strength of —— Le Chatelier. Bull. Soc. d'Encourag., 1904, **106**, Rev. Metall., 467—470.

Test pieces of iron, very mild steel, and mild steel, were cut from various plates, and treated as follows:—One piece served as a check, another was heated and cooled under conditions approximating to those obtaining in boilers, and a third was rapidly annealed by heating it to cherry redness and then letting it cool in the air. The test pieces measured 10 × 10 × 70 mm., and were broken in a machine. The results show that when it is impracticable to temper the whole of a big piece of metal work, it suffices to quickly anneal those plates which have been submitted to a good deal of forging.—L. F. G.

Steel; Fracture of Structural —— under Alternating Stresses. J. O. Arnold. Brit. Assoc., 1904. Engineer, 1904, **98**, 227.

The ordinary methods of examining steel fail, to a considerable extent, to show the cause of its sudden rupture under vibration and alternating tensile and compressive stresses. For instance, the steel plates of the boiler of a cruiser split longitudinally from end to end under the hydraulic test, notwithstanding the fact that the chemical composition of the steel and the results of the ordinary mechanical tests were good. The author has devised a machine for the purpose of ascertaining the resistance of steel to rapidly alternating stresses. Results obtained with a good boiler-plate steel indicate that, in all probability, the resistance under rapidly alternating stresess is inversely proportional to the rate of alternation. The results obtained with test-pieces of the boiler-plate mentioned above were erratic, but this was found to be owing to one side of the plate being brittle and the other tough under alternating stresses. The results with test-pieces from both sides of the boiler-plate, as received, and after various heat treatments, show that once a steel has become distinctly brittle under alternating stresses, it cannot be restored by heat treatment of any kind short of remelting. In the case under notice, the injury to the steel was due to unskilful reheating of the ingot, and not to an improper casting temperature, since the latter would necessarily have affected every portion of the plate, and not one side only. The micro-structures of the test-pieces from the two sides of the boiler-plate were in all respects identical, though, of course, that of each pair varied with the heat treatment to which they had been subjected.—A. S.

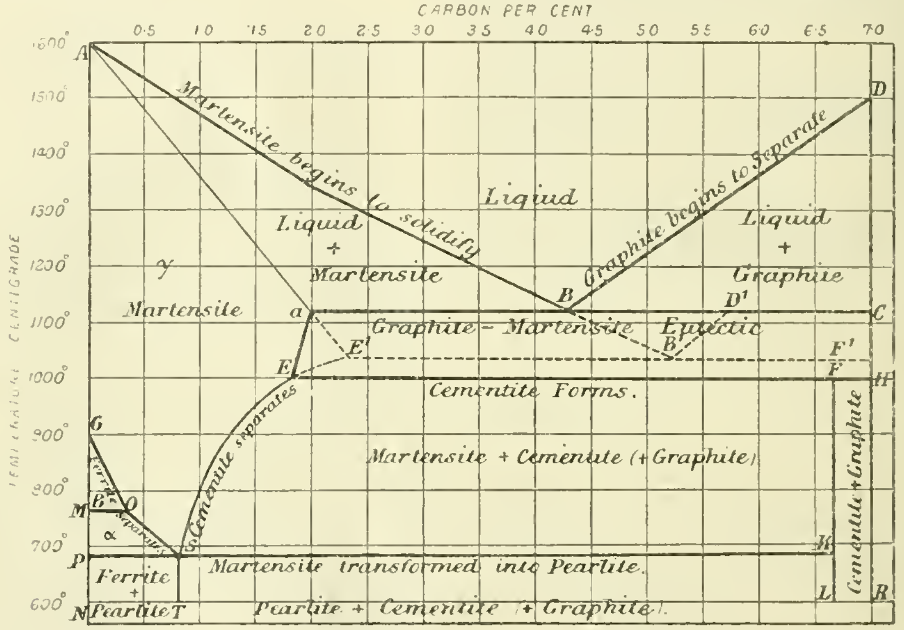
Solid State [Metals]; Change of Structure in the ——. W. Campbell. J. Franklin Inst., 1904, **158**, 161—184.

Changes of structure after a metal or alloy has passed completely from the liquid to the solid state are (1) those due to mechanical stress and to the growth of crystals on annealing the metal or alloy thus strained; (2) those due to changes in composition and to diffusion, such as cementation, decarburisation, diffusion of gold into lead, formation of alloys of copper and copper oxide, &c.; (3) those produced by change of temperature, like the conversion of α-, β-, or γ-iron into one of the other forms, or changes in structure during cooling of copper-aluminium, copper-tin, copper-antimony alloys, or of iron or steel. An account is given, with photo-micrographs, of the work of Le Chatelier on copper-aluminium alloys, and of Heycock and Neville on copper-tin alloys (this J., 1896, 810; 1901, 811). In the copper-aluminium alloys the general structure of the slowly-cooled alloys is that of grains and dendrites of the compounds Al_2Cu, AlCu, or $AlCu_3$, in a mass of eutectic, whilst the same alloys reheated to redness and quenched, become much more homogeneous and "martensite-like" in structure, regaining, however, their original structure when again reheated and slowly cooled. With regard to copper-tin alloys, the most remarkable point is that in some cases, during the cooling, crystals differing in composition from the mother-liquor, separate from the liquid, but afterwards react with the mother-liquor to produce a homogeneous solid, which on further cooling once more splits up into two constituents of different composition. The behaviour of the iron-carbon alloys is very clearly shown by the diagram, based on that of Roozeboom. Above A B D everything is liquid; below A a B C all is solid. The areas A B a and D B C represent mixtures of solid and liquid. Below 4·3 per cent. of carbon, martensite (about 2 per cent. of carbon) separates in the liquid; above 4·3 per cent. of carbon, graphite similarly separates. At 4·3 per cent. of carbon there is no separation till the whole solidifies as the martensite-graphite eutectic. When complete solidification has occurred, the structure is, up to 2 per cent. of carbon, dendrites of martensite, whilst above that point the martensite-graphite eutectic contains dendrites of martensite or free carbon, according as the carbon content was below or above 4·3 per cent. On cooling below a B C, graphite separates out in such a way that at 1000° C. all steels above 1·8 per cent. of carbon (E) contain graphite as well as the eutectic, with or without martensite; below this temperature martensite and graphite react, and form cementite, but so slowly that with ordinary cooling there may still be graphite below the line E F H. Between 1000° C. and 700° C. the martensite still loses carbon, which reacts with more martensite to form cementite, till, at the temperature of recalescence, all steels with more than 0·8 per cent. of carbon are transformed into the ferrite-cementite eutectoid (pearlite); from those with less than 0·8 per cent., ferrito begins to separate, as shown by the line G O S, and below the recalescence line pearlite forms. With the pearlite we have excess of ferrite or excess of cementite, according as the carbon is above or below 0·8 per cent. The diagram al shows the transformation of γ- into β- and β- into α-iro The effects of heat and mechanical treatment are illustrate by reference to a steel containing 0·50 per cent. of carbo and 0·98 of manganese, which showed two critical poin on heating: *Ac* about 700 C. (strong), and Ac_{2-3} abo 750° C. (slight), and on cooling, Ar_{2-3} about 700 C. (sligh and *Ar*, at 660° C. (strong).

Steel Cooled in Air.—Best elastic limit, when heated t 750° C.; greatest maximum load, 840° C.; best elongatio 750° C.; best reduction of area, 700° C. Photo-micrograph show that the whole steel has the finest structure at 733° C where the gradual coarsening of the martensite on heating t 700° C., and the gradual lessening in size of the ferrit result in a uniform texture for the whole steel.

Steel Quenched in Water.—Here the best results we given when the reheating was carried to 733° C.; and th micro-photographs show that the uniform fine structure the steel at that temperature was preserved on quenchin The results show that for *heat refining*, the steel which ha cooled down slowly from 1390° C., and is much overheate must be reheated to that temperature at which the chang due to *Ac* and Ac_{2-3} just balance, for then the whole ste has the finest structure. For *mechanical refining*, the ste should be allowed to cool, before rolling, to such a temper ture that, after rolling, the structure will be as close possible; and although general conclusions can hardly b drawn from a single set of experiments, it would appe that the best results are obtained when the bars leave th rolls as near Ar_{2-3} as possible. An allowance of 40° C. f cooling in the rolls is perhaps sufficient, so that the ba should be withdrawn from the furnace at, say, 740°—750

—J. T. D.



Passivity of Metals in relation to Time and Temperatur W. A. Hollis. Proc. Cambr. Phil. Soc., 1904, **12**, 462—46

The results of the author's experiments with iron, nick cobalt, and copper, lead him to the conclusion that th passivity of metals to fuming nitric acid represents relative condition, which is a function of the structure the metal, the time, and the temperature. There is critical temperature for each metal, above which passivit is no longer exhibited. The transition from the passi to the active condition is, in most cases, a sudden on The critical temperature is about 100° C. for iron, 10° for cobalt, about 80° C. for nickel (varying in differe samples), the change taking place slowly, and somewh above 10° C. for copper. A metal may be regarded being in the passive condition if, when brought into contact with fuming nitric acid, it has not been perceptibly acted upon after 10 seconds. Immediately below the critical point there is a zone of temperature, extending over about 10°, wherein a metal may behave as if it were in either the passive or active condition, according to external conditions. For example, iron plate can be heated with nitric acid to over 90° C. before its passivity is destroyed, yet if the plate and the acid be heated separately and then brought in contact, a vigorous evolution of gas occurs at 75° C. The critical temperature also varies with the purity of the metal.—A. S.

Ammonium Salts and Metals; Some Reactions between ——. W. R. Hodgkinson and A. H. Coote. Brit. Assoc., 1904. Chem. News, 1904, **90**, 142.

The action of ammonium nitrate, both in aqueous solution and in the fused condition, on some metals was examined. Except on cadmium, the rate of action of the aqueous solution and of the fused salt differed notably. Cadmium dissolves rapidly in an ice-cold saturated solution of ammonium nitrate, without evolution of gas. The solution gives off nitrogen only when heated to 100° C., when the cadmium ceases to dissolve. It contains a little free ammonia, and, apparently, the nitrite of cadmium and ammonium, since the cadmium can be completely precipitated by means of a current of carbon dioxide, leaving a solution containing mainly ammonium nitrite. Zinc and magnesium act in a similar manner, but more slowly and to a less extent, owing to the formation of somewhat insoluble double ammonium compounds. Aluminium, iron, mercury, and silver are not acted upon by an aqueous solution of ammonium nitrate. Nickel, copper, and lead are affected to a slight extent, lead becoming coated with a somewhat insoluble nitrite. Fused ammonium nitrate has no action on iron, mercury, or aluminium, but silver is acted upon slightly by the salt, when the latter is heated so strongly as to decompose, with formation of red fumes. When ammonium nitrate is just fused, it acts upon the following metals at rates about in the order given:—Cadmium, magnesium, zinc, copper, nickel, lead, bismuth. Weighed quantities of metals were allowed to act upon ammonium nitrate in a vacuum-tube maintained at the melting point of the salt. In the cases of cadmium and copper, the gas collected was pure nitrogen, the amounts corresponding to a little less than 4 atoms of nitrogen to 1 atom of cadmium, and nearly 3 atoms of nitrogen to 2 atoms of copper. The deficit of nitrogen may be due to the liberation of ammonia which takes place during the first phase of the reaction.

Powdered cadmium dissolves in a solution of aniline nitrate, and if the temperature be kept below 10° C., no appreciable evolution of gas occurs, and a considerable yield of diazoaminobenzene is obtained. The course of the reaction is very similar to that with the ammonium salt, a little aniline being liberated in the first instance.—A. S.

Gold and Silver in Zinc Ores; Crucible Charges for [Determination of] ——. E. J. Hall and E. Popper. XXIII., page 952.

Platinum-Gold-Silver Alloys; Analysis of ——. Hallard and Bertiaux. XXIII., page 952.

English Patents.

Ingot Iron and Steel; Manufacture of ——. B. Talbot, Leeds. Eng. Pat. 22,767, Oct. 21, 1903.

The pig iron and scrap employed are converted in a single furnace having two or more independent hearths, being first treated on a basic hearth, and finished on an acid-lined hearth. Briquettes of iron ore with carbon may be placed on the fore-hearth of the melting furnace, and, when heated, be pushed forward into the hearth proper, to be here treated with suitable additions of lime and iron oxide o eliminate phosphorus and silicon. The charge is preferably tapped from this to the refining hearth while it still contains about 2 per cent. of carbon. The finishing hearth may be worked, if desired, on the continuous system, with a permanent bath of metal.—E. S.

Cast-Iron; Process for Refining ——, *and Apparatus therefor.* H. Harmet, St. Etienne, France. Eng. Pat. 16,448, July 25, 1904. Under Internat. Conv., Aug. 28, 1903.

See Fr. Pat. 334,892 of 1903; this J., 1904, 119.—T. F. B.

Zinc; Treatment of ——. P. and A. Gührs, Berlin. Eng. Pat. 23,145, Oct. 26, 1903.

See Addition, of Aug. 31, 1903, to Fr. Pat. 332,657 of 1903; this J., 1904, 191.—T. F. B.

United States Patents.

Values [Precious Metals]; [Amalgamating] Apparatus for Recovering —— *from Sand or Dirt.* C. M. Poppenberg, Brainard, Minn., Administratrix of C. G. Poppenberg. U.S. Pat. 768,624, Aug. 30, 1904.

A casing is provided with upper and lower discharge spouts, the lower one communicating with a basin, above which is a series of mercury holders, suspended by lugs from ledges of the opposite casing walls. The holders are arranged set above set, and have depressions with sharp edges, the spaces between which permit downward passage of the sand, &c., into deflectors below each set of holders. Above the chamber containing the mercury-holders is another chamber the floor of which has numerous minute discharge apertures; a screen above rejects any particles which are too large, and "rocks" are rejected by a grating above the screen, both sets of coarse particles being passed into the upper spout under pressure from fluid admitted to the chamber.—E. S.

Precious Metals; Method of Extracting —— *from their Ores.* S. C. C. Currie, Assignor to W. Courtenay, New York. U.S. Pat. 769,254, Sept. 6, 1904.

Ores containing precious metals and sulphur are heated in hydrogen, then roasted, the roasted ore digested in a hot caustic alkali solution, after freeing from which it is chloriunated, and the solution of chlorides obtained precipitated by the hydrogen sulphide obtained in the first stage of the process. The residuum is treated with sodium thiosulphate. The alkaline solution resulting from washing the roasted ore with a caustic alkali solution is treated with hydrogen sulphide and then used again.—E. S.

Gold; Process of Extracting —— *from Ores, &c.* H. S. Stark, Johannesburg. U.S. Pat. 769,280, Sept. 6, 1904.

Crushed pyritic auriferous ores are treated with a solution of an alkali thiocyanate (sulphocyanide), in presence of an oxidising agent (including atmospheric oxygen), and the gold dissolved by the nascent cyanogen, and the hydrocyanic acid set free, are recovered. The residue of the treatment of such ores by the ordinary cyanide solution, are oxidised, to set gold free and to produce in the mass thiocyanate and thiosulphate of an alkali metal or metals, and by addition of a quantity of water in presence of air, a solution is formed by which the gold is dissolved. Or, pyritic residues of the cyanide treatment are oxidised, leached with water containing a thiocyanate, and re-leached repeatedly with the same liquor after successive extractions of the gold.—E. S.

Precious Metals; Process of Extracting —— *from Ores or Slimes.* H. R. Cassel, New York. U.S. Pat. 769,938, Sept. 13, 1904.

The process consists in adding solutions of a bromide and of a cyanide to the ore, and passing chlorine gas through the mixture to evolve bromine, and form solvents for the precious metals. Finally, the bromine is reconverted into bromide. See U.S. Pats. 732,708 and 732,709 of 1903; this J., 1903, 915.—E. S.

Tilting Metallurgical Furnace. J. A. Potter, Pittsburg, Pa. U.S. Pat. 769,712, Sept. 13, 1904.

At opposite ends of a furnace, which can be tilted endwise, are regenerators running on tracks in the line of the longitudinal axis of the furnace. Ports in the ends of the furnace communicate with ports in the regenerators. A receptacle is arranged below one end of the furnace and means are provided for tilting the furnace below the ports, so as to pour at least a part of the bath from the end port into the receptacle,—E. S.

French Patents.

Steel; Manufacture of ——. J. Vernon. Fr. Pat. 342,412, April 18, 1904.

See Eng. Pat. 1966 of 1903; this J., 1904, 609.—T. F. B.

Chrome-Nickel Steel; Manufacture of Cemented Pieces of ——. A. De Dion and G. Bouton. Fr. Pat. 342,591, April 23, 1904.

Pieces of chrome-nickel steel, containing, say, from 1 to 3 per cent. of chromium, and from 4 to 6 per cent. of nickel, with 0·12 per cent. of carbon, receive by simple cementation, without hardening, great superficial hardness. See Fr. Pat. 342,061 of 1904; this J., 1904, 903.—E. S.

Armour Plates and Projectiles; Manufacture of ——. F. C. Fairholme and J. E. Fletcher. Fr. Pat. 342,614, April 25, 1904.

See Eng. Pat. 1850 of 1903; this J., 1904, 609.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Carbon Primary Cell. F. Haber and L. Bruner. Z. Elektrochem., 1904, **10**, 697—713.

The chemical and physical changes occurring in the carbon cell, carbon—fused caustic soda—iron, have never been fully explained, despite the great economic importance of the subject. The authors have carried out a long series of experiments, and show that this cell must no longer be considered as a primary cell with carbon as the source of E.M.F., but rather as an oxygen-hydrogen gas-cell. The iron electrode becomes passive in fused caustic soda, the presence of manganate assisting the change, and in this form is a well-defined oxygen electrode, the oxygen being supplied from the air. On the other hand, both carbon and carbon monoxide react rapidly with fused caustic soda, producing sodium carbonate and hydrogen, and it is this hydrogen alone which causes and conditions the E.M.F. at the carbon. Careful measurements were made of the potential at both the oxygen and hydrogen electrodes under varied conditions. The authors consider that their results will be sufficiently definite to show that there is no hope of the application of this cell.—R. S. H.

Films on Aluminium Anodes; Electrical Properties of ——. W. R. Mott. Electrochem. Ind., 1904, **2**, 352—355.

Taking the thickness of film previously calculated by the author (this J., 1901, 792), the specific resistance in phosphate and sulphate solutions is found to be 10·0 × 10^{10} ohms and 0·8 × 10^{10} ohms per c.c. respectively. The specific resistance of the solid film decreases as a logarithmic function of the temperature. The critical voltage and current for any aluminium anode is defined as the voltage and current at which the heating effect can just be balanced by the cooling effects; above the critical point the characteristic behaviour of the aluminium electrode disappears. The dielectric strength of films formed with phosphate solutions is calculated as one million volts per centimetre.—R. S. H.

Anodic Oxygen Evolution. F. Foerster and A. Piguet. Z. Elektrochem., 1904, **10**, 714—721.

In using polished platinum electrodes Foerster and Mueller found that, as the electrolysis continued, the potential of the anode rose slowly from that at which oxygen was first given off, until it attained a considerably higher value, although the current was kept constant (this J., 1902, 1235). The present authors have carried out a number of experiments to investigate this problem, and have used different metals as electrodes. The effect is observed in both alkaline and acid solutions, but varies considerably with the particular metal employed and with the conditions of experiment. With high current density and a low temperature the rise of potential is greatest. The only explanation which the authors consider satisfactory is that put forward by Haber, who assumes that during electrolysis some of the evolved gases become adsorbed by the electrodes and thus form a layer around them. The actual thickness of this layer will, of course, vary according to the experimental conditions, but the rise of potential and the properties of such a layer seem to be in agreement in all the cases considered.—R. S. H.

Copper Sulphate Solutions: Electrolysis of ——. F Foerster and G. Coffetti. Z. Elektrochem., 1904, **10** 736—741.

Recent observations have shown that a measurable curren can be passed between a platinum cathode and an anode i copper sulphate solutions at as much as 0·1 volt below th potential of metallic copper, *i.e.*, below the point at whic copper can first be deposited. The authors prove tha this is due to the reduction of cupric to cuprous ions $Cu^{\cdot\cdot} + \ominus \longrightarrow Cu^{\cdot}$. At ordinary temperatures, since th concentration of cuprous ions is limited to a low value, th experimental realisation is difficult, but at 90° and 70° C currents of 1·6·10^{-3} amp. per sq. cm. and 0·85·10^{-3} amp per sq. cm. respectively can be maintained without causin the deposition of metallic copper. In neutral solution cuprous oxide, produced by hydrolysis, is deposited at th cathode, and the oxidation of the cuprous salt by the air which also occurs in acid solutions, further tends to restor the equilibrium between the cuprous and cupric ions.
—R. S. H.

Potassium Acetate; Electrolysis of ——. F. Foerster an A. Piguet. Z. Elektrochem., 1904, **10**, 729—736.

In addition to the formation of carbon dioxide and ethan at the anode and hydrogen at the cathode, it has for lon been known that secondary reactions lead to the productio of ethylene, methyl acetate, and oxygen at the anode. Th authors have investigated the electrolysis, so far as it i influenced by different metallic anodes, by the potential the anode and by the use of alkaline solutions. The yie of ethane is also lowered by electrolytic oxidation of aceti acid to carbon dioxide and, to a small extent, to carbo monoxide. With iron and palladium anodes the evolutio of oxygen predominates, corresponding to the low potenti observed in these cases. With platinised electrodes th potential is found to be higher, and here, with increasin current density, the evolution of oxygen diminishes an the oxidation of acetic acid increases. Finally, with brig platinum and iridium anodes, both the potential and yie of ethane are greater. In alkaline solutions the yield always lower than in the corresponding neutral solutio this appears to be due to the prevention of the formation layers of acetic acid around the anode. The authors favo the view of Jahn that the production of ethane is due t the electrolytic oxidation of acetic acid, $2CH_3CO_2H + O =$ $C_2H_6 + 2CO_2 + H_2O$.—R. S. H.

Electrolysis with Rotating Cathode. H. E. Medway. XXIII., page 952.

English Patents.

Plates for Secondary Batteries. W. P. Thompso London. From Pflüger Accumulatoren-Werke, Ac Ges., Berlin. Eng. Pat. 24,626, Nov. 12, 1903.

See Fr. Pat. 336,549 of 1903; this J., 1904, 377.—T. F.

Galvanic Battery; Improved High-voltage ——. L. Gournay, Paris. Eng. Pat. 14,066, June 21, 1904.

A porous vessel containing a perforated, corrugated, a amalgamated zinc plate, and filled with a concentrat solution of aluminium sulphate, is placed within a th perforated leaden vessel, the intervening space being fill with "electrolytically agglomerated" lead peroxide. T double vessel is placed within a receptacle, charged w water acidulated with sulphuric acid. The battery lea ıre attached to the zinc and lead electrodes by rivets and a ;older of antimonial lead. The liquid in the inner cell nay be "fixed" by sulphuric acid, or cellulose, gelatinous ;ilica, &c., and the acidulated water by such absorbents as ;ellulose, silica, gelatinous alumina, or the like. If the iquid in the inner cell is kept "free," the amalgamated zinc s wrapped in canvas, to retain the mercury on the plate. Such cells may be combined as desired. For a voltaic grouping of several elements in the same receptacle, these re arranged in tightly fixed partitions in the following rder: amalgamated zinc, aluminium sulphate solution, a porous partition, lead peroxide, perforated sheet of lead, cidulated water, and sheet of lead not perforated, forming body with a sheet of amalgamated zinc, and so on. The malgamated zinc may be replaced by an alloy of zinc with odium or potassium.—E. S.

United States Patent.

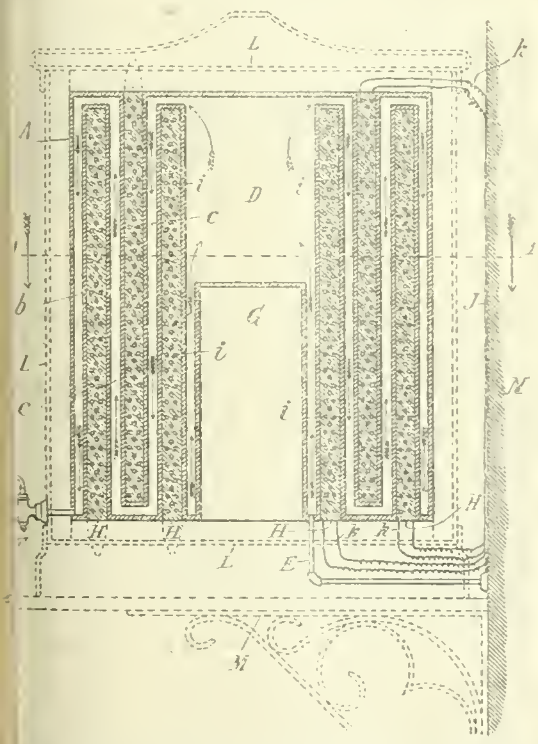
lectrolytic Meter. H. J. Wood, Shenectady, Assignor to General Electric Co., New York. U.S. Pat. 770,033, Sept. 13, 1904.

ee Eng. Pat. 7587 of 1903; this J., 1904, 493.—T. F. B.

French Patents.

lectrically Heating Liquids; Apparatus for ——. E. R. Waterman. Fr. Pat. 342,896, May 3, 1904.

he liquid to be heated enters the apparatus by the pipe E, rculates, in the direction shown by the arrows, around the



ıting devices H H, and is drawn off at F. The heating effected by wire resistance coils, embedded in asbestos, l contained in the concentric cylinders H H. G is a sed air space, and D a liquid space to accumulate a body heat in order to maintain, in some degree, the temperae of the liquid after the current has been cut off. The ole is enclosed in the outer casing L, to shield it from currents and prevent too rapid radiation.—W. H. C.

one; Apparatus for the Production of ——. B. J. X. Gosselin. Fr. Pat. 342,295, April 14, 1904.

a horizontal tube, a metallic piece, annular in crosstion, and having numerous projecting arms or wings, is secured by tinfoil, or amalgamated metal, this short encircling, metallic piece embracing the longer horizontal tube at its middle. Within the tube a somewhat longer tube, the middle portion of which is enlarged, is sealed at both ends, so that the open ends of the enclosed tube project outwards. There are two apertures in the periphery of the enclosing tube to admit passage of a current of the air to be ozonised. The enclosed tube receives through it a flow of water, to which one of the electrodes of a source of electricity is connected, the other electrode being connected to the surrounding metal piece. A glass cap, with opening to admit of passage over the main tube, is connected airtight to each end, and is fitted to the extreme wing on either side of the metal piece. An aperture on the side of each cap admits air to maintain the circulation.—E. S.

(B.)—ELECTRO-METALLURGY.

Complex Sulphide Ores; Electrolytic Production of Zinc and Lead from ——. C. H. Burleigh. Electrochem. Ind., 1904, 2, 355—357.

The finely crushed ore is very carefully roasted, since the subsequent extraction depends upon having as much as possible of the ore in the form of oxide and the remaining sulphur as sulphide rather than sulphate. The extraction of the zinc and lead is effected with a hot solution of "soda" of 25 to 40 per cent. strength. In this way all the lead and 85—95 per cent. of the zinc is extracted. The residue, containing iron, copper, gold, silver, and gangue can be treated with cyanide or by some smelting process. The solution of zinc and lead is electrolysed at first with a low potential (1·5 to 1·7 volts) to deposit lead and then at 2·5 to 7 volts, when the zinc can be recovered in a coherent form with a 95 per cent. efficiency.—R. S. H.

English Patents.

Aluminium; Process for Hard-Soldering ——. C. and L. Michelis, C. Kruse, and O. Kuhn, Hanover. Eng. Pat. 26,375, Dec. 2, 1903.

Silver is first electro-deposited on those parts of the aluminium which are to be soldered, and a hard solder is then used. Such a solder, corresponding very nearly to the colour of aluminium, may be composed of equal parts by weight of brass, zinc, and aluminium; or, a tougher one could be formed of 10 parts each of silver and brass, 14 parts of aluminium, 2 parts of copper, and 4 parts of zinc. —E. S.

Cast Iron; Process for Hard-Soldering ——. C. and L. Michelis, C. Kruse, and O. Kuhn, Hanover. Eng. Pat. 26,376, Dec. 2, 1903.

After thoroughly cleaning the parts to be joined, they are electro-coated with copper in an alkaline copper bath. The subsequent soldering or brazing may be effected with the usual solders.—E. S.

United States Patents.

Electric Furnace. M. R. Conley, Assignor to Electric Furnace Co., New York. U.S. Pat. 769,250, Sept. 6, 1904.

The furnace consists of a receptacle of like cross-sectional area at top and bottom, composed of resisting material adapted to become incandescent on the passage of an electric current through it. The receptacle has "integral extensions" at each side, with which a series of arms, of greater electrical conductivity than the receptacle, can be connected in different planes, each arm being provided with a switch so that the distribution of the electricity through the furnace can be controlled.—E. S.

Electro-plating Machine. J. Bailey, Walsall. U.S. Pat. 770,148, Sept. 13, 1904.

See Eng. Pat. 15,735 of 1902; this J., 1903, 306.—T. F. B.

French Patent.

Metals [of the Rare Earths]; Process and Apparatus for Obtaining —— in a Pure State. Elektroden Ges. Fr. Pat. 342,581, April 23, 1904.

The process is for the preparation of metals fusible with difficulty, especially those of the rare oxides, such as thorium and zirconium. The oxide of the metal is intimately mixed with excess of magnesium, potassium, or other suitable metal, and the mixture heated in an atmosphere of hydrogen or nitrogen, the heat of the reaction being supplemented, not only externally, but by the electric current. The furnace consists of a horizontal cylinder of refractory material, with a central bore from end to end, each end being occupied by a closely fitting electrode. A vertically ascending tube near one end, and a vertically descending tube at the opposite end, both valved, permit passage of gases.—E. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Iso-erucic Acid. G. Ponzio. Gaz. chim. ital., 1904, **34**, 50—55. Chem. Centr., 1904, **2**, 623.

The author prepared erucic acid by saponifying colza oil, freeing it from arachidic acid by treatment with glacial acetic acid, in which the arachidic acid is insoluble. The erucic acid was converted into iodobehenic acid by treatment with phosphorus tri-iodide, and from this, iso-erucic acid (m. pt. 54° C.) was obtained by the action of alcoholic potassium hydroxide solution. When iso-erucic acid is oxidised by means of nitric acid, it yields nonylic acid, $C_8H_{17}CO_2H$, and brassylic acid, $CO_2H(CH_2)_{11}CO_2H$, whilst its dibromide when treated with alcoholic potassium hydroxide solution is converted into behenoleïc acid, $CH_3(CH_2)_7C : C(CH_2)_{11}CO_2H$. These reactions show that iso-erucic acid has the double linking not between the first and second carbon atoms from the carboxyl group as stated by Alexandroff and Saytzeff (J. russ. phys.-chem. Ges. **24**, 486), but between the thirteenth and fourteenth carbon atoms, and that it consequently has the same structural constitution as erucic acid, $CH_3(CH_2)_7CH:CH(CH_2)_{11}CO_2H$.—A. S.

Oleïc Acid Series; New Acids of the ——. G. Ponzio. Gaz. chim. ital., 1904, **34**, 77—85. Chem. Centr., 1904, **2**, 693—694.

The higher members of the $C_nH_{2n-2}O_2$ series of acids with the double linking in the 1.2-position can be prepared from the *a*-iodo derivatives of the corresponding saturated acids, *e.g.*, palmitic, stearic, arachidic, and behenic acids by treatment with alcoholic potassium hydroxide solution. The hitherto unknown 2.3-oleic acid, $CH_3(CH_2)_{14}CH:CH.CO_2H$, was obtained by converting stearic acid into its *a*-bromo-derivative by treatment with phosphorus and bromine, preparing the corresponding iodo-derivative by heating the bromine compound with alcoholic potassium iodide solution, and then boiling the iodine compound for six hours with alcoholic potassium hydroxide solution. A mixture of 2·3 oleic and *a*-hydroxystearic acids was obtained. The 2·3-oleïc acid melts at 59° C. and re-solidifies at 52° C.; it is easily soluble in ether and chloroform, slightly soluble in cold alcohol and soluble in light petroleum spirit. When fused with potassium hydroxide, it yields palmitic and acetic acids. The sodium, calcium, barium, and silver salts, the ethyl ester, the amide, and the dibromide (2·3-dibromostearic acid) of the acid were prepared. The author considers that in an analogous manner to iso erucic acid (see preceding abstract), the iso-oleïc acid described by Saytzeff (J. prakt. Chem., 1888, **37**, 269), has probably the same structural constitution as oleïc acid.—A. S.

Oil of Safflower (Carthamus tinctorius). G. Fendler. Chem.-Zeit., 1904, **28**, 867—868.

The seeds of this plant (from German East Africa) are pear-shaped, 6—8 mm. long, 4—5 mm. maximum breadth. Thin, hard, shining greyish or yellowish-white husks enclose a very soft, greenish-white seed. 100 seeds weigh 5·2 grms. of which the weight of the husks is 2·4 grms., and that o the kernels 2·8 grms. Ether extracts from the whole seed 25·8 per cent., from the kernels 59·37 per cent. of fat The oil, obtained by percolation with ether and evaporatio of the ether, is golden yellow and almost inodorous, bu quickly acquires a very disagreeable rancid flavour. Th following constants of the oil, and of the fatty acid obtained from it (5·84 per cent. reckoned as oleïc acid corresponding to an acid value of 11·63), were determined Oil:—sp. gr. at 15° C., 0·9266: m. pt., − 5 C.; solidifi cation point, begins at − 13° C., incomplete even a − 18° C.: saponification value, 191; iodine value (Hübl) 142·2; unsaponifiable matter, 0·708 per cent.; butyro refractometer reading at 40° C., 65°. Fatty acids:—sp. gr. a 15° C., 0·9135; m. pt., 17° C.; solidification point, 12° C. acid (saponification) value, 199; mean molecular weight 281·8; acetyl-acid value, 151·4; acetyl value, 52·9; acetyl saponification value, 207·4; iodine value (Hübl), 148·2 iodine value of liquid acids, 150·8; acid (saponification value of liquid acids, 191·4; mean molecular weight o liquid acids, 293·1. In a thin layer, the oil dried com pletely at the ordinary temperature within six days; mor rapidly at a higher temperature. The oxygen absorbed, b Livache's test, was after 18, 40, 64, 136 hours respectivel 0·6, 4·3, 6·4, 7·5 per cent. The oil is not suitable fo food, but will be useful for soap-making, and in th manufacture of varnishes.—J. T. D.

English Patent.

Soap Powders; Manufactures of Dry ——. C. Harve London. Eng. Pat. 25,010, Nov. 17, 1903.

Ordinary hard soap is automatically fed into a series c high speed disintegrators. The ground soap is then con veyed by means of spirals or worms to another disintegratio machine where it is mixed with automatically measure quantities of crystallised sodium carbonate, anhydrous bor acid, boron nitride and ammonium chloride. The followin proportions of ingredients are specified: desiccated har soap, 28 parts; sodium carbonate (crystals), 69 parts anhydrous boric acid, boron nitride, and ammoniu chloride, of each 1 part.—W. P. S.

French Patents.

Oils and Fats; Enzymic Saponification of —— witho introducing Appreciable Quantities of Impurities. M Nicloux. Addition, dated April 11, 1904, to Fr. Pa 335,902, Oct. 14, 1903 (see this J., 1904, 327).

Various methods of preparing the active agent from cast seeds are claimed in addition to those described in t main patent (*loc. cit.*). Thus the crushed seeds or se cake may be treated with cotton-seed oil, which is subs quently filtered through silk, yielding a very active filtrat Or, instead of filtration, centrifugal force may be employe and the supernatant oil will then require only the additi of acidified water for direct saponification. Or benzene other solvent may be added to the filtered oil before usi centrifugal force. Again, the castor-seed cake may treated with benzene, &c. and the supernatant liquid sep rated and evaporated. Or the crushed grain may be treat with hot castor oil, which is filtered through fabric a allowed to stand at 80 to 90° C., when aleurone is deposite whilst the active agent left in suspension may be separat by treatment with benzene and centrifugal force. Oth combinations of these different methods are also describe To prepare an active dry substance a large excess solvent is used, and the deposit separated from this in t centrifugal machine treated with a fresh portion of solve and again separated. This dry deposit requires to suspended in oil before use.—C. A. M.

Soap: Manufacture of ——. F. A. V. Klopper. Fr. Pat. 342,691, April 27, 1904.

A certain proportion of wheat gliadin and glutenin added to the soap during the manufacture, with the obj of combining with free alkalis and rendering them innocuo without introducing the drawbacks of superfatted soa (tendency to become rancid, &c.).—C. A. M.

Soap; Manufacture of a Floating ——. F. W. Zimmermann and A. A. Stöhr. Fr. Pat. 342,750, April 30, 1904.

SEE Eng. Pat. 13,451 of 1904; this J., 1904, 871.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

French Patents.

Vehicles for Colouring Matters in the Manufacture of Pigments; Production of ——. E. H. Strange and E. Graham. Fr. Pat. 342,327, April 2, 1904. Under Internat. Conv., April 11, 1903.

SEE Eng. Pat. 8335 of 1903; this J., 1904, 448.—T. F. B.

Calcium Sulphate and Carbonate occurring as Residues in the Manufacture of Caoutchouc Goods, Colours, Ceramic Ware, and Cement Blocks, and in other Chemical Industries; Utilisation of ——. A. Morin. Fr. Pat. 342,797, May 2, 1904. IX., page 937.

(*B.*)—RESINS, VARNISHES.

United States Patent.

Turpentine Still. J. F. Bailey, Valdosta, Ga. U.S. Pat. 770,149, Sept. 13, 1904.

A DISTILLATION apparatus is claimed which consists of a distillation tank and a condensing coil immersed in water. The still is heated by a series of steam pipes extending ransversely through it, and having their projecting ends onnected with "headers" on opposite sides of the tank. With one of these "headers" a boiler supplying steam is onnected, and with the other a steam pump for forcing water both into the cooling vat and the steam boiler, with he necessary valves for controlling the flow of steam and water.—M. J. S.

French Patent.

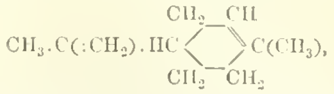
Resinous Products [Turpentine]; Apparatus for the Distillation of ——. G. Coi. Fr. Pat. 342,425, April 18, 1904.

THE apparatus consists of a cylinder of wrought iron nclined at a suitable angle to the horizontal. Its walls orm two concentric envelopes so arranged that there are o rivets or joints in the inner wall, and all chance of eakage is thus prevented. The inner chamber has an nlet tube for the introduction of material, and an outlet or the escape of vapours into the condenser, and is heated y means of a steam coil at the bottom. A door at the nd, kept closed by means of a screw, permits the introduction of an open vessel beneath the inlet tube. The material falls into this and leaves behind the ligneous impurities, &c., which are thus dried separately, obviating the anger of spontaneous combustion, which may take place when such impurities are carried over with turpentine apour into the condenser, as in the methods of dry istillation.—C. A. M.

(*C.*)—INDIA-RUBBER, &c.

Caoutchouc: Pyrogenic Decomposition of ——. R. Ditmar. Gummi-Zeit., 1904, **18**, 1013—1016, 1038—1041, 1058—1061.

THE author gives a detailed review of the investigations which ave been made with regard to the nature of the products f the destructive distillation of caoutchouc. He concludes hat the pyrogenic decomposition of caoutchouc may be egarded as proceeding in the following manner: The large aoutchouc molecule is in the form of an open chain. The olyprene decomposes primarily into a series of aliphatic erpenes with long open chains, which then split into ompounds with short chains, the lowest member of the eries being isoprene, $CH_3.C(:CH_2).CH:CH_2$. These open-hain compounds polymerise and form dipentene, and sesqui-, i-, and poly-terpenes of a cyclic nature. The formation f open-chain and of cyclic compounds almost certainly proceeds simultaneously, and one can scarcely hope to be able to arrest the decomposition of the caoutchouc at a point where only aliphatic terpenes have been produced. The author refers to numerous errors which occur in the literature of the subject with regard to caoutchine, $C_{10}H_{16}$, owing to confusion of the compound with the caoutchene discovered by Bouchardat, and also to the custom of calling it di-isopene. Caoutchine is really a cyclic terpene—



$$CH_3.C(:CH_2).HC\langle\begin{matrix}CH_2-CH\\CH_2-CH_2\end{matrix}\rangle C(CH_3),$$

and, to prevent further confusion, the author proposes the name dipentene for it. A bibliography is appended to the paper.—A. S.

India-Rubber; Presence of Oxygenated Compounds in ——. P. Alexander. Gummi-Zeit., 1904, **18**, 867—869.

CONTRARY to Weber's statements (Gummi-Zeit., **17**, 397 and 952, and **18**, 461) the oxygenated constituents of Pontianac rubber, *i.e.*, those soluble in acetone, have the composition $C_{25}H_{40}O$, whilst the portion insoluble in acetone is a hydrocarbon with a composition closely approximating to $C_{10}H_{16}$, and in general character resembles the hydrocarbon found in other rubbers. The dinitro method showed that the insoluble portion contains 77 per cent. of rubber substance. Guaryrule rubber also appears to consist chiefly of a true hydrocarbon, and the dinitro method indicated slightly above 60 per cent. of caoutchouc. The author considers it doubtful that oxygen compounds exist in rubbers, except in those portions which are soluble in acetone and usually recognised as resin.—R. L. J.

English Patent.

Caoutchouc; Method of Manufacturing Artificial ——. L. L. A. Seguin and J. F. G. de Roussy de Sales, Paris. Eng. Pat. 22,956, Oct. 23, 1903.

SEE Fr. Pat. 336,206 of 1903; this J., 1904, 329.—T. F. B.

French Patent.

Calcium Sulphate and Carbonate occurring as Residues in the Manufacture of Caoutchouc Goods, Colours, Ceramic Ware, and Cement Blocks, and in other Chemical Industries; Utilisation of ——. A. Morin. Fr. Pat. 342,797, May 2, 1904. IX., page 937.

XIV.—TANNING; LEATHER, GLUE, SIZE.

English Patent.

Hides and Skins; Treatment of —— *anterior to and during Tanning.* J. Muir, Beith, Scotland. Eng. Pat. 18,677, Aug. 29, 1903.

THE following claims are made: (1) For the use of a fleshing machine, more particularly in connection with fatty skins. The machine consists of a cylinder fitted with spiral knives, and provided with mechanism for regulating the pressure and presenting the hides to the knives. The cylinder is made to revolve at a high rate of speed. (2) For removal of hair from limed skins by drumming them in a cylinder, that is by attrition of one skin on another instead of by hand labour with a stone or knife. (3) In the above drum (*a*), apertures or slits in its walls to allow of escape of the loosened hair, and (*b*) a shelf fixed at an angle to the door, so that when the latter is removed the skins fall out automatically. (4) Piling the skins in the pits on a false bottom, so that the whole may be lifted and removed in one operation.—R. L. J.

French Patents.

Vegetable Tannage; Rapid ——. M. Berthon. Fr. Pat. 342,600, April 25, 1904.

To induce rapid absorption of tannin from strong liquors without injury, the limed skins are soaked for 2—4 days in the following liquor at 10°—15° C.: Water, 100 litres; hydrochloric acid, 3 litres; barium chloride, 2 kilos.; sea salt, 18 kilos. When transferred to a new liquor made from natural bark or wood (30 parts per 100 of water) for 6—24 hours at 20—25° C., the salt rapidly passes out, and the plumping agents (acid and barium chloride) resist the otherwise injurious action of the strong tannin. The after-liquors are old ones successively strengthened, resinate of manganese being added to the last. A fortnight in layer pits completes the tannage.—R. L. J.

Leather; Artificial ——. H. Karle. Fr. Pat. 342,622, April 25, 1904.

Cotton and similar fibres are formed into a felt, which is impregnated with a mixture of rubber, gutta-percha, and oils, capable of being vulcanised. After rolling into suitable forms or patterns, the whole is vulcanised, and then coloured and finished by various methods.—R. L. J.

Vegetable Tanning or other Substances and Mineral Matters on Hides and Skins; Fixing ——. F. R. Carmichael. Fr. Pat. 342,762, April 30, 1904.

A solution of casein (100 parts) in (1) neutral soap (20 parts), (2) glycerin (10 parts), or lactic acid is drummed into the skins, the presence of free alkali being carefully avoided, so that loosely held tannins, extractive matters, or mineral substances are fixed in the hide to give weight and substance. A similar solution is used as a substitute, together with oils, for egg-yolk in stuffing mixtures, *e.g.*, powdered casein, 13 parts; dry soap, 6 parts; wool grease, 4 parts; mineral oil, 9 parts; pale rosin oil, 9 parts; water, 58 parts.—R. L. J.

XVI.—SUGAR, STARCH, GUM, Etc.

Starch Syrups; Examination of ——. A. Rössing. XXIII., page 953.

Sugars; Enzymic Inversion of ——. N. P. Barendrecht. XVII., page 945.

Molasses; Destruction of Sulphurous Acid in Sulphited ——. M. E. Pozzi-Escot. XVII., page 946.

Molasses; Use of Oxidising Agents in the Fermentation of Sulphited ——. H. Alliot and G. Gimel. XVII., page 946.

Sugars and Starch; Determination of —— *in Vegetable Substances.* J. S. Ford. XXIII., page 953.

English Patent.

Drying Starch from Rice or other Amylaceous Products. W. F. Bate, Manchester. Eng. Pat. 23,703, Nov. 2, 1903.

Rice starch or other amylaceous products are dried in a vacuum apparatus, comprising an open-ended receptacle mounted in a casing connected with a suction or vacuum pump; the casing carries a false bottom for the said receptacle. There is also a filter bed interposed between the receptacle and the casing, and means are provided for clamping the former to the casing so as to form an air-tight connection.—T. H. P.

United States Patents.

Condenser for Vacuum-pans [Sugar Manufacture]. J. F. Utrilla, Jersey City, N.J. U.S. Pat. 769,574, Sept. 6, 1904.

The claim is for the combination of an injector pipe with a condenser cylinder, and a gas-discharge pipe connecting the upper portion of the cylinder with the discharge-pipe of the injector.—L. F. G.

Starch; Process of Making Soluble ——. J. David, Assignor to Otto Bredt and Co., Barmen, Germany. U.S. Pat. 769,061, Aug. 30, 1904.

See Eng. Pat. 23,370 of 1903; this J., 1904, 29.—T. F. B.

French Patents.

Saccharine Liquors and Molasses; Extraction of —— *from Plants and Refuse.* S. Meisels. Fr. Pat. 342,555, April 22, 1904.

Refuse vegetable matters, such as sawdust, wood-refuse, straw, maize-stalks, &c., are moistened and heated with a soda-lye of 3—5 per cent. strength for several hours under a pressure of about 10 atmospheres. The boiled mass is largely diluted with water and subjected to a pressure of 20—24 atmospheres, in order to "dissolve the cellulose." The mass is then aërated with sterilised or ozonised air and converted into sugar by means of mucedinæ.—J. F. B.

Beetroot Chips; Extraction of the Juice from —— *by Heating and Pressing.* A. Wagner and Soc. Selwig and Lange. Fr. Pat. 342,784, May 2, 1904.

The fresh beetroot chips are heated, without the addition of liquid, to a temperature sufficient to precipitate the albuminoid matters; the heating may be effected either indirectly or directly by means of steam or hot gases; the chips are then pressed in the hot state to extract the juice. —J. F. B.

[Saccharine] Liquids; Elimination of Coloured Impurities from ——. E. Koperski. Fr. Pat. 342,229, April 12, 1904.

Coloured liquids of any kind are decolorised by treatment at the boiling temperature with zinc dust and animal charcoal. In the case of very dark saccharine liquids, it is advantageous to acidify them with an organic acid, such as tartaric acid, before treatment.—J. F. B.

Massecuites; Malaxeur for Crystallising, Concentrating, and Cooling —— *with Circulation.* H. Roy. Fr. Pat. 342,786, May 2, 1904.

The system of crystallising massecuites by the aid of agitation is operated in a vertical, cylindrical malaxeur, provided with a conical bottom and stirring arms carried by a vertical shaft; the usual heating and cooling coils are also provided. Parallel with the axis of the malaxeur there is an external pipe, which can be put into communication with the interior at various levels. By means of this pipe, the thinner material, which accumulates near the top of the mass, can be decanted off and returned through a special circulating pump at the bottom of the malaxeur. If desirable, the decanted molasses can be re heated or concentrated in a vacuum pan before it is returned to the malaxeur.—J. F. B.

Desiccating and Cooling Granular Products, such as Crystallised Sugar, &c.; Apparatus for ——. F. Hall. Fr. Pat. 342,619, 1904. I., page 929.

XVII.—BREWING, WINES, SPIRITS, Etc.

Hops; The Bitter Constituents of ——. C. J. Lintner and J. Schnell. Z. ges. Brauw., 1904, **27**, 666—669.

The authors isolated the α-hop bitter acid in the form of a brown crystalline mass by decomposition of its lead compound by sulphuric acid and extraction with ether. The α-hop bitter acid was decomposed by hydrolysis with alcoholic caustic soda, and yielded, in addition to resinous bodies and valeric acid, about 30 per cent. of a very well crystallised derivative, occurring in the form of colourless, tabular, elongated crystals, melting at 92·5° C. This product does not resinify on exposure; it is sparingly soluble in water, but soluble in most organic solvents. A study of its properties showed it to be a hydroxy-ketonic acid having the formula $C_{15}H_{24}O_4$. Since the α-hop bitter acid yields only valeric acid on oxidation with permanganate, it is regarded as a combination of the above hydroxy-ketonic acid with a valeric acid residue, and its formula should be written $C_{20}H_{32}O_5$, instead of $C_{20}H_{30}O_5$ as found by analysis. The authors propose the following nomenclature for the crystalline bitter constituents of hops:—*Lupulinic acid* for the β-hop bitter acid, $C_{25}H_{36}O_4$; *Humulone* for the α-hop bitter acid, $C_{20}H_{32}O_5$, since it is probably a lactone; and *Humulinic acid* or *Humulin* for the above hydroxy-ketonic acid decomposition product of humulone.—J. F. B.

Sugars; Enzymic Inversion of ——. H. P. Barendrecht. Z. physik. Chem., 1904, 49, 456—482.

In the inversion of cane-sugar by acids the formation of invert-sugar is always proportional to the concentration of cane sugar, but this is not the case with invertase, except at very low initial concentrations (up to about 1 per cent.) of cane-sugar. To account for this, the hypothesis is set up that the catalytic action of invertase is due to a kind of radiation. The inversion of cane-sugar by invertase is retarded to an equal extent by invert-sugar, glucose, and levulose; hence the inversion is not a simple matter of chemical equilibrium, otherwise invert-sugar would show exceptional powers of retardation. Mannose and galactose retard inversion to twice the extent of glucose. Thus, the further hypothesis is suggested that the radiation emitted by invertase is of two different orders: either has the property of inverting cane-sugar, but the one s absorbed only by glucose, the other only by levulose, whilst foreign hexoses absorb either indifferently. Mannitol and dulcitol, which contain one asymmetric carbon atom less than the hexoses, retard somewhat less. Salicin, which contains a glucose differing from that produced from cane-sugar, retards, molecule for molecule, twice as much as glucose. There is no difference between the yeast-enzymes which invert cane-sugar and maltose. Since the maltose molecule is less easily broken down, weakened invertases fail of effect on the maltose though they may be still active towards cane-sugar. Equilibrium between maltose and its primary product of inversion (*i.e.*, bi-rotating glucose) is reached much sooner than in the case of cane-sugar. The inversion is retarded equally by levulose and by galactose.—W. A. C.

Top-Fermentation Yeast; Relations between the Quantity of Pitching Yeast and the Attenuation and Yeast Crop with ——. J. J. van Hest. Z. ges. Brauw., 1904, 27, 633—636 and 651—654.

When different proportions of yeast are sown in wort of he same concentration, the attenuations at the end of the first day are approximately proportional to the quantity of yeast sown. After that time the proportionality ceases and he attenuations tend towards equalisation; high fermentaion temperatures also tend to equalise the attenuations. n the series of experiments here recorded, wort of 10·7° Balling was pitched with proportions ranging between ·0001 and 20·0 litres of "normal pitching yeast" (see his J., 1904, 30) per hectolitre, and fermented for eight ays at 17·5° C. At the end of that time the final attenuaion was in all cases identical and perfectly independent of he quantity of pitching yeast. The yeast crop, naturally, was greater the greater the quantity of yeast sown, but fter deducting the original quantity of pitching yeast from he quantity of the crop, the absolute value of the yeast ncrease reached a maximum with a sowing of 1 per cent., nd then decreased. The point at which there was no ncrease at all lay between 10 and 20 per cent. of pitching east. The number of times the yeast cells had multiplied coefficient of reproduction) was inversely proportional to he quantity sown; this coefficient is also a measure of the atio of young cells to old cells. Similar experiments made t a temperature of 25° C. yielded results of the same nature, ut the yeast crops and coefficients of reproduction, especilly with the smaller sowings, were generally higher than t the lower temperature. Increase in the concentration of he wort, and aeration during fermentation, the quantity of itching yeast being constant, also caused an increase in he reproduction coefficients, but not in a degree proportional to the increased nutrition available. Increased eproduction by these methods soon reaches a limit, because he yeast requires a certain degree of dilution of its food nd a certain amount of dissolved oxygen in the wort in rder to perform its biological functions. The usual limits f practical brewery conditions, as regards proportion of pitching yeast and concentration of wort, correspond pproximately to the maximum degree of healthy reproduction. With the usual brewery sowing of 0·5 per cent. of "normal" pitching yeast, each cell has at the time of pitching an available free space of 500 times its own volume; at the end of the fermentation at 17·5° C. the yeast had multiplied six times, and each cell then had a free space of 83 times its volume. In the cases where, owing to heavier sowings, the free space at the end of fermentation was less than 83 times, the resultant yeast was generally debilitated to an extent proportional to the restriction of its free space. In top fermentation it is the younger generations of cells which rise to the surface and are used for pitching; it is therefore important that these young cells shall not have suffered from malnutrition and overcrowding during their growth. The cause which prevents the yeast from growing indefinitely, so long as there is excess of nutrition and air, is the accumulation of excreta, *i.e.*, products of metabolism other than alcohol and carbon dioxide, the two latter, in the author's opinion, having very little inhibitive influence. The considerations of the amount of free space available for each yeast cell, as determined by the amount of the original sowing, are also discussed from the point of view of fitness in the struggle for existence and the power of the yeast in suppressing infecting organisms.—J. F. B.

Beers; Comparison between the Composition and Properties of —— *prepared from Barleys rich and poor in Albumin.* R. Wahl. Amer. Brew. Rev., Aug. 1, 1904. Chem.-Zeit., 1904, 28, Rep. 255.

Beers were prepared in a perfectly parallel manner from Montana barley malt (albuminoid content of barley, 9·23 per cent.) on the one hand, and from Minnesota barley malt (albuminoid content of barley, 15·16 per cent.) on the other. Both beers were stored for a month at 3°—4° C. and then kept in bottle at 0·75° C. for another month. At this temperature both beers became turbid after a few days, but the turbidities subsided, in the Minnesota beer after two weeks, and in the Montana beer after four weeks. The clear beers were tested, both in the pasteurised and unpasteurised condition, for their susceptibility towards chill, with the result that the Montana beer was found to be the more susceptible. The analysis of the nitrogenous constituents of the two beers gave the following results:—

——	Montana Beer.	Minnesota Beer.
	Per Cent.	Per Cent.
Original wort solids	13·98	13·98
Albumin	0·018	0·027
Albumose	0·109	0·137
Peptone	0·201	0·302
Amides	0·36	0·504
Total albuminoids	0·68	0·97
Albumin deposited during cold storage	0·0024	0·0024

Thus the higher proportion of albuminoid constituents in the Minnesota beer had no evil effects in rendering the beer susceptible to chill, but, on the other hand, it had a favourable influence in increasing the palate fulness and the permanence of the "head." The author gives the preference to barleys rich in albumin for brewing purposes, so far as American barleys are concerned.—J. F. B.

Beer and Brewing; Surface Influences in ——. F. Emslander and H. Freundlich. Z. physik. Chem., 1904, 49, 317—328.

The authors discuss the various physical phenomena which are met with in the brewery as the results of surface influences of various kinds. Owing to the fact that beer consists partially of a pseudo-solution ("sol") of organic colloids, the particles of which possess surfaces of separation from the liquid in which they are suspended phenomena of the nature of "adsorption," *i.e.*, concentration and retention of certain of the dissolved matters on the outer surfaces of the colloid particles, are produced. Electrical experiments similar to those described by Biltz for other colloid "sols" (see this J., 1904, 459 and 619) proved that the organic colloids of beer are positive relatively to the liquid by which they are surrounded. The beer colloids migrate to the cathode under these conditions in the form of a thick, flocculent mass which carries with it most of the colouring matter. The foam surrounding the cathode is yellow, very glutinous and permanent, whereas, that near the anode is pure white and transient. Owing to the surface influence of "adsorption" these colloidal bodies attract to themselves the colouring matter, the flavouring and odorous bodies, and the carbon dioxide. To them the qualities known as "permanence of head," "fulness of body" and "condition" of the beer are, therefore, attributable. Geffcken has recorded (this J., 1904, 914) how, in the case of ferric hydroxide "sol," also a positive colloid, there is an analogous instance of the retention of carbon dioxide by "adsorption." Cases of "adsorption" occur in all the filtration operations in the brewery, for instance, in running off the wort from the mash the soluble extractive matters are retained with exceptional firmness by the insoluble colloids of the grains. Passing on to other influences exerted by surfaces upon the brewing operations, the authors discuss the different powers of different surfaces in discharging a state of supersaturation of the carbon dioxide during fermentation. Since a rough or greasy surface discharges the gas with greater facility than a clean smooth surface, and since a rapid removal of the carbon dioxide favours the rapidity of fermentation, the following values for the apparent attenuations reached by the same wort fermented in vessels of different internal structure for nine days at 7°—8° C. are explained:—Wood, dry, untreated, 72·8; paraffined wood, 71·3; wood boiled and saturated with wort, 69·9; wood with pitch coating, 68·4; wood, lacquered, 57·4; glass, 52·9 per cent. The rapidity of clarification also followed the same order.—J. F. B.

Brewery Refuse; Purification of ——. H. M. Wilson. Brewers' J., 1904, 40, 635—637.

Owing to the fact that brewery refuse rapidly undergoes acid fermentation, it is very refractory towards the action of the ordinary purifying organisms, and consequently the septic tank treatment is not one to be recommended for this purpose. The most satisfactory results were obtained by successively treating the refuse by chemical precipitation, filtration or percolation, and straining through sand. The refuse was first rendered alkaline by the addition of milk of lime, about 45 grains of lime per gallon of liquid being generally found sufficient. After allowing the mixture to settle, the liquid portion was then subjected to double contact filtration, the filters being constructed as follows:—The first was underdrained by channels formed of loose bricks laid on the concrete bottom of the bed. The latter was then made up of 6 ins. of clinker sized from 1 in. to $1\frac{1}{2}$ in., then 12 ins. from $\frac{3}{4}$ in. to 1 in., 12 ins. from $\frac{1}{2}$ in. to $\frac{3}{4}$ in., and the top 9 ins. from $\frac{1}{8}$ in. to $\frac{3}{8}$ in., 3 ft. 3 ins. in all. The second bed, underdrained in the same way, consisted of 12 ins. of sifted ashes of 1 in. size, 12 ins. of $\frac{3}{4}$ in., 9 ins. from $\frac{1}{8}$ to $\frac{3}{4}$ ins., 3 ins. of fine lime-stone chippings, and again 3 ins. of fine ashes free from dust; 3 ft. 3 ins. in all. The first bed was also covered at the inlet end with an extra layer of fine ashes 3 ins. in depth, to catch the fine suspended matter carried forward from the settling tank by the flushes of liquid. The effluent from these filters, not being sufficiently clean to run into a river, was then pumped up into a tank, and passed by means of a rotating sprinkler on to a coke filter, consisting of a bed, 6 ft. in diameter and 6 ft. deep, of coke breeze, about a quarter of which had been obtained from some first contact beds at sewage works, and the remainder direct from the gas works. The pieces were about the size of apples, and a layer of stones was placed at the bottom of the bed for drainage purposes. By supplying the effluent to this filter in intermittent doses every 5 minutes for 8 hours a day to the amount of 140 gallons per sq. yard per day, the resulting effluent was quite satisfactory and contained nitrates. A final straining through sand was found to be necessary as usual. The albuminoid ammonia was reduced to 0·15 part per 100,000, and the oxygen absorbed to 1·8 parts. An earth-filter was tried instead of the coke-bed, and yielded nearly the same results. The above experiments were to some extent determined by the nature of the existing works at the brewery, but in constructing new works, the best course would be to provide tanks for chemical treatment, a first percolation filter and another at a lower level, and finally a shallow sand strainer. To prevent acid fermentation of their contents, the tanks should not be too large, and the filters should be of sufficient area to allow of only a moderate quantity per yard being passed through them. The actual amount of purification effected during the experiments amounted to 96 per cent. as regards the albuminoid ammonia, and 93 per cent. reckoned on the oxygen absorbed.—W. P. S.

Molasses; Use of Oxidising Agents in the Fermentation of Sulphited ——. H. Alliot and G. Gimel. Bull. Assoc. Chim. Sucr. et Dist., 1904, 22, 88—92.

The method of Saillard for removing sulphurous acid, by boiling with sulphuric acid, is too costly owing to the large consumption of fuel. The authors find that calcium hypochlorite and manganese dioxide are among the chemical oxidising agents presenting most interest. Calcium hypochlorite, from its cheapness and more rapid action, is to be preferred, and its employment is more general, since there is no need for it to act in an acid medium as is the case with manganese dioxide. Moreover, the salts of manganese, although not injurious, retard fermentation. The advantages secured are the disappearance of sulphurous acid, either free or as potassium bisulphite, bactericidal action and consequent purity of fermentation, and an acceleration in the multiplication of yeast cells. The quantity of hypochlorite used is 50 grms. per hectolitre.—L. J. de W.

Molasses; Destruction of Sulphurous Acid in Sulphited ——. M. E. Pozzi-Escot. Bull. Assoc. Chim. Sucr. et Dist., 1904, 22, 92—101.

Although the use of sulphurous acid as an antiseptic is valuable in obtaining pure fermentations, large quantities give rise to the production of sulphuretted hydrogen by enzymic hydrogenation, with formation of metallic sulphides in the pipes, and the sulphurous acid also acts injuriously by retarding the development of the yeast. It has no sensible action on the activity of sucrase and zymase of yeast. In active fermentation with acclimatised yeast, part of the sulphurous acid is reduced, part oxidised, and part absorbed. It is not possible to destroy the acid by chemical reduction in distillery wort, and electrolytic reduction introduces substances injurious to yeast. By using a scrubber and working at 60°—70° C. it is possible to oxidise sulphurous acid practically with atmospheric air. This action may be assisted by manganese protoxide, which was found to have only a negligeable influence when present to the extent of 0·5 grm. per litre. Worts fermented in presence of a large quantity of sulphurous acid contain notable quantities of fatty acid, aldehyde, and higher alcohols. Calcium hypochlorite is useful if added in quantity to merely reduce the quantity of sulphurous acid, but electrolytic oxidation introduces a large quantity of accessory products in presence of which yeast develops with difficulty.—L. J. de W.

Sugars and Starch; Determination of —— *in Vegetable Substances* [*Malt*]. J. S. Ford. XXIII., page 953.

English Patents.

Malting Apparatus. R. Plischke and A. Beschorner, Vienna. Eng. Pat. 28,264, Dec. 23, 1903.

See Fr. Pat. 337,983 of 1903; this J., 1904, 556.—T. F. B.

Whey into Vinegar; Method of Converting ——. A. Barbier, Paris. Eng. Pat. 16,189, July 21, 1904.

See Fr. Pat. 334,071 of 1903; this J., 1904, 32.—T. F. B.

Distillery or other Impure Effluents containing Matter in Suspension; Bacterial Bed System of Treating ——. A. M. Cowie. Eng. Pat. 20,025, Sept. 17, 1903. XVIII. B., page 947.

French Patent.

Albumin-Tannate; Soluble —— [*for Filtering and Clarifying Wine, &c.*]. Soc. Lasmolles and R. de la Faye. Fr. Pat. 342,682, April 27, 1904.

Powdered casein (46 parts), tannin (16 parts), and sodium bicarbonate (8 parts), are mixed together. This powder forms a clear solution in tepid water, and when added to acid liquors such as wine, the insoluble albumintannate precipitates out, carrying with it suspended matter. Infusorial earth may be used in conjunction. Filter cloths soaked in the solution are said to become much improved for the filtration of weakly acid, turbid liquors.—R. L. J.

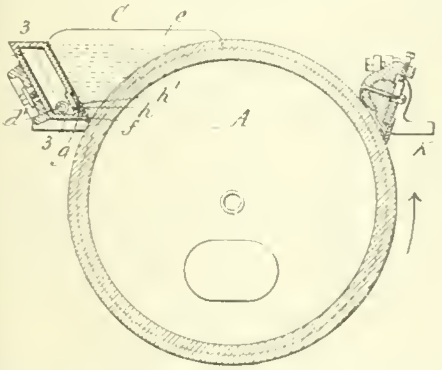
XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

United States Patents.

Evaporating Liquids [*Milk*]; *Process for* ——. J. A. Just, Pulaski, N.Y. U.S. Pat. 765,343, July 19, 1904.

The liquid in the form of a film is evaporated by exposing it to the action of a heated surface on one side, and to a cooled surface on the opposite side. This method prevents the overheating of the material, and keeps the outer surface



f the film in a porous condition, so that evaporation easily akes place. A is a hollow cylinder, heated by passing team into the interior, and capable of being rotated in the irection of the arrow by suitable means. A flat waterooled box (3) is placed at an angle against the cylinder, nd so adjusted that only a thin film of liquid can escape s the cylinder rotates. The liquid to be evaporated is upplied at C, and the dried product is taken off by the craper K. The use of the cooled surface allows a sufficiently high temperature to be applied to ensure the terilisation as well as the complete desiccation of the aterial without damage from overheating.—W. H. C.

French Patent.

oods; Process of Sterilising ——. K. C. L. G. Budde. Fr. Pat. 342,769, April 30, 1904.

he food—green peas, for instance—is heated for 10 minutes ith a 0·005 per cent. solution of formaldehyde, and afterards for 10 minutes with a 0·025 per cent. solution of ydrogen peroxide, and then canned. Other foods, such as sh, milk, or meat, may be similarly sterilised, but without eating, if the treatment be more prolonged. The hydrogen eroxide may be replaced by sodium peroxide or perlphate.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Brewery Refuse; Purification of ——. H. M. Wilson. XVII., page 946.

English Patents.

ewage and other Fluids; Purification of ——. A. A. Adams, London, and E. Springborn, Glasgow. Eng. Pat. 19,599, Sept. 11, 1903.

he sewage is conducted into a settling tank containing a rizontal grating covered with filtering material (coke). fter passing this grating the liquid flows from the lower part of the tank into a distributing main, and from the latter to a number of filter channels. These are fitted with box screens and a series of filters. The filters, consisting of any suitable filtering material, packed between perforated walls, are in pairs, so that while one is lowered into the channel, the other is suspended in the air. By this means the filters are alternately aerated. The channels discharge into a main effluent conduit. A space of 2 feet is left between the successive pairs of filters, a bed of gravel confined by low walls extending across the channel, being placed in this space. The second wall of each gravel bed is perforated by tubes sloping upwards.—W. P. S.

Distillery or other Impure Effluents containing Matter in Suspension; Bacterial Bed. System of Treating ——. A. M. Cowie, Dufftown, Scotland. Eng. Pat. 20,025, Sept. 17, 1903.

To the usual bacterial installations are added sludging compartments provided with sludging boards for the purpose of removing suspended matter, especially yeast. The compartments are preferably made deep and narrow.—A. G. L.

Sewage and other Fluids; Apparatus for Treating ——. W. J. Schweitzer, White Plains, N.Y., U.S.A. Eng Pat. 14,003, June 21, 1904.

See U.S. Pat. 763,026 of 1904; this J., 1904, 758.—T. F. B.

Ammonia; Process for the Extraction of —— *from the Sewage Waters of Towns, and similar Liquids.* R. Schilling and C. Kremer, Berlin. Eng. Pat. 14,966, July 14, 1904.

The clarified sewage-waters are led on to layers of coke, slag, or the like contained in closed receptacles, and after remaining some time are removed, and hot gases passed through the layers of coke, &c. After these are well heated, the entrance of gases is stopped, and the filters are again filled for renewal of the process. The gases are led away to be treated for recovery of the ammonia. The hot gases used are, preferably, produced by the combustion of the slime deposited during the preliminary purification.—E. S.

(*C.*)—DISINFECTANTS.

English Patent.

Insecticide. G. Muller, Mulhausen, Germany. Eng. Pat. 18,678, Aug. 29, 1903.

"Saccharic acid" is claimed as an insecticide. Owing to its hygroscopic nature, it is to be mixed with some "animal or mineral powder" (*e.g.* talc), and in the state of powder is blown into the air by distributing bellows.—T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

Sulphite Wood Pulp; Notes on the Boiling of ——. Montanus. Wochenbl. f. Papierfab., 1904, **35**, 2832—2833.

The improvements introduced in recent years in the manufacture of sulphite wood pulp have led to a considerable shortening of the boiling process, so that in the Mitscherlich apparatus the boiling is reduced to 28—30 hours, and in the Ritter-Kellner to 14—16 hours. The time of boiling is regulated by the nature of the wood, strength of liquor, &c.; it also depends on the kind of pulp it is desired to make. If easy bleaching be not a desideratum, and if a strong, tough cellulose be required, the process of "high" boiling is adopted, *i.e.*, the boiling is stopped whilst the liquor still contains a relatively high percentage of sulphur dioxide. But if an easy bleaching pulp be required, it is boiled "low" until little or no sulphur dioxide remains. Pulp boiled "low" is, however, proportionately weaker; it leaves the boiler with a pale to chocolate-brown colour. The browner the stuff as it leaves the boiler, the less the quantity of chlorine required for bleaching. Sometimes a "high"-boiled pulp will turn brown when not desired to do so, especially if the blowing-off of the gases be delayed. If, as a compromise, a pale, strong pulp, which does not present too great difficulties in bleaching, be desired, the temperature in the boiler should not be allowed to rise too rapidly, but the whole boiling should be conducted more slowly than for pulp which has not to be bleached. The "brown-boiled" pulp, above referred to, must not be confounded with the interior scorched pulp obtained when the wood is not fully covered with liquor. For the preparation of a fine "white-boiled" pulp, it is recommended to use perfectly fresh pine wood, in which all the sap is still present, and to boil it slowly with a strong sulphite solution. If properly prepared the resulting pulp will be nearly as white as if it had been bleached.—J. F. B.

Sulphite Cellulose; Bleaching of ——. Montanus. Wochenbl. f. Papierfab., 1904, **35**, 2761—2762.

In the author's experience the consumption of bleach, in bleaching sulphite wood-pulp to a "high white," works out at an average of 14 per cent. The author never uses acid, and does not beat the pulp to a higher temperature than 35°—40° C. If the stuff, for any reason, has to be kept for a long time in the bleaching engine, it is best to mix it cold. Thorough washing after bleaching causes a certain fall back in colour; the use of an antichlor also dulls the white slightly. In the case of a pulp which bleaches with difficulty, the author does not add an unnecessarily large quantity of bleach, but discharges the engine whilst the stuff is still yellowish and contains a residue of chlorine. After a few days the same stuff is loaded back into the engine with quite a small addition of bleach, which then brings about a far better white than if the whole quantity of bleach had been employed in a single operation; but if the cellulose is well boiled and not browned, this double bleaching is never necessary. The bleach solution is made up to a density of 3·5° or 4° B., but the active chlorine should always be determined chemically. The composition of the water has a great influence upon the bleaching process. The consumption of chlorine is relatively less in hollanders which take a heavy charge than in the smaller ones.—J. F. B.

Sulphite Cellulose; Manufacture of Tissue Paper from ——. C. Meyer. Papier-Zeit., 1904, **29**, 2685—2686.

For the manufacture of tissue paper from wood cellulose, a machine of the Fourdrinier type with several drying cylinders is the most satisfactory. Sulphite pulp is preferable to soda pulp, on account of its superior strength. The chief difficulties encountered are occasioned by the presence of resinous impurities in the raw material, which cause sticking and tearing. The whole secret of successful manufacture lies in a suitable boiling and bleaching of the pulp. The boiling liquor should be as rich as possible in sulphurous acid, and the duration of boiling must not be curtailed. The condition of the wood is also important; it must not be too fresh, and wood which has been floated down the rivers always gives the best results. The residual sticky impurities are removed by bleaching. This operation is not as a rule an easy one, since the resinous bodies in combination with gypsum form a hard scale on the fibres. Bleaching should be conducted at a lukewarm temperature with 18—20 per cent. of bleach, without the assistance of acid. A preliminary treatment with sodium carbonate is not necessary with a well-boiled pulp; the use of antichlor is desirable. With a suitable machine, a speed of 35 metres per minute is attainable, working on tissues at 17 grms. per square metre. The wire should not be coarser than 85—90 mesh (German measure), otherwise very inferior results are obtained. If the shaker does not work with perfect uniformity and horizontally, it will destroy the wire and had better be discarded; the dandy roll may also be omitted with advantage. The stuff should be sized very sparingly, but plenty of alum should be used. With steel knives in ordinary beaters it is usual to allow two hours for opening out the fibres, four hours for beating proper, with gradually increasing pressure, and two hours for brushing out and for making the stuff even. Beating must on no account be hurried, but the time can be shortened considerably by using broad bronze or basalt-stone beating surfaces, which rapidly impart the desirable "wetness" to the pulp without beating it "dead."—J. F. B.

Bank-Note Papers. Liber. Wochenbl. f. Papierfab., 1904, **35**, 2757—2761.

Details are given of comparative tests made with three papers made from pulps of the following composition: (*a*) 30 per cent. of flax and 70 per cent. of hemp, both in the partially crude, semi-white state; (*b*) 85 per cent. of pulp (*a*) with 15 per cent. of raw unbleached cotton; (*c*) pure ramie pulp. The pulps were beaten for a very long time, especially pulp (*a*), and the consequent "wetness" made the treatment on the hand-mould very difficult. The strength tests of the unsized papers showed that the paper (*a*) was the strongest, with an average breaking length of 8310 metres; the presence of the cotton in the paper from pulp (*b*) caused the lowering of the breaking length to 7096 m., a fall of 14·7 per cent.; the strength of the ramie paper was only 6112 m. The effect of animal sizing on the three papers was different; the strength of (*a*) was increased 43 per cent., that of (*b*) 30 per cent., and that of (*c*) only 18 per cent. The rosin sizing of the same pulps in the beater caused decreases of strength amounting to 6 per cent. in (*a*), 12·5 per cent. in (*b*), and 3 per cent. in (*c*). The ramie fibre responds less to the influence of the sizing, whether animal or rosin, than the other fibres, owing to its cruder nature. The presence of incrustations on the surface of the ramie fibres accounts for the unabsorbent nature of the paper, and also causes the marked deficiency of felting properties, as shown by the comparative weakness of the waterleaf paper, although the individual ramie fibre is stronger than either flax or hemp. In the case of pulp (*b*) the unbleached cotton is also less absorbent than the flax and hemp, and the paper is less strengthened by the animal size than paper (*a*). When the rosin-sized papers were subsequently sized with gelatin the paper containing the cotton increased 25 per cent. in strength, whereas the ramie paper increased only slightly. The author concludes that ramie is unsuitable for the manufacture of strong papers, and its great transparency is not favourable to the water-marking. Phormium (New Zealand flax) is a fibre which felts very well, and should prove an excellent constituent for water-marked bank papers; certain of the Russian notes contain a layer of phormium mixed with hemp. Since the strength requisite for bank notes can only be obtained by using semi-crude fibres beaten very "wet," the resultant transparency causes difficulties in fine engraving. In the author's opinion the desirable strength, combined with opacity, would be afforded by the use of the Japanese paper-mulberry fibre if it were obtainable in a regular supply. A very good substitute for this can, however, be got from several European species of mulberry trees of the genus *Morus*. The author has prepared pulps from these, and finds that they bleach well and give very strong papers, with an exceptionally high resistance to crumpling.—J. F. B.

Paper Machine; Cleaning the Wire of the ——. J. K. Wochenbl. f. Papierfab., 1904, **35**, 2837—2838.

The writer recommends the use of a steam jet for keeping the wire cloth of the paper machine free from impurities. A spraying pipe, connected with a ¾-in. steam pipe, is placed on the under side of the wire cloth, about 4 ins. in front of or behind the tension roll or near one of the other guide rolls. The spray should not be more than 2 ins. away from the surface of the wire. This spray can be applied at any convenient time, but preferably immediately after the machine stops work, the wire being run round several times for the purpose; a regular spraying every other day should suffice to keep the wire in good condition.—J. F. B.

English Patents.

Paper and like Material; Machine for Coating ——. L. W. Noyes, Mechanicsville, N.Y., and J. W. Krueger, New York, U.S.A. Eng. Pat. 11,253, May 16, 1904.

In order to increase the speed with which a web of paper may be passed through the coating machine, the web, as it emerges from the coating devices, is engaged by a suction box, from which it is transferred to a double or compound apron composed of a short endless apron of continuous material, and a long endless apron of perforated material. Both aprons travel in the same plane, and the brushes operate upon the paper, whilst the latter is supported by both aprons; after the short apron has returned, however, the web still passes on the long apron over a final suction box, immediately above which is another brush; the long apron then returns, and the paper passes on to the driers. —J. F. B.

Pulp Strainers for Paper Manufacture. P. Nebrich, Prag-Schmichow, Germany. Eng. Pat. 16,403, July 14, 1904.

A compartment is formed by two vertical slotted strainer plates situated in a vat; the top of this compartment is closed by a movable cover, and a valved opening at the bottom communicates with a waste-channel. The crude pulp is introduced into the compartment between the two strainer-plates, and is there subjected to the oscillating movement of a centrally pivoted plate swinging on a horizontal axis. The oscillating motion at each stroke forces the fibres through two diagonally opposite half-sections of the strainer-plates, at the same time creating a suction on the complementary half-sections, which washes the slots free from knots. The latter collect at the bottom, and are removed from time to time through the waste valve. —J. F. B.

United States Patent.

Binding Mediums for Colours [for Paper, &c.]; Production of ——. C. H. Voigt, Assignor to L. Voigt, Leipzig-Plagwitz, Germany. U.S. Pat. 770,202, Sept. 13, 1904.

As a substitute for animal glue to be used with colouring naterial for pasteboard, &c., 100 parts of starch, 4–6 parts f a mixture of an "alkaline sulphate and a superoxide compound," and 300—500 parts of water, are heated together under pressure at 100°—200° C.—M. J. S.

French Patents.

Printing Papers; Manufacture of ——. J. von Schmaedel. Fr. Pat. 342,206, April 11, 1904.

A solution of a suitable glucoside, such as esculin, saponin, &c., is added to the paper either by impregnation of the inished or partially finished paper, or by incorporation with he pulp. The saponin renders the paper very pliable, and nables it to take a surface which is eminently fitted for eceiving the colours and inks in printing.—J. F. B.

Paper Pulp; Filter for ——. F. G. Busbridge. Fr. Pat. 342,265, April 13, 1904. Under Internat. Conv., Nov. 17, 1903.

EE Eng. Pat. 25,073 of 1903; this J., 1904, 677.—T. F. B.

Celluloid Composition; New ——. R. Ortmann. Fr. Pat. 342,464, April 19, 1904.

Ordinary pyroxylin, 1 kilo., is mixed with 0·065 litre of urpentine, 0·25 litre of a ketone, and 0·25 litre of ether; ·5—0·75 litre of methyl alcohol is then added, and the ixture is allowed to remain for 12 hours before being illed between hot rolls. Venice turpentine and acetone ield the best results, but any turpentines or derived resins nd any ketones may be used.—J. F. B.

Collodion and Cellulose Solutions; Apparatus for Filtering and Spinning Filaments from ——. Soc. Desmarais et Morane and M. Denis. Fr. Pat. 342,655, April 26, 1904. V., page 933.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Cinchonine Iso-Bases. Z. H. Skraup and R. Zwerger. Monatsh. Chem., 1904, 25, 894—906.

URTHER experiments have been made with a view to conrming the authors' opinion that the relations between nchonine and the so-called iso-bases, *i.e.*, *α-i-* and *β-i-*nchonine, and allocinchonine may be most clearly shown by formulæ differing not so much structurally as stereochemically. The work comprised experiments on: the action of hydrochloric acid on *α-i*-cinchonine both at the ordinary and at higher pressures; decomposition of hydrochloro-*α-i*-cinchonine by alcoholic potash; heating trihydrochlorocinchonine with hydrochloric acid in a sealed tube; action of hydrochloric acid on *β-i*-cinchonine; allocinchonine and hydrochloric acid; *α-i*-cinchonine and hydrobromic acid; action of chlorine on the cinchonine bases.—A. S.

Clove Oil; Refractive Index of ——. W. H. Simmons. Chem. News, 1904, 90, 116.

The author points out the usefulness of the determination of the refractive index to distillers of clove oil. With pure oils the refractive index is approximately proportional to the percentage of eugenol. In the case of adulterated oils, however, the refractive index cannot be regarded as a measure of the amount of eugenol, as is shown by the figures for No. 9 in the following table:—

Sample.	Specific Gravity at 15°/15° C.	Rotation. $[\alpha]_D$	Refractive Index. $n_D^{20°}$	Phenols.
				Per Cent.
No. 1	1·0606	..	1·5382	93·0
,, 2	1·0509	− 0° 44′	1·5318	88·0
,, 3	1·0506	− 0° 53′	1·5304	86·0
,, 4	1·0475	− 1° 0′	1·5304	86·0
,, 5	1·0455	− 0° 23′	1·5297	85·5
,, 6	1·0560	− 0° 35′	1·5310	92·0
,, 7	1·0549	− 0° 40′	1·5340	91·5
,, 8	1·0507	− 0° 54′	1·5336	87·0
,, 9	1·0617	− 0° 20′	1·5327	82·0

—A. S.

Acorus Calamus; Constituents of the Essential Oil of ——. H. Thoms and R. Beckstroem. Ber. Pharm. 38, 187. Pharm. J., 1904, 73, 428.

The following constituents have been recognised in the essential oil of sweet flag (*Acorus calamus*):—Free normal heptylic and palmitic acids, eugenol, asaryl aldehyde, esters of acetic and palmitic acids, the crystalline body, $C_{15}H_{26}O_2$, m. pt. 168° C., previously detected by Schimmel and by Soden and Rojahn, which the authors name *calameone*, and asarone, $C_{12}H_{16}O_3$. Asarone forms a solid compound with phosphoric or arsenic acid, in the same manner as cineol [eucalyptol]. During the reaction it becomes polymerised, forming *parasarone*, $(C_{12}H_{16}O_3)_3$, a product which becomes transparent and vitreous at 173° C., and melts at 203° C., and is readily soluble in most organic solvents.—A. S.

Cascara Bark; Chemical Examination of ——. H. A. D. Jowett. Amer. Pharm. Assoc., 1904. Chem. and Druggist, 1904, 65, 509.

The author finds that cascara sagrada contains emodin, glucose, and small amounts of (1) a substance apparently an isomeride of emodin, and possibly identical with the *iso*-emodin obtained from *Rhamnus frangula* bark; and (2) a substance which yields syringic acid when treated with acids. No evidence could be obtained of the existence of chrysophanic acid or chrysarobin, or of glucosides yielding, on hydrolysis, emodin, chrysophanic acid, or rhamnetin (compare this J., 1893, 513; 1898, 792; 1901, 66). Emodin, though insoluble in water, is soluble in the aqueous extract of cascara bark, and can be extracted only slowly and with difficulty by shaking with immiscible solvents. This behaviour probably accounts for the statements that cascara bark does not contain emodin. If the aqueous extract be treated with acids, the substances soluble in water are decomposed with formation of resins, and the emodin can then be readily extracted. Cascara sagrada also contains a hydrolytic enzyme capable of decomposing amygdalin, and about two per cent. of a fat consisting of arachidic acid, both free and combined with an alcohol, and substances, probably glycerides, yielding linolic and myristic acids on hydrolysis. The alcohol with which the arachidic acid is combined, has been named *rhamnol*. It has the composition $C_{20}H_{34}O$, melts at 135°—136° C., and is identical with the alcohol obtained from Kô-sam seeds by Power and Lees (this J., 1903, 1013). Physiological experiments showed that emodin is not the active constituent of cascara sagrada. The active principle or principles were not isolated, but are contained in that portion of the extract which is precipitated by lead subacetate. It is also soluble in water and in alcohol.—A. S.

Phenol; Volumetric Determination of ——. F. X. Moerk. XXIII., page 953.

Aldehydes [*in Essential Oils*]; *Detection of* ——, *and the Constitution of Nitrosodimethylaniline.* G. Velardi. XXIII., page 952.

Rhubarb; Colorimetric Valuation of ——. A. Tschirch. XXIII., page 953.

United States Patents.

Metatolylsemicarbazide. J. Callsen, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 765,164, July 19, 1904.

By treating *m*-tolylhydrazine with cyanic acid or its salts, metatolylsemicarbazide is obtained in the form of colourless crystals of m. pt. 183°—184° C., sparingly soluble in cold water, soluble in hot water and alcohol, and insoluble in ether. It is said to possess therapeutic (antipyretic) properties.—T. F. B.

Polychloral, and Process of Making same. S. Gærtner Halle-on-the-Saale, Germany. U.S. Pat. 768,744, Aug., 30, 1904.

Chloral is polymerised by gradually adding an amine (*e.g.*, pyridine) to cooled chloral, with constant stirring, until the mass solidifies, when it is shaken with dilute hydrochloric acid, and the residue washed and dried. Polychloral, as thus obtained, is a slightly volatile anæsthetic substance, capable of volatilisation without melting, converted by hot water or hot alcohol into chloral hydrate or chloral alcoholate, and decomposed by alkalis into chloroform and formic acid.—T. F. B.

Iron and Arsenic; Soluble Compound of ——, *and Process of Making same.* L. Spiegel, Charlottenburg, Germany. U.S. Pat. 768,886, Aug. 30, 1904.

See Fr. Pat. 336,127 of 1903; this J., 1904, 383.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

English Patent.

Sensitising Dyestuffs [*for Photographic Purposes*]; *Manufacture of New* ——, *and Intermediate Products for Use therein.* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 25,144, Nov. 18, 1903.

See U.S. Pat. 752,323 of 1904 and Fr. Pat. 337,704 of 1903; this J., 1904, 337 and 486 respectively.—T. F. B.

United States Patent.

Colour Photography. W. C. South, Berwyn, Pa. U.S. Pat. 769,773, Sept. 13, 1904.

See Eng. Pat. 125 of 1903; this J., 1903, 380.—T. F. B.

French Patent.

Photographs on Linen or other Fabrics or Substances; Production of ——. O. Fulton and W. M. Gillard. Fr. Pat. 342,328, April 5, 1904. Under Internat. Conv., May 16, 1903.

See Eng. Pat. 11,219 of 1903; this J., 1904, 622.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

Nitrocellulose; Determination of the Stability of ——. E. Bergmann and A. Junk. XXIII., page 953.

Double Acetylides. A. E. Edwards and W. R. Hodgkinson. XXIV., page 954.

English Patents.

Compositions for Fuses, Self-Propelling Explosive Projectiles, or the like; Slow-Combustion ——. W. T. Unge, Stockholm. Eng. Pat. 23,766, Nov. 2, 1903.

See Fr. Pat. 336,266 of 1903; this J., 1904, 385.—T. F. B.

Explosives. H. J. Haddan, London. From J. Führer, Vienna. Eng. Pat. 3253, Feb. 9, 1904.

The disruptive power of explosives consisting of ammonium nitrate and aluminium powder is found to be considerably increased by the addition of the higher nitro-derivatives of benzene, phenols, and naphthalene, and especially toluene. An example of such an explosive mixture is ammonium nitrate, 65 parts; carbon, 2 parts; dinitrotoluene, 10 parts; aluminium, 23 parts. The addition of carbon is also claimed as rendering the mixture less hygroscopic.—T. F. B.

[*Explosive*] *Nitrated Carbohydrates.* A. Hough, Dover, N.J., U.S.A. Eng. Pat. 12,627, June 3, 1904. Under Internat. Conv., June 13, 1903.

See U.S. Pat. 751,076 of 1904; this J., 1904, 385.—T. F. B.

United States Patents.

Explosive. H. von Dahmen, Assignor to Firma G. Roth, Vienna. U.S. Pats. 770,046 and 770,047, Sept. 13, 1904.

See Eng. Pat. 3253 and Fr. Pat. 341,633 of 1904; see above, and this J., 1904, 882.—T. F. B.

Lubricant for Oiling Guns; Alkaline ——. J. G. Wild, Assignor to Winchester Repeating Arms Co. U.S. Pat. 768,835, Aug. 30, 1904. III., page 931.

French Patent.

[*Nitrocellulose*]; *Method for Nitrating* ——. J. Selwig Fr. Pat. 342,502, April 21, 1904.

While cellulose is being nitrated in a centrifugal nitrating apparatus it is proposed to make the acid circulate continuously through the material by means of a pump, for the purpose of producing a more uniform nitration and avoiding local centres of heating.—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

United States Patent.

Pouring and Filtering; Apparatus for ——. E. Keller and A. Ferrell, Baltimore, Md. U.S. Pat. 768,605 Aug. 30, 1904.

The funnels are held in an adjustable rack above the row of beakers in which the filtrate is to be received. The beakers holding the liquids to be filtered are mounted in another rack, in which they are held by clamps, which also hold pouring rods against the lips of the beakers. By suitable mechanism, the beakers can be tilted to the desired extent and a continuous stream of liquid poured into the funnels. Means are provided for adjusting beakers of different sizes in the rack so that their lips are all in the same line.—W. H. C.

INORGANIC—QUALITATIVE.

Phosphide, Arsenide, and Antimonide of Hydrogen; Reagent for ——. P. Lemoult. Comptes rend., 1904, **139** 478—480.

Mercuric iodide dissolved in excess of potassium iodide solution, but not rendered alkaline as in preparing Nessler's reagent, forms a very sensitive reagent for the detection of phosphine, arsine, and stibine, with each of which i forms a crystalline precipitate, orange-yellow, light brown and dark brown respectively, of formula RHg_3I_3. The precipitates are readily decomposed by alkalis or by strong nitric acid or *aqua regia*.—J. T. D.

Precious Metals; Coloration of the Borax Bead by Colloidal Dissolved —— [Detection of]. J. Donau. Monatsh. Chem., 1904, **25**, 913—918.

The author finds that the colorations imparted to a fused borax bead by the precious metals afford an extremely sensitive test for their detection. The colour produced is, in general, the same as that of a colloidal solution of the metal. In the case of gold, the bead is first coloured red or purple; on heating for a longer time, the colour changes first to blue, then to greenish-blue, and finally disappears. The smallest weight of gold which can be detected is 0·025 μ grm. (0·000025 mgrm.). Alkali salts, silicic acid, and iron have practically no influence on the test; platinum, if the amount present be greater than 6 per cent. of that of the gold, obscures the reaction. The coloration is not produced if the gold solution contains free sulphuric acid or free halogens. Silver colours the borax bead yellow, the coloration appearing after 1—2 mins., but disappearing again on continued heating; the smallest amount which can be detected is 0·18 μ grm. In the case of platinum the borax bead appears fawn-coloured by transmitted light, and "milky" by reflected light. The smallest quantity which can be detected is 0·05 μ grm. The coloration disappears on continued heating of the borax bead, but it persists longer than in the case of gold. Iridium and osmium colour the bead in the same manner as platinum, but no turbidity is to be observed by reflected light. With rhodium the borax bead appears brown by transmitted light and a slate-gray by reflected light. Palladium and ruthenium colour the bead black. Figures are cited showing that the above colour reactions are much more sensitive than the usual methods for the detection of small quantities of the precious metals.—A. S.

INORGANIC—QUANTITATIVE.

Flue Gases; Rapid Method for Testing ——. H. Le Chatelier. Bull. Soc. d'Encourag., 1904, **106**, Rev. Metall., 471—472.

The author has devised the following apparatus:—Two wires of silver or platinum, 1 metre long, are fixed parallel to and electrically insulated from each other. The ends are 1 cm. apart, and are steeped in a semi-fluid mixture composed of equal weights of flax and kaolin or some pure clay, and the mass connecting the ends is then dried and calcined. This porous mass is next soaked in a 10 per cent. solution of copper nitrate, dried, and calcined till the mass blackens. It is then reduced in an illuminating-gas flame, and tested to see if it allows an electric current to pass. The open ends of the wires are then connected to the poles of a Leclanché battery, and put in circuit with a galvanometer or an electric bell. The covered ends of the wires are placed in the path of the hot flue gases, which should have a temperature of about 500° C. When there is an insufficiency of air to complete combustion, the copper oxide on the dry clay is reduced to copper, the electric current then passing, and actuating the bell or galvanometer. When there is sufficient air, no current passes, copper oxide being a bad conductor.—L. F. G.

Hydrogen Contents of Gaseous Mixtures; Method for the Continuous Determination of ——, and Apparatus therefor. W. P. Thompson, Liverpool. From Verein. Maschinenfabr. Augsburg und Maschinenbauges. Nürnberg, A.-G., Nuremberg, Germany. Eng. Pat. 15,706, July 14, 1904.

The method is based on the fact that the conductivity of hydrogen, both for heat and for electricity, is considerably greater than that of other gases, and therefore the conductivity of the gaseous mixture affords an indication of its hydrogen content. One form of apparatus consists of a wide tube, through which passes a current of the gas to be examined, and which contains a coiled tube heated by a current of some fluid (gas or liquid) which enters it at a constant temperature. From the temperature of the heated fluid as it emerges from the coiled tube the hydrogen content of the gas under examination can be calculated. In another form of apparatus, the variation in conductivity of the gaseous mixture is judged by the variation in length of a metal rod placed in the gas and heated to a constant temperature. In a third form, the hydrogen content is ascertained by the alteration in resistance of a helix placed in the gaseous mixture, and heated by a constant electric current; whilst a fourth form consists of two electrodes fixed a certain distance apart in a tube through which the gas circulates, the variation in potential difference between the electrodes affording a basis for calculating the hydrogen content of the mixture.—T. F. B.

Phosphorus in Calcium Carbide; Determination of ——. H. Lidholm. Z. angew. Chem., 1904, **17**, 1452—1453.

The author finds that in the determination of phosphorus in calcium carbide by evolving and burning acetylene from it, and determining the phosphoric acid in the collected products of combustion, if dilute alcohol be used instead of water alone, the rate of evolution and combustion can be made perfectly regular. Ten grms. of the powdered sample are placed in a crucible, which is put into a very wide necked 500 c.c. flask, the cork of which carries a stoppered dropping-funnel, a tube for the entry of hydrogen, and a reflux condenser, the upper end of the latter being connected with a burner. The burner is placed under a vertical wide glass tube, connected with a wash-bottle containing water; during the experiment a strong current of air is aspirated through the wide tube and wsh-bottle, in both of which are collected the products of combustion of the acetylene. The apparatus is filled with hydrogen, which is then lighted at the burner; 50 c.c. of alcohol are poured in through the funnel, and water is gradually added. When no more gas is evolved, hydrochloric acid is added till the lime is dissolved, the liquid boiled, and the flame allowed to burn 10 minutes after all luminosity has disappeared, and the absorbing apparatus is then washed out into a beaker, with water and ammonia, the liquid filtered from any separated silica, and the phosphoric acid determined by means of magnesia mixture. Closely concordant results are said to be obtained. The solution of the lime by hydrochloric acid is merely to render the boiling safer; all the phosphorus is evolved by water alone.—J. T. D.

Chloric Acid; Determination of ——. W. S. Hendrixson. Amer. Chem. J., 1904, **32**, 242—246.

The author has found that metallic iron readily reduces free chloric acid even in very dilute solutions. Chlorates or bromates may be estimated by adding excess of iron in the presence of sulphuric acid. The reduction is complete in about an hour, and no heating is necessary. The iron is then oxidised with nitric acid and the halogen hydracid titrated by Volhard's method. The advantages claimed are great simplicity, and absence of errors due to heating. Perchloric acid is not reduced, so does not interfere.
—F. Sdn.

Alkali Chromates; Action of Nitric and Acetic Acids on ——. [Determination of Chromium.] A. Leuba. Ann. Chim. anal. appl., 1904, **9**, 303—304. Chem. Centr., 1904, **2**, 849.

The author finds that in the analysis of minerals containing chromium, if the melt obtained by fusing with sodium carbonate be dissolved in nitric acid, the hydroxides of iron and aluminium subsequently precipitated by ammonia always contain chromium. This is owing to the reducing action of nitric acid on the alkali chromate. By repeatedly evaporating a quantity of potassium bichromate with nitric acid, 9 per cent. of it undergoes decomposition with formation of chromium sesquioxide. Acetic acid acts in a similar manner to nitric acid.—A. S.

Iodine; Determination of —— in presence of Bromine and Chlorine. E. Thilo. Chem.-Zeit., 1904, **28**, 866.

When silver nitrate solution is added to a solution containing chloride, bromide, and iodide, the whole of the iodine is precipitated first as silver iodide, followed by the bromine, no silver chloride being formed till the whole of the bromine has been precipitated. The point at which the precipitation of the iodine is complete is determined by placing drops on a strip of filter-paper freshly wetted with dilute palladium chloride solution. The method is applied to crude iodine or cuprous iodide as follows:—5 grms. of the substance are treated with 50 c.c. of water and 2 grms. of zinc dust, and when all the iodine is converted into zinc iodide the mixture is filtered into a 500 c.c. flask, the residue washed, transferred to a small beaker, dissolved in dilute nitric acid, excess of zinc dust added, and the mixture filtered into the flask. After making up, 50 c.c. are titrated with N/10 silver nitrate solution, till a drop gives no black spot on the palladium paper. Chlorine or bromine, if present, may now be determined in the liquid by adding a crystal of potassium chromate, titrating with the N/10 silver nitrate, adding nitric acid to dissolve the red silver chromate, filtering in a Gooch crucible, and weighing. The excess of silver in the filtrate is titrated with thiocyanate, after reducing the chromate by ferrous sulphate (and, if need be, concentrating the liquid). From the weight of the mixed precipitate, and the amount of silver it contains, the chlorine and bromine can be calculated. It is stated that relatively small amounts of iodine can be determined in presence of considerable quantities of chlorine and bromine by this method. In testing commercial potassium iodide, the silver iodide separates in a colloidal form, and the end-point cannot be determined; but the addition of 1—2 grms. of sodium chloride completely overcomes this difficulty.—J. T. D.

Gold and Silver in Zinc Ores; Crucible Charge for [Determination of] ——. E. J. Hall and E. Popper. School of Mines Quart., 1904, **25**, 355—358.

As the result of a large number of experiments, the authors conclude that, in the determination of gold and silver in zinc ores by the crucible method, the amount of litharge used should be just sufficient to give a lead button large enough to collect the gold and silver, since lead oxide in the slag seems to interfere with the complete decomposition of the ore, and prevent the formation of a slag which is free from lumps, and which can be readily poured. The amount of sodium carbonate should be from four to five times that of the ore. Borax glass should be added in amount sufficient to prevent the charge from being entirely basic, and to assist in fluxing the gangue minerals not acted on by sodium carbonate alone. If necessary, an amount of argol sufficient to reduce the whole of the litharge should be added, whilst if the ore contain more than 15 per cent. of pyrites, the addition of a couple of [iron] nails will prevent the formation of a brittle button. The following charge was found to be the most suitable one for a 20-grm. crucible, the quantities being given in A.T. (assay tons): Ore, $\frac{1}{3}$; sodium carbonate, $1\frac{1}{3}$; borax glass, $\frac{1}{2}$; litharge, $\frac{4}{5}$. The most suitable temperature is 750°—775 C., and the time required for the fusion is 30—35 minutes. The method gives good results with ores containing up to 7·5 per cent. of copper.—A. S.

Platinum-Gold-Silver Alloys; Analysis of ——. Hollard and Bertiaux. Ann. Chim. anal. appl., 1904, **9**, 287—292. Chem. Centr., 1904, **2**, 852.

The authors find that by the usual methods for the analysis of platinum-gold-silver alloys, the results are too low for the gold and too high for the platinum and silver, but are very accurate for the gold and platinum together. The following method is recommended for the determination of the silver: The alloy, cut into small pieces or rolled out to a leaf, is dissolved in *aqua regia* (1 vol. of nitric acid + 5 vols. of hydrochloric acid), the solution is evaporated to the consistence of a syrup, and then evaporated to dryness three times with addition of nitric acid, the residue boiled with a few c.c. of water, 2 c.c. of nitric acid, and 2 drops of hydrochloric acid, the liquid diluted to 100 c.c., the silver chloride filtered off, washed well, dissolved in 30 c.c. of a 20 per cent. solution of potassium cyanide, the solution diluted to 150 c.c. and electrolysed. The separated silver is dissolved in nitric acid, and determined by titration with thiocyanate solution.—A. S.

Electrolysis with Rotating Cathode. H. E. Medway. Amer. J. Science, Silliman, **18**, 56—58. Chem. Centr., 1904, **2**, 809.

By using the rotating platinum crucible cathode previously described (this J., 1903, 823), many metals can be separated in a short time, by the aid of a high current density, as is shown by the following results: 0·2 grm. of cadmium was separated in 10—15 minutes from a solution slightly acid with sulphuric acid; the current density was 5—6·6 and the cathode was rotated at the rate of 650—700 revolutions per minute. Towards the end of the process, ammonia was gradually added to prevent re-solution of the deposited cadmium. Tin was completely deposited in 15—20 minutes from 20 c.c. of a solution of stannous ammonium chloride to which had been added 100 c.c. of a cold saturated solution of ammonium oxalate; current density, 6·6—12. The whole of the zinc was deposited in 25—30 minutes from 50 c.c. of a solution of zinc sulphate containing 4 grms. of potassium oxalate; current density, 6·6—8·3. Gold was completely precipitated in 25—30 minutes from 25 c.c. of a solution of the chloride, to which had been added excess of potassium cyanide and 30 drops of ammonia solution.

—A. S.

ORGANIC—QUALITATIVE.

Aldehydes; Detection of ——, and the Constitution of Nitrosodimethylaniline. G. Velardi. Gaz. chim. ital., 1904, **34**, 66—74. Chem. Centr., 1904, **2**, 733—734.

The reaction of Rimini (Gaz. chim. ital., **31**, [1], 84), which depends upon the splitting up of Piloty's benzenesulphonehydroxamic acid, $C_6H_5SO_2NHOH$, in alkaline solution, into benzenesulphinic acid and nitroxyl, $:N.OH$, the latter then combining with any aldehyde present to form the corresponding hydroxamic acid, is of general applicability, and can be used for the detection of unsaturated aldehydes in complex mixtures, *e.g.*, in natural oils. The reaction is not, however, a quantitative one, as the liberated nitroxyl also acts on unsaturated compounds at their double linkings, with formation of the corresponding oximes:— $R.CH:CH.R \rightarrow R.C(:NOH)CH_2R$. For the detection of aldehydes in essential oils, a few drops of the latter are heated with a trace of Piloty's acid and alcoholic potassium hydroxide solution, the mixture is cooled, diluted with water, some ether added, and then, after neutralising with hydrochloric acid, also some ferric chloride. Petitgrain, cinnamon, orange-peel, lavender, bergamot, angelica, fennel, rosemary (French), and lemon oils, among others, gave a red coloration; coriander and sassafras oils, on the other hand, a yellow coloration. The reaction with nitroxyl can also be used to ascertain the constitution of nitroso compounds, which behave in this respect like aldehydes. For instance, nitrosodimethylaniline, when treated with nitrohydroxylaminic acid, yields, on addition of barium chloride, the barium salt of dimethylaminonitrosophenylhydroxylamine, $C_6H_4.N(CH_3)_2.N(NO)OH$. It is thus a true nitroso compound of the constitution, $C_6H_4(NO)N(CH_3)_2$.—A. S.

ORGANIC—QUANTITATIVE.

Organic Matter; New [Electrolytic] Method for the Destruction of —— in Toxicological Analysis. O. Gasparini. Atti. R. Accad. dei Lincei Roma, 1904, **13**, [2], 94—100. Chem. Centr., 1904, **2**, 852—853.

The substance to be analysed is covered with concentrated nitric acid, and after some time a current of 4—6 ampères is passed through. An E.M.F. of 8 volts is used.—A. S.

Petroleum; Determination of Impurities in Crude ——. R. Nettel. Chem.-Zeit., 1904, **28**, 867.

Mud from the borehole is determined by mixing a known quantity of the oil with petroleum spirit, filtering, and weighing.

Water is determined by mixing 100 c.c. of the oil with an equal volume of petroleum spirit in a stoppered separator adding 50 c.c. of N/10 hydrochloric acid, and shaking vigorously for five minutes. The mixture is then left at rest at 65° C. for half an hour, and 25 c.c. of the separated acid are titrated with alkali. From the loss of strength of the acid, due to dilution, the amount of water in the oil is calculated. The author has proved experimentally that—1. The water in crude petroleum has neither acid nor alkaline reaction. 2. The added acid mixes thoroughly with any water present (experiments with known quantities of added water showed exactly the quantities added).

3. The crude oil has itself no reaction on the hydrochloric acid.

Solidifying Point.—The oil is cooled in a test-tube fitted with a two-holed cork. Through one hole passes the hermometer. Through the other is dropped at each degree-nterval a small shot. At the solidifying point the shot emains on the surface. With dark-coloured oils the shot nay be painted with zinc-white. On gradually warming ne solidified oil, the melting point is indicated by the inking of the shot.—J. T. D.

Sugars and Starch; Determination of —— in Vegetable Substances. J. S. Ford. Analyst, 1904, **29**, 277—279.

N the determination of sugars in substances like malt, which contain starch, it has been suggested that the material e first boiled with alcohol to destroy the enzymes present, fter which the sugars can be extracted with water. The uthor points out that this destruction of the enzymes does ot take place with alcohol of any strength, the best result eing obtained with about 95 per cent. (volume) alcohol; he actual volume of alcohol taken does not appear important, provided there is sufficient to cover the substance nd to boil readily. In the case of vegetable substances of n acid nature, boiling with alcohol even for half an hour ives rise to some inversion of sucrose, if present, and even with malts, slight hydrolysis occurs. If the substance be istinctly acid, a very slight excess of ammonia may be dded to the alcoholic mixture before boiling.—T. H. P.

Starch Syrups; Examination of ——. A. Rössing. Z. öffentl. Chem., 1904, **10**, 277—279. Chem. Centr., 1904, **2**, 855.

HE author's method for the determination of dextrose this J., 1904, 386), failed in the case of three samples f starch syrup recently examined by him, the amount of extrose found exceeding considerably the amount calculated from the direct cupric-reducing power of the sample, lthough by the latter method, the reducing dextrins would e returned as dextrose. No other kinds of sugar were resent. The syrups in question had been prepared by means of dilute hydrochloric acid, and the inaccurate esults were found to be due to the fact that when starch s hydrolysed by means of very dilute hydrochloric acid nder certain conditions, the reducing power of the glucose roduced is diminished by the baryta treatment (*loc. cit.*) o a considerably greater extent than is that of a normal pecimen of glucose.—A. S.

Phenol; Volumetric Determination of ——. F. X. Moerk. Amer Druggist, **45**, 144. Pharm. J., 1904, **73**, 453.

s the ordinary method of determining phenol by treating with excess of bromine in presence of hydrochloric or lphuric acid, and determining the excess of bromine by lding potassium iodide and titrating with thiosulphate olution in presence of starch, the final reaction is obscured o some extent by the precipitated tribromophenol. If, owards the end of the titration, a small quantity of chloroorm be added, the tribromophenol is dissolved, and the nal point of the titration can be more readily observed.
—A. S.

Rhubarb; Colorimetric Valuation of ——. A. Tschirch. Pharm. Centralb., **45**, 496. Pharm. J., 1904, **73**, 428.

HE method is based upon the hydrolysis of the anthraucosides and the subsequent extraction of the oxymethylnthraquinones by ether. 0·5 grm. of the finely-powdered ubarb is heated for 15 minutes with 50 c.c. of 5 per cent. lphuric acid under a reflux condenser. After cooling, e mixture is extracted with successive quantities of ether, ntil that solvent remains colourless when treated with a ace of potassium hydroxide. The separated aqueous quid is then heated, to expel dissolved ether, boiled for a rther 15 minutes as before, and again extracted with successive quantities of ether. When no more soluble matter removed, the combined ethereal extracts are shaken with 0 c.c. of a 5 per cent. solution of potassium hydroxide, in ccessive portions, until the alkaline liquid is no longer loured red. The red solution is diluted to 500 c.c. with stilled water, 100 c.c. are withdrawn and diluted to 1 litre, en 350 c.c. of this solution are taken and diluted to 1 litre. The depth of colour of the solution should now be about the same as that of an alkaline aloe-emodin solution of the strength of 1 : 1,000,000. It is matched against the colour of a solution containing a known weight of aloe-emodin rendered slightly alkaline with potassium hydroxide. Rhubarb of good quality should yield from 2·8 to 4 per cent. of oxymethylanthraquinones by this method.—A. S.

Nitrocellulose; Determination of the Stability of ——. E. Bergmann and A. Junk. Z. angew. Chem., 1904, **17**, 982—985, 1018—1023, 1074—1077.

The apparatus and method described have been in use in the Prussian testing station for the past six years. The apparatus consists of a closed copper bath provided with a condenser and 10 countersunk tubes of 20 cm. length. By boiling amyl alcohol in the bath, the tubes can be kept at a constant temperature of 132° C. The explosive to be tested is placed in a glass tube 35 cm. long and 2 cm. wide, having a ground neck into which an absorption bulb is fitted. The whole apparatus is surrounded by a shield, in case of explosion. In carrying out the test, 2 grms. of the explosive are placed in the glass tube and well pressed down. The absorption bulb is half filled with water, and fitted into the ground neck of the glass tube, which is then placed in one of the tubes in the bath previously brought to the boiling point (132° C.). The evolved oxides of nitrogen are absorbed in the water in the bulb, and at the end of two hours the tubes are removed from the bath, and, on cooling, the water from the bulb flows back and wets the explosive. The contents of the tube are filtered and washed. The filtrate is oxidised with permanganate, and the nitrogen determined as nitric oxide by the Schulze-Tiemann method. The authors conclude that a stable gun-cotton does not evolve more than 2·5 c.c. of nitric oxide per grm. on being heated at 132° C. for two hours, and a stable collodion cotton not more that 2 c.c. under the same conditions. When, in the course of purification, the evolution of nitric oxide is once brought below the limits specified, further purification does not appreciably diminish the proportionate evolution of nitric oxide per grm. In the tables which follow, the figures represent c.c. of nitric oxide per grm. on heating at 132° C. or two hours.

Pulping and Washing.—The influence of these two processes is shown in the following table:—

	Collodion Cotton.		Guncotton.	
	1 Hour.	2 Hours.	1 Hour.	2 Hours.
	c.c.	c.c.	c.c.	c.c.
Half pulped	..	..	6·1	..
Fully pulped	0·8	1·7	1·5	2·8
5 changes hot water....	0·7	1·7	0·9	2·2
50 „ „	0·7	1·5	0·8	2·4

Moisture.—The percentage of moisture in the sample to be tested should be kept as low as possible. A nitrocellulose containing 1·97 per cent. of moisture gave an evolution of 2·6 c.c. per grm., while the same sample with 3·4 per cent. of moisture gave an evolution of over 50 c.c. per grm.

Sodium Carbonate.—Under the conditions of the experiment, the addition of dry sodium carbonate to an unstable nitrocellulose diminishes the rate of decomposition. If sodium carbonate be intimately mixed with a stable nitrocellulose, the rate of decomposition will be increased. The following table shows the effect of sodium carbonate under different conditions:—

Conditions.	Stable Nitrocellulose, 2 Hours.	Unstable Nitrocellulose. 2 Hours.
	c.c.	c.c.
Without addition..................	2·5	23·9
+ 5 % dry Na_2CO_3..................	2·5	13·3
+ 10 % „ „	2·5	7·1
+ 5 % $Na_2CO_3 10H_2O$	2·5	7·0
+ 10 % „ „	5·2	7·1
+ 5 % Na_2CO_3 dissolved in water	16·8	18·2

Calcium Carbonate and Mercuric Chloride.—These two bodies showed practically no influence on the rate of decomposition.

Alcohol.—When an unstable nitrocellulose is extracted for a short time with alcohol a stable compound is immediately produced.

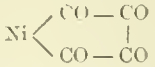
Solubility in Ether-Alcohol.—The percentage solubility of a nitrocellulose rises on heating at 132° C. A sample which before heating had a solubility of 4·7 per cent., had its solubility increased to 82·5 after six hours' heating. See also this J., 1903, 511, 924 and 1208; 1902, 687—689, 819—825 and 1470-1; 1901, 8—13, 609—617 and 1555—6; 1899, 174 and 857-8; 1898, 1180; 1897, 283—290.
—G. W. McD.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Nickel Carbonyl; Constitution of ——. H. O. Jones. Brit. Assoc., 1904. Chem. News, 1904, **90**, 144—145.

Nickel carbonyl reacts like a ketonic substance in that it forms compounds with hydroxylamine and hydrazine. It also reacts with Grignard's alkyl-magnesium iodides yielding products containing nickel, magnesium and iodine. With phenyl-magnesium iodide it yields a product, which when treated with acids gives rise to a mixture consisting chiefly of diphenyl and benzoin. All reactions of nickel carbonyl which have been described previously can be equally well explained by means of either of the two formulæ—

and



but benzoin should theoretically be formed in a much simpler way from a compound with the second formula.—A. S.

Titanium and Tin Compounds; Some ——. F. Emich. Monatsh. Chem., 1904, **25**, 907—912.

Barium-titanium fluoride, $2BaTiF_6.H_2O$, was prepared by treating a solution of potassium-titanium fluoride with the requisite quantity of barium chloride solution, in a platinum dish, and filtering off and washing the barium compound. On strongly heating the barium titanium fluoride in a platinum retort connected with a platinum U-tube cooled by a mixture of solid carbon dioxide and ether, there was found, in the neck of the retort after cooling, a white transparent substance, soluble in water and consisting of titanium fluoride.

The author found the solidifying point of titanium chloride to be −23° C., and the boiling point of tin tetraiodide, 341° C. (corr.).

A quantitative yield of potassium tin fluoride $K_2SnF_6.H_2O$ can be obtained by treating a solution of 27 grms. of tin tetrachloride in 270 c.c. of water with a warm solution of 57 grms. of crystallised potassium fluoride in 170 c.c. of water. The precipitated tin compound is recrystallised from boiling water and washed with cold water till free from chlorine. Barium-tin fluoride can be prepared in a similar manner.—A. S.

Acetylides; Double ——. A. E. Edwards and W. R. Hodgkinson. Brit. Assoc. 1904. Chem. News, 1904, **90**, 140.

The authors describe the action of acetylene on some silver salts. A number of organic salts such as silver acetate, benzoate and butyrate, yielded the same acetylide as that obtained from a neutral or faintly alkaline solution of silver nitrate. From a solution of silver nitrate in nitric acid of sp. gr. 1·3, an acetylide containing nitric acid as nitrate was obtained. Silver salts dissolved in potassium cyanide or in thiosulphate solution were not acted upon by acetylene. The product obtained by the action of acetylene on pure silver thiocyanate suspended in water, is explosive. It contains both sulphur and cyanogen, but it was not obtained in a pure state. From a boiling solution of silver bichromate, acetylene precipitates an orange-red salt of the composition ($Ag_2O.C_2H_2.Ag_2CrO_4$), whilst chromic acid liberated. When dry the salt is very sensitive to frictio and explodes violently at 157° C. The corresponding con pounds from silver sulphate, selenate, tungstate, an molybdate are all much less sensitive than that from th bichromate, and explode much more feebly. The con position of the products obtained from silver phosphate ar vanadate was not determined satisfactorily; the compoun explode in a very feeble but peculiar manner.—A. S.

Enzymes; Origin of ——. C. Beckenhaupt. Woch. f Brau., 1904, **21**, 548—551.

The author quotes the results of several recent investigatio which tend in his opinion to support the view that t activity of enzymes is a function connected in some mann with the mineral constituents of the medium. It is su gested that the enzymes are formed by the combinati of an albuminoid or nitrogenous molecule, such as aspar gin, with certain mineral constituents, the latter playi an important part, which part is determined by "molecul vibrations" under the influence of external forces, suc as moisture, heat, &c.—J. F. B.

New Books.

Anleitung zur Verarbeitung der Naphtha und ihr Produkte. Von N. A. Kwjatkowsky, Chem. u Ing. in Moskau. Autorisierte und Erweiterte deutsc Ausgabe. Von M. A. Rakusin. Julius Spring Monbijouplatz 3, Berlin, N. 1904. Price M. 4.

8vo volume containing subject matter filling 138 pag followed by a bibliographic index (5 pages) and two tabl The text is illustrated with 13 engravings. The treatme of the subject may be classified as follows:—I. Histori Statistical and Geographical; Petroleum industry in Bak &c. II. Origin and Occurrence of Petroleum. III. Chen cal Condition and Physical Properties of Petroleum. I Distillation of Petroleum and Petroleum Spirit, and App ratus required. V. Distillation of Petroleum Residu Apparatus, Increasing the Yield of Machine Oils, &c. V Decomposition of Crude Petroleum Naphtha in prepari Aromatic Hydrocarbons and Illuminating Oils. VII. R fining the Kerosine Distillate, &c. VIII. Refining t various Petroleum Fractions. IX. Purification of Lub cating Oil Distillates. X. Testing the Goods and th Properties, Apparatus required. XI. The different Co mercial grades of Petroleum Products. XII. Storage Petroleum oils, &c. XIII. (Appendix) Utilisation of t Spent Acids and Alkali Lyes.

The Industrial and Artistic Technology of Pai and Varnish. By Alvah H. Sabin, M.S., Lecturer New York University and the Massachusetts Institute Technology, &c. First Edition. John Wiley and So New York. Chapman and Hall, Ltd., 1904. Pri 12*s.* 6*d.*

Large 8vo volume, containing 364 pages of subject matt and the alphabetical index. The text contains numero illustrations, and may be classified as follows:—I. Intr duction. II. Early History. III. Varnish, Etymolog IV. and V. Linseed Oil. VI. Manufacture of Varni VII. Tung Oil. VIII. Japans and Driers. IX. Ros X. Spirit Varnishes. XI. Pyroxylin Varnishes. XII. O paints and Paints in Japan. XIII. Varnish or Enan Paints. XIV. Chinese and Japanese Lacquers. X Protection of Metals from Corrosion. XVI. Water-p Coating. XVII. Ships'-Bottom Paints. XVIII. Ship a Boat Painting. XIX. Carriage Painting. XX. Ho Painting. XXI. Furniture Varnishing.

FOOD INSPECTION AND ANALYSIS FOR THE USE OF PUBLIC ANALYSTS, HEALTH OFFICERS, SANITARY CHEMISTS, AND FOOD ECONOMISTS. By ALBERT E. LEACH, S.B., Analyst of the Massachusetts State Board of Health. First Edition. John Wiley and Sons, New York. Chapman and Hall, Ltd., London. 1904. Price 31*s.* 6*d.* nett.

LARGE 8vo volume containing 770 pages of subject matter with 119 illustrations, and at the close of the work and ollowing the alphabetical index, 40 plates giving microphotographs of cereals, legumes, miscellaneous starches, urmeric. sago, coffee, tea, chicory, cocoa, spices, and fats. The subjects treated may be generally gathered from the ollowing chapter headings :—I. Food Analysis and State Control. II. The Laboratory and its Equipment. III. Food, its Functions, Proximate Components and Nutritive Value. IV. General Analytical Methods. V. The Microscope in Food Analysis. VI. Milk and Milk Products. VII. Flesh Foods. VIII. Eggs. IX. Cereals and their Products, Legumes, Vegetables, and Fruits. X. Tea, Coffee, nd Cocoa. XI. Spices. XII. Edible Oils and Fats. XIII. Sugar and Saccharine Products. XIV. Alcoholic Beverages. XV. Vinegar. XVI. Artificial Food Colours. XVII Food Preservatives. XVIII. Artificial Sweeteners. XIX. Canned ud Bottled Vegetables, Relishes, and Fruit Products.

ABORATORY MANUAL OF ORGANIC CHEMISTRY FOR BEGINNERS. By Dr. A. F. HOLLEMAN. Appendix to Author's Text Book of Organic Chemistry. Translated from the Dutch by A. JAMIESON WALKER, Ph.D , B.A. With the co-operation of the Author. First Edition. John Wiley and Sons, New York. 1904. Price 4*s.* 6*d.* Chapman and Hall, Ltd., Henrietta Street, Covent Garden, London, W.C.

MALL 8vo volume containing 69 pages of subject matter ith two illustrations, and an alphabetical index. It is a oncise manual of qualitative reactions of organic comounds, and forms the companion volume of Holleman's ext Book of Organic Chemistry, also translated by A. J. Valker (see this J., 1903, 659).

Trade Report.

I.—GENERAL.

PATENTS ACT, 1902; OFFICIAL NOTICE RELATING TO THE ——.

Examination of Previous Specifications.

The following notice appeared in the *Illustrated Official urnal (Patents)* of 21st September :—

The Board of Trade, in pursuance of the provisions of tion 1, subsection 11, of the Patents Act, 1902, do hereby the 1st January, 1905, as the date for the coming into eration of section 1 of the above-mentioned Act, and do ler accordingly.

LGIUM; TRADE OF —— WITH THE UNITED KINGDOM IN 1903.

Foreign Office Annual Series, No. 3275.

The following figures give the quantities in tons of certain icles imported into Belgium from the United Kingdom ing 1903, the figures for 1902 being added in brackets:—Bitumen and resin, 129,857 (141,699); chemical pro-ts, 39,989 (38,159); dyestuffs, 10,849 (13,571); lard tallow, 5409 (5049); minerals, 114,409 (127,241); oil e, 9836 (7867); oil seeds, 4946 (5111); salt, 21,810 (,552); soap, 3075 (2482); vegetable oils, 10,233 (,464).

Among the exports from Belgium which came to the ted Kingdom were chemical products, 50,275 (57,692); stuffs, 7427 (7892); glass, 87,316 (92,187); lard and ow, 3628 (2723); minerals, 421,095 (includes cement, .159) (387,675); paper, 16,310 (15,161); resin and bitumen, 5201 (4809); starch, 7550 (7537); sugar, 43,387 (41,230); vegetable oils, 10,229 (11,455); zinc, 33,120 (42,294).

UNITED STATES; TRADE OF —— IN 1903-4.

Foreign Office Annual Series, No. 3279.

Subjoined is a list of certain articles imported into the United States during the fiscal year ended June 30, 1904, with the value in dollars, and the sources of supply in order of importance:—

Article.	Value.	Countries of Origin.
	Dols.	
Cement	1,993,303	Germany, Belgium, United Kingdom.
Chemicals, drugs, and dyes—		
Dyes	636,702	Germany, United Kingdom.
Wine lees	2,550,223	Italy, France, Portugal.
Quinine bark	501,375	Netherlands, United Kingdom.
Coal-tar colours and dyestuffs.	4,918,503	Germany, Switzerland, United Kingdom.
Dyewoods, logwood	663,572	British West Indies, France, United Kingdom, Switzerland.
Glycerin	2,583,270	France, United Kingdom.
Gums—		
Copal, cowrie, and dammar.	2,127,228	British Oceania, British East Indies, Dutch East Indies, United Kingdom.
Gambier	1,251,782	British East Indies, United Kingdom.
Shellac	3,505,229	British East Indies, United Kingdom.
Indigo	1,282,497	Germany, British East Indies, United Kingdom.
Bleaching powder	772,532	United Kingdom, Germany, France.
Potassium chloride	2,407,957	Germany, Belgium, United Kingdom.
Potassium nitrate	366,526	British East Indies.
Quinine sulphate	852,164	Germany, Dutch East Indies, United Kingdom.
Caustic soda	74,072	United Kingdom, Germany.
"Sal soda"	20,855	United Kingdom.
Soda ash	188,750	United Kingdom.
Sulphur	3,229,539	Italy, Japan, United Kingdom.
Sumac	276,891	Italy, United Kingdom.
Vanilla beans	1,424,647	Mexico, France, French Oceania, United Kingdom.
Earthenware and china	12,005,008	United Kingdom, Germany, France.
Leather	4,909,231	Germany, United Kingdom, France.
Oil—		
Animal—		
Whale or fish	638,591	Canada, Scandinavia, United Kingdom, Germany.
All other	34,830	United Kingdom, Canada, Germany.
Mineral	280,746	United Kingdom, Canada.
Vegetable—		
Olive, &c.	1,875,825	Italy, France, Spain, United Kingdom.
All other	5,952,702	United Kingdom, British East Indies, Germany, Spain, Italy, France.
Volatile or essential	2,396,745	France, Italy, Germany, United Kingdom, Turkey, British East Indies.
Paints	1,674,019	Germany, United Kingdom, France.
Paper stock, rags	1,511,835	Germany, United Kingdom, Belgium, France.
Paper and manufactures thereof.	5,319,086	Germany, United Kingdom, France, Belgium.
Plumbago	991,134	British East Indies, United Kingdom, Italy, Canada.
Salt	515,230	United Kingdom, British West Indies, Italy, Dutch West Indies.
Plate glass	979,819	Belgium, Germany, United Kingdom, France.
Other glass and glassware	5,603,349	Belgium, United Kingdom, Germany.
Glue	598,546	United Kingdom, France, Germany.
Indiarubber—		
Unmanufactured	42,214,219	Brazil, United Kingdom, Belgium, Germany, Portugal.
Manufactured	1,157,042	Germany, United Kingdom, France, Belgium.
Iron ore	1,593,279	Cuba, Canada, Spain.

Articles.	Value.	Countries of Origin.
Sugar, &c.—	Dols.	
Molasses	1,018,198	Cuba, British West Indies, San Domingo, Canada.
Sugar	71,409,639	Cuba, Dutch East Indies, British West Indies, British Guiana, San Domingo.
Tin	21,486,311	British East Indies, United Kingdom, Netherlands, Italy, Germany, British Australasia.
Soap	900,841	United Kingdom, France, Germany.

Among the exports during the same period were :—Chemicals, drugs, and dyes. 14,474,323 dols. (1903, 13,697,601) ; hides and skins, 6,414,638 dols. (1903, 5,290,948) ; paints, 2,756,581 dols. (1903, 2,350,937) ; glass and glassware, 1,978,481 dols. (1903, 2,150,699).

Belgium ; Chemical Industry in ——.

Foreign Office Annual Series, No. 3275.

The glass exports, which were so well maintained in 1902, showed a considerable decline in value during 1903, the actual loss on the comparison being 122,720*l*. This decrease was mainly due to the lessened demand from the United Kingdom, the United States, Germany, Australia, Canada, and Japan. The total volume of the exports of glass from Belgium in 1903 was 237,501 tons, with a value of 3,578,120*l*.

The cement industry, as far as the export trade was concerned, made good progress, the figures being 599,091 tons, with a value of 623,040*l*., increases of 10 per cent. on the volume and 2·5 per cent. on the value over 1902. The countries to which large quantities of this material were exported were the United Kingdom (208,159 tons valued at 216,484*l*.), Canada (29,717 tons), Cape Colony (22,906 tons), the United States (90,137 tons), and the Netherlands (51,308 tons).

The decline noted in the sugar exports of 1902 continued during 1903, and the total exports fell from 134,394 tons in 1902 to 116,655 tons in 1903, this latter quantity being exactly half the amount of the volume exported in 1901.

V.—PREPARING, BLEACHING, Etc., TEXTILES, YARNS, AND FIBRES.

Weighting of Silk ; Effect of Excessive —— on the present Position of the Silk Industry.

A. Bolis. Chem.-Zeit., 1904, **28**, 796—797.

The present depressed state of the silk-manufacturing industry is attributed to a variety of causes, namely, the high price of raw silk, competition of Tussah and "artificial" silks, and of mercerised cotton, and other causes, but especially to the loss of confidence in the durability of silk fabrics which has been brought about by the practice of excessive weighting. Weightings may be divided into three classes, according to the proportions employed, namely, those amounting to (1) not more than 50 per cent., (2) from 50 to 150 per cent., and (3) from 150 to 300 per cent. of the weight of the silk. Only the first of these, it is considered, should be used. To control the practice of weighting, the author advocates, with Pinchetti, the establishment, in all silk-manufacturing centres, of public laboratories, where the nature of the weighting agents used could be examined, and their amount determined. Moreover, it is believed that much useful work could be done by such laboratories in investigating the action of weighting agents on the tenacity, &c. of the fibre, and in fixing with some degree of precision, the proportion of charge which may be safely allowed.—E. B.

VII.—ACIDS, ALKALIS, Etc.

Gypsum Production of the United States.

Eng. and Mining J., Sept. 15, 1904.

According to the *Geological Survey*, the output of gypsum in the United States in 1903 was 1,041,704 short tons, valued at 3,792,943 dols., as against 816,478 shor toos, valued at 2,089,341 dols., in 1902. The production reported as crude gypsum, land plaster, plaster of Paris, an wall plaster, according to the condition in which the gypsu first reaches the market. The figure given as that of th total production is, therefore, an estimate arrived at by con puting the whole output as crude gypsum. The total valu given is that of the product in its different forms as reaches the market.

IX.—BUILDING MATERIALS, Etc.

Cement Industry in Canada.

Eng. and Mining J., Sept. 15, 1904.

The Portland cement industry is making rapid strides Canada, and the time is approaching when the requiremen of that country will be supplied entirely by domestic manu facturers. The chief centre of the industry is in Ontari which made 695,260 barrels in 1903, as compared with 31,9 barrels ten years ago. There were nine plants in operati and four under construction.

X.—METALLURGY.

Iron and Steel Production of France i first Six Months of 1904.

Bd. of Trade J., Sept. 29, 1904.

The French *Journal Officiel* of 25th September publis statistics relating to the production of iron and steel France during the first six months of 1904, with comparati figures for the corresponding period of the preceding ye on which the following table is based :—

	First Six Months.	
——	1903.	1904.
Cast iron—	Tons.	Tons.
Forge pig	1,095,120	1,193,21
Foundry pig	270,301	287,4
Total	1,365,421	1,480,6
Iron—		
Wrought iron (various)	295,554	261,91
Sheets	23,191	17,35
Total	318,745	279,2
Steel—		
Rails	118,541	137,61
Wrought steel (various)	394,740	464,1
Sheets	153,290	149,91
Total	666,571	751,6
Bessemer and Siemens-Martin ingots	942,658	1,042,6

Sardinia ; Mineral Production of ——.

Foreign Office Annual Series, No. 3268.

The following table gives the quantity and value minerals produced in Sardinia in 1903 :—

Minerals.	Quantity.	Value.
Zinc—	Tons.	£
Calamine	112,547	525,310
Blende	11,323	46,620
Lead	40,751	207,475
Silver	401	9,435
Arsenic	49	160
Manganese	742	930
Antimony	1,385	4,494
Lignite Anthracite	25,187	14,21
Copper	20	141
Ochre	742	1,21
Total	193,147	810,3

109,223 tons of zinc ore were exported, and also 32,580 ns of lead ore and 3154 tons of pig lead.

146,990 tons of salt were mined during the year; the port amounted to 5244 tons.

XII.—FATS, FATTY OILS, Etc.

OIL-SEED AND OIL-CAKE EXPORTS FROM ODESSA.

Foreign Office Annual Series, No. 3277.

Ravison is the most important oil-seed as regards the port trade, 53,000 quarters being exported from Odessa uring the period between August 1, 1903, and June 1904. he bulk of this was shipped to Hull. Very little business as done in rape seed or colza from this port, and ouly 000 quarters of colza were exported from Odessa (all to otterdam and Marseilles) during the same period, while e total amount of rape seed shipped from the port (to ull and Rotterdam) was 1100 quarters. The prospects r rape seed and colza this year, both as regards quantity ıd quality, are poor.

The following comparative table shows the quantities ported in 1901–3 inclusive :—

Articles.	Quantity.		
	1901.	1902.	1903.
	Tons.	Tons.	Tons.
nseed	935	4,022	2,902
emp seed	1,853	3,170	1,501
ıvison	1,548	..	14,150
ustard seed	..	100	31
lza	..	187	..
her oil seeds	1,144	3,773	536
Total	5,480	11,252	19,120

32,048 tons of oil cake were exported in 1903, compared ith 30,450 tons in 1902, and 29,518 tons in 1901; of these antities, the following came to the United Kingdom :— 03, 4900 tons; 1902, 5370 tons; 1901, 7560 tons.

OLIVE OIL PRODUCTION OF SARDINIA.

Foreign Office Annual Series, No. 3268.

The production of olive oil in the province of Cagliari, hich was very small in the preceding years owing to the vasion of the *Mosca olearia* (olive fly), has increased now is insect has disappeared, and it reached 606,345 galls. in 03; the province of Sassari produced 748,429 galls.—a tal of 1,354,774 galls., compared with 1,175,280 galls. in 02, and 1,120,258 galls. in 1901.

XV.—MANURES, Etc.

HEMICAL MANURES; CONSUMPTION OF —— IN ITALY.

Foreign Office Annual Series, No. 3265.

The amount of chemical manures consumed annually in aly is about 477,500 metric tons. Superphosphates are prered and consumed in large quantities. The annual consumpn of phosphates in Italy is at present about 400,000 metric ns, whereof 370,000 metric tons are mineral phosphates, e remainder being prepared with bone powder or with ne ashes. The greater part of the phosphates is prepared the 50 more or less important factories in Italy. The antities imported from France, the United Kingdom, and lgium are no longer very considerable. Thomas slag is imrted from Luxemburg, Belgium, and in smaller quantities om the United Kingdom. The consumption thereof has creased considerably during the last few years. Bone st is used to a certain extent in its natural state without y special preparation, but it is not of much importance. e consumption of sodium nitrate in Italy is not so imrtant as in other countries, but it is on the increase, and s already reached 20,000 metric tons, almost all from ili. Italian agriculture also consumes about 12,500 metric tons of ammonium sulphate annually. It comes mostly from the United Kingdom. Italy produces barely one-third of the consumption. The consumption of potassium sulphate and chloride is still limited as compared with the consumption of other manures. Owing to the high cost of transport they are used almost in a pure state. The importation amounts to about 3,000 metric tons, and is from Stassfurt. In addition to these, large quantities of nitrogenous organic manures, such as guano, blood, dried meat, horns, refuse from tanneries, &c., are used in Italy for agricultural purposes. It is difficult to give the exact quantity used, but there is no doubt that its value amounts to several millions of francs per annum.

XVI.—SUGAR, STARCH, Etc.

SUGAR PRODUCTION OF FRANCE.

Bd. of Trade J., Sept. 29, 1904.

The *Journal Officiel* of 13th September contains statistics of the production of sugar in France during the 1903-4 campaign (1st September, 1903, to 31st August, 1904). In 1903-4 the number of sugar factories working in France was 292, as compared with 319 during the previous campaign. The total quantity of sugar despatched from the factories (expressed in terms of refined sugar) amounted to 769,291 metric tons in 1903-4, as compared with 825,274 metric tons in 1902-3.

SUGAR PRODUCTION OF GERMANY.

Bd. of Trade J., Sept. 22, 1904.

The *Reichsanzeiger* for September 14th publishes statistics of the production of sugar in Germany during the campaign 1903-4. In 1903-4 the quantity of raw beet used in sugar manufacture was 12,706,527 metric tons, as compared with 11,255,958 metric tons during the 1902-3 campaign; the amount of raw sugar produced in 1903-4 was 1,662,814 metric tons, against 1,503,703 metric tons in 1902-3; whilst the production of refined sugar amounted to 1,411,129 metric tons in 1903-4, as compared with 1,367,086 metric tons in 1902-3. The total output of sugar (raw and refined) during the period from September, 1903, to August, 1904, expressed in terms of raw sugar, was 1,929,415 metric tons, as compared with 1,755,397 metric tons in the corresponding months of 1902-3.

XVII.—BREWING, WINES, SPIRITS, Etc.

ALCOHOL; DUTY-FREE ——.

Pharm. J., Sept. 24, 1904.

The following statement has lately been issued by the Treasury Department :—

Return for the Years 1902-3 *and* 1903-4, *respectively, showing the Applications for Exemption for* (1) *Trade Purposes;* (2) *Scientific or Educational Purposes.*

——	1902-3.	1903-4.
Applications for trade purposes :—		
Number received	54	30
„ granted	8	†4
Quantity of spirit on which exemption was granted	*341	*206,452
Applications for scientific or educational purposes :—		
Number received	65	53
„ granted	49	†27
Quantity of spirit on which exemption was granted	*358	*2,272

* These figures represent the total number of proof gallons of spirits used duty-free for the respective purposes in the year to which the figures relate.

† These numbers are in addition to the applications granted in the previous year, the privilege not being limited to one year, but continuing year by year until revoked.

SPIRIT (BRANNTWEIN), AND WASTE LIQUORS FROM ITS RECTIFICATION; UNTAXED DELIVERY OF —— FOR TECHNICAL PURPOSES IN RUSSIA.

Z. Spiritusind., 1904, **27**, 881.

By an order of the Imperial Council, confirmed by the Tsar, and dated May 12, 1903, the Russian Minister of Finance was authorised to allow, experimentally for three years, the untaxed delivery of spirit and of waste liquors from spirit rectification, in the denatured condition, for technical purposes, for lighting, heating, and power purposes, for the preparation of pharmaceutical products, for hygienic and medicinal purposes, and for disinfection, and to fix the conditions under which the delivery and the use of denatured untaxed spirit can be permitted. According to the regulations issued on June 18, 1903 by the Minister of Finance, spirit which is to be denatured for the above mentioned purposes must have an alcohol content not less than 85° Tralles. If, instead of ordinary raw spirit, a product containing more than 1 per cent of fusel oil is denatured, this fact must be stated upon the containing vessel when such denatured spirit is sold. Spirit for heating, lighting, and power purposes, &c., must be denatured as usual by the addition of a mixture of substances according to the prescription of the Technical Committee of the Department of Indirect Taxation; spirit for technical purposes, in which the ordinary denaturing process cannot be applied, can be denatured by other means, to be specially defined for each case. Mixtures for the ordinary denaturing process are to be bought at the bonded spirit warehouses; materials for special denaturing processes may be purchased privately, but, before being used, must be submitted to examination in the Central Chemical Laboratory of the Ministry of Finance or in the Laboratory of the Government Excise Department. The amount of spirit to be denatured must in each case be not less than 10 wedro (123 litres).—A. S.

XIX.—PAPER, PASTEBOARD, Etc.

PULP AND PULP WOOD; CANADIAN EXPORT OF ——.

U.S. Cons. Reps., No. 2058, *Sept.* 17, 1904.

The statistics for the fiscal year 1904 show that, while the export of wood pulp from Canada decreased, the export of the raw material (pulp-wood), all of which goes to the United States, increased The value of total export of pulp-wood in 1904 was 1,758,049 dols., an increase over 1903 of 229,489 dols. The total export of pulp decreased 23 per cent., the value being 2,409,074 dols., against 3,150,943 dols. during the previous year. The falling off was chiefly in the export to Great Britain, the value of which decreased 51 per cent., from 1,129,173 dols. to 548,720 dols., while the value of exports to other countries fell from 226,002 dols. to 52,912 dols. The value of Canada's total exports of paper, however, rose from 849,519 dols. to 1,097,212 dols., an increase of 247,693 dols., or 29 per cent. of the total value of the exports during 1903. Great Britain took 447,672 dols. worth; the United States, 163,000 dols. worth; and other countries, 486,531 dols. worth.

XXII.—EXPLOSIVES, MATCHES, Etc.

EXPLOSIVES IMPORTED INTO NATAL.

Bd. of Trade J., Sept. 29, 1904.

A Government notice (No. 554 of 1904) issued by the Natal Colonial Secretary, on Aug. 22, 1904, lays down the tariff fees payable for the examination by the Government chemist of dynamite and other explosives imported into Natal, as follows:—For the first 100 cases of dynamite or other explosive, 10*s.*; for every additional 100 cases or part of 100 cases, 5*s.* One sample from each 100 cases or part of 100 cases must be sent to the Government laboratory for examination, and cases of detonators will be regarded as separate shipments of explosives.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 20,154. Hecht and Rott. Safety containers for inflammable liquids.* Sept. 19.
„ 20,184. Thompson (Matricardi). Furnaces. Sept. 19.
„ 20,276. Aktiebolaget Separator. Centrifugal separators. [Appl. in Sweden, Oct. 3, 1903.]* Sept. 20.
„ 20,297. Campbell. Furnaces. Sept. 20.
„ 20,641. Parry. Machinery for separating pulverulent and granular substances from mixture containing same. Sept. 26.
„ 20,857. Kostalek. Filters.* Sept. 28.
„ 20,938. Shiels. Apparatus for heating, cooling evaporating, condensing, &c. Sept. 29.
„ 20,942. The Cotton Seed Co., Ltd., and Stanley Drying apparatus. Sept. 29.
„ 20,984. Pearson. *See under* XVIII. B.
„ 21,052. Oakley. Washing machine. Sept. 30.
„ 21,088. Wilkins and Overend. *See under* X.
[C.S.] 22,057 (1903). Doyle. Furnaces. Sept. 28.
„ 28,525 (1903). Mechwart. Filtering apparatus Oct. 5.
„ 642 (1904). Pidgeon. Rousers for mixing pur poses. Oct. 5.
„ 15,389 (1904). Czapikowski. Filters. Oct. 5.
„ 16,588 (1904). Matcham. Combined rotary kiln and dryers. Sept. 28.
„ 17,270 (1904). France. Sprinkler for liquids semi-liquids, and pulverulent materials. Sept. 28
„ 17,772 (1904). Forbes. Filtering apparatus. Oct. 5
„ 17,957 (1904). Tobler and Rheinische Webstul und Appretur Maschinenfabr. Drying apparatu Oct. 5.

II.—FUEL, GAS, AND LIGHT.

[A.] 20,125. Hawliczek. Recovery of by-product resulting from the destructive distillation of coa in "bee-hive" coking ovens. Sept. 19.
„ 20,277. Abel (Siemens und Halske A.-G.). Manu facture of incandescence bodies for electric g lamps. Sept. 20.
„ 20,326. Craig. *See under* VII.
„ 20,371. Rincker and Wolter. Production of o gas.* Sept. 21.
„ 20,784. Chalk Power Gas Synd., Ltd., and Pearso Process for the continuous and concurrent pr duction of fuel gas and lime. Sept. 27.
„ 20,845. Wilson. Gas producers. Sept. 28.
„ 20,870. Koppers. Process of and apparatus f obtaining by-products in the dry distillation gasification of fuel.* Sept. 28
[C.S.] 21,360 (1903). Shedlock. Artificial fuel and th manufacture thereof. Oct. 5.
„ 24,588 (1903). Settle and Padfield. Manufactu of coal gas. Oct. 5.
„ 18,262 (1904). Koppers. Coke ovens. Oct. 5.
„ 18,291 (1904). Cotton. Process and apparatus f generating a combustible gas from carbonaceo liquids. Oct. 5.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 20,697. Imray (Meister, Lucius und Brüning). Process for purifying orthonitrotoluene. Sept. 26.

„ 20,870. Koppers. *See under* II.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 20,527. Newton (Bayer and Co.). Manufacture of new anthracene dyestuffs suitable for dyeing and printing. Sept. 23.

„ 20,697. Imray (Meister, Lucius und Brüning). *See under* III.

[C.S.] 24,409 (1903). Ransford (Cassella and Co.). Manufacture of *o*-nitro-*o*-amido-*p*-acetamidophenol, and dyestuffs therefrom. Sept. 28.

„ 25,541 (1903). Newton (Bayer and Co.). Manufacture of oxyanthraquinones. Oct. 5.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 20,178. Johnson (Badische Anilin und Soda Fabrik). The discharge of dyed textile fabrics. Sept. 19.

„ 20,513. Sutherland. Method of cleansing or degumming stalk fibres. Sept. 23.

„ 20,637. Valette. Manufacture of artificial silk.* Sept. 26.

„ 20,664. Ward and Kenworthy. Apparatus for dyeing and treating textile fabrics and materials. Sept. 26.

„ 21,079. Calico Printers' Assoc., Ltd., Bryce-Smith and Hanson. Printing woven fabrics. Oct. 1.

[C.S.] 20,673 (1903). Müllers and Spindler. Manufacture of figured plush Sept. 28.

„ 20,942 (1903). Naeyer. Dyeing vats. Oct. 5.

„ 17,240 (1904). Destrée and Wiescher. Dyeing of hanks or yarns. Oct. 5.

„ 17,242 (1904). Krais and The Bradford Dyers' Association, Ltd. Finishing piece goods. Oct. 5.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 20,195. Imray (Meister, Lucius und Brüning). *See under* XX.

„ 20,241. Fryklind. Process for producing ammonia or ammonium salts from nitrogenous organic substances containing a high percentage of water. Sept. 20.

„ 20,326 Craig. Obtaining carbonic acid gas from the products of carbonaceous combustion, and apparatus therefor. Sept. 21.

„ 20,652. Hargreaves. Production of sulphate of baryta. Sept. 26.

„ 20,784. Chalk Power Gas Synd., Ltd., and Pearson. *See under* II.

„ 20,835. Hargreaves. Generation and application of chlorine. Sept. 28.

„ 20,952. Eschelmann, Harmuth, and Tov. Tentelevskago Ximichesk Zavoda. Apparatus for the manufacture of sulphuric anhydride.* Sept. 29.

[C.S.] 24,806 (1903). Hinz. *See under* XI.

„ 26,668 (1903). Meurer. Producing metal sulphates or other salts from metal sulphides and sulphide ores containing iron. Oct. 5.

„ 4487 (1904). Granier. *See under* XI.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 20,879. Bredel. Manufacture of quartz glass from quartz sand, silica, and the like.* Sept. 28.

„ 20 880. Bredel. Manufacture of articles from quartz glass.* Sept. 28.

[C.S.] 25,686 (1903). Stanley and Jeffcote. Process and apparatus for applying glazes, enamels, and bodying material to bricks, tiles, and like goods. Oct. 5.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 21,018. Bottomley and Paget. Attachment of metals to fused silica and analogous materials. Sept. 30.

[C.S.] 25,686 (1903). Stanley and Jeffcote. *See under* VIII.

„ 26,115 (1903). Hodgkinson. Impregnating wood and other porous materials to protect against damp, fungus, or insects, or for colouring. Oct. 5.

X.—METALLURGY.

[A.] 20,159. Gillies. Apparatus to be used in the separation and recovery of sulphides from their ores.* Sept. 19.

„ 20,160. Gillies. Apparatus for recovering zinc and other sulphides from their ores by the wet or chemical process.* Sept. 19.

„ 20,300. Ogle, Sulman, and Picard. Treatment of ores, slimes, and the like. Sept. 20.

„ 20,468. Duncan. Manufacture of steel.* Sept. 22.

„ 20,542. Thompson (Wickels Metallpapier Werke). Substitute for tin foil, and process for making the same.* Sept. 23.

„ 20,543. Armstrong. Furnaces or apparatus for obtaining zinc. Sept. 23.

„ 20,656. Auchinachie. *See under* XI.

„ 20,782. Bloxam (Soc. Anon. d'Études Electrochimiques). *See under* XI.

„ 20,797. Fink-Huguenot. Process for the preparation of metallic oxides by direct combustion of the metal, and apparatus therefor. [Fr. Appl., April 19, 1904.]* Sept. 27.

„ 20,842. Crosthwaite. Alloy. Sept. 28.

„ 20,877. Goodwin and Hollidge. Magnetic separators. Sept. 28.

„ 21,018. Bottomley and Paget. *See under* IX.

„ 21,081. Dawes. Magnetic separators for ores, &c. Oct. 1.

„ 21,088. Wilkins and Overend. Puddling and heating furnaces. Oct. 1.

[C.S.] 14,398 (1903). Worsey and Hoal. Extraction of gold from gold ores. Oct. 5.

„ 21,324 (1903). Dawes. Magnetic separators for ores, &c. Oct. 5.

„ 23,333 (1903). Moss. Magnetic separators for ores or like materials. Sept. 28.

„ 25,248 (1903). Rouse and Cohn. Method of converting powdered iron ore or iron waste or natural iron sands into briquettes or lumps. Sept. 28.

„ 25,794 (1903). Hadfield. Manufacture of manganese steel. Oct. 5.

„ 26,668 (1903). Meurer. *See under* VII.

„ 9584 (1904). Routin and Monraille. Metallic alloy. Sept. 28.

„ 16,205 (1904). Edelmann and Wallin. *See under* XI.

„ 17,038 (1904). Meadows. Preparing metallic mixtures. Sept. 28.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 20,285. Martin. Fireproofing electric cables. Sept. 20.

„ 20,656. Auchinachie. Continuous electric furnace for reducing metallic oxides and other compounds. Sept. 26.

„ 20,782. Bloxam (Soc. Anon. d'Études Electrochimiques). Electrolytic extraction of zinc from its ores, and apparatus therefor. Sept. 27.

[A.] 20,809. British Thomson-Houston Co., Ltd. (General Electric Co.). Electric furnaces. Sept. 27.

„ 20,810. British Thomson-Houston Co., Ltd. (General Electric Co.). Electric furnaces. Sept. 27.

[C.S.] 14,309 (1903). Dutertre and Nodet. Electric roasting oven. Sept. 28.

„ 24,806 (1903). Hinz. Process for the electrolytic manufacture of peroxides of magnesium and zinc. Oct. 5.

„ 25,853 (1903). British Thomson-Houston Co., Ltd. (General Electric Co.). Insulating material for electric conductors. Oct. 5.

„ 4487 (1904). Granier. Process and apparatus for the manufacture of sulphate of copper and caustic alkalies by the electrolysis of alkaline chlorides. Oct. 5.

„ 12,188 (1904). Tourneur. Producing electric energy by the utilisation of the chemical energy of any suitable combustible without the employment of thermal engines. Sept. 28.

„ 16,205 (1904). Edelmann and Wallin. Electric furnaces and the extraction of zinc by means of the same. Oct. 5.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 20,185. Ambleston. Apparatus for removing or extracting the oil or oily fibre from nuts, *e.g.*, palm nuts. Sept. 19.

„ 20,474. Boult (Burton). Process of manufacturing hydroxystearic acid from oleic acid. Sept. 22.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

[A.] 21,062. Bennett and Mastin. Manufacture of pigments. Oct. 1.

(*C.*)—India-Rubber.

[C.S.] 7795 (1904). Karavodine. Treatment and utilisation of waste vulcanised rubber and ebonite. Oct. 5.

„ 17,313 (1904). Price. Process for the devulcanisation or regeneration of rubber waste. Oct. 5.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

[C.S.] 17,979 (1904). Müller. Manufacture of imitation leather. Sept. 28.

„ 18,135 (1904). Flick. Process and composition for treating leather. Oct. 5.

XVI.—SUGAR, STARCH, GUM, Etc.

[A.] 20,166. Gouville and Jarvis. Caramelisation of carbohydrates. Sept. 19.

[C.S.] 15,297 (1904). Drewsen. Process of manufacturing products from cornstalks, sugar-cane, and analogous pithy stalks. Oct. 5.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 20,534. Nathan. Brewing beer. [German Appl., Oct. 7, 1903.]* Sept. 23.

[C.S.] 26,360 (1903). Tuckfield and Garland. Process of recovering alcohol and other volatile matters from waste or other products. Sept. 28.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—Foods.

[A.] 20,273. Bromhead (Chem. Fabr. Helfenberg). *See under* XX.

„ 20,291. Kennedy. Treatment of milk.* Sept. 20.

„ 20,292. Taylor. Cream substitute.* Sept. 20.

„ 20,339. Hatmaker. Milk food and method of manufacture. Sept. 21.

„ 20,340. Hatmaker. Milk food and method of manufacture. Sept. 21.

„ 20,658. Bernstein. Utilisation of the protein substances of milk. Sept. 26.

„ 20,885. Combret. Alimentary products constituting a phosphated vinegar. [Appl. in Belgium, Sept. 28, 1903.]* Sept. 28.

[C.S.] 17,431 (1904). Grenard. Preserving compound for the conservation of eggs and other alimentary substances. Oct. 5.

(*B.*)—Sanitation; Water Purification.

[A.] 20,889. Kremer and Schilling. Method of and apparatus for the bacterial purification of sewage and the like.* Sept. 28.

„ 20,984. Pearson. Apparatus for producing pure water by distillation, automatic and continuous in operation. Sept. 30.

„ 21,059. Noake. Method of aerating or oxygenating sewage. Oct. 1.

[C.S.] 28,137 (1903). Bonnotte. Manufacture of a compound for preventing scale in steam boilers. Sept. 28.

(*C.*)—Disinfectants.

[A.] 21,053. Morgan. Method and process of disinfecting.* Sept. 30.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 21,101. Birkbeck (Brooks). Process for making a substitute for cork. Oct. 1.

[C.S.] 18,117 (1904). Bradley. Paper-making machines. Sept. 28.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 20,195. Imray (Meister, Lucius und Brüning). Manufacture of iodine compounds. Sept. 19.

„ 20,273. Bromhead (Chem. Fabr. Helfenberg, Ltd., formerly Eugen Dieterich). Process for producing a stable non-alcoholic solution of iron-peptone or iron-manganese-peptone.* Sept. 20.

„ 21,047. Darzens. Manufacture of certain aldehydes and intermediate products. [Fr. Appl., Nov. 28, 1903.]* Sept. 30.

[C.S.] 22,163 (1903). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of acidyl derivatives of rufigallic acid alkyl ethers. Sept. 28.

„ 26,480 (1903). Imray (Meister, Lucius und Brüning). Manufacture of pyrocatechol derivatives. Oct. 5.

„ 15,784 (1904). Boult (F. Fritzsche und Co.). Manufacture of protocatechuic aldehyde. Oct. 5.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 20,157. Bonnaud. Paper and other surfaces for photographic printing. Sept. 19.

„ 20,272. Shepherd. Colour sensitometers. Sept. 20.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 20,251. Nicolay. Match.* Sept. 20.

„ 20,284. Hope. Explosives. Sept. 20.

[C.S.] 21,511 (1903). Yonck. Explosives. Oct 5.

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R. L. Jenks	XIII. C., XIV., XIX.
F. H. Leeds	II., III., XIII., XXI.
A. G. Levy, B.Sc.	VIII., IX.
G. W. MacDonald, M.Sc.	XXII.
N. H. J. Miller, Ph.D.	XV.
C. A. Mitchell, B.A.	XII., XXII.
R. W. Moore	Trade Report.
Barker North	V., XI.
T. H. Pope, B.Sc.	XVI., XVII., XX., XXI.
F. W. Renant	Index.
Chas. Salter	II., III., IX., XVI., XVII.
M. J. Salter	XIII.
F. Shedden	XX.
A. Shonk	General.
W. P. Skertchley	XII., XVIII.
E. Sonstadt	III., VII., X., XV.
A. B. Steven, B.Sc.	IV., V.
E. Howard Tripp, Ph.D.	III., VII., XVI.
L. J. de Whalley, B.Sc.	XVI.

Canadian Section.

Chairman: F. J. Smale.

Vice-Chairmen: { W. H. Ellis.
Thos. Macfarlane.

Committee:

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Jeffrey H. Burland.
Thos. Davies.
G. P. Girdwood.
W. L. Goodwin.
Edgar B. Kenrick.
W. R. Lang.
A. McGill.
W. Lash Miller.
Jas. P. Murray.
Harold Van der Linde.

Hon. Treasurer: M. J. Taylor, 77, Front Street East, Toronto.

Hon. Local Secretary:
Alfred Burton, 42, Front Street West, Toronto.

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Chairman: Eustace Carey.

Vice-Chairman: Frank Tate.

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T. Lewis Bailey.
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Vice-Chairman:

Committee:

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Wm. Pearce.
Boverton Redwood.
L. T. Thorne.
Thos. Tyrer.
Chas. Wightman.

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Julian L. Baker, 7, Addison Road, Bedford Park, W.

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Vice-Chairman: F. Scudder.

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B. Hart.
W. B. Hart.
K. Markel.
W. J. Pope.
H. Porter.
W. Thomson.

Hon. Local Secretary:
Julius Hubner, Ash Villa, Cheadle Hulme, Cheshire.

SESSION 1904—1905.

Friday Nov. 4.—Chairman's Address: "Spontaneous Combustion from an Insurance Point of View."

Newcastle Section.

Chairman: J. T. Dunn.

Vice-Chairman: W. L. Rennoldson.

Committee:

P. P. Bedson.
H. S. Collins.
Ellwood Holmes.
H. Louis.
N. H. Martin.
John Pattinson.
W. W. Proctor.
Geo. Sisson.
Harry Smith.
A. Spiller.
J. E. Stead.
C. E. Stuart.

Hon. Local Secretary and Treasurer:
F. C. Garrett, Durham College of Science, Newcastle-on-Tyne.

New York Section.

Chairman: Russell W. Moore.

Vice-Chairman: Chas. F. Chandler.

Committee:

H. C. Aspinwall.
L. Baekeland.
V. Coblentz.
G. Drobegg.
A. H. Elliott.
E. G. Love.
Wm. McMurtrie.
H. A. Metz.
Wm. H. Nichols.
T. J. Parker.
F. Schniewind.
G. C. Stone.
C. B. Zabriskie.

Hon. Treasurer: R. C. Woodcock.

Hon. Local Secretary:
H. Schweitzer, 40, Stone Street, New York, U.S.A.

Nottingham Section.

Chairman: J. T. Wood.

Vice-Chairman: S. F. Burford.

Committee:

L. Archbutt.
F. J. R. Carulla.
R. M. Caven.
J. Golding.
F. Stanley Kipping.
H. B. Mayfield.
J. O'Sullivan.
J. M. C. Paton.
A. L. Stern.
G. J. Ward.
J. White.

Hon. Treasurer: S. J. Pentecost.

Hon. Local Secretary:
S. R. Trotman, King's Walk Chambers, Parliament Street, Nottingham.

Scottish Section.

Chairman: R. T. Thomson.

Vice-Chairman: J. S. Macarthur.

Committee:

W. S. Curphey.
L. Dobbin.
D. B. Dott.
Thos. Ewan.
J. Arnold Fleming.
W. Frew.
G. H. Gemmell.
R. Hamilton.
Jas. Hendrick.
Jas. Hope.
H. Ingle.
W. G. Johnston.
J. Falconer King.
M. A. Parker.
T. L. Patterson.
D. J. Playfair.

Hon. Secretary and Treasurer:
Thomas Gray, c/o Gourlay and Deas, 180, Hope Street, Glasgow.

Sydney, N.S.W., Section.

Chairman: A. Liversidge.

Committee:

W. A. Dixon.
J. F. Elliott.
L. Meggitt.
J. Morison.
A. A. Ramsay.
J. A. Schofield.
R. Greig Smith.
H. G. Smith.
T. Steel.

Hon. Local Secretary:
T. U. Walton, Colonial Sugar Co., O'Connell Street, Sydney, N.S.

Yorkshire Section.

Chairman: H. R. Procter.

Vice-Chairman: G. W. Slatter.

Committee:

W. Ackroyd.
C. S. Bedford.
J. E. Bedford.
F. Branson.
B. A. Burrell.
John W. Cobb.
W. M. Gardner.
F. W. Richardson.
A. Smithells.
Geo. Ward.
Thorp Whitaker.

Hon. Local Secretary and Treasurer:
T. Fairley, 17, East Parade, Leeds.

Notices.

ANNUAL GENERAL MEETING, NEW YORK. PHOTOGRAPHS.

The Columbia University Groups may be obtained from Mr. Harry Coutant, 5, West 31st Street, New York, and 8, Alice Court, Brooklyn, N.Y.

The Mount Vernon Groups may be obtained from Mr. G. Prince, Pennsylvania Avenue and 11th Street, Vashington, D.C.

The Boston Groups may be obtained from Mr. E. hickering, 21, West Street, Boston, Mass.

The prices vary according to size and form of reproduc- on, but those exhibited cost from 3 dols. to 4 dols. apiece. emittances must accompany orders.

The Secretary is awaiting the receipt of particulars of ther photographs taken from time to time.

RARE MINERALS FOR RESEARCH.

Mr. A. B. Frenzel, of 1540, Sherman Avenue, Denver, olo., U.S.A., Commissioner of Rare Minerals for Colorado the St. Louis Exposition, and a member of this Society, ill give to any member of the Society, for research work, for demonstrating purposes in any institution of learning, y reasonable quantities of ores containing uranium, nadium, tungsten, or molybdenum, free on board, Denver, olorado. Members should communicate direct with Mr. renzel.

COMMUNICATIONS.

Authors of communications read before the Society, or y of its Local Sections, are requested to take notice that der Rule 43 of the Bye laws the Society has the right of iority of publication for three months of all such papers. fringement of this Bye-law renders papers liable to be jected by the Publication Committee, or ordered to be stracted for the Journal, in which case no reprints can furnished to the author.

List of Members Elected

24th OCTOBER 1904.

len, William R., c/o Watson, Jack, and Co., Montreal, Canada, Dyestuff and Chemical Manufacturer.

pleyard, Percy, Albany, West Australia, Chemist.

mpbell, J. H., 41, Summit Street, Brooklyn, N.Y., U.S.A., Chemist.

mpion, A., Coopers Hill, Englefield Green, Surrey, Chemist and Metallurgist.

whirst, J. A., 36, Southfield Square, Bradford, Yorks, Analyst.

glehard, Charles, 41, Cortlandt Street, New York City, U.S.A., Platinum Importer and Manufacturer.

dd. Henry Wippell, 100, Fore Street, Exeter, Analytical Chemist.

rnaas, John C., 69, Barclay Street, New York City, U.S.A., Dyestuff Merchant.

bbs, A. E., Wyandotte, Mich., U.S.A., Manufacturing Chemist.

ndlach, Walter, 153, E. 79 Street, New York City, U.S A., Superintendent of Colour Works.

rriman, Norman F., c/o Union Pacific Railroad Laboratory, Omaha, Neb., U.S.A., Engineering Chemist.

rrington, Dr. B. J., Macdonald Chemistry and Mining Building, McGill University, Montreal, Canada, Director of Chemistry and Mining Building.

rris, Norman B., 50, West Broadway, New York City, U.S.A., Manufacturing Pharmacist.

Harrison, H. E., 1688, Buckingham Place, Chicago, Ill., U.S.A., Chemist.

Heaton, Noel, 20, Baker Road, Harlesden, N.W., Colour Manufacturer.

Henley, F. R., 9, Beaufort Gardens, London, S.W., Brewer's Chemist.

Holdich, A. H., 55, Clarendon Road, Whalley Range, Manchester, Analytical Chemist.

Jewell, Wm. M., Park Ridge, Ill., U.S.A., Chemist and Engineer.

Jewson, F. T., Thornly Park Terrace, Paisley, N.B., Chemist.

Jones, Arthur B., c/o General Chemical Co., Station F, Box 12, Cleveland, Ohio, U.S.A., Superintendent.

Jones, Geo. F., c/o De Beers P.O. Explosive Works, Somerset West, Cape Colony, Technical Chemist.

Koerner, H. Theo., Beyerstrasse 28, Chemnitz, Germany Student of Chemistry.

Kübler, Alfred, 69, Barclay Street, New York City, U.S.A Vice-President, Geigy Aniline and Extract Co.

Le Maistre, F. J., 65, Bruce Avenue, Westmount, Montreal, Canada, Graduate (Inorganic Chemistry).

Le Sueur, E. A., 50, McLaren Street, Ottawa, Ont., Canada, Electrical and Chemical Engineer.

Marston, John P., 247, Atlantic Avenue, Boston, Mass., U.S.A., Merchant.

Mays, Edmund A., 100, N. Moore Street, New York City, U.S.A., Chemist.

Noake, Frank, S. S. Mond Gas Co., Trindle House, Dudley, Chief Engineering Assistant.

Patz, E. O., 215, Water Street, New York City, U.S.A., Manager, Berlin Aniline Works.

Pennington, Thomas, Platteville, Wis., U.S.A., Chemist.

Pfahler, H. W., 208, Linden Street, Holyoke, Mass., U.S.A., Chemist.

Ruef, Harry Herbert, 335, Marshall Street, Elizabeth, N.J., U.S.A., Chemist.

Sand, Dr. Henry J. S., University College, Nottingham, Lecturer and Demonstrator.

Slator, Dr. Arthur, University ollege, Nottingham, Lecturer and Demonstrator.

Sparre, Fin, Experimental Department of E. I. du Pont Co., Wilmington, Del., U.S.A., Chemist.

Teller, George L., The Columbus Laboratories, 103, State Street, Chicago, Ill., U.S.A., Chemist.

Vandenbergh, Dr. F. P., Pelham Manor, Westchester Co., N.Y., U.S.A., Consulting Chemist.

Weightman, Aubrey H., 1915, Walnut Street, Philadelphia, Pa., U.S.A., Chemical Manufacturer.

Wherry, H. P., c/o Boston and Montana Smelter, Great Falls, Mont., U.S.A., Chemical Engineer.

Wild, Irving L., 235, College Street, Middletown, Conn., U.S.A., Electrical Engineer.

Wright, Chas. L., Electric Illuminating Co., Cleveland, Ohio, U.S.A., Chemical Engineer.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

Aykroyd, H. E., l/o Ilkley; Ashdown, Apperley Bridge, near Bradford, Yorks.

Baty, Ernest J., l/o Birkenhead; Nunclose, Prince's Avenue, West Kirby, Cheshire; and (Journals) c/o The Dee Oil Co., Saltney, near Chester.

Bennie, P. McN.: Journals to Fitzgerald and Bennie Laboratories, P.O. Box 118, Niagara Falls, N.Y., U.S.A.

Bolam, Dr. H. W., l/o Leith Technical College; 2, Summerfield, Leith, N.B.

Cameron, Alex., l/o Lexham Gardens: Whitcher Place, Rochester Road, Camden Road, N.W.

Caspari, Dr. W. A., l/o Langham Road; 28, Coleshill Road, Teddington.

Clayton, Dr. G. Christopher, l/o Maldon Lodge; Etonfield, Wavertree, Liverpool.

Cleveland Chemical Society; Journals to c/o Prof. C. F. Mabery, Case School of Applied Science, Cleveland, Ohio, U.S.A.

Connor, Chas. C.; all communications to 4, Queen's Elms, Belfast, Ireland.

Cronquist, G. W., l/o Sweden; Rhenania Chamotte und Dinas Firebrick Co. Ltd., Bendorf a/Rhein, Germany.

De Wilde, Prof. P.; Journals to Hotel d'Orient, Bône, Algeria.

Evershed, F.; all communications to Kenley, Surrey.

Fitzgerald, F. A. J.; Journals to Fitzgerald and Bennie Laboratories, P.O. Box 118, Niagara Falls, N.Y., U.S.A.

Hodgkins, D. H., l/o Newark; 82, Lafayette Avenue, Passaic, N.J., U.S.A.

Lessing, Dr. R., l/o Brunswick Square; c/o Gas Light and Coke Co., Tar Works, Beckton, E.

McCowan, Wm., l/o Neilston; Essex Wharf, Narrow Street, Limehouse, E.

Mond, Robt. L.; Journals (temporarily) to c/o Thos. Cook and Son, Cairo, Egypt.

Munroe, Prof. Charles E., l/o Columbian University; George Washington University, Washington, D.C., U.S.A.

Neilson, Thos., l/o Mexico; Highland Bay Smelter, Murray, Utah, U.S.A.

O'Brien, Claude H.; all communications to Tamunua, Navua, *viâ* Suva, Fiji.

Oglesby, W. R.; Journals to c/o Alma Cement Co., Wellston, Ohio, U.S.A.

Olshausen, B. A., l/o New York; 1505, St. Andrew's Place, Los Angeles, Cal., U.S.A.

Parker, Chas. E., l/o New Street; 151, College Avenue, New Brunswick, N.J., U.S.A.

Pizey, J. H., l/o Muswell Hill; Anchor Chemical Works, Provanmill, Glasgow.

Rawson, Christopher, l/o New York; 44, St. Augustine's Road, Bedford.

Roscow, J. F., l/o Norwich, Conn.; P.O. Box 417, Boonton, N.J., U.S.A.

Tilley, Jas. W., l/o Brixton Hill; 95A, Southwark Street, London, S.E.

Vernon, R. H., l/o Lausanne; Cornell University, Ithaca, N.Y., U.S.A.

Wingate, Hamilton M., l/o Wynell Road; 90, Queenswood Road, Forest Hill, S.E.

MEMBER OMITTED FROM LIST.

O.M. Kearns, H. W., Baxenden House, near Accrington, Dyer.

CHANGE OF STYLE.

His Majesty the King has been pleased to confer the honour of Knighthood on Mr. Thos. Stevenson, M.D., Guy's Hospital, S.E.

Deaths.

Chattaway, Wm., Apothecaries' Hall, London, E.C. Oct. 7.

Pattinson, Dr. H. S., Newcastle-on-Tyne. Oct. 26.

Storar, John, of Reckitt and Sons, Ltd., at Coniston Lodge, Hornsea. Oct. 6.

Annual General Meeting,

NEW YORK, 1904.

The following is an outline of the proceedings of th Annual General Meeting and the excursions connecte therewith. It is impossible to give adequate expressio here to the deep debt of gratitude which the visitors owe t those fellow members and ladies, not only in New York, b in all the other cities visited, who devoted themselves s unsparingly in order to uphold the traditions of America hospitality and make a record meeting.

It is hoped to publish detailed reports of visits to work and other places of interest as they come to hand. F this the Council will be to some extent dependent on th further courtesy of those manufacturers and others w have already laid the Society under so deep an obligation.

NEW YORK.

The following is a list of the committees charged with t various arrangements for the New York meeting and f providing the facilities of travel in connection with t visits to various other cities included in the programme entertainment:—

BRITISH COMMITTEE.

The President.

E. Divers.
R. W. Greeff.
Samuel Hall.
H. Hemingway.
B. E. R. Newlands.
F. B. Power.
Boverton Redwood.
W. S. Squire.
Thos. Tyrer.
T. J. Wrampelmeier.

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Executive Committee.

H. Schweitzer, Chairman.
T. J. Parker, Secretary.
R. C. Woodcock, Treasurer.

Virgil Coblentz.
E. G. Love.

Finance Committee.

W. H. Nichols, Chairman.

Chas. F. Chandler.
H. A. Metz.
T. J. Parker.
R. C. Woodcock.

Hotel and Transportation Committee.

C. B. Zabriskie, Chairman.

Leo Baekeland.
De Laguel Haigh.
Wm. F. Hoffmann.
Clifford Richardson.

Entertainment and Programme Committee.

E. G. Love, Chairman.

Leo Baekeland.
Marston T. Bogert.
Gustav Drobegg.
A. P. Hallock.
G. C. Stone.
Maximilian Toch.

Invitation and Press Committee.

E. J. Lederle, Chairman.

W. F. Fuerst.
R. W. Moore.
Wm. J. Schieffelin.
R. C. Schnepphaus.
H. W. Wiley.
D. Woodman.

Reception Committee.

Virgil Coblentz, Chairman.

A. C. Bedford.
F. J. Butterworth.
W. B. Cogswell.
Thomas A. Edison.
William H. Erhart.
H. C. Grant.
Edward Hart.
J. Hasslacher.
A. C. Humphreys.
E. J. Lederle.
William McMurtrie.
Wm. H. Nichols.
Chas. Pellew.
Wm. J. Schieffelin.
F. Schniewind.
F. M. Smith.
I. F. Stone.
F. G. Zinsser.

Ladies' Committee.

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Mrs. Leo Baekeland.
Mrs. Marston T. Bogert.
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Mrs. William McMurtrie.
Mrs. Wm. H. Nichols.
Miss Parker.
Mrs. Thomas J. Parker.
Mrs. Clifford Richardson.
Mrs. Wm. J. Schieffelin.
Mrs. Hugo Schweitzer.
Mrs. Maximilian Toch.
Mrs. Fred. G. Zinsser.

The names given above by no means exhaust the list of hose who co-operated in receiving and entertaining the isitors. The Hotel and Transportation Committee made hemselves responsible for the whole of the railway trip, for otel accommodation in all cities visited, and for transport f baggage, while the work entailed upon the Executive and inance Committees still engages their attention. Sub-ommittees of the Reception Committee met the various teamers on arrival, and saw the visitors safely lodged in he Hotel Seville, Madison Avenue and 29th Street, the ociety's headquarters, where their comfort was looked after y Mr. L. Raegener, a member of the Society who is part wner of the hotel.

Wednesday, September 7th.

The programme began with a reception at the Chemists' lub, 108, West 55th Street, at 9 p.m., at which some 50 guests were present, including many of the foremost cientists of Europe, who were passing through New York n their way to the Congress of Arts and Sciences at t. Louis.

Thursday, September 8th.

After a council meeting at Havemeyer Hall, the general eeting of the Society was held in the Gymnasium of olumbia University, 116th Street, Amsterdam Avenue his J., Oct. 15, 1904, 924—926). Among those present ere the President and President-elect, Prof. C. F. Chandler Chairman of the New York Section), Dr. H Schweitzer hairman of the Executive Committee and Hon. Sec. of e New York Section), Mr. T. J. Parker (Secretary of the eception Committee), President Remsen (Johns Hopkins niversity), Prof. Hart (Lafayette College), Dr. Russell . Moore (U.S. Customs), Judge Waite, Dr. L. Baekeland, r. Charles Baskerville (College of the City of New York), rof. M. T. Bogert (Columbia University), Prof. W. H. handler, Prof. V. Coblentz (College of Pharmacy), Presi-ent Humphreys (Stevens Institute of Technology), Dr. E. G. ove, Dr. Wm. McMurtrie (American Chemical Society), r. W. J. Schieffelin (Chairman, New York Section of Ame-can Chemical Society), Dr. H. W. Wiley (U.S. Department Agriculture), Mr. R. C. Woodcock, Prof. T. M. Drown President, Lehigh University), Dr. Eames, President Finley College of the City of New York), Prof. Dr. H. Erdmann erlin), Prof. Dr. Oscar Liebreich (Berlin), Prof. Mohlau resden), Prof. Ostwald (Leipsic), Mr. Thos. Tyrer (past resident of the Society), Dr. F. B. Power, Dr. R. Messel, r. Max Muspratt (Vice-Presidents), Dr. J. Lewkowitsch ember of Council), and Mr. Eustace Carey (Chairman of verpool Section).

Photographs were taken of the Council and also of embers in front of the Library of Columbia University; pies of these may be obtained from Harry Coutant, 18, lice Court, Brooklyn, N.Y. (see notice, p. 963).

Luncheon was provided in the open piazzas of Claremont, old residence near the University and Grant's Tomb, erlooking the Hudson. Thence 24 automobiles took the rty for a drive through the upper part of the city, and Riverside Drive and through Central Park to the Hotel ville.

At 7.30 p.m. the visitors were entertained at dinner by e New York Section at the Waldorf-Astoria Hotel, Fifth venue and 34th Street (see J., Oct. 15, 1904, 926—927). overs were laid for 270. On the daïs, besides the esident and President-elect, were Prof. C. F. Chandler oastmaster), President Ira Remsen, Profs. Ostwald, iebreich, and Möhlau, Drs. Hallock, Wiley, and Schweitzer, r. Thos. Tyrer, President Finley, and Mr. Clive-Bayley, itish Vice-Consul.

The menu was executed by Tiffany. The cover, in romo-collotype, showed at the top a sketch of the port of ew York and the arrival of a steamer, in the middle were e two hemispheres united by the scroll of the Society of hemical Industry, and at the bottom the power station d Falls of Niagara. For each guest there was a gilt ree-handled loving-cup, a white chrysanthemum, and a f of laurel.

Meanwhile the Ladies' Committee entertained the ladies a theatre-party, which was followed by a supper at the aldorf-Astoria Hotel.

By the courtesy of various members of the New York Section, many visitors were made honorary members of the University Club and other important New York clubs.

Friday, September 9th.

Excursion 1.

Guide: Mr. T. J. Parker.

Nichols Chemical Co.'s Copper Refinery at Laurel Hill.

Through the courtesy of this Company the steamer *Quaker City* took the party to the works, after inspecting which they were entertained at luncheon by the officials of the Company. Both ladies and gentlemen took part in this excursion.

Mr. Wm. H. Nichols, in welcoming the visitors, gave a short account of the growth of the works. Years ago, he said, the enormous works over which they had been conducted consisted of a small plant worked by two men, of which he himself was one. Now the premises covered many acres of ground. The copper refinery was nearly twice as large as any other works of its kind in the world, and the amount of copper produced at Laurel Hill was over one-fifth of the total production of the world. He could not lay claim to the scientific knowledge possessed by many of those present, but he attributed his success and the success of the works to his knowledge of men, and hence to the men whom he had drawn around him to assist him. One of the first of these had been Mr. Herreshoff, and he would add that these works were the first in the State of New York in which a chemist had been employed. He then called upon Mr. Herreshoff to address the company.

Mr. Herreshoff said that in large works the usual plan was to cast the copper into plates, as had been shown. The impure copper contained gold and silver, for the complete removal and recovery of which the electrolytic method was employed. In addition to gold and silver, other metals that were never removed before by the ordinary firing methods—namely, arsenic, tellurium, selenium, and antimony, &c., which make copper very brittle—were also thus removed. The copper thus produced was of 99 per cent. purity. The success of the electrolytic process had caused a great many mines to be opened which could never have been worked otherwise. Their method was the well-known series system. True, the multiple system was more generally used, but it was curious that the largest works in the world employed a method that was generally condemned. In their method there were serious difficulties to be overcome, but certainly they had overcome them.

In regard to the other parts of the plant, the reverberatory furnaces were very simple. The Bessemer converter had been first introduced 18 to 20 years ago in France, and was now used largely in the West in large copper plants. The molten matte, as it came from the smelting furnaces, was run into bowls and air blown in to oxidise the sulphur. The matte consisted of 55 per cent. of copper, 20 per cent. of sulphur, and 25 per cent. of iron. The iron was very easily oxidised, but silica had to be supplied. In the application of silica many difficulties were encountered. They confined themselves to the use of a brick lining, consisting largely of silica, 85 per cent. or more. The thickness of the bricks was about 18 ins. The revolving liquid inside caused a rapid combination of the oxygen and iron. In 15 minutes the contents of a converter, fed with 4 tons of matte, was oxidised, the residue taken out, and the copper left. The point at which this was to be done was determined by the little scintillations thrown out—a phenomenon requiring a practised eye to observe. 90 per cent. copper was poured out. The process was an intermittent one, each operation taking one hour and a half or two hours. When the lining was reduced to about one-half of its original thickness, it was removed by what was known as a lapp machine, something like a rock drill, and made up with fresh material.

Excursion 2.

Guide: Mr. George C. Stone.

The members of the party visited the Spiegel Furnace of the New Jersey Zinc Co., the works of the Balbach Smelting and Refining Co., and of the Murphy Varnish Co. at Newark.

In the evening there was a Reception at the Majestic Hotel, in Central Park West, the weather proving too wet for the party to avail themselves of the Roof Garden, which is a feature of this hotel.

SATURDAY, SEPTEMBER 10TH.

Excursion 3.

Guide : Mr. GEORGE F. KUNZ.

Most of the ladies and many of the gentlemen visited the establishment of Messrs. Tiffany and Co., Union Square, where jewels, jewel cutting, and setting were shown. Statuary, bronzes, porcelain, and glass, in which the highest forms of art are exhibited, are also a feature of this establishment. Here too was seen "Kunzite," a new lilac-coloured spodumene from Pala, California, so called in honour of the Director, who, together with Dr. Chas. Baskerville, has devoted considerable study thereto. The mineral affords, when cut, a new gem of great beauty.

Others visited the Metropolitan Museum of Art, Fifth Avenue and 82nd Street. Among the principal modern pictures of a collection still further enriched by the loan collection of W. H. Vanderbilt, may be mentioned Turner's "Grand Canal at Venice," Meissonier's "Friedland," Millet's "Sowers," Rosa Bonheur's "Horse Fair" (that in the National Gallery is a small replica), Leighton's "Lachrimæ," and a "Holy Family," by Knauss—considered to be equal to the best work of Murillo.

The Cesnola Collection of Cyprian Antiquities, the Bishop Collection of Jade, and the Morgan Collection of Porcelain are the finest of their respective classes in the world.

After luncheon at the Casino, Central Park, the members drove to the American Museum of Natural History, Eighth Avenue and 77th Street, and inspected the paleontological collection, which includes the celebrated series of fossil horses collected by Prof. Marsh, and regarded as conclusive evidence of the truth of the theory of evolution; the paleontological collection of the late Prof. J. Hall; the gem room; and the Bement Collection of minerals.

Excursion 4.

Guides : Dr. A. H. ELLIOTT and Mr. M. TOCH.

The works of the New York Edison Co.; Westinghouse, Church, Kerr, and Co.'s power house for the Pennsylvania Railroad at Long Island City; and the Ravenswood works of the Consolidated Gas Co., were visited. Luncheon was served by invitation of the Consolidated Gas Co.

Excursion 5.

Section A.—Guide : Dr. M. WALLERSTEIN.

A party of gentlemen visited the brewery of George Ehret, lunching afterwards with Section C.

Section B.—Guide : Dr. WM. McMURTRIE.

Another party visited the works of the Tartar Chemical Co., Brooklyn, and later joined Section C. at lunch.

Section C.—Guide : Dr. A. P. HALLOCK.

A third party, consisting both of ladies and gentlemen, visited the mineral water factory of Carl H. Schultz, 440, First Avenue, and, with Sections A. and B., were entertained at a sumptuous lunch by invitation of the company.

It should here be mentioned that Mr. Carl H. Schultz also gave to the Society a very ample supply of mineral waters, wines, and spirits for the use of the special train in which the party afterwards travelled.

The paint works of the F. W. Devoe and C. T. Reynolds Co., and John W. Masury and Sons, Brooklyn, were also open to members.

Excursion 6.

Guides : Mr. GEORGE C. STONE and
Mr. E. L. RANSOM.

A party of gentlemen visited the works of the Pacific Coast Borax Co. and Tide Water Oil Co. at Bayonne, N.J.

By the courtesy of Mr. W. J. Matheson, who placed steam yacht *Lavrock* at their disposal, a small pa of members, including the President and President-el were enabled to wait upon the President of the Uni States at his marine villa at Sagamore Hill, Oyster President Roosevelt expressed his great regret at be unable to receive the Society at the White House, ow to his absence, for a much needed rest, from Washing at the time of the Society's visit to that city. He offe them a most cordial welcome to the United States.

On Saturday evening a smoking concert and Vaude entertainment was offered to the members at the "Lie kranz," a German Club, whose object is indicated by name. Members found on the tables copies of "A. No Vol. II.," of "The Journal of the Sassiety of Chom Industry," issued that day by an irresponsible Publicat Committee in New York. The "Table of Attempts" cluded "Council Notices," "Changes of Address," " Members Elected," "A Few New Elements" by " Hoonderville," and other original papers and songs. hoped to obtain some further copies for home memb After supper an illuminated address was presented Sir Wm. Ramsay to the New York Section on be of the European visiting members, in order to place record their feelings of gratitude and esteem for the ma ficent reception accorded to them. Credit is due Mr. David Perry for the expedition with which the add was prepared, in view of the very limited time that available for this purpose.

SUNDAY, SEPTEMBER 11TH.

The New York portion of the Annual Meeting conclu on Sunday with a steamer trip up the classic Hudson R as far as West Point. Near the city the river presents either hand, a varied scene of docks and shipping, w further to the north the Palisades, rising on the wes shore, form a beautiful contrast to the more gentle sl of the eastern. Scarcely a mile is passed that does remind the student of much of interest in American hist The Palisades attain their greatest height of 550 directly opposite Hastings. West Point, the highest p reached, is the home of the United States Mili Academy.

During the trip Mr. Thos. Tyrer, on behalf of the l visitors, presented a silver vase to Mrs. Charles E. Pel Chairman of the Ladies' Committee, wife of the Adj Professor of Chemistry at Columbia University, and dau ter of Prof. C. F. Chandler. Beautiful weather favo this trip, the haze of early morning soon giving wa bright sunshine, in which the scarlet tint of the ma those harbingers of autumn, only served to set off brilliant green of the foliage which clothed the banks either side.

MONDAY, SEPTEMBER 12TH.

At 8 a.m. the whole party left New York by the W 23rd Street Ferry for the special train by the Pennsylv Railroad to Philadelphia.

The following American and Canadian members acc panied the party:—Dr. L. Baekeland, New York; M. T. Bogert, New York; Mr. H. J. Case, New Y (special correspondent of the Central Press); Mr. W. Drey New York; Mr. M. L. Hersey, Montreal; Mr. W. H stetter, Cincinnati; Mr. Theo. Körner, New York; Mr. J. Krebs, Wilmington, Del.; Dr. E. G. Love, New Yo Mr. A. P. Van Gelder, Emporium, Pa.; and Mr. C. Zabriskie, New York.

The President-elect, Mr. Wm. H. Nichols, was preve from joining the party by the sudden illness of Mrs. Nich and Mr. T. J. Parker was also detained by illness. B however, joined later.

The following representatives of the Pennsylvania R road were also in attendance:—Mr. H. C. Bates, Tou Agent; Mr. T. S. Wilson, Special Baggage Master; Mr. N. W. Hower, Stenographer, with a full staff, includ some 30 car attendants, &c.

(*To be continued.*)

New York Section.

Meeting held at Chemists' Club, on March 25th, 1904.

DR. VIRGIL COBLENTZ IN THE CHAIR.

THE PREPARATION OF COTTON FIBRE FOR SURGICAL PURPOSES.

BY FRED B. KILMER.

The use of cotton fibre in surgery as an application to wounds is of comparatively recent origin. Cotton cloth in strips has long been employed as an outer or retaining bandage. Lint was, until quite recently, made, as its name implies, of flax. About 1837, loose cotton was suggested for the direct covering of wounds, but was not generally adopted. In 1864, Augustus Touraine, a surgeon-major in the army of Maximilian, published a formula and process for the preparation of "Hydrophile" cotton.

The real introduction of absorbent cotton into surgery is due to Lister, who propounded the doctrine that both wound treatment and dressing should prevent the access of micro-organisms, and that when micro-organisms have entered in spite of every care, they should be destroyed or rendered incapable of harm. The Lister system, as first practised, called for the use of cotton and gauze dressings impregnated with antiseptics. The first of these dressings used was non-absorbent, but very early cotton fibre and gauze were demanded which would absorb wound discharges and antiseptic solutions.

Absorbent cotton fibre, under the name of "Absorbent Cotton," became an article of commerce about 1877. Now wherever surgery is practised cotton fibre in some form is the basis of every form of dressing. The industry is noted for its rapid growth. Twenty years ago there was no maker who could produce as much as one hundred pounds at one time, and even the largest purveyors rarely handled more than that amount in a year. The wholesale price of absorbent cotton in 1881 was 1·12 dols. per pound for pound packages; in smaller packages, 2·25 dols. per pound. At the present time the wholesale price ranges from eighteen cents for the lower grades to thirty cents per pound for the higher types.

There are single retail dealers at the present time who handle 40,000 lb. of absorbent cotton in a year. One of the laboratories in the United States, where this article is produced, has in process upwards of 20,000 lb. at one time. The table which follows is an estimate made by one of the largest manufacturers :—

Cotton used in Surgery in the United States.

—	1878.	1886.	1898.
Raw cotton .... lb.	1,000	5,000	20,000
Absorbent cotton .. lb.	5,000	250,000	3,000,000
Bandages .... lb.	10,000	20,000	100,000
Gauze .... yds.	1,200	120,000	20,000,000
Lint................ lb.	50,000	15,000	40,000
Miscellaneous dressings .... lb.	500	2,000	20,000

The present output of cotton for surgical purposes is upwards of 6,000,000 lb. per year, and there is invested in this industry a capital aggregating five millions of dollars. There is also an increasing demand for this class of material in various industries. The increased demand has reduced the cost while the products have also greatly improved. As to surgical cotton, the best produced as recently as 15 years ago was yellow, dirty, and not absorbent. It was packed in wads and put up in all sorts of boxes and paper wrappings.

The improvement introduced about 1887 by an American maker, whereby the absorptive power and the whiteness was increased, and the cotton put up in continuous sheets with layers of tissue paper between, had a pronounced effect upon the consumption.

Absorbent cotton carefully made from clean straight fibre, of the type known as Texas Strict Middlings, is elastic and springy, and will absorb about fifteen times its weight of water. The moisture is quickly diffused through the whole of the fibre. It does not pack and lie hard on the flesh, but stands up, forming an absorbent cushion. Cotton made of a low grade fibre, or from mill waste or old rags lacks absorbing and diffusing power and when wet packs down like so much clay.

Selection of Fibre.—In the preparation of cotton for surgical uses, the selection of the raw cotton, the grade, and the staple are not the only factors to be considered. The high class fibres represented in the Sea Island and Egyptian types, which are long stapled and small in diameter are unsuitable, since they would produce a thread too fine for surgical gauze, and could be made absorbent only with difficulty. The Egyptian and Brazilian types are rough and woolly; the brown varieties of these types can scarcely be made white in the processes which are employed. The East Indian fibres are rarely used, for the reason that those which are low in price are short, harsh, brittle, weak in staple, and often very badly stained, and mixed with leaves and dirt. The most desirable kinds are those represented by the American types known as Orleans, Texas, Allenseed, Mobile, and Benders.

The grade known as strict middlings gives the best results.

To make a good product, the fibre must be free from seed, leaf, sand, and mud, which even under the most careful treatment will appear in the finished product, and cannot be made absorbent. Stained, tinged, or off-coloured fibre will never become white, and absolute whiteness is of prime importance.

In every pod of cotton, when the plant reaches maturity, there remains an under-growth of short hairs at the base of the seed. If the ginning process is run very closely, these hairs are removed, and mixed with the longer fibre. They are not perfect fibres, and never become fully absorbent or white, and have a great tendency to form what are known as nibs or nebs. Again, unripe or immature fibres have to be reckoned with. They are extremely thin and transparent, with little or no twist. When spun into yarn they contract and tie themselves into knots. These unripe fibres contain no cellular opening, do not form capillary tubes, and do not become absorbent. Under the action of chemical agents they have a tendency to become brittle. In the carding operations such fibres become entangled with the perfect fibres, and prevent the formation of a smooth web.

In spinning mills, where the better grades of woven cloths are produced, all nebs, unripe, immature, and short fibres are removed in the carding and combing processes. The carded, or combed-out product, known as "card waste," "combers' waste," "linters' waste," "fly waste," &c., is consumed in the manufacture of low-priced surgical cotton. The higher grades can only be produced from cotton fibres of a good grade and staple.

The process now generally followed for rendering cotton fibres absorbent is that originally devised by Slocum and modified by the writer. At a first glance, the chemical processes involved will appear quite like the familiar bleaching methods, but there are essential points of difference.

Cotton fibre can be bleached without being rendered absorbent, and it can also be made absorbent without being bleached. On the Continent, cotton fibre and woven gauze are made absorbent and prepared for surgical use by simple extraction of the fatty matters with solvents such as petroleum ether, carbon bisulphide, or by an alkaline treatment without bleaching. The resulting product is fairly absorbent, but is not white.

Bleached cotton cloth and fibres which are not absorbent are well-known products. No bleacher in the trade would dare subject his fibre to the very drastic treatment used in the processes here outlined.

The principal operations in the preparation of cotton fibre for surgical uses, in the form of absorbent cotton and surgical gauze, may be summarised as follows :—

I. *Mechanical Operations.*—(1) Sampling and inspection to establish grade. (2) Mixing. The blending of different varieties of raw cotton to ensure uniform quality and colour, and an even fleece or thread. (2) Opening. In this process the matted masses of cotton fibre are opened out and shell, sand, leaf, &c., are removed. (4) Beating, blowing, lapping, or "scutching" (a continuation of the process of opening). At the end of this the cotton is rolled in an even sheet or lap. (5) Carding. In this process the fibres are further opened out and individually separated; very fine impurities are removed, together with short and unripe fibres. As the cotton leaves the card, the fibres, if they are to be made into absorbent cotton, are gathered together in a web or fleece; if they are to be made into surgical gauze they are gathered into a rope a little less than an inch in diameter, called a "sliver."

II. *Chemical Processes.*—(1) The cotton fibre (mechanically cleaned) is packed in boilers and washed with water (2) Alkaline hydrolysis. In this process the non-cellulose constituents of the fibre, wax, fatty oils, pectose, &c., are hydrolysed. (3) Extraction of alkali and hydrolysed products. (4) Oxidation. The removal of colouring matter, residues, and by-products of the alkaline treatment (the first stage of bleaching). (5) Hydro-extraction of oxidising chemicals. (6) Acid oxidation. A continuation of the oxidation and bleaching action. (7) Hydro-extraction of acids and acid products. (8) Second alkaline hydrolysis. (9) Hydro-extraction of alkaline products. (10) Second acid oxidation (completion of bleaching). (11) Neutralisation of chemicals and removal of neutralisation salts. (12) Hydro-extraction.

III. *Mechanical Processes.*—(1) Opening. The fibre at this point is bleached and absorbent, but somewhat matted and tangled, and must be opened for subsequent operations. (2) Drying (at 220° F.). (3) Lapping. Gathering into sheets preparatory to carding. (4) Carding. The fibres are individually separated and formed into thin films and the films gathered into layers. (5) Rolling in layers with thin tissue paper between each layer. The rolls are cut into sizes, pound, half-pound, quarter-pound, ounce, &c., and packed into cartons or rolled into packages. (6) Sterilisation.

The mixing or blending process is important, whether the final product is to be absorbent cotton or surgical gauze. Short and defective fibres, if present, must have a proper proportion of perfect fibres to make a suitable web or thread. When cotton waste is employed, the mixing or blending operation becomes a fine art.

The operations of opening, beating, blowing, scutching, likewise require considerable skill.

In the final product no dyes nor fillers can be used to aid in covering up unsightly particles. Every speck, seed, leaf, &c., must, if possible, be removed. If these specks are light in gravity, their removal is practically impossible.

The fibres must be well opened out. There must be no tangled masses or the cotton will not be acted upon by the chemical agents used in the subsequent operations. Fibres to be used for absorbent cotton are best left in their natural curl or twist, in as even sheets as possible, lying crosswise on each other in such a way as best to be receptive of the hydrolysing solutions. On the contrary, fibres to be used in gauze are laid parallel to each other and then twisted together.

After the mechanical treatment outlined in the table the sheeted fibres (laps) are packed in vats or kiers for the chemical treatment. This is shown in the table as taking place in twelve stages. These are sometimes carried out in one vat by passing the fibre through; but more often, after the first alkaline treatment, the fibres are removed to an open vat, washed, and then passed through to subsequent processes in crates or in bunches moved by hand. Washing machines of the rake type, such as are used in wool scouring, are also utilised.

In packing into kiers, when a considerable percentage of short fibres is present, the fibres have a tendency to become so closely pressed that the solutions do not readily penetrate. With regular fibres, this packing is avoided by the natural elasticity of the hairs, and their tendency to spring up and allow a free movement of the extractin liquids.

The essential feature of rendering the fibres absorbent i embraced in the stage designated in the table as number : or alkaline hydrolysis. This consists of boiling the fibr in a solution of caustic soda of about 1 per cent. strengt This is varied with the condition of the fibre, its colou tenacity, &c., of which the operator must judge in eac individual case. The boiling is conducted under lo pressure, continuing from 12 to 48 hours. Extractio under a vacuum has been tried, but found to be of n advantage. In fact, in experiments noted by the write the fibre was not wholly absorbent when boiled in a vacuu

In the alkaline treatment a portion of the cellulose dissolved. Upon this point I have made the followin experiments:—Carded and cleaned cotton fibre were dri to constant weight, boiled in solutions of caustic soda varying strength for different periods, washed until fr from alkaline reaction, and again dried to constant weigh The losses are shown in the following table :—

Loss of Weight of Cotton Fibre by Boiling in Caustic Soda Solution.

Strength of Solution.	Loss on Boiling for	
	Half Hour.	One Hour.
Per Cent.	Per Cent.	Per Cent.
1	4·41	5·71
2½	5·08	7·33

The products of the alkaline treatment are not easi removed from the fibre, especially in the mass. In ordina bleaching processes the fibres become white in the proce which follows the first, or alkaline, treatment. The washi away of the saponified products is a long operation, and the end of it the fibre structure is not freed of its conten Their final removal takes place subsequently.

The first alkaline treatment is followed by the bleachi proper. Here the fibres are subjected to the prolong action of a solution of hypochlorite containing, approx mately, 0·1 per cent. of chlorine. The hypochlorites lime and soda have both been used. The former is employ almost exclusively in the cheaper grades of cotton a gauze. The soda bleach produces a softer, whiter, a more elastic product. The Thompson process, viz., utilisi the combined action of hypochlorite and carbon dioxi has been tried, but has been found too expensive and dif cult to manage with large masses of loose fibre. Sodiu peroxide has also been tried experimentally, but the prese price was found to be prohibitive.

In practice, the oxidation is carried to the utmost lim that the fibre will allow. The requirement is not only attack the colour, but to penetrate every molecule and break every existing combination, even those remaini from the alkaline hydrolysis. The way is thus prepare for the removal in the subsequent operations of everythin except the cellulose.

It can easily be imagined that in the process he described the cellulose itself is attacked and oxidise That the cellulose is oxidised is shown by the gre rapidity with which these fibres take up basic coal-t dyes. In fact, the affinity of the fibres for these colou is, in a rough way, a measure of their absorbency. Th fibre is always more or less tender and gives the usu reaction for oxy-cellulose.

The residues of hypochlorite solution are next wash away, as shown in the table under No. 6, and the fib subjected to acid oxidation, in a solution of either sulphur acid (2 per cent.) or hydrochloric acid (1 per cent.). Th oxidation and bleaching is carried one point further. I practice, the process is pushed to a partial solution of th inorganic constituents of the fibre. The acid being carefull washed out, there follows a second alkaline treatment, No. in the table of operations. The object of this process is attack any matter not reached in the first alkaline treat ment; to remove fatty matters decomposed in the chemica process, and to render soluble any residue still remaining in the fibre.

The strength of the alkali is generally about 0·25 per cent. of NaOH, and the time of boiling is short. After washing away the alkali, a second acid treatment follows. Any residue soluble in acids is removed, inorganic salts are dissolved, iron compounds and stains are cleared, and the cotton assumes a full white.

The next step is of considerable importance. It is difficult to remove all traces of acid, but if they are not removed the fibre becomes tender on drying. In practice, after very long washing with water, antichlor (or soap wash) is used. After treatment with antichlor the fibres are crisp and emit a crackling sound.

The soap treatment is preferred, but the soap must be thoroughly washed away, or the fibres will turn yellow. There is a temptation to leave in a considerable amount of soap, as the soap overcomes any difficulty in absorptive power. Calcium chloride is also added for a similar purpose. With some makers it is the custom to use sulphuric acid in the final acid treatment, and to allow a considerable portion of this to remain upon the fibre. This acid fibre is next treated with soap, and there is deposited with the fibre sulpholeate compounds which render the fibre soft and flexible and apparently increase its hygroscopic property. The inevitable decomposition and yellowing follow, to the ultimate detriment of the product.

The last treatment of the chemical process (No. 11) in the table should be a prolonged washing in water until no trace of soluble matter remains.

The character and quality of the water used in the preparation of cotton fibre for surgical uses is of great importance. Water acceptable for use in the ordinary processes of bleaching and dyeing will here be a source of trouble. The reason for this is easily explained. Each fibre of absorbent cotton is a capillary porous cell of absorbent cellulose. Each individual cell becomes a filter, and particles of water are taken in and passed through with great rapidity. There are about 150,000,000 fibres n a pound of absorbent cotton, and if 1,000 lb. are packed n a cylinder, and water passed through, we have a filter-bed of no mean capacity. To a certain extent these cellulose cells are capable not only of straining out sedimentary matter from the water, but also of dissociating salt and colouring matter. The fibres rapidly take up algæ and other organisms. In waters containing large numbers of organisms, naturally covered with gelatinous envelopes (such as diatoms), the upper layer of closely packed cotton becomes covered with a slime, like that found in filter beds. When impure water is passed through a considerable depth of cotton, the water is to a degree purified, and the cotton rendered unfit for use. Not only is very hard water objectionable for use in the preparation of absorbent cotton on account of the reactions with the chemicals used, but also the fibres, being absorbent, hold so much of the water, that, upon drying, a portion of the lime and alts remain.*

To produce the finest product the water must be soft, lear, free from suspended matter, and, as far as possible, ree also from dissolved organic matter.

Following the chemical processes come the mechanical operations noted in the table. The cotton fibres as they eave the drier are in tangled masses. So crisp are they hat when pressed they emit a sound. The first of the mechanical operations which follow are for the opening out f the fibres (opening and lapping). The fibres are then arded, and as they pass from the cards gathered into ayers. The fibres of absorbent cotton have a tendency to ontract and form themselves into tangled nebs; hence, in well-carded absorbent cotton, the amount of card-waste is arge.†

The layers, consisting of several films from the cards, laced on top of each other, are rolled up with tissue paper. This rolling in tissue is an American invention, and is of great utility, preventing the felting of the fibres, which would occur if the cotton were rolled upon itself. The cotton fibre unrolls like a sheet or blanket, and can be cut or torn with ease.

One manufacturer of absorbent cotton adds a final and most important process, viz., sterilisation. Sterilised or aseptic cotton fibre is a product of very recent times. While the methods of antisepsis have by no means been discarded, still in many conditions (as, for example, when an aseptic wound is made by the surgeon), and for many uses during the course of an operation, simple aseptic, absorbent cotton fibre is the only material required. Many hospitals sterilise the fibres at the time of use. Sterilised absorbent cotton fibre and sterilised surgical gauze and other dressings have, however, become permanent articles of commerce.

The sterilising agents used for absorbent cotton rolled in tissue is formaldehyde gas. For gauze and other dressings, steam is employed. In the laboratories in which these notes are made, the sterilising chambers are long steel cylinders similar to the chambers used in quarantine, and have a capacity of about 2,000 lb. of cotton each.

The cotton is run into the chambers, the doors are closed, the chamber is warmed, and a vacuum of about 20 ins. is drawn. Formaldehyde gas (or steam) is then admitted to the chambers, and the fibres are almost instantly penetrated. In practice, the gas or steam is removed by the vacuum pump and a fresh charge is admitted. The fibres are in contact with the formaldehyde gas for about two hours, with steam one hour.

The material is so packed that the sterilising agents can penetrate the fibres, but it is so enclosed that the cotton cannot be infected unless the packages are broken open.

Bacteriological tests, made by placing infected strips within the chambers, have demonstrated the efficiency of the process for ordinary forms of organisms.

Surgical Gauze.—Absorbent gauze cloth, made of cotton fibre, is at once a covering and protection. It may be used to bind together separated parts. Its threads act as compresses to severed blood vessels. The absorptive power of gauze is very great when properly prepared, its qualities make it the most useful wound-dressing material known.

The gauze of the cotton trade, known as "Cheese Cloth" or "Tobacco Cloth," is quite distinct from surgical gauze. In the United States, in England, and in some parts of the Continent, gauze is spun and woven solely for surgical uses.

Cotton fibre, after primary mechanical treatment as above, when it is to be made into surgical gauze, passes through a series of mechanical and chemical operations, the principal ones of which are here noted.

I. *Mechanical Processes.* — (1) "Combing," (2) "Drawing," (3) "Slubbing," (4) "Roving," (5) Spinning," (6) Weaving operations: (*a*) Winding, (*b*) Warping, (c) Sizing, (*d*) Drawing or twisting the warp, (*e*) Weaving.

II. *Chemical Operations.*—The woven gauze cloth is made of non-absorbent fibre, and must be made absorptive. This requires operations similar to those for rendering cotton absorbent. (1) "Grey washing," (2) "Bowking," decomposition of fatty, resinous, and waxy matters in the threads preparatory to removal by subsequent operations; (3) Washing, (4) Alkaline hydrolysis, (5) Extraction of alkali and hydrolysed products, (6) Oxidation (first stage of bleaching), (7) Extraction of oxidising agents, (8) Acid oxidation, (9) Second alkaline hydrolysis, (10) Extraction of alkaline products, (11) Second acid oxidation—completion of bleaching, (12) Neutralisation of chemicals and removal of salts produced thereby.

III. *Mechanical Processes.*—1. Opening. The gauze cloth at this point is white and absorbent, but folded and twisted, and must be opened to full width for the next operation. 2. Tentering (stretching, drying, calendering). 3. Rolling (folding automatically). If the material is intended for antiseptic gauze, it is impregnated with the antiseptic solution at this point. 4. Packing into containers. 5. Sterilisation.

In selecting and blending the fibres, great care must be taken to secure evenness in length, freedom from leaf,

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* Instances have occurred where soap was used, as noted in the rocess marked No. 11 in the table, and the water used in the ubsequent washings contained an excessive amount of alum. In hese cases it was found that the soap became coagulated, rendering he fibres non-absorbent.

† In lower grades the nebs are allowed to pass through.

shells, dirt, and above all, to give exactly the right twist to the thread. In spinning, the object is not to secure a tight, strong, hard twisted thread, but rather an even smooth one, with the fibres so laid as to be readily rendered absorbent. A vital point is that the sizing must be one that is perfectly soluble and that can be quite removed in the main chemical processes. The process of rendering the gauze absorbent is very drastic. Considerable oxidation takes place, with an average loss of 11 per cent. in weight. The finished product is carried beyond the stage of bleaching before the desired absorbtive power is reached. In small laboratories this work is carried on in the piece, while the larger establishments have automatic apparatus for the chemical washing, &c. The finishing of surgical gauze is of considerable importance.

The use of fillers, such as gums, starches, dextrines, &c., or softeners, such as soaps and fats, is very undesirable. In some grades to be found in the market the amount of such dressings is such as to preclude the use of the material with iodoform, mercuric chloride, or other sensitive antiseptics.

It is comparatively easy in trade to obtain a price for gauze much above its actual value. For example, a gauze which in the grey is 36 ins. in width will, under the ordinary treatment, finish up only 35 ins. in width. A free use of starch, however, may aid in holding it out to width. By manipulating the tentering machine, the longitudinal threads may be stretched so as to give an increase in length of from 10 to 20 per cent.

In dealing with gauze, it is usual to take a piece one inch square as a standard. If we take such a square of a fairly high grade, such as is represented by one having 40 longitudinal and 44 cross threads per square inch we shall have 84 inches of thread.

Again, the size of the thread will make a difference in the weight of cotton in each square inch.

With surgical gauzes, as found in the market, there is a marked variation in the quality of the fibre, the number of threads to the inch, and the size and weight of the threads. The National Formulary (United States, unofficial) names as standard cloths, Lehigh E. and Stillwater brands. These have 32 threads per square inch each way, and weigh about 800 grains to the square yard. The gauze cloth now found in commerce exhibits a great variation.

The earlier surgical gauzes were made of Egyptian cotton, with equal number of threads each way, hand finished. The hand finish kept the threads straight. The final product was less white but more elastic. It came from the bleach unchanged in tensile strength.

Surgical gauze is to be used as a protective covering, a bandage, and a dressing. It must have strength and sufficient power and capacity to absorb, to hold, and to act upon all discharges. It must contain nothing inimical to wound tissue. It must be aseptic; in other words, its value depends upon its preparation rather than upon its textile composition. The gauze, within its final container, is sterilised by saturated steam in a vacuum.

Classes of Cotton Dressings.—The progressive evolution of surgery has demanded cotton dressing possessing certain characteristics which may be crudely defined as follows:—Non-absorbent dressings which resist absorption into the fibres themselves. These absorb by capillarity and act as filters and protectives. Absorbent dressings capable of absorbing into the fibres and interstices the serous discharges, and solutions applied to wound surfaces. Antiseptic fibres impregnated with antiseptics, or dressings which work antiseptically, dry sterile absorbent cotton fibre which absorb serous discharges and hold them in a dry condition. Aseptic dressings free from living organisms (sterilised).

Dressings impregnated with antiseptics may still contain organisms and be the means of carrying infection to a wound; hence all dressings applied to a wound must be antiseptic and surgically clean. Sterility, once attained, must be maintained until the dressing reaches the wound surface.

Lister first impregnated lint with very pure phenol, his object being to form a crust over the wound, and thus prevent putrefaction. This was followed by mixtures o oil and carbolic acid, carbolated pastes, and putty encased in muslin or lint, and, in 1871, gauze cloth was introduced by him. The Continental surgeons, who had been the first to adopt absorbent cotton, were also the first to impregnat the fibres with antiseptics. The list of antiseptic dressing made of cotton is to-day quite meagre. The most commonl used are mercuric chloride, iodoform, boracic acid, and Lister's gauze of mercury and zinc. The method o preparing these need not be detailed here.*

Antiseptic gauze is supplied in two forms, moist an dry. In dry gauze a volatile solvent is used, and, upo evaporation, the antiseptic is left upon the fibre. The usua standard for such a gauze would be the percentage b weight of the finished product.

In moist gauze a non-volatile solution or emulsion i made by the aid of glycerin and the gauze is impregnated the excess of solution is extracted, and the gauze lef undried. The standard adopted for such antiseptic gauz is that the gauze when dry shall contain the require percentage of antiseptic by weight.†

Mixtures of carbolic acid with oils, fats, and soap certainly neutralise the activity of the acid, from a chemica and bacteriological point of view. Mercuric chloride form an inert compound with serous fluids from the tissue Lister redissolved the precipitate formed by corrosiv sublimate and serum in an excess of blood serum. Thi preparation was quickly abandoned. The chemical activit and bacteriological power of mercuric chloride in solutio depends upon its free ions. Yet in surgery, sodiu chloride and ammonium chloride are used to increase th solubility of the mercuric salt. In the case of ammoniu chloride undoubtedly a double salt is formed (sal-Alem broth, Lister), and it is the free ions of the double salt tha are active. Lister also introduced a so-called double sal the cyanide of mercury and zinc. From the chemist' point of view there was in this salt no combination, and th soluble mercuric cyanide was nearly all washed away in th preparation of the mixture, leaving only zinc cyanide, a inert substance. Mercuric chloride, in contact with cotto fibre, is in the course of time reduced to oxide. Th change seems to take place more rapidly if the fibre is dr Mixtures of soap and mercuric chloride and iodoform f impregnating gauze are very common. Here there is decomposition of the mercuric salt and the iodoform, an in turn a combination of the mercury and free iodine. A these compounds, however, satisfy the surgeon, and th chemist must be suited.

With the development of surgical technique the use antiseptic cotton and gauze has markedly decreased. The has been a marked reduction in the proportion of ant septics used, and a gradual abandonment of antiseptic Plain aseptic sterilised dressings of cotton or gauze a now used in many instances, to the entire exclusion antiseptic preparations.

In addition to the already noted forms of surgic dressings made of cotton, still others may be enumerated.

Absorbent cotton fibres, compressed into small hul have found considerable favour in military practice. . preparation of cotton fibres partially felted so as to form cross between lint and loose fibres is known under the nam of lintine. Combinations of cotton fibre and other cell loses have also been manufactured, the advantage of t cellulose being that the fluids absorbed are soon diffus and spread over the entire area of the dressings.

There are a number of modifications of cotton fibre use. Carbonised cotton fibres have found a very limite use in surgery. Many other fibres and substances hav been suggested as substitutes for cotton or for mixing wi it, *e.g.*, peat, ramie, and flax, but all these lack one or mo essential features, while cotton fibre in various forms com more and more into use in surgery.

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* Styptic cotton, *i.e.*, cotton fibre impregnated with a solution ferric chloride or subsulphate, belongs to the class of cott prepared with non-absorbent fibre, its use antedates antisepsis, a it is not used in modern surgery.

† In some instances the impregnation is adjusted so that ea square measure of the gauze contains a definite measure of t antiseptic.

Absorbent cotton fibre and gauze cloth, have found numerous uses in the industrial arts.

Water, watery solutions, oils, syrups, jellies, and varnishes can be strained or perfectly clarified as may be desired. Dairies consume large quantities of both cotton and gauze for the straining and clarification of milk. In chemical laboratories, in addition to use for filtering purposes, there is an increasing use of absorbents for absorption of fats, &c., as in milk analysis.

The use of prepared cellulose as an absorbent is undoubtedly capable of great extension. In this paper it has been noted that the prepared fibre has a marked power in removing certain coloured matters from solution, forming in certain instances lake-like compounds. From the basic salts of certain metals the fibres take up notable proportions of the basic oxides. This phenomenon is increased in well-prepared absorbent cotton fibre. A farther study along this line might prove of considerable value.

In the electrical industry considerable use is found for absorbent cotton fibre, as also in the preparation of films, cements, and varnishes. Absorbent cotton fibre is also utilised in the manufacture of incandescent mantles.

There is a constantly increasing demand for absorbent cotton fibres in the preparation of collodion compounds. In many of the industrial uses here noted it is required that the fibre shall be free from foreign matters and from chemicals. In certain of them the presence of immature fibres, nibs, &c., is objectionable. For other uses a low content of ash is very desirable. In bacteriological work and for filtering milk, &c., sterilised fibres are preferred.

Ash of Cotton Fibre.—A consideration of the ash in cotton fibre is important in view of the attempts of several Pharmacopœias to prescribe the amount which shall be present in absorbent cotton, and also in view of the fact that in the use of absorbent cotton for many purposes, the quantity and quality of the ash is a factor of considerable moment. The writer has often been asked for a process to produce a cotton entirely ash free. At other times trouble has arisen over the presence, in considerable quantities, of such constituents as lime, magnesium, and iron in the finished product. The table first given shows the amount of ash in samples of raw cotton fibre as found in the American market.

Ash of Raw Cotton Fibre (based on Uncleaned Fibre with Natural Moisture).—Orleans, 1·5; Texas, 1·8; Egyptian, 1·6; Sea Island, 1·8; Peruvian, 1·7; Strict Middlings, No. 300, 1·65; "East Indian," 2·72 per cent.

Davis, Dryfus, and Holland (quoted in Cotton by C. P. Brooks) gives the ash of several varieties of Indian cotton as follows:—Dhollerah, 6·22; Dharwar, 4·16; Bengal, 3·98; Broach, 3·14; Comrawuttee, 2·52 per cent.

The United States Department of Agriculture gives results of analysis of 10 samples of American staples as follows:—Minimum, 0·93; maximum, 1·80; Average, 1·37 per cent. ash.

The amount of ash in the fibre is small in comparison with the amount in other parts of the plant as shown below.

Ash of the Cotton Plant, American grown.

——	Maximum.	Minimum.	Average.
	Per Cent.	Per Cent.	Per Cent.
Entire plant mature, 31 specimens in falling stage.	..	..	2·15
Roots, 18 specimens..........	1·58	0·47	0·92
Stems, 20 „	3·28	0·74	1·45
Leaves, 19 „	17·26	9·33	13·11
Bolls, 6 „	6·02	3·43	4·90
Burrs, 3 „	12·96	1·70	9·21
Seed, 15 „	4·96	2·80	3·78
Fibre..........................	1·80	0·93	1·37

In cotton fibre, as it is delivered from the market to the gin, is found a varying proportion of impurities which increase the percentage of ash. Thus the percentage of ash in absorbent cotton varies somewhat in proportion to the thoroughness with which the cotton is cleaned by the mechanical processes before chemical treatment. How much of the ash the mechanical and chemical treatment removes is shown in the sample marked 300 (see below), where the proportion of ash in the ground fibre was 1·65 per cent., and after being made absorbent, 0·123 per cent.

As far as my researches have extended, I find the following standard for ash in absorbent cotton:—

United States Pharmacopœia, 1890.—Not more than 0·8 per cent of ash.

British Pharmacopœia, 1898. — Less than 1 per cent. of ash.

German Pharmacopœia, 4th Edition.—Not more than 0·3 per cent of ash.

The percentage of ash present in a sample of absorbent cotton sold in various markets is as follows:—American, 0·063, 0·120, 0·177, 0·180, 0·150, 0·177; American, N.P., 0·265; American, 390, 0·123; German, 0·073, 0·178; French, 0·216, 0·094; English, 0·200, 0·092.

Test for Purity.—A few of the Pharmacopœias have established standards for the purity of absorbent cotton. Among these are the following:—"Purified cotton should be perfectly free from all visible impurities and on combustion should not leave more than 0·8 per cent. of ash. When purified cotton previously compressed in the hand is thrown on the surface of cold water it should readily absorb the latter and sink, and the water should not acquire either an acid or an alkaline reaction." (Evidence of Proper Purification, U.S. Pharmacopœia, 1890.) "It should readily be wetted by *water*, to which it should not impart either an alkaline or an acid reaction. On incineration in air it burns leaving less than 1 per cent. of ash. It dissolves in concentrated solution of copper-ammonio-sulphate." (British Pharmacopœia, 1898.)*

"Purified cotton, moistened with water, should not change the color of litmus paper. Having been immersed in boiling water, the liquid should hardly produce an opalescence with solution of silver nitrate, barium nitrate, or ammonium oxalate. The red tint which is produced by the addition of a few drops of sulphuric acid and three drops of a solution of potassium permanganate should not disappear within a few minutes. If purified cotton is thrown on water it should become moist and sink at once. On burning it should not leave more than 0·3 per cent. of ash." (German Pharmacopœia, 4th Edition.)†

Purified cotton should readily become wet when brought into contact with warm water, and the washings should be neutral. 0·3 grm. of purified cotton when ignited and incinerated should leave no weighable amount of residue. (Pharmacopœia Svecia, 1901.)

All these standards are open to criticism; that of the U.S. P. is particularly faulty in that absorbent cotton heavily charged with impurities will, if previously pressed in the hand, sink when thrown on the surface of water. This authority is also indefinite as to the amount of water to be used. If a large amount of water is used with a small portion of cotton, alkaline or acid reaction easily escapes observation. The British Pharmacopœia is likewise open to criticism in this same respect; impure cotton may be immersed in water without imparting either an acid or an alkaline reaction.

The test of sinking in water is a test neither of purity nor of absorbent power. Soaps, glycerin compounds, and calcium chloride will increase the apparent absorbency enough to comply with this test.

A very simple test for the presence of substances added to give artificial absorbtive power is, to thoroughly wash the cotton in water, to dry it thoroughly, and then to drop it in water. If it has been made absorbent by added substances its power is diminished under this treatment.

In my laboratory the following tests have been found of service in rapid quantitative work:—A portion of cotton (generally 2 grms.) is percolated with alcohol. Another portion is percolated with ether, the solvents being slightly

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* The word "copper-ammonio-sulphate" in the B.P., 1898, is an error: solution of cuprammonium oxide was evidently intended.

† The following Pharmacopœias contain no reference to absorbent cotton. Pharmacopœia Espanola, Pharmacopœia Danica (1893), Pharmacopœia Chilensis (1886), Pharmacopœia Portuguesa (1876), Pharmacopœia Helvetica (1893), Pharmacopœia Belgica (1885). The Pharmacopœia Venquela (1898) gives a process for preparing absorbent cotton, but has no requirement for purity.

warmed and passed through twice. If no residue then remains upon evaporation, the extraction has been thorough. Purified ether and purified alcohol are to be used, or else there will be a residue due to impurities in the solvent.

For the presence of bleaching materials due to faulty processes, left by design, or added to give absorbtive power, take 5 grms. of the absorbent cotton and wash it well with 100 c.c. of distilled water, either by letting it stand for some hours in the water or by boiling it for a few minutes. The water must be absolutely pure and the vessels perfectly clean. With pure absorbent cotton the water remains clear; bleaching chemicals and soaps show a cloudiness if present in notable quantities. If no cloudiness appears, or if it is only faintly cloudy upon concentration to half or one fourth its bulk, the water may be tested for the presence of chemicals such as chlorides (from the chlorine of the bleaching bath).

Calcium chloride (sometimes added to give hygroscopic power) and sulphuric acid may be detected by the usual tests. Salts of the fatty acids (soaps) are detected by their reaction with mercuric chloride or acetic acid. Soaps, when present in considerable amounts, are also manifest in the ether residues, and glycerin in the water residues, when the cotton is extracted with these solvents.

Tests for the purity of absorbent gauze present a much wider range than those for the purity of absorbent cotton. Here, in addition to the impurities mentioned in the foregoing, such as the natural fats, waxes, colouring matters, and bleaching chemicals, there are often present also many added substances.

The number of substances used for dressing and felting gauze to give a better finish, to make weight, or to increase the apparent size of the thread, is very large. Only those of more common occurrence are here noted. As staying or dressing materials: starch, flour, dextrine, glue, albumin, casein, gums, tragacanth, senegal, arabic, &c. Loading materials: gypsum, chalk, chlorides, and sulphates, sodium and zinc salts, china clay, barium chloride, sulphate, and carbonate. Substances added to make the fabric soft, pliable, and hygroscopic: glycerin, glucose, calcium, zinc, and magnesium chlorides, sodium, and ammonium salts. The number of substances is so large that no general method of examination can be given; specific methods for each would require too much space. The rough and simple method used in our practice is, first to examine the external or physical properties. Then a practised eye can detect filling at once. A heavily charged gauze will lose much of its filling by brisk rubbing between the fingers, and dust will fly off upon tearing.

Sydney, N.S.W., Section.

Meeting held on August 10th, 1904.

MR. HENRY G. SMITH IN THE CHAIR.

THE BACTERIAL ORIGIN OF THE VEGETABLE GUMS.—PART II.

BY R. GREIG SMITH, D.Sc.

It will be remembered that the arabin and metarabin gums were first obtained in the laboratory by growing *Bact. acaciæ* and *Bact. metarabinum* upon a medium containing saccharose, potato-juice, tannin, and agar. The medium as at first prepared was excellent for the purpose of producing slime, but unfortunately it subsequently became uncertain in its action, and this could only be accounted for by differences in the composition of the potato-juice, which was made at various times from different lots of potatoes. Further research, however, showed that one reason for the discrepancies lay in the fact that the bacteria rapidly lost the power of producing slime from saccharose. There seemed also to be a variable constituent of the potato-juice, possibly dextrose, that prohibited the formation of the typical by-product. As the potato-juice medium was so unsatisfactory, a number of experiments were made with the object of obtaining a medium better adapted to the slime-forming requirements of the bacterium. This entailed an investigation into the nutrition of the organism, and incidentally a number of other questions were considered.

In experimenting with the various nutrients, the effects were measured by the weights of slime that were produced. The slimes were grown upon the surface of 20 c.c. portions of agar media which had been allowed to solidify in ordinary 9-cm. Petri-dishes. The material used for infecting the plates was prepared by growing the bacteria upon saccharose-potato-agar (without tannin) at 30° C. for from 24 to 48 hours. At that temperature the bacteria grew exceedingly well, and were practically without slime. After a certain period of incubation, the slimes were removed from the experimental agar-plates as thoroughly as possible and weighed directly. Duplicate tests made at the same time and incubated under the same conditions generally agreed, but when made at different times and possibly under different conditions, they did not always agree. The yield of slime appeared to depend largely upon the vitality of the bacterium when infected. The largest yield of slime, *viz.*, 25 per cent. (5 grms. from 20 c.c. of medium), was obtained from the most favourable medium when the bacteria had been subcultivated for some weeks at close intervals, such as every two or three days. When the bacteria were allowed to rest for, say, a month, the amounts of slime were very much less, and after they had been subcultivated for a few months upon sugar-free media, the gum-forming faculty was temporarily lost.

A series of preliminary experiments, in which the balance was not used, indicated that a quantity of slime could be obtained upon an agar medium containing levulose, asparagine, potassium citrate, and tannin. Further experiments were made to discover the optimum quantity of each of these nutrients, &c., and the comparative effect of other nutrients.

The bacterium responded quickly to levulose, the maximum yield being obtained with 2 per cent. of sugar. The yield gradually fell until, with 10 per cent., only four-tenths of the maximum was produced. With regard to the other carbonaceous nutrients, saccharose was found to be as useful as levulose when the organism had been trained to utilise that particular sugar. Glycerin, mannite, and maltose were not quite so good, while dextrose, galactose, lactose, and raffinose were useless. A curious point was that while levulose produced the maximum quantity, invert sugar produced none. Experimental trials with mixtures of levulose and dextrose showed that as the proportion of dextrose was increased, the yield of slime decreased. Dextrose was thus not only useless for enabling the bacterium to form gum, but it also prevented the organism from utilising levulose. It was furthermore found that dextrose also prohibited the production of gum from maltose. Galactose behaved like dextrose in producing no slime and in preventing the utilisation of levulose and maltose.

These experiments with sugars have a direct bearing upon a certain hypothesis regarding the origin of gum from cellulose. Botanists seem to have agreed that gum is derived more or less directly from cellulose, probably because it had been found in certain trees in *lacunæ*, which had been produced by the swelling and ultimate deliquescence of the cell walls. It is probable that the destruction of the wood tissue had been caused by the activity of microscopic moulds, and that the gum had flowed into the cavity exactly as it flows into the cavities in the fruit of the almond and the peach. Fragments of cellular tissue are sometimes found embedded in gums, such as gum tragacanth, but rather than indicating a cellulose origin of the gum, I think this points to the presence of insect life, *e.g.*, tree-borers, in the wood in the neighbourhood of the puncture through which the gum had exuded. I have shown that the gum has a bacterial origin, so that its direct production from cellulose is out of the question. The results with the sugars show that dextrose, the hydrolytic product of cellulose, is useless for the production of gum. And if we use the name in its broadest sense and include the hemicelluloses, pectins, and other celluloses, we know that the dextrose or galactose, which generally accompanies the other saccharine products of hydrolysis, would prohibit the formation of gum. The experimental evidence goes to show that the gum is formed by the bacteria from levulose and maltose, the wandering sugars of Brown and Morris.

When varying quantities of asparagine were contained in the media upon which the slime was grown, it was found that the maximum yield was obtained with 0·1 per cent., and that larger amounts had no effect one way or the other in modifying the activity of the organism. Upon comparing peptone, asparagine, and urea with different sugars, &c., the asparagine clearly gave the best results. With the exception of levulose, from which the same weight of slime was obtained, the yields from the urea plates, in which the nitrogen was equivalent to that in the asparagine plates, varied from two-thirds in the case of saccharose to three-fifths with mannite. Peptone gave practically no slime.

It was found, upon testing various alkaline salts, that the acid radicles fell into four groups; they either (1) accelerated, (2) were indifferent, (3) depressed, or (4) prohibited the production of slime. The first group included succinates and citrates; the second contained tartrates and, possibly, chlorides; the third had sulphates, phosphates, and oxalates; while the fourth included acetates, lactates, and formates. When the quantity of salt was investigated, it was found that 0·1 per cent. of succinate or of citrate was the optimum. Of these two salts, the latter was, if anything, the better. As the bacterium produced among its acids succinic, acetic, formic, and lactic, it is interesting to note that the first of these accelerated and the others prohibited the production of gum. One is inclined to regard the by-products of bacteria and of yeasts either as depressants or prohibitants; but succinic acid does not appear to come under either of these groups. So far as yeasts are concerned, succinates undoubtedly hasten fermentation, but possibly not more so than do phosphates.

The investigation of the action of tannin was interesting. The best quantity was 0·1 per cent., but as much as 0·3 per cent. could be used; more than that destroyed the cohesiveness of the agar during sterilisation. All tannins did not seem to have the same slime-producing effect, as it was found that a fresh lot was not so active as the older sample. In order to test the action of different known tannins upon the medium, I obtained a number of specimens from Messrs. Harrington Bros. The baterium enabled these to be separated into two classes, one of which increased the yield of slime, and included the sumach tannins used by dyers; the other was either inactive or depressed the yield, and contained the gall-nut tannins, such as the pure forms, as well as those used by calico-printers. The addition of glycerin to the medium and a longer period of incubation checked the depression due to the second group of tannins. Since *Bact. acaciæ* can distinguish between certain of the tannins, it is possible that it might form the basis of a biological method for the recognition of these substances. With regard to the function of the tannin in the medium, I am of the opinion that by causing the agar-jelly to be somewhat contractile, it enables the bacteria to be slowly fed with nutrients in solution—that is to say, the bacteria can obtain the water necessary to form the slime (which contains 97 per cent. of water) much more easily when tannin is present than when it is absent.

The optimum temperature for slime formation lies about 17° C. As the temperature rises, the slime becomes less. At 22° it was two-thirds, and at 30° it was one-fourth the maximum.

From the experiments briefly treated in the foregoing, it appeared that an optimum medium for the formation of slime in the laboratory should contain levulose 2, glycerin 1, asparagine 0·1, tannin (preferably sumach) 0·1, potassium citrate 0·1, agar 2 grms., and tap-water to 100 c.c. This medium is not only an excellent substratum for enabling *Bact. acaciæ* to form its slime; but it is also a means of distinguishing between other gum bacteria, some of which do not produce slime upon it.

As there might be the possibility of checking the gum-flux of fruit trees by the application of saline manures, experiments were made with various salts which were added to the optimum medium. These, however, showed that there would be little hope of checking the gum-flux with any salt, excepting, perhaps, nitrate of potash. Upon a medium prepared according to the prescription detailed above, but without glycerin, 20 grms. of slime were obtained from 100 c.c. of agar. The addition of 0·2 per cent. of potassium nitrate reduced the yield to 8 grms., and larger percentages of salt had no further influence. The same reduction was obtained with 0·6 per cent. of sodium chloride, while double the quantity checked the growth of the bacterium.

In my work connected with the formation of gum in plants and the relationship between the gum and certain bacteria, I have always endeavoured to produce the typical bacterial product in the laboratory. This was not always capable of being done, but in the present instance the production of arabin and metarabin in the laboratory by *Bact. acaciæ* and *Bact. metarabinum*, both isolated from the tissues of trees, was a much more decided proof that the bacteria produced these gums in the plant than would have been their production in the plant after an infection with the bacteria. The proof was more decided, for the simple reason that we could not have been absolutely certain that the trees would not have developed gum-flux independently of the infection, possibly as the result of a previous or a subsequent accidental infection with the same or other organisms.

However, an infection experiment was made, but it was done with the idea of testing if the bacterium, isolated from a member of the *acaciæ*, could bring about a production of gum in one of the *Rosaceæ*. Peach trees, after having been infected with *Bact acaciæ*, developed gum-flux, but the gum which exuded was metarabin. This was rather a curious result. That the tree should have produced insoluble metarabin after an infection with the soluble arabin bacterium was unexpected. Some light was, however, thrown upon the matter by the bacteriological examination of the infected plant. In the tissues I found *Bact. acaciæ*, *Bact. metarabinum*, and forms intermediate between these two organisms. The peach tree had apparently altered, and was rapidly altering *Bact. acaciæ* into *Bact. metarabinum*, a process which, as I have already shown, could not be done in the laboratory. It is therefore evident that the host-plant is able to modify the gum-forming faculty of the bacterium, and that so profoundly that the acquired character is practically permanent. In the case of *Bact. metarabinum*, isolated from *Acacia penninervis*, the formation of metarabin had been maintained for two years, during which time the organism had been subcultivated in the laboratory. The influence of the host-plant upon the bacterium explains how the gums from certain species of trees are so constant in character, that from the fruit trees (*Rosaceæ*) being practically always the insoluble cerasin (metarabin), and that from certain *Acaciæ* being always the soluble arabin.

During the research I kept in view the possibility of gum being produced industrially, perhaps from the waste liquors in the manufacture of potato-starch or from molasses, but at present there seems to be little possibility of its being prepared from these substances. The gum is not readily formed in fluid media, and the agar medium appears to be a necessity for the production of the slime in quantity. Molasses acts as a complete food for the bacterium, and the addition of other nutrients is unnecessary. It does not, however, produce a maximum yield of slime, probably on account of its excess of saline matter. Speaking roughly, 20 parts of agar, with 20 parts of saccharose, 10 of glycerin, and 1 each of asparagine, tannin, and potassium citrate would yield 250 parts of slime, containing 7·5 parts of dry slime, or, say, 6 parts of gum. The cost of producing this small quantity of gum, in materials and labour, would be in excess of its value. We must therefore look at present to growing the gum in trees and augmenting the production by the infection of suitable kinds.

In this Journal (1902, 1381) appears a paper by Mr. Thos. Steel and myself upon gum levan, which is formed in solutions of saccharose, such as cane-juice, by the biochemical activity of *Bacillus levaniformans*. The organism is a comparatively large spore-forming bacterium, measuring 2 to 3 μ in length. I have found it frequently in plant tissues during the investigations connected with the vegetable gums, and it undoubtedly occurs widely distributed in the vegetable kingdom. It is not, however, the only organism that can form levan. In a sweet gummy exudate from a tree, *Eucalyptus Stuartiana*, I obtained *Bact eucalypti*, a small non-sporulating bacterium, 1 μ in length, which grew in solutions containing peptone, saccharose, and salts, producing the strong opalescence so characteristic of levan. It also degraded the saccharose to reducing sugars. Both gum and reducing sugars were produced in the same proportions and at the same rate as in the case of *Bac. levaniformans*, so that the table showing the composition of the nutrient saccharose medium during the cultivation of one bacterium would also apply to the other. Practically the same acids and subsidiary products were obtained. Butyric acid was the only exception, but it is probable that, had an older culture been examined, as was the case with *Bac. levaniformans*, that acid would have been found. One point noted in addition was that the acids in the nutrient media containing chalk were formed from the reducing sugars and not from the saccharose. The activity of the organism was tested upon saccharose, but the gum was formed naturally from raffinose, the manna of the eucalypt, with which the gum was mixed.

I have found a gum-forming bacterium frequently in vegetable tissues, and although I have not yet discovered a natural gum produced by it, yet there is every probability that such does exist. It was obtained first from the sugar cane, and then in the gum-resin of *Araucaria Cunninghamii*, the Moreton Bay pine. It probably has nothing to do with the production of the gum of the latter, which is undoubtedly arabin.

The organism produced slime readily upon the levulose-tannin medium already described, and the slime yielded a gum which became insoluble in water after it had been coagulated by alcohol. This property altered in time, for, when the bacterium had been subcultivated in the laboratory for two years, it was no longer converted into an insoluble form when dehydrated with alcohol. The gum mucilage made paper adhere firmly to glass, and when tested was found to react as follows: Basic and ammoniacal lead acetates gave curdy masses; ferric chloride produced a brownish clot; barium hydroxide thickened the mucilage; Schweitzer's reagent produced a gelatinous slime; dilute iodine gave a reddish tinge; while Fehling's solution gave no reaction; copper sulphate, followed by potassium hydroxide, produced a gelatinous blue precipitate, which coagulated to a curdy mass upon boiling. The other usual gum reagents gave no reactions.

The gum was easily hydrolysed to galactose by 5 per cent. sulphuric acid. It was, therefore, a galactan. In saccharose media the sugar was not inverted, and, besides the gum, there were produced ethyl alcohol, carbon dioxide, lauric, palmitic, succinic, acetic, and formic acids.

In the disease known as "gummosis," or gumming of the sugar-cane, the plants become sickly and eventually die as a result of the plugging of the large vessels of the vascular strings with a yellow gum or slime. With badly infected canes the gum exudes from the ends of the bundles when the canes are cut transversely. The gum has been named vasculin by Cobb, who saw bacteria in the fresh gum. His field experiments, in which the canes were infected with *gum*, were inconclusive.

From the gum that exuded from the cut ends of the vascular strings of a diseased cane, I separated a bacterium to which I have applied Cobb's name, *Bacterium vascularum*. It grew slowly upon ordinary glucose-gelatin, which it slowly liquefied, as hemispherical colonies of yellow slime. A quantity of the gum was grown upon cane-juice agar, and after purification portions were tested with the usual reagents. Precipitates were obtained with neutral, basic, and ammoniacal lead acetates, barium and calcium hydroxides, copper sulphate, and ferric chloride. A slimy voluminous precipitate or coagulum was given with alcohol. The natural gum, scraped from cut canes, was tested at the same time as the bacterial product, and the reactions were found to be identical. The bacterial gum as grown upon the artificial media was similar in appearance to the natural product. This is different from those gums that have been already recorded, but is explained by the fact that cane-gum, although it is popularly called a gum, is in reality a slime.

Mr. Thos. Steel had already done much work with the natural gum, and I have left to him the publication of its chemical nature.

A number of experiments were made with various nutrients to test their influence upon the production of slime. The product was not weighed like the arabin slimes, but the quantity was estimated visually as it appeared upon the surfaces of the agar slopes. This is not so good a method as by making use of the balance, but the yields were small in comparison with the arabin slime, and on this account the visual method seemed the better at the time. The bacterium grew well when peptone was present to the extent of from 0·1 to 0·5 per cent. Levulose, saccharose, and, to a less extent, dextrose were the only carbohydrates which favoured slime production. None was formed when glycerin, starch, dextrin, maltose, or lactose were the sources of carbon. With regard to salts, potassium phosphate was decidedly beneficial; all other salts were indecisive, with the exception of common salt, which prevented the growth of the bacterium. As sodium chloride is the only salt which acted as a poison, it is possible that it may be useful in checking the disease, the more especially as healthy crops of sugar-cane can be grown in soil containing anything under 1 per cent. But better than the use of preventives is the growth of varieties of cane insusceptible to the disease. With regard to the reaction of the medium, a faint acidity, equal to 0·01 per cent. of tartaric acid, was found to give the best result. This doubtless explains why the bacteria are to be found in the faintly acid juices of the large vessels of the vascular bundles, and not in the relatively highly acid cellular tissue, the juice of which has an acidity equal to 0·2 to 0·3 per cent. of tartaric acid. The optimum temperature was found to be 30° C.; no slime was formed at 37°. The production of the gum at the lower temperature, and not at the higher, explains why cold weather increases the prevalence of the disease. As no invertase is secreted by the bacterium, it cannot directly cause a degradation of the sugar in the cane.

Associated with a mould, a bacterium is found in the phenomenon which I have named the "red string of the sugar-cane." The bacterium produces a colourless slime from saccharose and levulose, but the mould when growing in the slime produces a red colour which becomes diffused throughout the bacterial product. The red slime fills up the large vessels of the vascular strings, producing a condition similar to that which is found in gummosis. It is, however, found only in some of the strings, and a general gummosis does not appear to be produced. The gum was obtained from the slime by the method employed in obtaining the bacterial arabin, and it was found to behave to reagents precisely like arabin. Upon hydrolysis it yielded galactose only, so that it may be called a pseudarabin. I have obtained the same gum from a yellow race of the bacterium isolated from the quince.

These instances of the formation of vegetable gums by bacteria are sufficient to indicate that *all* exuded gums have in all probability a bacterial origin. I would go further and say that until they can be shown to be otherwise, all vegetable gums and even mucilages are the products of bacteria.

ERRATUM.

In Part I. of this paper, this J., 1904, page 107, line 45, for *neutral* read *natural*.

DISCUSSION.

Mr. THOS. STEEL remarked that the different effects on the growth of the *Bact. Acaciæ* of tannins from various sources was most interesting and suggestive, particularly in the light of much that had recently appeared on the subject of tannins in the Society's journal. It was curious to find that succinic acid, contrary to what might be expected, acted as an accelerator in producing a growth of slime by the bacterium, while oxalic had an inhibitory effect. Were the acids experimented with in the free state or combined with a base? Another most interesting fact was the remarkable change produced in the character of the bac-rium by the host-plant, a bacterium which could not, so ar, be changed in artificial cultures, at once altering its form hen grown in the living tree. It was very curious to find ndoubtedly different species of bacteria producing a subance of the nature of gum levan; this was probably due the mode of attack on the sugar molecule being similar. e congratulated the author on having thrown so much ght on the origin of the vegetable gums.

Dr. G. Harker said that he was most struck perhaps by e fact that while levulose was easily converted into the m, dextrose was perfectly immune to the attacks of the cterium. It recalled the work of Emil Fischer on the eaking up of complex sugars by means of enzymes, in hich he showed how the polysaccharide, which could be nsidered as a chain of $C_6H_{10}O_5$ groups differing from one other in structure, might be broken up link by link only the right enzyme could be found to attack the last link. F. Armstrong (Trans. Chem. Soc., Dec. 1903) had also own how α-methyl glucoside could be converted under e influence of the enzyme maltase, into α-glucose, while methyl glucoside was converted by another enzyme, nulsin, into β-glucose. These forms were simply stereomeric. He asked Dr. Greig Smith how far the experients were of a quantitative nature. Had he established y relation between the amount of gum formed and the antity of sugar which disappeared? Also what tests had en made to prove that the gum obtained was the same in l cases?

The Chairman said that the marked differences shown by e action of dextrose and levulose seemed to point to a tarding influence of the aldehydic group over that of the tonic. The action of the tannins also indicated a difference structure. There were often several tannins in the same oup of plants, and no less than three distinct tannins were und in eucalyptus exudations alone. With regard to the tion of succinic acid, it seemed conclusive that nature did deavour to get rid of this acid when formed in plants, and this was shown by the deposition of large quantities of aluminium succinate in the trees of *Orites excelsa*. The acid in this tree was formed by the oxidation of the normal butyric acid occurring in the sap, and was perhaps brought about by bacterial agency. The economic results likely to eventuate from the author's researches were likely to be far-reaching.

Dr. Greig Smith said, in reply to Mr. Steel, that the acids were added as salts of potash generally, but as the cultures and the media were always faintly acid, some of the free acid would always be present. With regard to the question of Dr. Harker, the relation between the gum produced and the sugar that had disappeared was not determined, and no tests were made to see if the gum was the same in all cases. It was possible that the constitution of the complex gum molecule might vary according to the sugar employed, but as the cultural characters of the organism were constant with a particular sugar, it was probable that the gum was always the same when that sugar was used. A marked difference in the chemical constitution as evidenced by a difference in the solubility of the gum would alter the character of the bacterial colonies. This had been noted with a certain gum-forming organism, *Bact. Atherstonei*, which altered its cultural characters in the laboratory, showing the transition from an insoluble to a soluble gum. The point raised by the Chairman concerning succinic acid was interesting. Delbrück (this J., 1903, 813) said that small quantities of toxic substances stimulated yeast cells, but if this were the case why should not lactates and acetates have behaved like succinates in the case of *Bact. Acaciæ?* One could always infer the behaviour of substances upon the bacterial cell from the action upon the cell aggregates or higher plants, for it had been shown by Gabritschewsky (Centralbl. f. Bakt. Orig., 32, 256) that calcium was not required by bacteria, and that therefore oxalic acid had no injurious influence upon them. Its toxicity for the higher plants was admitted.

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—PLANT, APPARATUS, AND MACHINERY.

English Patents.

frigerating Machines; Carbonic Anhydride ——. F. Windhausen and F. Windhausen, jun., Berlin. Eng. Pat. 17,040, Aug. 5, 1903.

e machine is of the counter-current type described in g. Pat. 9084 1901 (this J., 1902, 760), in which carbon dioxide liquefied in the condenser passes through a regulating valve into an intermediate receiver, &c. In the present machine, this receiver, containing spaces separated by temperature-exchanging surfaces, has two tubes or coils, one within the other, into one of which a part of the liquefied carbon dioxide passes to evaporate at a higher pressure and temperature than obtains in the evaporator, and lower than in the condenser, whereby the other portion of the liquefied carbon dioxide passing through the other tube or coil, is cooled on its way to the evaporator. (Compare also the two following abstracts.)—E. S.

Refrigerating Machines; Carbonic Anhydride ——. F. Windhausen and F. Windhausen, jun., Berlin. Eng. Pat. 17,040A, Aug. 5, 1903.

IN machines of the type described in the preceding abstract, having an intermediate receiver, there is, according to the present invention, a double-acting compressor, the end spaces of which are connected by a channel, to which a delivery tube is attached by means of a pressure or delivery valve; and there is a movable piston or plunger for altering the volume of vapour drawn in from the intermediate receiver.—E. S.

Refrigerating Machines; Carbonic Anhydride ——. F. Windhausen and F. Windhausen, jun., Berlin. Eng. Pat. 17,040B, Aug. 5, 1903.

IN a carbon dioxide refrigerating machine, of the type described in the two preceding abstracts, a combination is made of two compressors, so connected that one of them is double-acting for the vapours from the evaporator, whilst in the other, vapours drawn in from the evaporator are compressed at one end to about the pressure in the intermediate receiver, and are then passed to the other end, where they are compressed, together with the vapours from the intermediate receiver, to the pressure of the condenser into which they are passed.—E. S.

Distilling, Evaporating, or like Apparatus; Manufacture of ——. A. Jouve, Lyon, France. Eng. Pat. 21,765, Oct. 9, 1903.

SEE Fr. Pat. 330,666 of 1903; this J., 1903, 1086.—T. F. B.

Evaporating Liquors; Process of ——. H. H. Lake, London. From E. N. Trump, Syracuse, N.Y., U.S.A. Eng. Pat. 28,572, Dec. 29, 1903.

SEE U.S. Pat. 743,352 of 1903; this J., 1903, 1285.—T. F. B.

Vacuum Pans. H. H. Lake, London. From E. N. Trump, Syracuse, N.Y., U.S.A. Eng. Pat. 28,593, Dec. 29, 1903.

SEE U.S. Pat. 743,351 of 1903; this J., 1903, 1285.—T. F. B.

Safety Devices for Preventing Explosions in the Blast Pipes of Furnaces. P. Trapp, Falkirk, Scotland. Eng. Pat. 23,785, Nov. 3, 1903.

A FLAP valve is arranged against a seating in the upper part of the horizontal portion of the blast pipe in such a way that so long as the pressure of the blast is maintained, the valve is closed. Should, however, the blast fail, the flap drops, shutting off the blast pipe and allowing any back pressure of gas from the furnace to escape into the air.—W. H. C.

Mixers. J. F. Gandolfo, Du-Buque, Iowa, U.S.A. Eng. Pat. 3922, Feb. 16, 1904.

Two pairs of oppositely rotating, curved blades work in a bowl-shaped mixing pan, and are so arranged that they give somewhat in case of meeting any obstruction.
—W. H. C.

Furnaces; Heating ——. R. McAulay, Dumbarton, Scotland. Eng. Pat. 6786, March 21, 1904.

THE fuel- and air-ports are so arranged that the fuel gases from the producers are thoroughly mixed with the heated air from the regenerators, and are projected downwards towards the centre of the hearth.—W. H. C.

Grinding Mill; Improved ——. F. Stark, Ludwigshafen, Germany. Eng. Pat. 15,746, July 15, 1904.

A VERTICAL grinding disc rotates against a vertical grinding face, both having specially arranged cutting teeth. Means are provided for feeding the material to be ground, for renewing the grinding faces, and for regulating the feed.
—W. H. C.

Kilns and Driers; Combined Rotary ——. C. A. Matcham, Allentown, Pa., U.S.A. Eng. Pat. 16,588, July 27, 1904. Under Internat. Conv., Jan. 11, 1904.

SEE U.S. Pat. 755,513 of 1904; this J., 1904, 435.—T. F. B.

UNITED STATES PATENTS.

Separator; Centrifugal Liquid ——. J. A. Dahlquist and C. L. Holm, Assignors to Nya Aktiebolaget Radiator, Stockholm. U.S. Pat. 770,679, Sept. 20, 1904.

SEE Eng. Pat. 5716 of 1902; this J., 1902, 1464.—T. F. B.

Drying Apparatus; Tubular ——. M. Salzmann, Magdeburg-Buckau, Germany. U.S. Pat. 770,823, Sept. 27, 1904.

THE apparatus consists of a revolvable casing, inclined to the horizontal, containing two series of tubular passages, connected at the middle portion of the casing by an intermediate chamber with perforated sides. The tubes are surrounded by steam-jackets with an axial steam-supply pipe. Material supplied by suitable means to one series of tubular passages falls into the intermediate chamber, where it is pulverised by a roller, and then passes through the other series of passages into the discharge-trough.
—L. F. G.

Treatment [Drying] of Material; Apparatus for Continuous ——. W. H. Gesner, New York, Assignor to Caribbean Manufacturing Co., New York. U.S. Pat. 771,141, Sept. 27, 1904.

MATERIAL is delivered from a mixing chamber through a normally closed opening to an inclined casing surrounded by a steam-jacket, and containing a suitably rotated hollow shaft and hollow screw through which steam circulates.
—L. F. G.

Mixer. F. A. Hetherington, Indianapolis, Ind. U.S. Pat. 770,855, Sept. 27, 1904.

ONE of the end bearings in a horizontal mixer is removable. The mixer blades are attached to a hollow shaft which fits as a sleeve over the polygonal middle portion of the rotating shaft journalled in the above bearings, so that the removable bearing can be removed, the rotating shaft withdrawn axially, and the hollow shaft with the mixer blades withdrawn transversally from the casing of the mixer.
—L. F. G.

II.—FUEL, GAS, AND LIGHT.

Bunsen Flame; Water-Gas Equilibrium in the ——, *and the Chemical Determination of Flame Temperatures.* F. Haber and F. Richardt. J. f. Gasbeleucht., 1904, **47**, 809—815, 833—837, 861—869, and 877—880.

A CRITICAL review of past work on the subject of gas flames is first given, and then an account of the authors' experiments and results. The gases evolved from the inner cone of the Bunsen flame (compare this J., 1891, 992, 993) were quantitatively examined, and the relations between the concentrations of the four substances, carbon dioxide, hydrogen, carbon monoxide, and steam, were determined. It was found that in the green inner cone the water-gas equilibrium, $CO + H_2O \rightleftarrows CO_2 + H_2$, is produced very rapidly. The reaction-constant of the system was, within the limits of experimental error, the same as that calculated from Hahn's results (this J., 1903, 1038) for the temperature of this zone. After the withdrawal of the gaseous mixture from the combustion-zone and during the passage through the cooling zone, the equilibrium was not displaced to any notable extent. It is concluded from the experiments that the same result for the temperature of the inner combustion-zone is obtained by calculation from the composition of the products of combustion by the aid of the reaction-isochore of the water-gas equilibrium, as by thermo-electric measurements. The same numbers are also obtained by calculation from the heats of combustion and specific heats (Mallard and Le Chatelier) of the individual gases.—A. S.

Water-Gas Process ; Theory of the ——. v. Jüptner. Chem.-Zeit., 1904, **28**, 902—903.

An attempt is made to apply the principles of physical chemistry, especially Guldberg and Waage's equilibrium law, to the reactions concerned in the production of water-gas. The author's conclusions are that in order to obtain the best results : (1) The pressure must not be too high ; (2) the temperature must not fall below 800°—900° C. ; (3) with pressures up to four atmospheres the temperature should not exceed 900°—1000° C. These conditions hold for the ideal state, *viz.*, when there is equilibrium in the generator. If there be not equilibrium, the composition of the gas will alter on its way through the generator, and its final composition will depend on the height of the coke-column, the velocity of the current of steam, and the temperature. It is of great practical importance to introduce the steam at the coldest part of the generator, so as to avoid the reaction $2CO = C + CO_2$ in the cooler parts.—J. T. D.

Aerogen Gas. Stern. Chem.-Zeit., 1904, **28**, 902.

Aerogen gas is prepared by driving air, by means of clockwork or other power, through a meter, on the drum axis of which is a hydraulic arrangement for introducing nto the stream a regulated quantity of light petroleum spirit. The inflammable mixture so obtained is burned under a mantle, and gives a light of 50 candles for 100 hours at a cost of a shilling. As the mixture is made at the ordinary temperature there is no condensation ; there is also practically no danger of explosion ; and the gas is not poisonous. It can be used for heating and for driving small motors, as well as for lighting, and its cheapness and the implicity of its manufacture make it most suitable for mall private gas installations.—J. T. D.

Sulphur in Coal ; Photometric Determination of ——. S. W. Parr and C. H. McClure. XXIII., page 1000.

English Patents.

Coke ; Manufacture of ——. J. J. C. Allison, Butterknowle, Durham. Eng. Pat. 24,670, Nov. 13, 1903.

Non-coking coals are powdered, mixed with pitch, tar, or ther bituminous matter, formed into pellets by first melting nd then dropping them into water from a height. They re finally carbonised in coke-ovens.—L. F. G.

Coal ; Method of Treating —— *for Coking Purposes.* W. J. Patterson, Pittsburg, Penn. Eng. Pat. 17,580, Aug. 12, 1904.

he coals are stored in one entire mass, as they come from e washers. This mass is allowed to stand until the water as percolated downwards, carrying the sludge with it, and e coal is then removed from the top of the mass. —L. F. G.

Water- or like Gas from Small and Dust Coal ; Apparatus for Generating ——. L. Wesselsky, Dresden, Germany. Eng. Pat. 19,220, Sept. 7, 1903.

o prevent the crushing together, and consequent defective urning, of the fuel, which commonly occurs when coal dust nd "smalls" are used in the production of water-gas, means re provided for lessening the pressure of the fuel on the rate, so that the combustible as consumed may by its own eight fall freely on to the grate. A horizontal supporting oor or conical body, may be arranged above the grate, in e upper part of the generator, to support the main superincumbent mass of fuel, an annular space being left round e support to enable the fuel to descend as required : in his case the grate is of inverted conical form, and is built p of rings, suitably spaced apart, a series of converging eps being thus provided for the fuel to rest upon. ifferent forms of apparatus, embodying the same principle, e described and claimed.—H. B.

Gas Retorts. H. Gielis, Berlin. Eng. Pat. 24,068, Nov. 5, 1903.

E Fr. Pat. 338,684 of 1903 ; this J., 1904, 653.—T. F. B.

Gas Producers. L. Wilson, Glasgow. Eng. Pat. 27,823, Dec. 18, 1903.

See U.S. Pat. 762,568 of 1901 ; this J., 1904, 715.—T. F. B.

Combustion Chambers of Steam Boilers and the like for the Manufacture and Burning of Gas ; Process and Apparatus in connection with the ——. P. Stiens, Rotterdam. Eng. Pat. 14,971, July 4, 1904.

The gas generator is arranged within the combustion chamber (of the steam boiler or the like) in which the gas produced is to be burnt, so that the generator itself is maintained at the requisite temperature. The gas generator consists of a chamber divided by a horizontal grate, or perforated partition, into two compartments. Upon the grate rests an incandescent layer of reducing material, such as retort carbon, iron, or the like, and into the space above this a mixture of water, petroleum, and air is injected. The gas produced passes down through the reducing material and is discharged into a number of perforated pipes surrounding the generator ; it then burns on escaping through the perforations, heating both the boiler and the generator itself. In starting the apparatus, air and petroleum alone are admitted to the generator, until the reducing layer has become incandescent.—H. B.

Gas and Air ; Apparatus for the Production of Mixtures of ——. A.-G. für Selas-Beleuchtung, Berlin. Eng. Pat. 15,238, July 22, 1904. Under Internat. Conv., Oct. 21, 1903.

This specification relates to improvements, with regard to the arrangement of valves described in Eng. Pat. 17,788 of 1903 (this J., 1904, 859).—H. B.

Gas, Poor, Free from Tarry Matters ; Apparatus for Producing ——. L. Boutillier, Paris. Eng. Pat. 16,763, July 29, 1904. Under Internat. Conv., Aug. 25, 1903.

The producer described in Eng. Pat. 7979 of 1904 (this J., 1904, 653) is improved by providing the vertical distillation-retort, at its upper end, with a pipe for leading off the liberated hydrocarbons, the said pipe discharging the latter underneath the grate, to mingle with the air and steam supplies and pass up through the incandescent fuel.—H. B.

Illuminating Gas ; Method of Purifying —— [*from Carbon Bisulphide*]. A. J. Boult, London. From C. S. Lomax, Everett, Mass., U.S.A. Eng. Pat. 14,445, June 27, 1904.

The cooled gas, freed from tar and ammonia, but not necessarily from carbon dioxide, is passed through a purifier containing "chemically divided" sulphur (preferably spent oxide heavily charged with free sulphur), impregnated with an amine (preferably commercial aniline). The sulphur acts as a catalytic agent, in the presence of which the aniline reacts upon the carbon bisulphide in the gas, to form sulphocarbanilide and sulphuretted hydrogen, according to the equation $2C_6H_5NH_2 + CS_2 + S = CS(C_6H_5NH_2)_2 + H_2S + S$. The sulphuretted hydrogen is removed from the treated gas as usual. The aniline may, if desired, be mixed with a suitable neutral solvent to aid in disseminating it throughout the sulphur. When the purifying material becomes exhausted, it is re-impregnated with aniline, when it is ready for further use.—H. B.

Incandescent Gas Light ; Method of Increasing the Intensity of ——. H. H. Lake, London. From Ges. für Flüssige Gase Raoul Pictet and Co., Berlin. Eng. Pat. 20,556, Sept 24, 1903.

Various forms of burner are described in which separate concentric supplies of combustible gas, and of air or oxygen (giving, if burnt, a non-luminous flame), are admitted to the interior of a mantle, or are projected, the one along the interior surface of the mantle and the other along the exterior surface, in order to produce a very high temperature. In other modifications, one mantle is surrounded concentrically by another, and oxygen (or combustible gas) is admitted into the interior of the inner mantle, whilst combustible gas (or oxygen) or concentric streams of oxygen and combustible gas, are admitted into the annular space between the two mantles. (Compare Fr. Pat. 322,601; this J., 1903, 358.)—H. B.

United States Patents.

Coal Briquettes; Process of Forming ——. E. H. Larkin, St. Louis, Mo. U.S. Pat. 770,503, Sept. 20, 1904.

About 3 per cent. of crude petroleum is mixed with 97 per cent. of coal slack, and to this mixture starch paste is added in the proportion of about 2 lb. of the paste to each 100 lb. of the petroleum-treated slack, the whole mass being finally pressed into blocks.—W. C. H.

Coal; Method of Treating and Handling —— *for Coking Purposes.* W. J. Patterson, Pittsburg. U.S. Pat. 770,778, Sept. 27, 1904.

See Eng. Pat. 17,580 of 1904; preceding these.—T. F. B.

Gas Producers, Furnaces, &c.; Apparatus for the Continuous Feeding and Distributing of Material in ——. C. W. Bildt, Stockholm. U.S. Pat. 770,491, Sept. 20, 1904.

See Eng. Pat. 9376 of 1904; this J., 1904, 709.—T. F. B.

Gas; Process of Manufacturing ——. A. Bougault, Assignor to Soc. Franç. de Constructions Mecaniques (Ancien. Établ. Cail), Paris. U.S. Pat. 770,554, Sept. 20, 1904.

See Eng. Pat. 12,506 of 1903; this J., 1903, 1079.—T. F. B.

French Patents.

Heating Appliances, the Heat of which is Produced by a Chemical Reaction. Hunger and Uhlig. Fr. Pat. 342,915, May 6, 1904.

A cylindrical metal vessel with a conical bottom is filled with lime or caustic soda, and a metal funnel containing water or vinegar placed inside, resting on the rim joined to the vessel. The funnel is provided with a hole near its apex, and with a metal cover pierced by a hole, whilst a hole is also pierced in the top of the cylindrical vessel. A strip of steel passes over the various holes so as to close them, and projects through the cover. On winding the strip round a key, the holes can be opened and the chemicals allowed to react.—L. F. G.

Drying Oven, Continuous ——*; for Combustible Materials and the like.* P. H. Pute-Cotte de Renéville. Fr. Pat. 343,089, May 11, 1904.

The oven is especially designed for the drying of briquettes, and consists of an upright square tower containing a set of inclined shelves arranged zigzag fashion. The material is fed in at the top, and, whilst sliding down the shelves is dried by a current of hot gases passed in from a furnace. In order to keep the tower hermetically closed, the material is fed into a conical hopper divided into two vertical compartments, which rotates slowly round an axis, the material being discharged alternately from each compartment, as the latter passes over a hole situated in the cover of the tower. —L. F. G.

[*Gas Manufacture.*] *Method for Completely Distilling Coal, and Apparatus for Use therein.* H. W. Woodall and A. M. Duckham. Fr. Pat. 313,091, May 1, 1904. Under Internat. Conv., July 27, 1903.

See Eng. Pat. 16,497 of 1903; this J., 1904, 744.—T. F. B.

Tissue for Incandescent Gas Mantles. H. Loewenthal. Fr. Pat. 338,931, July 18, 1903.

Fabrics for the manufacture of mantles are made of threads of "compounds of cellulose soluble in water."—H. B.

Wicks of Artificial Silk for Candles. V. Plersdorff. Fr. Pat. 343,086, May 11, 1904.

Claim is made for the use of twisted or plaited wicks of artificial silk, and especially of the waste material. It is stated that such wicks absorb fat more readily than cotton wicks, and burn without carbonisation.—C. A. M.

Candles, Lamp Oils, Edible Fats, Unguents or Pomades, Soaps, &c.: Manufacture of ——. C. Dreymann. Fr. Pat. 343,158, May 14, 1904. XII., page 988.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum; A Radio-active Gas from Crude ——. E. F. Burton. XXIV., page 1003.

English Patents.

Tar; Process for Treating —— *for the Elimination of Water and Recovery of Volatile Products therefrom* W. Oppenheimer and T. O. Kent, London. Eng. Pat. 12,696, June 5, 1903.

See Fr. Pat. 334,472 of 1903; this J., 1904, 55.—T. F. B.

Peat and Turf; Treating [*Distilling*] —— *to obtain valuable Products.* T. R. Hanmer, Manchester. Eng Pat. 24,326, Nov. 10, 1903.

Air-dried turf, peat, or bog is heated in a retort, and the products of distillation are separated and collected for the making of wood spirit, acetic acid, tar, and charcoal. The gas is to be utilised for heating the retorts, or for "burning purposes."—L. F. G.

United States Patent.

Ammonia-Water Apparatus. H. A. Abendroth, Berlin. U.S. Pat. 771,031, Sept. 27, 1904.

The apparatus is provided with superposed cells having covered openings or doors in the side, and near these openings, overflow pipes supported in the bottoms of the cells. These overflow pipes are made in sections, telescoping one in the other. Compare U.S. Pat. 712,891 of 1902; this J., 1902, 1526.—E. S.

French Patents.

Tar; Process of Solidifying ——. S. G. Coulson. Fr Pat. 343,691, June 4, 1904. Under Internat. Conv. Jan. 28, 1904.

See Eng. Pat. 2102 of 1904; this J., 1904, 780.—T. F. B.

Hydrocarbons, such as Crude Petroleum and Petroleum Oils of all Densities; Process for Refining Commercial ——. H. P. J. B. Goffart. Fr. Pat. 342,588, April 23 1904.

The hydrocarbon is treated with a metallic powder, such as zinc, which acts catalytically and at the same time as a reducing agent, decomposing the colouring matter and reducing the unsaturated hydrocarbons, which are stated to be generally more highly coloured than the saturated compounds. For example, petroleum of sp. gr. 0·835 to 0·840 is refined by keeping it in contact with powdered zinc placed on an asbestos filter contained in a jacketed funnel a temperature of about 70° C. being maintained for five hours. Correspondingly higher temperatures and longer treatment are required for heavier oils, and very viscous oils are advantageously treated under pressure.—T. F. B.

Petroleum or other Mineral Oils; Process for Solidifying —— *with a view to their Application for Heating* V. J. Kuess. Fr. Pat. 343,545, May 30, 1904. Under Internat. Conv., Nov. 6, 1903.

See Eng. Pat. 7481 of 1904; this J., 1904, 817.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Rosanilines; Nomenclature of ——. J. Schmidlin. Comptes rend., 1904, **139**, 504—505.

HE author proposes to take as the basis of his nomencla-ure the real base of Parafuchsine, $(C_6H_4NH_2)_2:C:C_6H_4:NH$, hich he terms rosaniline. The corresponding carbinol is esignated rosanilinecarbinol, whilst Parafuchsine would be osaniline hydrochloride. The homologues of the base of arafuchsine are called rosamonotoluidine, rosaditoluidine, nd rosatritoluidine, containing one, two, and three toluidine uclei respectively. The leuco bases are called leucaniline, ucomono-, leucodi-, and leucotritoluidine. Thus the orresponding terms in the author's nomenclature and that f Baeyer (this J., 1904, 862) are:—

Baeyer.	Schmidlin.
Diaminofuchsonimine.	Rosaniline.
Diaminodimethylfuchsonimine.	Rosaditoluidine.
Diphenylaminofuchsonphenylimine.	Triphenylrosaniline.

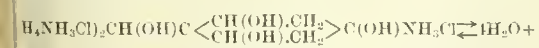
—E. F.

etrahydroxycyclohexane - Rosanilines: a New Class of Colourless Derivatives. J. Schmidlin. Comptes rend., 1904, **139**, 506—507.

IE salts of rosaditoluidine and rosatritoluidine are very luble in strong hydrochloric acid. If the solution be lowed to stand for 24 to 48 hours, the liquid becomes colorised and transformed into a mass of perfectly white ystals. These are extremely soluble in water. They are ible at the ordinary temperature. At 50° C. they lose mols. of water, forming black trihydrochlorides, which solve in water to a red solution. On heating the colour-s compounds to 100° C. they form characteristic green agenta homologues.—E. F.

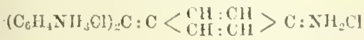
rbinol Salts and Cyclohexane-Rosanilines: Phenomena of Decolorisation. J. Schmidlin. Comptes rend., 1904, **139**, 521—524.

IE fact that the colourless salts of tetrahydroxycyclo-xane-rosaniline lose 4 mols. of water on heating, with rmation of black compounds (see preceding abstract) is garded as a direct proof of the quinonoid constitution of saniline salts, thus:—



$$H_4NH_3Cl)_2CH(OH)C<\begin{matrix}CH(OH).CH_2\\CH(OH).CH_2\end{matrix}>C(OH)NH_3Cl\rightleftarrows 4H_2O+$$

Colourless salt.



$$(C_6H_4NH_3Cl)_2C:C<\begin{matrix}CH:CH\\CH:CH\end{matrix}>C:NH_2Cl$$

Black salt.

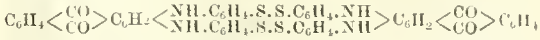
t is found that when solutions of rosaniline salts are olorised by addition of mineral acid, heat is evolved; o, a solution of rosanilinecarbinol in acetic acid loses its our, but absorbs heat, approximately the same amount as volved in the former reaction. Hence it is concluded t these colourless compounds are salts of rosaniline-binol, $C(OH)(C_6H_4NH_2.HCl)_3$. The only salt of this ss which could be obtained in a fairly pure state was trihydrochloride of hexamethylrosanilinecarbinol; it is eedingly hygroscopic, turning black on exposure to ist air, and giving a highly coloured solution in cold er. When the carbinol salts are neutralised by acid, t is evolved, the benzene nuclei being converted into ahydrobenzene nuclei; these cyclohexane salts, on atment with acid, lose 4 mols. of water (heat being orbed), and are converted into the quinonoid rosaniline s.—T. F. B.

Sulphur Dyestuffs; Study of the ——. P. Friedlaender and F. Mauthner. Z. Farben- u. Textil-Ind., 1904, **3**, 333—337.

The method of study adopted by the authors consisted in the preparation of simple sulphur-containing dyestuffs synthetically, in order that from a study of their properties conclusions might be drawn as to the composition of the more complicated commericial products. As a starting point, use was made of aromatic compounds which contain amino or hydroxy groups. These compounds can, in many cases, be easily "sulphurised" either by boiling with sodium polysulphide solution or by other means. The number of sulphur atoms entering the molecule depends on the conditions. As a rule, in "alkaline sulphurising," the sulphur takes up the ortho position to the amino or hydroxy groups, and the o-aminomercaptans and o-hydroxymercaptans obtained, must be looked upon as the chief components of the dyestuff formation. If the reaction be carried further, these primary mercaptans change rapidly, and condensations of various kinds take place, by preference thiodiphenylamine derivatives being formed from simple benzene derivatives. The sulphur which enters into the rings of these compounds appears not to be affected by sodium sulphide; the solubility of the sulphide dyestuffs must therefore be due to the presence of sulphur in other forms of combination probably as –SH groups or bisulphides, which latter are easily changed by sodium sulphide into soluble mercaptans. A sulphide dyestuff should fulfil the following conditions:—(I.) It should have a molecule with one or more chromophor groups. (II.) It should have bisulphide groups in the molecule, which cause it to be soluble in sodium sulphide with formation of –SH groups, this reduced body being reconverted into the original substance during the dyeing process. (III.) It should have the property, not necessarily following from I. and II., of dyeing unmordanted cotton direct from sodium sulphide baths. The authors have prepared a large number of dyestuffs containing sulphur which answer the above conditions entirely or in part.

Azo Dyestuffs containing Sulphur.—o-Dihydroxydiphenylbisulphide was prepared by pouring a solution of potassium xanthate into diazotised o-aminophenol. The bisulphide combines with diazotised naphthionic acid in alkaline solution. The free colour-acid forms yellowish-brown needles very slightly soluble in water. The formula is $SO_3H.C_{10}H_6.N:N.C_6H_3(OH)S.S(OH)C_6H_3.N:N.C_{10}H_6.SO_3H$. Alkalis give easily soluble salts. Sodium sulphide colours it violet, slowly in the cold and quickly on heating, but the colour goes back on exposure to the air, the bisulphide group being split off and an azo derivative of thiopyrocatechol formed. In this case the attraction of the fibre for the sulphur compound is practically no greater, either in alkaline or in sodium sulphide solution, than it is for the combination of naphthionic acid and phenol, so the sulphur has here no influence on the dyeing properties. The compound from benzidine and 1 mol. of dihydroxydiphenylbisulphide is, on the contrary, a direct-dyeing cotton dyestuff. The compound from 1 mol. of benzidine, 1 mol. of α-naphthylamine, and 1 mol. of dihydroxydiphenylbisulphide is almost insoluble in alkalis, and is only dissolved very slightly by sodium sulphide, so that the presence of the bisulphide group here is not enough to make the large molecule soluble enough for use in dyeing.

Quinone-imine Dyestuffs containing Sulphur.—The dyestuff produced by the action of diaminodiphenylbisulphide on gallocyanine has no affinity for the cotton fibre, but dissolves in sodium sulphide solution. Diaminodiphenylbisulphide reacts on quinizarin in the presence of acetic and boric acids. The leuco body formed at first oxidises rapidly to a dark blue insoluble dyestuff, which can be crystallised from ethyl benzoate and quinoline, and has apparently the formula—

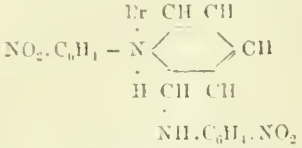


$$C_6H_4<\begin{matrix}CO\\CO\end{matrix}>C_6H_2<\begin{matrix}NH.C_6H_4.S.S.C_6H_4.NH\\NH.C_6H_4.S.S.C_6H_4.NH\end{matrix}>C_6H_2<\begin{matrix}CO\\CO\end{matrix}>C_6H_4$$

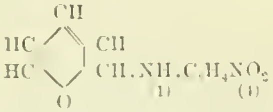
The dyestuff is not dissolved by alkaline sodium sulphide, but dissolves in alkaline hydrosulphite to form an indigo-like vat with a blue bloom, which dyes cotton a fast bluish grey. The sodium sulphide is not strong enough to make it soluble, and the hydrosulphite does so owing to the fact that it reduces the carbonyl groups as well.—A. B. S.

Pyridine Dyestuffs. W. König. J. prakt. Chem., 1904, 70, 19—56.

a-p-Nitrophenylamino-p-nitrophenyldihydropyridonium bromide—



a compound probably existing also in the tautomeric form $NO_2.C_6H_4.NH(HBr).CH:CH.CH:CH.CH:N.C_6H_4.NO_2$ is obtained by the action of cyanogen bromide on a mixture of pyridine and *p*-nitraniline dissolved in absolute alcohol. It forms bluish-red plates, m. pt. 149° C., or dark blue needles; is insoluble in water, ether, and benzene, moderately soluble in alcohol and acetic acid with a pink colour and yellowish-green fluorescence, and easily soluble in pyridine. It dyes silk from an alcoholic solution a pink colour which is very fugitive to light. Concentrated hydrochloric acid decomposes it, according to the conditions of reaction, into either *p*-nitrophenylpyridonium chloride or tetrachlorohydroquinone. Sodium carbonate, at the ordinary temperature, has no action upon it. Caustic soda, under the same conditions, precipitates a red compound, which, on the further addition of the reagent, becomes in turn brownish-red and dull purple. On heating with this reagent, the compound is decomposed into a substance which has not been identified, but which has the characteristic odour of, and appears, in fact, to be crotonaldehyde, anhydroglutaconic-aldehyde-*p*-nitraniline, or, as it is proposed to term it, *a-γ*-nitrophenylaminopenfurane—



being formed as an intermediate product. Bromine acts upon the dyestuff, forming dibromo-*p*-nitrophenylpyridonium perbromide, which, on boiling with acetic acid or acetone, is resolved into 2.6-dibromo-4-nitrophenylpyridonium bromide. The isomeride of the above dyestuff, prepared from *m*-nitraniline, of m. pt. 167° C., dyes silk in an orange colour with a faint yellowish-green fluorescence. The analogous dyestuffs, obtained from *o*- and *m*-toluidine and *o*- and *p*-anisidine, dye silk in orange, orange salmon-pink, and pink colours respectively. The compound (m. pt. 175° C.) derived from *p*-aminodimethylaniline dyes silk and wool in violet shades resembling those yielded by Crystal Violet. Ammonia and caustic soda change the colour of the aqueous and alcoholic solutions of this dyestuff to pale yellow, the original colour not being restored by the addition of acids.—E. B.

Nitrotoluene: Electrolytic Reduction of ——. W. Löb and J. Schmitt. XI. A., page 987.

Photographs in Natural Colours by the Three-Colour Process: Use of Leuco Bases for the Preparation of ——. E. König. XXI., page 998.

English Patents.

Colouring Matters Containing Sulphur [Sulphide Dyestuffs] and Intermediate Products: Manufacture of ——. G. W. Johnson, London. From Kalle and Co., Biebrich-on-Rhine, Germany. Eng. Pat. 19,973, Sept. 16, 1903.

See Fr. Pat. 335,383 of 1903; this J., 1904, 183.—T. F. B.

Acid Nitriles [Omega-cyanomethylaniline Derivatives]; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 25,164, Nov. 21, 1903.

See Fr. Pat. 338,818 of 1903; this J., 1904, 820.—T. F. B.

Azo Dyestuffs; Manufacture of New ——. H. E. Newto London. From Farbenfabr. vorm. F. Bayer and Co Elberfeld, Germany. Eng. Pat. 26,132, Nov. 30, 1903.

See Addition, of Nov. 27, 1903, to Fr. Pat. 323,808 of 1902 this J., 1904, 747.—T. F. B.

French Patents.

Omega-cyanomethylanthranilic Acid; Production of —— [*Indigo Dyestuffs.*] Badische Anilin und Soda Fabri Fr. Pat. 338,902, July 1, 1903.

See Eng. Pat. 14,676 of 1903; this J., 1904, 604.—T. F.

Fluoranes, Halogenated; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 342,518, April 21, 190

Dichloro- and dibromofluorane and their derivatives ar obtained by condensing phthalic anhydride or its halogenated derivatives with *m*-chloro- or *m*-bromophenol, thei homologues or halogenated derivatives in presence of a condensing agent. The products are colourless crystallin powders, readily soluble in chloroform and hot nitrobenzen and soluble in sulphuric acid with yellow to olive coloratio The preparation of two new compounds, *o*-chloro-*p*-cres and 3.4-dichlorophenol, is also described in the paten They are obtained by diazotising *o*-chloro-*p*-toluidine an 3.4-dichloro-aniline respectively, and boiling the resultin solutions.—E. F.

Indigo; Manufacture of ——. L. Lilienfeld. Fr. Pat. 343,078, May 11, 1904.

The aromatic glycins, such as phenylglycin, are heated *i* *vacuo* or in an indifferent or reducing gas (nitroge hydrogen, coal-gas, &c.) with caustic alkalis and some co densing agent, such as metallic sodium or the metals of th alkaline earths or the oxides of these metals. When th action is finished, the cooled mass is dissolved in water an the indoxyl oxidised to indigo by blowing in air. By usin homologues or derivatives of the aromatic glycins, corr sponding indigo derivatives are obtained.—A. B. S.

Cyanines [for Photographic Purposes]; Process f Making New ——. Act.-Ges. f. Anilinfabrikation. F Pat. 342,656, April 26, 1904. XXI., page 999.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Cotton from Trinidad. Bull. Imp. Inst. (Suppl. to Boar of Trade J.), 1904, 2, 173.

The cotton is known locally as "Creole," or native cotto and appears to be a short-stapled or "Upland" variet The sample examined was of a pale cream colour, well cleane rather rough to the touch, and fairly strong. The lengt of the staple was 1·2—1·4 ins., which is a little abo the average (1·1 in.) for American "Upland" cotto Commercially it would be worth 8½*d*.—9*d*. per lb. "U land" cotton is stated to be better suited to the Trinida climate than "Sea Island" cotton.—A. S.

Fibres from Southern Rhodesia. Bull. Imp. Inst. (Supp to Board of Trade J.), 1904, 2, 168—169.

Sisal Hemp.—The sample was stated to have been deriv from a species of *Agave*. It consisted of soft, fine fibre, good colour, well cleaned, and fairly strong; average lengt of staple, 33 ins. It is said to resemble Mauritius hen rather than Sisal hemp, and is worth 32*l*.—34*l*. per to (See also this J., 1903, 1192.)

Banana Fibre.—The specimen consisted of a somewh soft fibre, of a dull, pale brown colour, of fair strengt it was stronger and more even than is usually the case wi banana fibre; average length of staple, 27 ins. It is wor 25*l*.—26*l*. per ton. (See also this J., 1903, 737.)

Pineapple Fibre.—This consisted of very fine, whit well-cleaned fibre, strong but very short; average lengt of staple, 11 ins. If the fibre could be obtained of great ength it would be worth 30*l.*—40*l.* per ton. Pineapple ibre is stated to be used in India and China as a substitute or silk, for mixing with wool or cotton, and in the manu-acture of lines and thread. In the Philippines it is used or the preparation of the fabrics called "piña" and rengue."

Baobab Tree Fibre.—The sample consisted of the bark f the tree in an unprepared state. The soft inner bark vould probably be worth 4*l.*—5*l.* per ton. The fibre was sed some years ago for the manufacture of strong, light-oloured wrapping papers, and was then sold at 8*l.*—10*l.* er ton.—A. S.

Mercerising Industry; Studies on the ——.

F. J. G. Beltzer. Monit. Scient., 1904, **18**, 732—748.

his is a summarised account of the process of mercerising, nd treats the subject under the following headings:—Pre-minary treatments (gas-singeing, scouring, bleaching); ercerising liquids (alkaline, acid, and neutral); measure-ent of the degree of mercerising; mercerising apparatus, iving a general description of the various types of ma-hines in use; mercerising threads before being made into keins; dyeing mercerised cotton; examination of the rilliancy of mercerised cotton; mercerising fabrics; gas-ngeing mercerised dyed fabrics; examination of mercerised brics; mercerising ramie. The article concludes by giving general idea of the cost of the various stages of the process, cluding the cost of labour.—T. F. B.

otton; Weakening of —— by Acids under the Influence of Hot Air and Steaming.

A. Scheurer. Bull. Soc. Ind. Mulhouse, 1904, **74**, 211—219.

XPERIMENTS were made on the effect of oxalic, lactic, rtaric, citric, thiocyanic, *o*-, *m*-, and pyrophosphoric and osphorous acids on cotton under the influence of dry and oist heats. Solutions of oxalic acid containing 10 and grms. per litre were used, and solutions of the other acids equivalent strength. Thiocyanic acid had the greatest fect on the tensile strength of the cotton in a dry atmos-here at 40—50° C., the stronger solution causing the nsile strength to fall to less than half its original value ter 72 hours; the effect of thiocyanic acid and steam is so nall as to be negligible. Meta- and pyrophosphoric acids, the stronger solutions, caused a reduction of about one-ird of the tensile strength, both after three days hot-air eatment and after one hour's steaming. The action of osphorous and oxalic acids was somewhat less, the reduc-on being from 25 to 27 per cent. in either case. Lactic, thophosphoric, tartaric, and citric acids, in the order med, had still less effect on the tensile strength of the tton, the reduction lying between 10 and 20 per cent. he addition of glucose to the printing mixture containing alic acid diminished the destructive action of the acid der the influence of hot air or steam to a considerable tent, particularly in the former case.—T. F. B.

ordant Theories and the General Working of Mordanting with Primary Metallic Mordants.

P. Heermann. Färber-Zeit., 1904, **15**, 284.

EPLY to Knapstein, with the object of pointing out accuracies in his criticisms (this J., 1904, 898).—T. F. B.

heory of Dyeing; Contribution to the ——.

E. Knecht. Ber., 1904, **37**, 3479—3484.

OM a series of determinations of the amounts of dyestuff ken up by wool in dyeing with a number of acid dyestuffs homologous or analogous series with addition of sul-uric acid, it is shown that the amounts are proportional the molecular weights of the dyestuffs, if the same con-tions be observed. This result holds good if the amount dyestuff used be varied from 6¼ to 50 per cent. of the eight of the wool. The amount of water used can be ried between fairly large limits without affecting the antitative results; this is contrary to the "solution eory." The solubility of the dyestuff in water also pears to be without influence. The sulphuric acid used ust do more than simply liberate the free colour acid, r, if the dyeing be effected with 2 per cent. of the free colour acid of "Crystal Porceau," without addition of another acid, the bath will not be nearly exhausted, whilst, in presence of sulphuric acid, exhaustion is nearly complete. These facts are greatly in favour of a "chemical theory" of dyeing.—A. B. S.

Paranitraniline Red; Action of Amines on the "Mordant" of ——.

C. Favre. Bull. Soc. Ind. Mulhouse, 1904, **74**, 268—269.

THE addition of certain aromatic amino-compounds to the β-naphthol solution used for dyeing fabrics with Paranitraniline Red, has a considerable influence on the shade of the resulting dyeings. Thus, the addition of 20 per cent. of α-naphthylamine (on the weight of β-naphthol used) gives deep brown shades, fast to soaping, but not to light; the same quantity of β-naphthylamine changes the shade to brick-red, fast to soaping and light; whilst *m*-toluylenediamine produces chocolate shades, also fast to soaping and light.—T. F. B.

Half-Discharges on Tannin Mordants; Process for Producing ——.

C. Zundel. Bull. Soc. Ind. Mulhouse, 1904, **74**, 220—221.

ON printing fabrics, impregnated with tannin, with solutions of alkaline salts of potassium or sodium, such as silicates, sulphites, borates, carbonates, thiosulphates, &c., and subsequently steaming, a portion of the tannin is converted into gallic acid. After fixing, the portions of the fabric containing gallic acid are not dyed in such deep shades as the remainder of the fabric. The best results were obtained with a solution of normal potassium sulphite (39° B.) thickened with starch, the dyeing being performed with a basic dyestuff. O. F. Alliston, in a report to the Society, confirms these results, and finds also that all the above-mentioned salts, with the exception of the alkali thiosulphates, give similar half-discharges on fabrics mordanted with antimony tannate.—T. F. B.

Soda Water-Glass; Analysis of ——. P. Heermann.
XXIII., page 1000.

Molasses; Purification of —— by Electrolysis. [*Substitute for Tartaric Acid as By-Product.*] L. Garwitsch.
XVI., page 993.

ENGLISH PATENTS.

Cotton and Flax, Raw, and Cotton and Linen Goods; Treatment of ——, to Reduce the Inflammability thereof.

W. H. Perkin, jun., and Whipp Bros. and Todd, Ltd., Manchester. Eng. Pat. 24,222, Nov. 7, 1903.

RAW cotton or flax, and cotton and linen goods can be rendered fireproof by means of sodium stannate, without subsequent treatment with solutions of metallic salts or ammonium salts (see Eng. Pat. 8509 and Fr. Pat. 321,063 of 1902; this J., 1903, 623 and 142). The goods may be impregnated with a solution (30° Tw.) of sodium stannate, dried, and exposed to the air for some days, an insoluble fireproofing compound being thus formed in the fibre. See also this J., 1903, 92 and 294.—T. F. B.

Fabrics and Similar Materials; Means of Heating ——.

W. Mather and G. G. Hepburn, Manchester. Eng. Pat. 24,617, Nov. 12, 1903.

FABRICS "and similar materials" are heated by passing them, in a wet or dry state, through a bath of mercury, heated to the desired temperature. A suitable apparatus consists of a vat, the bottom of which is made with a number of semi-cylindrical troughs, adapted to contain the mercury; a rotating roller is fixed in each trough, and a roller is also supported between each pair of troughs, immediately over the partition between them, so that the fabric as it passes over the rollers, is alternately immersed in and removed from the mercury. These troughs are conveniently heated by gas-jets. The vat is provided with a cover, having a deep flange, which dips in a suitable liquid contained in a trough, which is provided round the upper edge of the vat; by this means a liquid seal is formed, loss of mercury vapour being thereby prevented.—T. F. B.

Yarn-dyeing Vat, with a Device for throwing in and out of Gear a Windlass for Lifting the Material out of the Colouring Liquor. E. J. Henser, Cottbus, Germany. Eng. Pat. 2062, Jan. 27, 1904.

The yarn is hung on horizontal rollers, which fit into a frame, which can be lifted bodily out of the dye-bath by means of a rope and pulley. These rollers each have a cog-wheel at one end, so that adjacent rollers revolve in opposite directions. The lifting arrangement is connected with a clockwork mechanism, so that after an arranged time the frame is automatically lifted out of the vat until it reaches a certain height, when it operates a lever, which throws the driving belt out of gear and stops the machine. —A. B. S.

Dyeing, and Apparatus therefor. J. O. O'Brien, Manchester. From H. l'Huillier, Paris. Eng. Pat. 13,302, June 13, 1904.

See Fr. Pat. 338,113 of 1903; this J., 1904, 605.—T. F. B.

Calico Printing. The Calico Printers' Association, Ltd., Manchester, and J. Garnett, Alexandria, N.B. Eng. Pat. 27,539, Dec. 16, 1903.

The cloth is first slop-padded or otherwise prepared or printed with a solution of β-naphthol, neutralised with caustic soda, and then treated by one of the two following processes. (1) The cloth is printed with a thickened, diazotised solution of *p*-nitraniline or other amine, and then printed by another roller with an organic acid (*e.g.*, tartaric acid or citric acid); the cloth is now mordanted, steamed, and dyed with a suitable dyestuff, *e.g.*, a basic dyestuff mixed with tannic acid. (2) The prepared cloth is printed with a mordant and then with a resist for the azo dyestuff (with another roller); it is now treated with a thickened diazotised solution of an amine, fixed, and finally dyed as in the first process.—T. F. B.

United States Patent.

Mercerising Yarn; Apparatus for ——. I. E. Palmer, Middletown, Conn. U.S. Pat. 770,920, Sept. 27, 1904.

A suitable framework, mounted in the mercerising tank, carries two yarn-supporting reels, one above the other; the lower one is fixed, whilst the upper one is vertically adjustable, and can be removed in order to place the yarn in position. The gearing is so arranged that both reels can be rotated, whatever the position of the upper reel. —T. F. B.

French Patents.

Fibres and Fibrous Substances; Process for Treating [Felting] ——. G. Goldman. Fr. Pat. 342,941, Feb. 15, 1904. Under Internat. Conv., Aug. 29, 1903.

See U.S. Pats. 758,243 to 758,247 of 1904; this J., 1904, 544.—T. F. B.

Retting and Degumming Vegetable Fibres; Process of ——. E. Poisson. Fr. Pat. 338,941, July 24, 1903.

The soluble soda or potash soaps which are formed by the decomposition of the fatty matter of vegetable fibres by treatment with alkali, are converted into insoluble soaps by treatment with solutions of aluminium or magnesium salts; after this treatment, the stalks, &c., can be much more easily removed from the fibre. The same treatment may also be applied to fibres which have been degummed by treatment with soap.—T. F. B.

Dyeing Furs, Hair, Feathers, and similar Materials by Means of p-Amino-p-hydroxydiphenylamine; Process of ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 338,915, July 8, 1903.

Unmordanted skins are dyed bluish-grey to blue-black by treatment with an ammoniacal solution of *p*-amino-*p*-hydroxydiphenylamine in presence of oxidising agents. By similarly treating furs mordanted with chromium salts, good blacks are obtained. The following is an example of the process:—2 grms. of *p*-hydroxy-*p*-aminodiphenylamine are dissolved in 200 c.c. of water containing 2 c.c. of ammonia (sp. gr. 0·91), 50 c.c. of a 3 per cent. solution of hydrogen peroxide is added, and the solution made up t 1 litre. The skin is worked in this solution for an hou and allowed to remain for a further 12 hours.—T. F. B.

Dyeing Furs, Hair, Feathers, and similar Materials b Means of 2-Nitroso-1-naphthol and 1-Nitroso-2-naphthol Process of ——. Farbwerke vorm. Meister, Lucius un Brüning. Fr. Pat. 338,919, July 9, 1903.

The materials (furs, feathers, skins) are dyed with a solu tion of either 1-nitroso 2-naphthol or 2-nitroso-1-naphtho with or without the addition of oxidising agents. suitable bath for chrome-mordanted skins consists 2 grms. of 2-nitroso-1-naphthol and 20 c.c. of a 3 pe cent. solution of hydrogen peroxide, with or without 2 c. of ammonia (sp. gr. 0·91), the whole made up to 1 litr Reddish-brown shades are obtainable by this process. —T. F. B.

Dyeing Hair, Feathers, and Furs; Process of ——. Act Ges. f. Anilinfabrikation. Fr. Pat. 342,714, April 2 1904.

Hair, feathers, or furs are dyed yellow to clear brow shades by treatment with dilute alkaline solutions 1.2-naphthylenediamine or its sulphonic acids in presenc of an oxidising agent. For example, a 3 per cent. solutio of hydrogen peroxide is added to an equal volume of 4 per cent. aqueous solution of the sodium salt of 1. naphthylenediamine-4-sulphonic acid; this solution i applied with a brush or by any other suitable means. Th shades so obtained are said to be very fast to ligh washing, and friction.—T. F. B.

Woollen Fabrics Dyed with Indigo; Process for Increasin the Fastness to Friction of ——. Farbwerke vorm Meister, Lucius und Brüning. Fr. Pat. 338,907, July 1903.

According to the claim, the fastness to friction of indig dyed woollen fabrics is greatly increased by treating th fabric, before dyeing, with solutions of metallic salts. —T. F. B.

Printing by Pulverisation; Machine for ——. E. Marinic Fr. Pat. 342,484, April 20, 1904.

The fabric is passed over a hollow cylinder, on which th design to be printed on it is cut. Smaller cylinders, number equal to the number of colours to be used, a arranged within the main cylinder, in contact with i inner surface, and are provided inside with nozzles throug which the colour-mixture is discharged in the form spray. On the surface of each small cylinder is cut th portion of the design which is to be printed in any pa ticular colour. By causing these small cylinders to rota at the same circumferential velocity as the main cylinde having first fixed them so that the designs are in regist with the design on the main cylinder, the fabric is print in the various colours with one treatment.—T. F. B.

Embossed and Printed Tissues; Manufacture of ——. A. Lacombe. Fr. Pat. 343,050, May 10, 1904.

The material is pressed by a pressure plate against anoth plate engraved with the pattern to be embossed. Thes plates are suitably heated. If it be required to pri colours in relief, the requisite dye is placed in the engrave portions of the pattern plate and is fixed on the materi by the pressure and heat.—A. B. S.

Printing with Indigo by the Aid of Hydrosulphites; Pro cess for ——. Cie. Paris. Coul. d'Aniline. Additio dated June 22, 1903, to Fr. Pat. 338,831, May 30, 1903.

See Eng. Pat. 13,827 of 1903; this J., 1904, 605.—T. F.

VII.—ACIDS, ALKALIS, AND SALTS.

Sulphur Trioxide Catalysis. F. W. Küster. Ges. deutsc Naturforscher u. Ärzte, Sept. 1904. Z. angew. Chem 1904, 17, 1512.

In a patent by Lunge it was claimed that, by the us of iron oxide containing arsenic as contact substance, i the manufacture of sulphuric anhydride, more satisfactory results were obtained than with pure iron oxide. The author states, however, that the presence of arsenic in the iron oxide has a deleterious influence, both on the yield of sulphur trioxide and the velocity of the reaction; and these views have, in the meantime, been, he considers, practically confirmed by Lunge (this J., 1904, 821). Contrary to Lunge, however, it was found that thorough drying of the reacting gases by means of phosphorus pentoxide caused a considerable decrease in the velocity of the reaction.

With vanadium pentoxide as contact substance, the gases having been dried by concentrated sulphuric acid, 52 per cent. of the sulphur dioxide was converted into sulphuric anhydride in two hours, and 84 per cent. in eight hours.

In the discussion, it was pointed out that the method of preparation of the contact substance has a considerable influence on the velocity of the reaction. The best yields are stated to be obtained by using iron oxide prepared by heating ferrous sulphate at 650° C. for one day.—A. S.

Perchromic Acid. E. H. Riesenfeld. Ges. deutsch. Naturforscher u. Ärzte, Sept., 1904. Z. angew. Chem., 1904, **17**, 1514.

The author has prepared several salts of perchromic acid by the action of a 30 per cent. solution of hydrogen peroxide on chromic acid or its salts. The ammonium salt, $(NH_4)_3HCrO_8$, explodes when struck, but the sodium salt is more stable. In aqueous solution, the salts give off oxygen and are reduced to chromates. If the salts are shaken with ether and a little water, some oxygen is evolved, and free perchromic acid (recognised by its characteristic blue colour) is produced. The anhydride of perchromic acid has the composition CrO_6.—A. S.

Hydrated Alumina. F. Russ. Z. anorg. Chem., 1904, **41**, 216—230.

The author's experiments show that "crystalline" alumina hydrate represents the final stage of a transformation which the freshly-precipitated hydrated alumina invariably undergoes (see this J., 1893, 599; 1900, 1014; 1902, 877). This transformation, slow under ordinary conditions, is accelerated by the presence of hydroxyl ions. The rate of transformation is dependent upon the concentration of hydroxyl ions. The difference in the behaviour of the two modifications to acids and caustic soda solution is one of degree only. The so-called "crystalline" hydrated alumina, when examined under the microscope with a magnification of 500, gave no evidence of crystalline structure. The results of the experiments also give some indications as to the most favourable conditions for the technical manufacture of alumina by Bayer's process (Eng. Pats. 10,093 of 1887 and 5296 of 1892; this J., 1888, 625; 1893, 263; see also this J., 1888, 748; 1893, 925). With a liquor containing alumina and soda in the molecular proportions 1 of Al_2O_3 to 1·24 of Na_2O, the best results are obtainable with a concentration equivalent to about 1·24 sp. gr. measured at 21° C., a yield of 85 per cent. of the alumina present following. By using a highly concentrated solution of caustic soda, it is theoretically possible to obtain a solution of sodium aluminate containing alumina and soda in the molecular proportions 1:1. If such a solution were diluted to a concentration of 3·3 mols. of Na_2O to 100 mols. of water, it would be supersaturated to the extent of 2·9 mols. of Al_2O_3, which would consequently be gradually deposited on stirring. The yield of alumina in such a case would be the highest obtainable, *viz.*, 88 per cent.—A. S.

Alkali Bromides; Electrolysis of —— and Action of Bromine on Alkalis. H. Ketzschmar. Z. Elektrochem., 1904, **10**, 739—817.

By the action of bromine on alkalis, hypobromites are at first always formed, although if equivalent quantities of bromine and alkali are brought in contact, at first a considerable proportion remains uncombined. Free bromine or hypobromous acid reacts with hypobromites to form bromates, $2HBrO + MBrO = MBrO_3 + 2HBr$, the reaction being quite analogous to the formation of chlorates, but proceeding more rapidly. Solutions of hypobromites of a concentration above N/10 are about as stable as similar hypochlorite solutions. On electrolysis of neutral bromide solutions, free bromine separates at the anode, and from this hypobromite is formed by reaction with the alkali from the cathode. Hypobromite formation proceeds until a definite concentration is attained, after which only bromate is produced. In strong alkali solutions hypobromite is also first formed up to a definite concentration, but bromate production commences at an earlier stage than in neutral solutions. In acid and neutral solutions the electrolytic bromate formation is due to a secondary reaction between the hypobromite and bromine or hypobromous acid, as shown in the above equation. In strong alkaline solutions, on the other hand, hypobromite is electrolytically oxidised to bromate.—R. S. H.

Molasses; Purification of —— by Electrolysis. [Caustic Alkali as By-Product.] L. Gurwitsch. XVI., page 993.

Soda Water-Glass; Analysis of ——. P. Heermann. XXIII., page 1000.

Nitrites and Nitrates; Production of —— by the Electrolytic Oxidation of Ammonia in presence of Cupric Hydroxide. W. Traube and A. Biltz. XI. A., page 987.

Nickel Salts; Reaction of Potassium Nitrite on ——. C. Reichard. XXIII., page 999.

Persulphates; Preparation of ——. E. Mueller. XI. A., page 987.

Phosphorus in Solutions; Quantitative Determination of ——. A. C. Christomanos. XXIII., page 1000.

English Patents.

Nitric Acid; Appliances for the Manufacture of ——. D. Donnachie, Stevenston, N.B. Eng. Pat. 24,332, Nov. 10, 1903.

The invention relates to the condensing apparatus for nitric acid vapour. The receiving tank for the vapours from the retort is connected to condensing pipes arranged in undulating series within cooling tanks. The pipes have trapped connections to small pipes which lead back the condensed acid to the tank, where, coming into contact with the hot vapours from the retort, impure vapours are given off, thus purifying the acid.—E. S.

Vitriol [Sulphuric Acid]; Manufacture of ——. M. Schwab and H. Greene and Sons, Ltd., London. Eng. Pat. 24,619, Nov. 12, 1903.

The ordinary lead chamber for the manufacture of sulphuric acid, is supplemented, on its inlet side, by a mixing tower having, preferably, two channels communicating with the chamber, one near the bottom and the other near the top. One of these channels is so disposed with regard to a steam jet or jets, and to the inlet of gases from a Glover tower or from a preceding vitriol chamber, that the pressure in the upper parts of the mixing tower is decreased, and the circulation of gases thus promoted. In long chambers, one or more vertical shafts are arranged, with a steam jet discharging horizontally at the lower end of the shaft towards the outlet end of the chamber.—E. S.

United States Patents.

Barytes; Process of Bleaching —— and Recovering Glauber Salt. W. D. Gilman, Sweetwater, Tenn. U.S. Pat. 770,963, Sept. 27, 1904.

Powdered barytes ore is heated with a solution of nitre-cake, and after separating the solution, the purified ore is washed with hot water. Impurities are precipitated from the solution and wash-waters by sodium carbonate or hydroxide solution, and the resulting solution of Glauber's salt is crystallised.—E. S.

Mineral Substances [Graphite]; Separation of —— by means of the Selective Action of Oil. C. Kendall, Upper Norwood, England. U.S. Pat. 771,075, Sept. 27, 1904.

See Eng. Pat. 1309 of 1903; this J., 1904, 115.—T. F. B.

French Patents.

Caustic Soda and Hydrochloric Acid; Manufacture of —— from Sodium Salts. C. Girard. Fr. Pat. 338,901, July 1, 1903.

Sodium sulphate (salt-cake) is prepared as usual, or by passing sulphuric anhydride vapours over damp salt, hydrochloric acid being recovered. The solution of sodium sulphate is then precipitated by barium hydroxide. The caustic lye produced may be evaporated, and the caustic soda fused, or it may be carbonated. Alternatively, crystals of sodium sulphate may be brought into contact with solid hydrated barium hydroxide, to give at once a strong lye, the water of crystallisation sufficing for the reaction. The barium sulphate resulting in either case is heated with carbon, and the sulphide is treated: (*a*) in saturated hot solution in an electrolytic cell with diaphragm, to obtain barium hydroxide, sulphur, and hydrogen; or (*b*) a mixture of barium sulphide, carbon, and a metallic oxide, is melted in an electric furnace to obtain a mixture containing barium carbide, which, decomposed by water, gives acetylene and barium hydroxide and an insoluble metallic sulphide. The latter is "calcined" to obtain sulphuric anhydride. Other alternatives in the cycle are given.—E. S.

Sulphuric Acid of High Purity; Process for Economically Producing —— in Lead Chambers. H. H. Niedenführ (Installationsbureau f. Chem. Ind.). Fr. Pat. 343,156, May 14, 1904.

See Eng. Pat. 1066 of 1904; this J., 1904, 714.—T. F. B.

Salt, Pure; Process for Making —— from Crude Rock Salt. H. Tee and H. H. Perkes. Fr. Pat. 342,920, May 6, 1904.

See Eng. Pat. 8117 of 1903; this J., 1904, 749.—T. F. B.

Erratum.

This Journal, 1904, 934, col. 1, line 1 from bottom, *for* "hydroxylamine" *read* "dihydroxylamine."

VIII.—GLASS, POTTERY, ENAMELS.

Glass; Action of certain Gases on —— in the neighbourhood of Heated Metals. G. T. Beilby. Brit. Assoc., 1904. Chem. News, 1904, **90**, 180–181.

The author has previously (Brit. Assoc. Report, 1903) described the formation of halos around pieces of metal foil on glass plates, when these are heated in the presence of the products of combustion of coal-gas and air, and also the formation of images of the heated metal on glass plates placed a short distance above the heated metal. Further experiments have shown that the halo and image are produced by decomposition of the glass brought about by the action of sulphuric anhydride, which has been formed by the oxidation of sulphur dioxide, under the catalytic influence of the heated metal. It is suggested that the localisation of the decomposition of the glass is due to ionisation produced by the heated metal, this having the effect of causing the particles of sulphur trioxide produced to be projected from the surface of the metal, some being carried up to the under surface of the covering glass, which they attack, producing the image, whilst the greater number do not reach thus far, but fall back on the surface of the lower glass plate, producing the halo around the metal.—A. S.

Clays; "Rotting" of ——. P. Rohland. Z. anorg. Chem., 1904, **41**, 325—326.

Clay-mixtures for the manufacture of porcelain are kept for at least three months in a moist atmosphere before being used, in order to increase their plasticity. The changes ("rotting") which the clay undergoes during this process have not yet been satisfactorily explained. Seger (this J., 1892, 162) found that small quantities of caustic soda, sodium carbonate, or sodium silicate diminished or destroyed the plasticity of the mixtures, whilst a slight addition of hydrochloric or acetic acid considerably increased it; he therefore recommended, instead of storage, the addition of a small quantity of acid. The author has repeated and extended Seger's experiments, and finds that, at first, the plasticity is increased by both hydroxyl and hydrogen ions, but whereas in presence of the latter the increase is permanent, in presence of hydroxyl ions the plasticity again diminishes after a short time, and is finally less than at first. The author considers that all substances which have the power of forming colloidal solutions with water exhibit the property of plasticity to a greater or lesser degree. Clay and porcelain masses contain such colloidal substances, partly of an inorganic and partly of an organic nature, and the combination of these substances in the dissolved condition with the peculiar clay substance, aluminium silicate, $Al_2O_3.2SiO_2.2H_2O$, may be regarded as the cause of the plasticity of such mixtures. The degree of plasticity may be expressed as $\frac{M}{N}$, or the ratio of the inactive substances M to the active (colloidal) substances N. The increase of plasticity of clay mixtures on storing ("rotting") is due to the formation of acid by the fermentation of the organic matter; the hydrogen ions produced first neutralise the hydroxyl ions present in the solution in contact with the clay, which have an injurious influence on the plasticity, and then the excess of hydrogen ions exercises an accelerating action on the coagulation of the colloidal substances, and consequently on the degree of plasticity of the mixture. The plasticity of clay mixtures can be increased by the addition of colloidal substances, *e.g.*, tannic acid, dextrin, aluminium hydroxide.—A. S.

English Patent.

Ceramic Products; Composition for the Manufacture of ——. C. Robin, Saint Genon, France. Eng. Pat. 17,235, Aug. 6, 1904. Under Internat. Conv., Aug. 7, 1903.

See Fr. Pat. 334,490 of 1903; this J., 1904, 63.—T. F. B.

United States Patents.

Cement [for Porcelain, &c.]; Process of Manufacturing Vitreous ——, and of Material Designed for the Production of same. P. Steenbock, Deutsch Wilmersdorf, Germany. U.S. Pats. 771,183 and 771,184, Sept. 27, 1904.

See Eng. Pat. 15,181 of 1904; this J., 1904, 901.—T. F. B

French Patent.

Glassware; Process of and Apparatus for the Manufacture of ——. A. Meister. Fr. Pat. 342,955, April 19 1904.

The glass flows directly from the melting furnace int moulds arranged in a casting-chamber heated by th furnace proper in such a way that the glass remains liqui during the casting, the proper shape being then given t the glass by blowing or by moulding. During th operation the outer opening of the moulding chambe is kept closed by the support of the moulds. The tabl which carries the moulds has a plate so arranged that i closes the chamber when the carrier is withdrawn. T enable the glass to be cast without measuring the quantity needed for each object, a ladle is provided which is capabl of being rotated, and which, by means of a gutter above it receives the glass during the changing of the moulds.
—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

Concrete in Smelting Works. F. I. Havard.
X., page 986.

English Patents.

Brick-Kilns. P. J. Sadler, Oldbury, Worcester. Eng. Pat 20,028, Sept. 17, 1903.

The improvements suggested consist of an arrangement o connecting flues and dampers, whereby the waste heat fr one kiln may be conveyed into another kiln of the series Each kiln of the series is provided with a chimney and wit a main connecting flue leading to a main stack or fan for inducing the draught. The heat from the bottom of one kiln is conveyed into the top or over the wicket, or over or under the draught into the side of another kiln.—W. C. H.

Quartz Bricks or Blocks; Fireproof ——. E. Stöffler, Zürich, Switzerland. Eng. Pat. 11,258, May 16, 1904. Under Internat. Conv., May 16, 1903.

Bricks are made by subjecting a mixture of quartz and magnesia to the action of steam under pressure and then burning the mass. With many quartz materials it is advantageous to first burn the rock, &c., and chill it with cold water before pulverising. The magnesia bricks are said to expand and bend less than similar bricks made with lime.
—A. G. L.

Adherence of Tiles and the like to Walls; Composition for Effecting the ——. G. B. Godson, London. Eng. Pat. 17,066, Aug. 4, 1904.

The composition consists of 40 per cent. of dextrin, 40 per cent. of powdered alum, and 20 per cent. of "adamant" cement, to which a sufficient quantity of gum arabic dissolved in water is added. This mixture is spread on the back of the opal glass or other tiles, and small pebbles, grit, coke, coke breeze, granite chips, &c., are scattered on its surface. As soon as the mixture is dry, the tiles are fixed in position by being pressed against the plaster, &c., previously placed on the wall.—A. G. L.

United States Patents.

Stones; Process of Colouring Natural Crystalline ——. E. Klie, Charlottenburg, Germany, Assignor to the Chem.-Techn. Fabr. Dr. Alb. R. W. Brand and Co. G. m. b. H. U.S. Pat. 770,643, Sept. 20, 1904.

The process of colouring natural crystalline stones containing calcium carbonate consists in drying the stone, placing it in a solution of metallic soaps in volatile oil (such as a metallic oleate in turpentine oil) in the presence of organic acids stronger than the fatty acids of the metallic soaps (such as acetic acid), and heating the said solution. See Eng. Pat. 5594, and Fr. Pat. 338,887 of 1903; this J., 1904, 188, 901.—W. C. H.

Stone; Manufacture of Artificial —— *from Magnesite.* C. Groyen, Bonn, Germany. U.S. Pat. 771,062, Sept. 27, 1904.

See Fr. Pat. 334,562 of 1903; this J., 1904, 65.—T. F. B.

Cement; Carborundo ——. L. E. Müller, Paris. U.S. Pat. 770,730, Sept. 20. 1904.

See Fr. Pat. 338,914 of 1903: following these.—T. F. B.

Cement; Manufacture of Acid-Proof and Impermeable ——. R. Liebold, Weimar, Germany. U.S. Pat. 771,080, Sept. 27, 1904.

See Eng. Pat. 4606 of 1904; this J., 1904, 490.—T. F. B.

French Patents.

Refractory Bricks from Quartz; Process for Making ——. E. Stöffler. Fr. Pat. 343,130, May 13, 1904. Under Internat. Conv., May 16, 1903.

See Eng. Pat. 11,258 of 1904; preceding these.—T. F. B

"Carborundociment" [Protective Facing for Masonry]: Powdered Product called ——. L. E. Muller. Fr. Pat. 338,914, July 8, 1903.

A coating used to harden furnace bricks is composed of carborundum, 90 to 60 parts; fireclay, 10 to 40; lime, 0 to 4; sodium or potassium silicate of 47° B., 20 to 50 parts. These materials are mixed intimately, dried, and re-powdered. The product is then mixed to a paste with water. In cases where it is meant to withstand chemical action the coating is composed of carborundum, 50 to 85 parts; calcined magnesia, 5 to 15; and fine sand, 10 to 25. In either case the carborundum may be replaced by other carbides or by metallic silicides and borides. Instead of with water, the mixture may be treated with other liquids, such, *e.g.*, as a solution of magnesium chloride.—A. G. L.

Cement; Manufacture of ——. B. Grau. Fr. Pat. 343,152, May 14, 1904.

Blast-furnace slag is treated in the fused state with steam, preferably superheated, and the resulting product is reduced to powder.—A. G. L.

X.—METALLURGY.

Temper-Carbon ("Temperkohle") in Iron; Influence of other Elements on Formation of ——. F. Wüst and P. Schlösser. Stahl u. Eisen, 1904, **24**, 1120—1123.

The authors show that temper-carbon can separate from pure carburised iron without requiring the influence of other elements. The amount produced is a function both of the temperature to which the iron is heated and of the total amount of carbon. The presence of silicon assists the formation of temper-carbon, which then occurs at a lower temperature and from iron with a lower total content of carbon. Manganese and, to a greater extent, sulphur oppose the formation, whereas phosphorus seems to have no influence.—R. S. H.

Molybdenum Carbide; New ——. H. Moissan and M. K. Hoffmann. Ber., 1904, **37**, 3324—3327.

A mixture of molybdenum, aluminium, and petroleum coke is heated in a closely covered carbon crucible in the electric furnace. The product is treated with sodium hydroxide solution to remove aluminium, and with dilute sulphuric acid. After removing from the residue any admixture of graphite, there remains a grey crystalline powder of sp. gr. 8·10 and hardness 6—7, oxidising when heated in air or with potassium chlorate or nitrate, readily attacked by nitric, slowly by other acids, burning spontaneously in fluorine, but attacked much less readily by chlorine or bromine at a red heat. Analysis assigns to it the formula MoC. It is analogous to Williams' tungsten carbide, and is probably present, as a double carbide, in molybdenum steel.—J. T. D.

Magnetic Alloys from Non-magnetic Metals; Production of ——. R. A. Hadfield. Brit. Assoc., 1904. Chem. News, 1904, **90**, 180.

The author describes a series of magnetic alloys prepared by F. Heusler. It was found that whilst the metals, copper, aluminium, and manganese, and alloys of copper and aluminium, are all non-magnetic, alloys containing the three metals in certain proportions, possess considerable magnetic properties. Although it would appear that the magnetic properties are due to the manganese, yet in alloys containing a fairly constant percentage of manganese, the magnetisability increases with the amount of aluminium up to a maximum, when the proportion of aluminium amounts to about one-half of that of the manganese. This is shown in the following table:—

Alloy containing		H = (Magnetising Force).				
Manganese.	Aluminium.	20.	40.	100.	150.	
Per Cent.	Per Cent.					
28	3·6	Unmagnetisable.				
28	5·7	Very slightly magnetisable.				
26	9·6	2220	2670	3200	3470	B = magnetic induction.
26	14·6	4500	4850	5380	5550	
25	13·8	3580	4075	4645	4900	

The author made some experiments with an alloy containing 60 per cent. of copper, 25—27 per cent. of manganese, and 12 per cent. of aluminium. It is very brittle, and cannot be forged either hot or cold. It is feebly magnetic immediately after casting, but becomes non-magnetic when heated to about 170° C. and quenched in cold water. By continued heating at about 80°—150° C., it regains its magnetic properties in an intensified degree. If lead be introduced into the alloy, it becomes more fusible, its transformation-point is lowered, and under suitable heat treatment, the magnetisability is even increased. Alloys of copper, manganese, and tin also possess magnetic properties; magnetisability is first shown when 10 per cent. of tin is present, whilst the most magnetic alloy is one containing 21—22 per cent. of tin to 30 per cent. of manganese. Alloys of antimony and manganese are also magnetic. —A. S.

Alloys of Copper and Antimony, and their Recalescence. A. A. Baikoff. J. Russ. Phys. Chem. Soc., 1904, **36**, 111—165. (See also this J., 1903, 744.)

THE author has prepared melting-point curves and tables for the alloys of copper and antimony, and also their cooling curves. The latter show that these alloys exhibit the phenomenon of recalescence. Copper and antimony form two compounds, $SbCu_2$ and $SbCu_3$. The violet alloy, $SbCu_2$, melts and decomposes at 516° C., and can be prepared by melting the alloy $SbCu_3$ and antimony together in such proportions that solidification begins at a temperature below 586° C.; mixtures of the two metals which commence to solidify at higher temperatures than 586° C., deposit only the alloy $SbCu_3$, which melts at 681° C. These results are in accord with those given by a study of the other physical properties of these alloys—hardness, expansion, and E.M.F. in galvanic elements. The alloy $SbCu_3$ exists in two modifications: (1) the α-form, stable at temperatures below 407° C., and (2) the β-form, stable only at higher temperatures. All mixtures of the two metals containing from 53·5 to 61 per cent. of copper, and consisting of mixed crystals of antimony and the compound $SbCu_3$, undergo, on cooling, two distinct changes: (1) polymorphic transformation of the β-form of the compound $SbCu_3$ into the α-modification, and (2) separation of the compound $SbCu_2$. The micro-structure of the different alloys confirms the above conclusions.—T. H. P.

Passivity of Metals. W. Muthmann and F. Fraunberger. Sitzungsber. Bayr. Akad. Wiss., 1904, 201—241. Chem. Centr., 1904, **2**, 972—974.

A LARGE number of experiments have been carried out with different metals, and it was found that, besides iron, chromium, nickel and cobalt, vanadium, molybdenum, tungsten, and ruthenium are capable of being rendered passive. The results are given of a large number of potential measurements made in N/1 potassium chloride solution against a normal electrode (mercury, mercurous chloride, N/1 potassium chloride solution) with the metals after treatment with various reagents and after filing, &c. The authors consider that the passive metals contain dissolved oxygen, and that the degree of passivity is dependent upon the amount and the pressure of the dissolved oxygen. The potential of a passive metal can thus be regarded as an alloy-potential, which in certain cases can approach very near that of pure oxygen. (Compare this J., 1903, 637.)—A. S.

Concrete in Smelting Works. F. I. Havard. Amer. Inst. Mining Eng., Sept. 1904. Eng. and Mining J., 1904, **78**, 460.

THE author describes the advantages and disadvantages which have been observed with the use of concrete (1 of cement to 7 of sand and "jig-tailings") flues and stack at a lead- and silver-smelting works. The cost of construction was about 0·11 dol. per sq. ft. *Effect of Heat:* Cracks were caused by temperatures above 100° C. Neutral furnace-gases at 120° C. caused so much damage by formation of cracks, that after two years, the stack, constructed of pipes 4 ins. thick, required repairing throughout. *Effect of Flue-Gases and Moisture:* In cases where the flue was protected on the outside by a wooden or tiled roof, and inside by an acid-proof paint, composed of water-glass and asbestos, the concrete was not appreciably damaged. Where the protective covering, both inside and outside, was of asphalt only, the concrete was badly corroded and cracked at the end of three years. Concrete unprotected from both atmospheric influences on the outside, and furnaces-gases on the inside, was quite destroyed at the end of three years. The presence of an excessive amount of moisture in the furnace-gases had a very injurious influence.—A. S.

Lead [in Brass, Bronze, &c.]; Volumetric Determination of ——. E. J. Ericson. XXIII., page 1000.

ENGLISH PATENTS.

Incorrodible Material [Iron-Hydrogen Alloy], and Method of its Production. G. W. Gesner. Eng. Pat. 16,029, July 19, 1904. XIII. A., page 989.

Steel and Armour Plates; Process of Treating ——. E. Engels, Düsseldorf, Germany. Eng. Pat. 16,419, July 25, 1904. Under Internat. Conv., March 21, 1904.

THE steel is heated in presence of oxygen, or of substances that yield oxygen, such as manganese dioxide, and, whilst still red hot, is plunged into molten lead (or other cooling bath); when withdrawn it may be rolled or pressed, and be then cemented on the side to be hardened. It is then hardened in oil or the like, and is annealed at a temperature lower than that used in cementing. The process may be varied according to circumstances, and the indicated special treatment may be used with or without combination with a cementation process. See also Eng. Pats. 25,932 of 1903 and 1842 of 1904; this J., 1901, 118 and 374.—E. S.

Ore-roasting and like Furnaces. H. H. Lake, London. From I. Santilippo, Casteltermini, Sicily. Eng. Pat. 19,353, Sept. 8, 1903.

SEE Fr. Pat. 334,444 of 1903; this J., 1904, 67.—T. F. B.

Copper, Silver, Lead, Mercury, and all other Metals adapted to be Precipitated from an Acid Solution by Means of Sulphuretted Hydrogen; Process for Separating from their Ores ——. P. Weiller, Vienna, and A. Weiller, Trieste, Austria. Eng. Pat. 7309, March 26, 1901.

SEE Addition, of April 7, 1904, to Fr. Pat. 336,989 of 1903; this J., 1904, 903.—T. F. B.

Alloy; New Metallic ——. Firm of Routin and Mourraille, Lyons, France. Eng. Pat. 9584, April 26, 1901. Under Internat. Conv., May 25, 1903.

SEE Fr. Pat. 332,605 of 1903; this J., 1903, 1247.—T. F. B.

Vanadium; Manufacture of Metallic —— from its Ores or any other Compounds of Vanadium. P. Auchinachie, Wrexham, Wales. Eng. Pat. 12,727, June 6, 1904.

THE ore or other compound of vanadium is strongly heated for about two hours with, preferably, concentrated sulphuric acid, to which a small proportion of sodium nitrate is added. The cooled solution is diluted with water, and after settling the clear blue solution of vanadium sulphate is electrolysed using iron electrodes, vanadium oxide being deposited; or the vanadium oxide may be separated by chemical means and in either case it is mixed with carbon and heated t about 2000° C. in an electric furnace. The vanadium i obtained from the residual melted mass by grinding unde steel rollers and washing the carbon away by water.—E. S.

Solder for Aluminium or Aluminium Alloys. R. F. y Pelletier and E. S. y Semprun, Madrid. Eng. Pat. 13,3 June 13, 1904.

AN alloy of silver, aluminium, and tin, in stated proportions is melted in a covered crucible, and immediately before solidification, about 10 per cent. of its weight of phosphorus i added; this alloy is referred to as "metal F." "Metal S" is obtained by adding sulphur in small pieces to melted zinc and casting the mass in "rails." "Metal FS" is obtaine by fusing 85 parts of "metal F" with 15 parts of "metal S. The solder for aluminium or its alloys is obtained by meltin, and adding together, in the order named, 10 parts each o "metal FS" and aluminium, 80 parts of zinc, and 320 part of tin, all by weight. See also Eng. Pat. 7016 of 1903; thi J., 1903, 801.—E. S.

UNITED STATES PATENTS.

Aluminium; Manufacture of ——. W. Rübel, Assignor t N. Bernstein, Berlin. U.S. Pat. 770,389, Sept. 20, 1904.

SEE Fr. Pat. 322,353 of 1902; this J., 1903, 369.—T. F. B

Blast Furnaces; Cooling Device for ——. L. Keyling, Berlin. U.S. Pat. 770,910, Sept. 27, 1904.

SEE Eng. Pat. 16,646 of 1902; this J., 1903, 800.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Nitrites and Nitrates; Production of —— by the Electrolytic Oxidation of Ammonia in presence of Cupric Hydroxide. W. Traube and A. Biltz. Ber., 1904, **37**, 3130—3138.

A MIXTURE of a 20 per cent. solution of sodium hydroxide and a 10 per cent. solution of ammonia containing dissolved cupric hydroxide equal in weight to about one-tenth of the ammonia present was used as the anode liquid of an electrolytic cell, and a 20 per cent. solution of sodium hydroxide solution, in an inner porous cell, as a cathode liquid. The currents used were 5, 10, and 15 ampères, and he electrodes thin sheet iron, the anode surface being from 15 to 25 sq. cm. per ampère. Sodium nitrite was produced during five to seven hours of electrolysis, up to quantities of 20—30 grms.; current yield, 75—90 per cent. The maximum strength of solution thus obtained was about 7 per cent.; but by starting with a solution already containing this amount of nitrite, the strength was increased to nearly 10 per cent. If the current be continued long enough, the amount of nitrite ceases to increase, and then diminishes, ill finally it entirely disappears. Examination of the liquid shows that the nitrite has been converted into nitrate. The yield of nitrate so obtained was about 75 per cent. of hat corresponding in theory with the current. Corresponding experiments have shown that the nitrites and nitrates of potassium and of barium are also obtainable in this way, hough in neither case have as good yields been yet obtained as with the sodium salts.—J. T. D.

Persulphates; Preparation of ——. E. Müller. Z. Elektrochem., 1904, **10**, 776—781.

THE production of potassium or sodium persulphate by the lectrolysis of acid sulphates is greatly aided by the presence of the fluorine ion. Thus, in 125 c.c. of a N/2·3 solution of potassium bisulphate, by substituting 20 c.c. of N/20 hydrofluoric acid for added free sulphuric acid, the yield of persulphate was raised from about 50 per cent. to about 5 per cent. Paraffined glass vessels were used. If a crust of persulphate be allowed to form on the anode, the beneficent effect of the hydrofluoric acid ceases.—W. A. C.

Potassium Cyanate; Electrolytic Preparation of ——. E. Paternò and E. Pannain. Gaz. chim. ital., 1904, **34**, [2], 152—155. Chem. Centr., 1904, **2**, 982.

THE authors find that the best yields of potassium cyanate re obtained by electrolysing a solution of potassium cyanide ontaining 4—6 grm.-mols. per litre, using a rotating anode, n E.M.F. of 4—6 volts, and an anodic current-density of —4 ampères per sq. dcm. Under these conditions nearly he whole of the cyanide can be converted into cyanate, which partly crystallises out during the electrolysis. For xample, from 72 grms. of potassium cyanide, with an E.M.F. of 4·5 volts and a current-density of 1·5—2·5 mpères per sq. dcm., 32 grms. of cyanate separated during lectrolysis, whilst a further 42 grms. were recovered from he solution by evaporation, thus giving a total yield of 0 per cent.—A. S.

Nitrotoluene; Electrolytic Reduction of ——. W. Löb and J. Schmitt. Z. Elektrochem., 1904, **10**, 756—764.

FOR the production of toluidine, the following cathode-materials were tried, and are arranged in ascending order f efficiency: nickel, zinc, copper, and copper with the ddition of powdered copper to the electrolyte. The reduc-on of *p*-nitrotoluene is decidedly easier than that of -nitrotoluene. The electrolytic preparation of *m*-azoxyoluene with nickel cathodes in a 2 per cent. solution of caustic soda is recommended as a laboratory method, also the preparation of toluidines with copper cathodes and powdered copper.—W. A. C.

Electrolysis of Alkali Bromides, and Action of Bromine on Alkalis. H. Kretzschmar. VII., page 983.

Sugar Industry; Application of Electrolysis in the ——. L. Gurwitsch. XVI., page 993.

Molasses; Purification of —— by Electrolysis. L. Gurwitsch. XVI., page 993.

ENGLISH PATENT.

Electric Energy; Production of —— by the Utilisation of the Chemical Energy of any suitable Combustible, without the Employment of Thermal Engines. H. Tourneur, Paris. Eng. Pat. 12,188, May 28, 1904. Under Internat. Conv., June 11, 1903.

SEE Fr. Pat. 332,982 of 1903; this J., 1903, 1298.—T. F. B.

UNITED STATES PATENT.

Incandescent Electric Material. A. Voelker, Berlin. Assignor to Soc. Anon. Ind. Verrière et ses Dérivés à Bruxelles. U.S. Pat. 770,991, Sept. 27, 1904.

"CARBON" is ground into grains of from 1 to 7 mm. in size, and this material is then divided into groups, the first of which contains only grains of 1 mm. in size, the second only 2 mm., and so on, each group being afterwards graduated by the addition of graphite or of silicates, depending upon whether the conductivity of the group is to be increased or decreased.—W. C. H.

FRENCH PATENTS.

Reducing Organic Substances by means of Titanium Compounds; Electrolytic Process for ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 338,934, July 20, 1903.

SEE U.S. Pat. 742,797 of 1903; this J., 1903, 1355.—T. F. B.

Electrolytic Apparatus. H. S. Blackmore and E. A. Byrnes. Fr. Pat. 343,047, May 10, 1904.

SEE U.S. Pats. 759,798 and 759,799 of 1904; this J., 1904, 613.—T. F. B.

Gaseous Medium from Air; [Electrolytic] Process for Extracting a ——. J. N. Alsop. Fr. Pat. 343,129, May 13, 1904. Under Internat. Conv., May 29, 1903.

SEE U.S. Pats, 758,883 and 758,884 of 1904; this J., 1904, 611 and 612.—T. F. B.

(B.)—ELECTRO-METALLURGY.

Iron; Electrolytic ——. A. Skrabal. Z. Elektrochem., 1904, **10**, 749—752.

IRON may be deposited electrolytically in two modifications. The first, from ferrous solutions at low current densities with iron anodes, is white, very hard, and brittle, and resists the action of corrosive liquids to a striking extent. On igniting it, hydrogen is expelled, whilst the metal becomes quite malleable. On the other hand, it gives up hydrogen on heating to 70° C. without losing its brittleness, and can then be recharged with hydrogen electrolytically; whilst after ignition it can neither be charged with hydrogen nor brought into the hard, brittle condition again. The second variety of electrolytic iron is produced from complex ions of bivalent iron at high densities with platinum anodes, and is grey, amorphous, and not very compact. Though not free from oxide, it contains more hydrogen than the first variety. It is not only very readily soluble in acids, but is capable of decomposing water. The author regards both varieties as solutions of more or less hydrogen in γ-iron, changing on ignition into the stable α-iron.

—W. A. C.

Metals capable of Decomposing Water; Electrolytic Separation of —— from Solutions of their Salts. A. Siemens. Z. anorg. Chem., 1904, **41**, 249—275.

Magnesium can be separated in the metallic condition, together with nickel, from aqueous solutions containing salts of the two metals, provided the concentration of the magnesium salt be sufficiently high. The following were the most satisfactory results:—

Concentration.		Current Density.	Temperature.	Percentage of Magnesium in the deposited Metal.
Nickel Sulphate.	Magnesium Sulphate.			
		Amp. per sq. dcm.	° C.	
N 1	8N	5	90	2·12
4N	8N	1	20	2·63

The deposits containing magnesium differ from those of pure nickel in being compact and adherent, and showing no tendency to "strip" as the latter do. The nickel-magnesium alloy adheres firmly to iron, whereas in electroplating iron with nickel it is thought necessary to deposit an intermediate layer of copper, in order to obtain an adherent coating of nickel. Magnesium can also be deposited in a similar manner with cobalt, and to a lesser degree with iron, but only in traces with zinc. Aluminium and the alkaline-earth metals cannot be deposited simultaneously with heavy metals from aqueous solutions. The alkali metals can be deposited in very small amounts with nickel and tin, but not with iron and silver. In all cases the deposits are not definite compounds of the two metals, but are solid solutions of the light metal in the heavy one. Deposits of a heavy metal containing a dissolved light metal are characterised by having a distinctly higher potential than deposits of the heavy metal in a pure condition. Alkali and alkaline-earth metals can, under certain conditions, be deposited electrolytically from solutions of their salts in acetone; on the other hand, magnesium, aluminium, and beryllium cannot be deposited in this way.—A. S.

Copper; Electrolytic Assay of ——. G. L. Heath. XXIII., page 1001.

English Patent.

Electric Furnace for Converting Pig Iron into Steel. G. Gin, Paris. Eng. Pat. 8216, April 9, 1904. Under Internat. Conv., June 4, 1903.

See Fr. Pat. 342,101 of 1904; this J., 1904, 904.—T. F. B.

French Patents.

Electric Furnace; Arrangement of ——. A. Voelker. Fr. Pat. 343,004, May 13, 1904.

The crucible or object to be heated, placed centrally in the cavity of the furnace, is surrounded by a packing consisting of pieces of charcoal, varying in diameter from 1 to 7 mm., arranged in classified layers or groups, whereby on passage of the current the heating is regulated by the position of the strata, such heating being in part on the resistance, and in part on the arc system. The conductivity of the packing medium may be further modified by addition, in places, of graphite or of silicates. (See U.S. Pat. 770,991 of 1904, XI. A., page 987.)—E. S.

Zinc; Process for the Direct Extraction of [in Electric Furnace] —— from its Ores. A. Rodriguez Bruna. Fr. Pat. 343,114, April 20, 1904.

Zinc ores are mixed with carbon, and the mixture is heated, under pressure, in an electric furnace. It is stated that the zinc may be thus obtained in the melted state, instead of as vapour. When blende is thus treated, certain by-products are obtained, including carbon bisulphide, which may be burnt with the other gases to produce sulphur dioxide, &c. —E. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Fats; Effect of Exposure to Light on ——. M. Winckel. Ges. deutsch. Naturforscher u. Ärzte. Z. angew. Chem., 1904, **17**, 1524. Chem.-Zeit., 1904, **28**, 931—932.

H. Kreis found that fats which had been exposed to sunlight gave a red coloration with a mixture of phloroglucinol and hydrochloric acid. The author examined a number of fats and oils, and found that the fresh substances did not give the reaction, but that they did after being exposed to direct sunlight for one hour. On keeping samples of lard (1) In the air exposed to direct sunlight, (2) Exposed to sunlight *in vacuo*, (3) Exposed to the air in the dark, and (4) *In vacuo* in the dark; and subsequently testing them, it was found that samples (1) and (2) gave the phloroglucinol reaction after half an hour and several hours respectively, whilst samples (3) and (4) became rancid, but did not give the colour reaction. The colour reaction was found to be caused by free oleic acid.—A. S.

Saponification; Theory of ——. R. Fanto. Monatsh. Chem., 1904, **25**, 919—928.

The author opposes the theory of Geitel and of Lewkowitsch (this J., 1898, 1007; 1899, 1031; 1900, 254; 1903, 596) on the ground that he was unable to detect mono- or diglycerides in the products of the partial saponificatio of fats with aqueous solutions of potassium hydroxide In his experiments with olive oil, ox tallow, tristearin, and (impure) triolein, the fat was heated with the potassiu hydroxide in a cylindrical flask immersed in boilin water for three or six hours, whilst the contents were kep in continual motion by means of a stirring device worked by a turbine. The products of the reaction were the decomposed with acetic acid, extracted with ether, an analysed, the glycerol and the acid value being determined and from the increase on the acid value of the original fat the amount of potassium hydroxide that had entered int the reaction could be calculated. From the results obtaine the author considers himself justified in stating, with refer ence to the saponification of fat with potassium hydroxid in homogeneous solution, (1) That the presence of di- an mono-acyl hydrins cannot be detected; (2) That in homo geneous solution the saponification is practically quadrimol cular. (See also this J., 1898, 673; 1904, 550, 905.)
—C. A. M.

Fatty Oils; Colour Reactions of ——. H. Kreis. XXIII., page 1001.

Wool-Fat Oleins [Detection of Mineral and Rosin Oils in ——]. J. Marcusson. XXIII., page 1001.

English Patent.

Fat-extracting Solvents; Process for the Removal —— from Materials. E. Bergmann, Ohlau, German Eng. Pat. 21,667, Oct. 8, 1903.

See Fr. Pat. 335,964 of 1903; this J., 1904, 328.—T. F.

French Patent.

Candles, Lamp Oils, Edible Fats, Unguents or Pomade Soaps, &c.; Manufacture of ——. C. Dreyman Fr. Pat. 343,158, May 14, 1904.

The following derivatives of fatty acids are claimed f these purposes:—(1) Esters, (2) Condensation products esters with other organic compounds, (3) Amides, (4) Pr ducts of the limited oxidation of unsaturated fatty aci either alone or mixed with fatty acids of a higher series with other fatty bodies. Claim is also made for a proce of mixing sulpholeic acids prepared in the usual way wi an oxide, hydroxide, or other suitable substance (e. calcium or magnesium oxides) before the distillation. Th addition is stated to reduce the loss of solid material duri he distillation. Loss by decomposition may also be prevented by converting the fatty acids into esters, which are istilled and then saponified in an autoclave. A method claimed) of obtaining a larger yield of a harder soap onsists in raising the saponification value of an olein by neans of regulated oxidation, and saponifying the product. —C. A. M.

Errata.

This Journal, page 942, col. 2 :—

l. 32 from top, *insert after* "into," *the words* "one of."

l. 37 from top, *insert after* "chloride," *the following* :— "previously ground like the hard soap, in others of the series of disintegrators already referred to."

l. 39 *delete the word* "(crystals)" *and substitute* "26" for "69."

l. 40 *insert before* "anhydrous," *the words* "combined water, 43 parts ;"

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

olasses ; Purification of —— by Electrolysis. [Pigment as By-Product.] L. Gurwitsch. XVI., page 993.

English Patent.

ncorrodible Material [Paint], and Method of its Production. G. W. Gesner, New York. Eng. Pat. 16,029, July 19, 1904.

N alloy of iron and hydrogen, containing 0·13 per cent. f the latter element, is claimed to possess "remarkable ualities in resisting corrosive influences." It is produced y exposing iron, or an iron ore, to an atmosphere of ydrogen at a temperature of about 1800° F., or by forcing ydrogen through molten iron. The product is pulverised y stamping and grinding. For use as a paint it is mixed ith linseed oil or other vehicle. If the powder is strongly ompressed and then heated to about 2000° F. for about wo hours, it coheres, without fusion, into solid masses. —M. J. S.

United States Patents.

ake [from Azo Dyestuff] : Red ——. W. Herzberg and O. Siebert, Assignors to Act.-Ges. f. Anilinfabrikation, Berlin. U.S. Pat. 770,430, Sept. 20, 1904.

EE Fr. Pat. 329,037 of 1903 : this J., 1903, 992.—T. F. B.

hite Lead ; Manufacture of ——. J. Oettli, Lausanne, Assignor to Syndicat pour l'Exploitation des Inventions du Prof. Oettli, Berne, Switzerland. U.S. Pat. 771,024, Sept. 27, 1904.

EE Fr. Pat. 328,490 of 1903 ; this J., 1903, 1096.—T. F. B.

inc White ; Manufacture of ——. J. Oettli, Lausanne, Assignor to Syndicat pour l'Exploitation des Inventions du Prof. Oettli, Berne, Switzerland. U.S. Pat. 771,025. Sept. 27, 1904.

EE Fr. Pat. 328,491 of 1903 ; this J., 1903, 1097.—T. F. B.

French Patents.

edium for Oil Colours which do not contain Lead ; Process for Making a ——. J. E. Kollinger. Fr. Pat. 338,913, July 8, 1903.

IL colours, not containing lead, are ground up with a edium consisting of vegetable oil, 20 to 50 parts ; rosin ap, 15 to 40 parts ; and turpentine, 0·5 to 4 parts. Colours epared thus are stated to have great covering power, and be perfectly resistant to heat ; it is also said that they are t decolorised by light, alkalis, or sulphuretted hydrogen. —T. F. B.

Lakes [from Azo Dyestuffs] ; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 338,923, July 13, 1903.

See Eng. Pat. 15,493 of 1903 ; this J., 1904, 670.—T. F. B.

Lakes very Fast to Water ; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 342,903, May 5, 1904. Under Internat. Conv., March 8, 1904.

Lakes very fast to water are produced by precipitating dyestuffs on a substratum of a basic aluminium salt. The basic chloride, nitrate, and thiocyanate are the most suitable for the purpose ; basic aluminium sulphates do not lend themselves very well to such treatment. The lakes may be prepared by adding a determined quantity of hydrochloric or nitric acid to a suspension of alumina in a solution of the dyestuff, or by adding sufficient alkali to precipitate the dyestuff on an aluminium salt which is not sufficiently basic. It is often advantageous to heat the mixture during the precipitation. The following example is given for preparing a fast yellow lake : 200 kilos. of a 4 per cent. alumina paste are incorporated with a solution of 1 kilo. of Naphthol Yellow S, and the lake is precipitated by the addition of a solution of 0·8 kilo. of aluminium chloride ($AlCl_3$, $6H_2O$).—T. F. B.

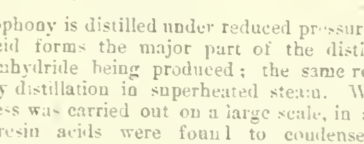
Colours [Pigments] : Manufacture of Oil ——. M. Hérisson. Fr. Pat. 342,550, April 22, 1904.

The basis of this pigment is barium silicate, to which are added hydrated silica, infusorial earth, kaolin, zinc oxide, and alumina in stated proportions.—T. F. B.

(*B.*)—RESINS, VARNISHES.

Resin Acids of the Coniferæ. I. Constitution of Abietic Acid. T. H. Easterfield and G. Bagley. Chem. Soc. Trans., 1904, **85**, 1238—1249.

When colophony is distilled under reduced pressure, abietic (sylvic) acid forms the major part of the distillate, no isosylvic anhydride being produced ; the same result was obtained by distillation in superheated steam. When the latter process was carried out on a large scale, in a stearin still, the resin acids were found to condense almost entirely in the first two coils, the abietene and other decomposition products being found mostly in the cooler coils. The decomposition of abietic acid to abietene occurs to a much greater extent when distillation is carried out in an iron still than in a glass retort ; thus abietic acid can be redistilled from a glass vessel under 100 mm. pressure, while from an iron still, considerable decomposition occurs even under 20 mm. pressure. By distillation under ordinary pressure, abietic acid is decomposed into abietene and oxides of carbon in such proportions as make it certain that abietic acid is abietene carboxylic acid. On distillation with small quantities of sulphur under ordinary pressure, or with large amounts under reduced pressure, retene is produced ; from this and from the empirical formulæ of the two compounds, it follows that abietene is decahydroretene. Kelbe (Ber., 1884, **17**, 1157) has shown that resin spirit is rich in *m*-cymene ; hence it is highly probable that abietic acid is decahydromethylisopropylphenanthrene-carboxylic acid of the constitution—



By analogy, pimaric acid is most probably a monomethyl derivative of abietic acid. Rimuic acid and podocarpic acid are considered also to be octohydrohydroxymethyl- and octohydrohydroxydimethylphenanthrene-carboxylic acid respectively.—T. F. B.

Nan-ta-Yok or Burmese Storax; Properties of ——. D. Hooper. Agric. Ledger, 1904, 115—122.

Source.—This balsam, which has long been used in Burma as incense and for medicinal purposes, is produced by *Altingia excelsa* (Noronha), a large tree (150 to 180 feet high) growing in the forests of the Indian Archipelago, Burma, Assam, and Bhután, and especially in the Tenasserim province of Burma. It is also found in China, Java, Cochin China, New Guinea, and the Sunda Archipelago. Three samples of resinous balsam from Java examined by Tschirch and van Itallie (this J., 1901, 1122) were said to be the products of two species of *Altingia*, but in Greshoff's opinion both trees were *Altingia excelsa*. The two aromatic exudations from South Tenasserim examined by the author had the following properties:—

Soft White Crystalline Balsam. — This resembled honey when fresh, but after two years crystallised, and became white, and had a fragrant odour of styrol. It melted at 41° C., and when heated on the water-bath lost 7·65 per cent. in weight, the volatile substances being chiefly essential oils. It gave the following values:—Acid value, 24·96; saponification value, 199·35; and iodine value, 57·3. About half the balsam consisted of an ester of cinnamic acid, the amount of the latter separated being 37 per cent. calculated on the original balsam.

Dark Brown Solid Balsam.—This consisted of resinous masses, which yielded a brown powder with an aromatic odour in which that of cinnamon predominated. After clarification with alcohol two samples gave the following results:—Resins, 53·72 and 54·70; organic impurities, 19·09 and 28·05; inorganic impurities, 22·24 and 10·67; and volatile oil and loss, 4·95 and 6·58 per cent. The purified resin (m. pt. 68° C.) was clear, of an amber colour, and had the fragrant odour of the crude balsam. It was soluble in chloroform, carbon bisulphide, and benzene, partially soluble in acetic ether, and slightly soluble in petroleum spirit.

——	Acid Value.	Saponification Value.	Iodine Value.
Crude resins	52·48	130·10	41·07
Pure resins	76·80	130·44	51·68

The brown balsam contained a trace of free cinnamic acid, and 9·7 per cent. of that acid in the form of an ester. The author's conclusion is that the white balsam is valuable as a perfume and as a source of cinnamic acid, whilst the brown balsam is of value as a perfume and as incense. Both possess a sweeter aroma than genuine storax, and when heated with sulphuric acid and potassium bichromate both evolve an odour of benzaldehyde. If examined by Dieterich's method (this J., 1898, 807) the brown resinous balsam cannot be regarded as true storax, whilst the white balsam only agrees with that resin in the saponification value. Hence the author's results confirm the statement of Tschirch and van Itallie (*loc. cit.*) that Nantayok resin differs in constitution from the genuine storax of Asia Minor.—C. A. M.

English Patents.

Gums and Resins; Impts. in and Apparatus for the Treatment of Products containing ——, *and for the Separation and Obtainment of the Gums and Resins therefrom.* J. Y. Johnson, London. From A. Foelsing, Offenbach-on-Maine, Germany. Eng. Pat. 21,020, Sept. 30, 1903.

The apparatus consists essentially of four parts: a closed extractor, in which the substance is exposed to the action of the hot solvent; a boiler, in which the solution so obtained is distilled for the recovery of the solvent and the extracted matter; a cooled coil, in which the vapour of the solvent is re-condensed; and a reservoir, intermediate between the condenser and the extractor, for the storage of the solvent. The special claim is for the use of selective solvents, by which resins can be extracted from substances containing rubber also, the substance to be treated being first rolled out into thin sheets and dried before placing it in the extractor.—M. J. S.

Varnishes; Manufacture of —— *by the Direct Solution of Gums without Previous Fusion.* A. Tixier, Billancourt, Seine, and L. Rambaud, Paris. Eng. Pat. 17,135, Aug. 6, 1903.

See Fr. Pat. 334,430 of 1903; this J., 1904, 69.—T. F. B.

United States Patent.

Wood; Method of Treating [Distilling] —— *for the Production of Paper Pulp, Turpentine, &c.* W. Hoskins, Lagrange, Ill. U.S. Pat. 770,463, Sept. 20, 1904.

Wood is subjected, in a digester, to the direct action of steam, at a temperature lower than that which would cause the decomposition of the resins; the "volatilisable condensable constituents" are then separated from the wood, the resinous constituents melted out, and the residual fibrous mass is treated with caustic soda-lye or other substance to reduce the fibre to pulp, which is suitable for paper-making. The alkaline liquor is evaporated and the residue distilled, to produce therefrom "oily and tarry products." The residue of this distillation is finally extracted with water to recover the alkali or other reagent employed.
—T. F. B.

(C.)—INDIA-RUBBER, &c.

Latex of Castilloa Elastica; Cause of Coagulation of ——. A. W. K. de Jong and W. R. Tromp de Haas. Ber, 1904, **37**, 3301—3305.

Three different latexes, containing respectively 3·5, 3·4, and 3·65 grms. of rubber per 10 c.c., were treated with increasing amounts of various coagulating agents, well shaken, allowed to stand, thrown into water, and the coagulum collected. Alcohol and acetone, employed as coagulating agents, were found to give yields increasing proportionally to the amount of coagulant used, up to a certain maximum, and then diminishing. (The maximum referred to is attained with $\frac{1}{2}$ vol. of alcohol and 1 vol. of acetone.) Glacial acetic acid coagulated the rubber in direct proportion with the amount added, 2 vols. coagulating the whole, and larger quantities causing no diminution. In the presence of water, however, the yields of rubber were smaller, but in the same general proportion with the different coagulants; in no case was the whole of the rubber coagulated. The latex was then purified by washing with water until 10 c.c. contained 0·65 grm. of rubber. Alcohol ($\frac{1}{2}$ vol.), acetone ($\frac{1}{2}$ vol.), and acetic acid, strong or dilute ($\frac{1}{3}$ vol.), now caused total coagulation, smaller quantities than those stated giving proportionally lower amounts, and excess having no adverse influence. The phenomenon of maximal point in the case of alcohol and acetone thus appeared to be due to constituents in the latex removable by washing. Pasteurisation of the latex almost destroyed the coagulating power of alcohol, much reduced that of acetone, but had no effect on that of glacial acetic acid. The filtrates from the fresh latex gave a precipitate with alcohol ($\frac{1}{2}$ vol.) or acetone ($\frac{1}{2}$ vol.), but little with glacial acetic acid. Addition of these filtrates to the washed latex restored the properties of the unwashed latex, *i.e.*, partial coagulation. It seemed, then, that alcohol and acetone precipitated soluble constituents that hinder coagulation. Again, fresh latex is not coagulated by heat, but washed latex is. Addition of these precipitates to washed latex also inhibited its coagulation by heat. Attempts were made to knead together mechanically, in a mass, finely divided solid rubber placed in various fluids. This was accomplished with alcohol, acetone, and glacial acetic acid, but failed with tannin, formaldehyde, alkalis, and hydrochloric acid. The first three liquids are known to be solvents for resin, and determinations of the amount of resin in the coagulum from washed latex, by Van Romburgh and Tromp de Haas' method (Bull. de l'Institut Bot. de Buitenzorg, **15**), showed amounts ranging from 9 to 12 per cent.—R. L. J.

Rubber ; Apparatus for [Coagulation of —— by] Smoking ——. J. R. Cardoso Danin. India-Rubber World, 1904, **30**, 413.

Rubber coagulated by "smoking" is stated to possess a pecial value, and in order to make the process less dependent ipon the skill of the native rubber collector, the author ecommends the adoption of the following simple apparatus. The latex is fed into a rotating cylinder mounted on friction ollers, and the smoke is introduced by a side tube.—A. S.

Rubbers and Rubber Vines from the East Africa Protectorate. Bull. Imp. Inst. (Suppl. to Bd. of Trade J.), 1904, **2**, 153—156.

Rubber from Takaungu.—Three specimens of a rubber-ine which occurs in considerable quantities near Takaungu, nd two samples of the rubber obtained from it, labelled Sokoki" and "Mtoni" respectively, were examined. The ine was identified as *Landolphia Kirkii.* The "Sokoki" ubber was not sticky, and exhibited very good physical roperties. It contained: moisture, 11·7; caoutchouc, 8·9; resin, 6·8; dirt, 2·6; ash (included in dirt), 0·87 er cent. The "Mtoni" rubber was almost identical in ppearance and character with the "Sokoki" rubber. It ontained: moisture, 9·1; caoutchouc, 78·2; resin, 4·1; dirt, 8·6; ash (included in dirt), 8·5 per cent. Both rubbers were valued at 3*s.* 2*d.*—3*s.* 3*d.* per lb.

Rubber from Kamasia Hills, Naivasha Province.—The vine was identified as *L. Kirkii.* The sample of rubber gave the following results on analysis:—Moisture, 10·8; caoutchouc, 68·3; resin, 11·5; dirt, 9·4; ash (included in dirt), 1·05 per cent. The rubber was not sticky, and exhibited fair elasticity and great tenacity. If properly prepared, it would probably be equal in value to the rubber from Takaungu.

Rubber from Rabai.—The vine was a species of Landolphia. The sample of rubber contained: moisture, 4·3; caoutchouc, 84·1; resin, 4·5; dirt, 7·1; ash (included in dirt), 3·62 per cent. The rubber was not sticky, and exhibited very good physical qualities. It was valued at 3*s.* 3*d.* per lb. (See also this J., 1903, 918.)—A. S.

Rubber of Urceola Esculenta from Burma. Bull. Imp. Inst. (Suppl. to Bd. of Trade J.), 1904, **2**, 156—159.

Five specimens were sent for examination, one of which contained three distinct kinds of rubber, which were analysed separately. The results of the analyses are given in the following table:—

No. of Sample.	Place of Origin of the Rubber.	Percentage Composition.					Value.	Remarks.
		Moisture.	Caoutchouc.	Resin.	Dirt.	Ash (included in Dirt).		
							Per lb.	
9,747	Bassein	1·9	54·0	42·6	1·5	0·64	..	.. ..
9,747 1	"	0·9	52·1	45·5	1·5	0·56	..	.. ..
9,762 A.	Pegu Division	11·6	70·7	12·1	5·6	1·86	About 3*s.* 2*d.*	Tonquin character.
" B.	"	5·9	76·4	10·9	6·8	1·32	" 3*s.* 6*d.*	Red Tonquin ball character; inclined to be heated, which would greatly affect its value.
" C.	"	9·7	73·7	8·3	8·3	2·03	" 3*s.*	Dark ball, slightly gummy and not well cured: might be difficult to sell at ordinary times.
9,865-1	"	2·6	75·7	18·0	3·7	1·02	3*s.* 6*d.*	Thick biscuit, strong: would command a ready sale.
0,583	Tenasserin Division.	4·0	89·5	9·8	5·7	1·16	4*s.*	Thin sheet, fairly strong; would fetch a good price if not heated.

The samples Nos. 19,747 and 19,747-1 were of much orer quality than the others, and from information ceived since the examination, it is stated that their tanical source is rather doubtful.—A. S.

ubber of Rhynchodia Wallichii and Chonemorpha Macrophylla from Burma. Bull. Imp. Inst. (Suppl. to Bd. of Trade J.), 1904, **2**, 159—161.

he Rhynchodia rubber was quite free from stickiness, d exhibited good elasticity and tenacity. It contained: oisture, 2·8; caoutchouc, 86·5; resin, 6·5; dirt, 4·2; h (included in dirt), 0·48 per cent. It was valued at . 6*d.* per lb. The Chonemorpha rubber was rather sticky, t exhibited fairly good elasticity and tenacity. The ecimem was too small for commercial valuation, but the llowing analytical results indicate that it was of inferior ality:—Moisture, 8·0; caoutchouc, 55·2; resin, 34·6; rt, 2·2; ash (included in dirt), 0·97 per cent.—A. S.

Pontianac from the Patiala State. Bull. Imp. Inst. (Suppl. to Bd. of Trade J.), 1904, **2**, 162—163.

he specimen examined, contained: moisture, 54·5: resin, ·6; caoutchouc, 7·6; dirt, 1·3; ash (included in dirt), 94 per cent. It closely resembled commercial Pontianac th in chemical composition and in appearance and general operties. It was valued at 20*l.* per ton.—A. S.

English Patent.

ums and Resins; Impts. in and Apparatus for the Treatment of Products containing ——, and for Separation and Obtainment of Gums and Resins therefrom. J. Y. Johnson. From A. Foelsing. Eng. Pat. 21,020, Sept. 30, 1903. XIII. B., page 990.

French Patent.

Vulcanised Caoutchouc and Ebonite; Regeneration of ——. V. de Karavodine. Fr. Pat. 338,945, July 25, 1903.

The material is pulverised and heated, with or without the addition of sulphur, in a metal mould at 150° to 200° C. under a pressure of 100 to 500 kilos. or more per sq. cm. The process may be used for obtaining vulcanite casts and for insulating cables. By adding mica or asbestos (which may previously be mixed with fused rosin, tar, drying oils, or caoutchouc solution with sufficient sulphur for vulcanisation) to the pulverised ebonite a very hard substance is produced.—C. A. M.

XIV.—TANNING; LEATHER, GLUE, SIZE.

Tanning Extracts; Manufacture of ——. F. A. Bühler. Chem. Ind., 1904, **27**, 478—487.

This is a general description of the plant and methods employed in the manufacture of extracts, with special reference to the handling of hard woods, such as quebracho. The numerous illustrations include plans and elevations for a model factory, arranged to produce 25,000 to 30,000 kilos. of extract daily.—R. L. J.

Tannin Content of Liquors from different Tannin Materials and Tannin Extracts; Variation of ——. J. Paessler. Collegium, 1904, 277—280, 284—290, 293—296.

It is well known that clear tannin extracts become turbid on standing, and deposit considerable quantities of a thick precipitate. Hence it is of interest to know whether this deposition is caused by the tannins or non-tannins separately or both together. Messrs. Youl and Griffith have already carried out experiments in this direction with strong liquors of valonia, myrobalans, and mimosa (this J., 1901, 428). The author has previously determined the variation of weak myrobalans liquor on keeping (this J., 1904, 71). He has now extended his investigations to liquors prepared from the undermentioned materials:—Oak bark, pine bark, mimosa bark, mangrove bark, valonia, trillo, myrobalans, divi-divi, knoppern, sumach, quebracho-wood extract, soluble quebracho extracts, oak-wood extracts, chestnut extract, and block gambier. Strong liquors of these materials were prepared in an extraction battery of the usual type, and, after being allowed to settle, were filtered and made up to 2° B. The liquors were then kept in open bottles at a constant temperature and subsequently analysed, according to the I.A.L.T.C. methods, after periods of 6, 18, 30, and 60 days. The bottles were weighed to commence with, and losses of weight due to evaporation made good with distilled water. The following are the tabulated results:—

—	Tannin Substances. Grms. contained in 100 c.c. of Liquor.			Non-Tannin Substances. Grms. contained in 100 c.c. of Liquor.			Total Soluble Matter. Grms. contained in 100 c.c. of Liquor.			Grms. of Non-Tannin Substance per 100 Grms. of Tannin Substance.	
	Freshly Prepared.	After 60 Days.	Loss.	Freshly Prepared.	After 60 Days.	Loss.	Freshly Prepared.	After 60 Days.	Loss.	Freshly Prepared.	After 60 Days.
Mangrove bark	3·37	3·37	0	0·56	0·55	2	3·93	3·92	0	16·5	16·5
Mimosa bark	2·85	2·79	2	0·63	0·41	35	3·48	3·20	8	22	14·5
Sumach	1·90	1·87	1·5	1·40	1·17	16	3·30	3·04	8	74	62·5
Quebracho wood	3·87	3·72	4	0·30	0·18	40	4·17	3·90	6·5	8	5
" extract	3·77	3·66	3	0·37	0·24	35	4·14	3·90	6	9	6·5
" " Soluble I.	3·22	3·09	4	0·68	0·51	25	3·90	3·60	8	21	16·5
" " " II.	2·53	2·53	0	0·97	0·87	10	3·50	3·40	3	38	34
Gambier	2·57	2·57	0	0·95	0·60	37	3·52	3·17	10	37	23·5
Oak	2·17	2·01	7·5	1·31	0·53	60	3·48	2·54	27	60	26
Pine bark	2·12	1·90	10	1·73	1·18	32	3·85	3·08	20	82	62
Oak-wood extract	2·28	1·99	12·5	1·38	1·31	5	3·66	3·30	10	61	66
Knoppern	2·55	2·15	16	0·77	0·50	35	3·32	2·65	20	30	23
Trillo	2·49	1·92	23	0·83	0·75	10	3·32	2·67	20	33	39
Myrobalans	2·29	1·74	24	0·98	0·57	42	3·27	2·31	29	43	33
Valonia	2·45	1·73	29	0·82	0·64	30	3·27	2·37	30	38	37
Divi-divi	2·15	1·53	29	1·12	0·87	22	3·27	2·40	27	52	57

The results show that the liquors prepared from tannin materials and tannin extracts can be divided into different groups according to their behaviour on keeping. (1) Liquors which even after standing for 60 days show no perceptible diminution in the percentage of tannins, such as those prepared from mimosa bark, mangrove bark, sumach, quebracho wood and extract, and gambier. (2) Those which show a moderate (8—16 per cent.) diminution, such as oak bark, pine bark, oak-wood extract, chestnut extract, and valonia liquors. (3) Those which show a larger diminution of from 23 to 29 per cent., such as trillo, myrobalans, valonia, and divi-divi liquors. The author concludes that the insoluble matters deposited from the tannin liquors on standing are valueless from a tanning point of view.

—F. D. T.

Mangrove Barks, and Leather Tanned with these Barks, from Pemba and Zanzibar. Bull. Imp. Inst. (Suppl. to Bd. of Trade J.), 1904, **2**, 163—166.

Zanzibar mangrove bark is said to be obtained from two different trees, "msinzi" (*Rhizophora mucronata*) and "mwi." The results refer to the air-dried bark:—

—	"Msinzi" from Pemba, 1901 Specimen.	"Msinzi" from Zanzibar.	"Magomi" from Pemba.	"Mkomafi" from Pemba.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Moisture	16·2	16·4	18·0	16·0
Total ash	..	5·65	7·39	7·51
Ash soluble in water	1·55	1·5	1·9	Traces
Total matter soluble in water	49·4	50·2	49·8	29·8
Tannin	31·3	35·8	32·8	23·2

The "mkomafi" bark is stated to be of no commercial value, but the "magomi" and "msinzi" barks would probably be worth from 3*l.* 10*s.* to 4*l.* per ton, c.i.f., Glasgow. Specimens of leather from Pemba prepared with "mkomafi" and "magomi" barks were valued as low-grade boot leather, worth, in the form of sides or whole hides, about 9*d.* per lb.

—A. S.

Leather; Influence of Self-contained Moisture upon the Strength of ——. M. Rudeloff. Mitt. königl. Materialprüfungsamt Gross-Lichterfelde-West, 1904, **22**, 8—47.

This investigation deals with the moisture naturally present in leather, as regards amount change in amount when the amount of moisture in the surrounding atmosphere (hereafter called "atmospheric conditions") changes, and the influence of such change on the extensibility and tensile strength of the leather. The communication is freely illustrated with tables and curve-diagrams. The following conclusions are drawn from the results. The amount of moisture in leather rapidly changes when the atmospheric conditions change. The change is rapid at first, but some days are required for complete equilibrium to be established. Equilibrium is more rapidly established when leather is losing moisture to the air than when absorbing it; but in both events the time required is longer for thick leathers than thin ones. Under similar atmospheric conditions different leathers in equilibrium hold different amounts of moisture, chrome-leather holding more than other kinds. Leather left in the air till of constant weight (in equilibrium holds a proportionately lower amount when the atmospheric moisture itself is small, and the proportion increases as the outside moisture rises, especially with chrome-leather. With increasing moisture content leather expands, the expansion being greatest when the moisture content, to begin with, is low. Chrome-leather stretches about 2·3 per cent. when the moisture is between 10 and 30 per cent., ordinary leather only 0·8 per cent. Under similar tensile stresses, mois leather stretches in general less than dry leather. As regards chrome-leather the tensile strength increases unti the moisture reaches about 50 per cent., whilst the tota stretch appears to reach a maximum at 30 per cent. o moisture. Ordinary leather appears to follow similar rules The experiments were conducted on strips of Rheuisl chrome-leather, oiled leather, and harness leather.—R. L. J

Albuminoids: Oxidation of —— by Calcium Permanganat I. Oxidation of Glue. Fr. Kutscher and M. Schenck Ber., 1904, **37**, 2928—2931.

Best commercial German gelatin (60 grms.) was dissolve by heating with 1 litre of water, oxidised with calcium permanganate (300 grms.), the solution filtered, and the lime removed by ammonium carbonate. From the filtrat there separated on evaporation first a somewhat insolubl ıbstance agreeing closely in properties with oxaluramide, though the percentage of hydrogen found was unduly igh, and finally a substance identified as ammonium xamate. Glycocoll is known to yield oxamic acid on xidation, and tho authors claim that their results further pport Kutscher and Zickgraf's theory that the so-lled hydrolytic decomposition products of albumin are ally pre-existent in the albumin. (Sitzungsber. d. königl. reuss. Akad. d. Wissensch., 1903, May 28.)—R. L. J.

FRENCH PATENT.

ides and Skins ; Apparatus suitable for Treating ——. C. Amidon. Fr. Pat. 343,237, May 17, 1904. Under Internat. Conv., Jan. 28, 1904.

EE U.S. Pat. 759,814 of 1904 ; this J., 1904, 671.—T. F. B.

XV.--MANURES, Etc.

hosphatic Manures ; Influence of Lime on the Action of ——. M. Nagaoka. Bull. Coll. Agric. Tokio Imp. Univ., 1904, **6**, 195. Chem.-Zeit., 1904, **28**, Rep. 291.

HE presence of lime retards the useful action of the hosphoric acid of organic fertilisers, the injurious influence f the lime, which persists up to the second crop after the pplication of the fertiliser, being twice as great in the case animal manures as in that of vegetable ones. The ganic constituents of the fertilisers, such as humus, minish the injurious effect of the lime. The relative anuring value of animal phosphatic manures is about rice that of vegetable fertilisers in the first year. In the cond year the relative value of vegetable fertilisers creases, but is always less than that of animal manures. —A. S.

XVI.—SUGAR, STARCH, GUM, Etc.

ugar Industry ; Application of Electrolysis in the ——. L. Gurwitsch. Z. Ver. Deutsch. Zuckerind., 1904, 1013—1045.

FTER a theoretical discussion of the subject and a review the processes hitherto patented, the author concludes at only three processes have a possible future, *viz.*, anodic ectrolysis with addition of lead saccharate (this J., 1902, 545), electrolysis with two diaphragms, and removal of kali metals by the aid of mercury cathodes. He further olds that electrolytic purification is less well adapted to the iginal juice or syrup than to the molasses.—W. A. C.

ilk-Sugar ; Hydration of —— in Solution. C. S. Hudson. J. Amer. Chem. Soc., 1904, **26**, 1065—1082.

N evaporating a solution of milk-sugar above 95° C., rge crystals of the anhydrous sugar separate out, whilst low this temperature the ordinary hydrated sugar is tained. The multi-rotation of either of these varieties in lution at 0° C. is shown to be due to a change in the state hydration. When a large excess of the ordinary hydrate agitated with water, a saturated solution corresponding an "initial solubility" is formed in a few minutes ; on rther agitation, dehydration takes place, and more sugar es slowly into solution up to a limiting "final solubility." t 0°, 15°, and 25° C. respectively, the initial solubilities are ·8, 20·9, and 25·3, and the final solubilities 34·8, 49·7, d 63·4, expressed in "millimols." per 100 grms. of water. —W. A. C.

ixtures of Sugars ; Melting Points of ——. H. Gillot. Bull. Acad. Roy. Belgique, 1904, 834—854. Chem. Centr., 1904, **2**, 890—891.

E author determined the melting points of the following ary mixtures of sugars :—Mannitol-dulcitol, mannitol-xtrose, dulcitol-dextrose, dulcitol-saccharose, dulcitol-tose, mannitol-saccharose, mannitol-lactose, saccharose-xtrose, saccharose-lactose, and lactose-dextrose. In no e was a simple isomorphous mixture produced, the dition of a small quantity of one sugar to another always ısing a lowering of the melting point. The forms of the lting-point curves of all the mixtures, except that of saccharose-lactose, point to the existence of definite compounds. The curve of the saccharose-lactose mixture consists of only two branches, the point of intersection corresponding to the eutectic mixture. The curve for the mixture of saccharose and dulcitol (the melting points of which lie close together) consists of two end portions inclined upwards, connected by a horizontal portion, but whether, as in the case of similar conductivity-curves of alloys, this form of curve indicates that isomorphous mixtures are formed by the sugars in the proportions corresponding to the horizontal portion, remains doubtful.—A. S.

Carbohydrates ; Action of Hydrogen Peroxide on —— in presence of Ferrous Sulphate. R. S. Morrell and A. E. Bellars. Brit. Assoc., 1904. Chem. News, 1904, **90**, 158—159.

In continuation of previous work (this J., 1902, 506 ; 1903, 1371), the change in optical activity of carbohydrates during oxidation with hydrogen peroxide in presence of ferrous sulphate, has been examined. In the case of the hexoses (glucose, fructose, and galactose), the decrease in the rotatory power is fairly proportional to the amount of peroxide added, up to 1 grm.-mol. of the latter. The diminution of optical activity is practically the same with glucose and fructose, but in the case of galactose, the decrease is much greater, and it was found that galactose yields a keto-acid of the hexose group rather than an osone. In the case of the bioses (maltose, lactose, and cane-sugar) there seems to be some connection between the diminution in optical activity on oxidation and the tendency to be hydrolysed. The order maltose, lactose, cane-sugar, forms an ascending series with regard to the tendency to be hydrolysed and the diminution in optical activity. Of the pentoses examined, arabinose lies between glucose and galactose with regard to the decrease in optical activity, but in the case of rhamnose, the original dextro-rotation changes to a lævo-rotation, the latter being due partly to the osone, and partly to an acid which is not rhamnonic acid.

In examining the action of bases on osones, it was found that an alcoholic solution of an osone when treated with guanidine gives a white semi-crystalline mass of the composition $CN_3H_5.C_6H_{10}O_6(C_2H_5OH)$. The guanidine compounds of glucose, fructose, galactose, arabinose, rhamnose, and maltose were also prepared. The glucose and maltose compounds are addition products of 3 mols. of the sugar with 2 mols. of guanidine. They give strongly alkaline aqueous solutions, from which the guanidine is completely and quantitatively removed by dilute mineral acids and oxalic acid. They are apparently not hydrolysed immediately by water, since the optical activity of their solutions is much less than that of the parent sugar. In the case of glucose, the specific rotation $[\alpha]_D = +29{\cdot}8°$ had become $[\alpha]_D = -5{\cdot}7°$ after five days. An aqueous solution of the compound neutralised by hydrochloric acid gave the same rotation as free glucose.—A. S.

Sugars ; Action of Methylphenylhydrazine on ——. R. Ofner. Ber., 1904, **37**, 3362—3363.

THE author has previously shown that pure benzylphenylhydrazine reacts with neither levulose nor dextrose. He now finds that methylphenyldextrosazone, which has been prepared by Fischer from glucosone and by Neuberg from levulose, may be obtained directly from dextrose itself ; the details of the preparation are given. In some cases, where an old sample of methylphenylhydrazine reddened by partial decomposition was employed, it was found that the primary - secondary phenylmethylphenyldextrosazone was formed with the methylphenyldextrosazone. It is evident that phenylhydrazine is formed in the spontaneous decomposition of methylphenylhydrazine, just as it is in that of benzylphenylhydrazine.—T. H. P.

Molasses ; Electrolytic Purification of ——. L. Gurwitsch. Z. Ver. Deutsch. Zuckerind., 1904, 1045—1059.

THE following process has been worked out on the laboratory scale, and is regarded as hopeful. The molasses, diluted with twice its weight of water, is electrolysed with vertical iron-mercury cathodes (this J., 1903, 872) ;

the anodic part of the cell is divided off by a septum of parchment-paper and charged with a 5 per cent. solution of calcium chloride, the anode being of iron. To prevent the deposition of iron at the cathode, the anodic liquor is continuously precipitated with milk of lime. The molasses, after electrolysis, is freed from calcium saccharate by means of carbon dioxide. In the most favourable experiment, purification by one "degree of purity" per 100 grms. of sugar was effected at an outlay of 4·48 watt-hours. The by-products are (1) mixed caustic alkalis in 25—30 per cent. solution, (2) a mixture of organic acids, suggested as a substitute for tartaric and citric acids in dyeing, and (3) precipitated ferric oxide, suitable for paint.—W. A. C.

Cochlospermum Gossypium D.C.; Gum of ——. P. Lemeland. J. Pharm. Chim., 1904, **20**, 253—260.

An examination of the gum of *Cochlospermum gossypium* furnished the following results:—Moisture, 22·72 per cent.; ash, 4·61 per cent.; the ash contains iron, calcium, and potassium as oxide and carbonate. 2·04 per cent. of the gum is soluble in water, the solution possessing a rotatory power of + 77·15. Determination of the galactans by Tollens' method gave 34·99 per cent. (expressed as galactose). No arabinose or sugar other than *d*-galactose could be isolated from the products. 22·59 per cent. of pentosans, equivalent to 25·64 per cent. of pentoses, was found. The total quantity of sugar could not be determined, owing to the difficulty experienced in hydrolysing the gum, the highest result obtained being less than the sum of the pentose and galactose. On oxidation with nitric acid, 71·8 per cent. of mucic acid (on the weight of gum used) was obtained.—T. F. B.

Keto-Hexoses; Reaction for ——. H. J. H. Fenton. XXIII., page 1001.

Saponarin: a Glucoside coloured Blue by Iodine. G. Barger. XXIV., page 1004.

English Patent.

Sugar; Annular Moulds for Treating —— *by Centrifugal Action.* J. C. F. Lafeuille, Paris. Eng. Pat. 26,779, Dec. 7, 1903.

The annular moulds serving for moulding and centrifugalising sugar slabs or loaves are cooled by causing liquids of gradually falling temperatures to circulate successively through the annular mould and round the separate moulds for slabs or loaves, the annular moulds being provided with means both for connecting them consecutively with the supplies of liquid and for discharging such liquids.—T. H. P.

United States Patent.

Sugar from Beets: Process of Making ——. M. Roeseler, Berlin, and A. Schaer, Holland, Mich. U.S. Pat. 770,700, Sept. 20, 1904.

The overflow from the centrifugals is freed from alkali salts by osmosis, the resulting liquid is treated with phosphoric acid to separate the surplus "alkalis" and a part of the organic non-sugar, the surplus phosphoric acid is neutralised by the oxide of an alkaline-earth metal, and the compound thus formed is precipitated by means of carbon dioxide and sulphur dioxide. The syrup so prepared is mixed with the fresh beet juice or concentrated syrup at any convenient stage of manufacture.—J. F. B.

French Patent.

Wood Cellulose: Process for Converting —— *into Sugar.* M. F. Ewen and G. H. Tomlinson. Fr. Pat. 343,006. May 9, 1904.

See U.S. Pat. 763,472 of 1904; this J., 1904, 797.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Malt with Short Grown Acrospire. E. Prior. Woch. f. Brau., 1904, **21**, 571—572.

On several sides recommendations have been made to employ malts with short acrospires, averaging two-thirds the length of the corn, when it is desired to improve the fulness of body and permanence of head of the beer. The author thinks, however, that such recommendations introduce a danger of obtaining an inferior modification of the endosperm, and consequently unstable beers. The real meaning of such recommendations is that the malt should not be over-modified, as is frequently the case when th maltster strives to attain an average length of acrospire o three-quarters the length of the corn. No definite rule fo malting can really be laid down on a basis of the lengt of the acrospire. The acrospire must be developed unti complete modification of the endosperm is attained, an no longer. Above all, a malt with a restricted acrospir should never be kilned according to the Bavarian method In order to avoid both extremes of modification, the barle should not be over-steeped, and should be grown ver slowly with low temperatures in the couches. For Bavaria malt a somewhat fuller steep is necessary, and the treatmen on the floor should be made in two stages; the malt shoul be germinated very cool until the acrospire attains a lengt of half the length of the corn, and then it should be allowe to felt at least once, preferably twice, in order to develo the rootlet and complete the modification. The author i in agreement with the advocates of a short-grown acrospir only so far as that is a means of avoiding over-modifica tion, but in no case must the desire for a short acrospire b permitted to govern the treatment if the nature of th barley be such as to demand a longer growth for complet modification.—J. F. B.

Culture Yeasts: Abnormal Cell Forms of ——. W Henneberg. Woch. f. Brau., 1904, **21**, 563—566 an 579—581.

The author's studies were made principally with the di tillery yeasts Races XII. and II. The abnormal for described are not to be confounded with the ordina "giant" cells, which are abnormal only in size, nor wi the "reserve" cells studied by Will, which have not be observed in these yeasts. Most of the abnormal ce here described were obtained in the course of experime on the longevity of the yeast on storage, and they form a certain proportion of the cells which survived the vario tests. The mass of yeast in which they occurred was da brown in colour, having a neutral or faintly alkali reaction and the odour and taste of yeast-extract. Hen these abnormal forms originated under conditions of au digestion, in a medium highly charged with albuminoi and poisonous excreta; they are therefore pathologic forms. The greater portion of the pasty mass consist of dead cells, almost emptied by digestion, with cell wa intact and containing globules of fat and residues plasma; the normal living cells were very rich in fat a sporogenous. The abnormal forms observed compri "medium sized round cells" rich in fat or in albu granules, sometimes in both, "large round cells" c taining vacuoles, and irregularly shaped "broad cell similar in size to the large round cells. Many small ce still living, had either no, or very thin, invisible cell wa In many cases normal budding chains were observ originating from the medium round cells. Very rare certain irregular-shaped amœba-like cells were prese When transferred to a hanging drop of wort many of round and broad cells died owing to the change in c centration; some shrivelled up, others burst and oth showed double cell-walls. Those which survived swel considerably owing to the formation of large vacuoles, surrounding layer of protoplasm being observed to be of rapidly moving granules. In many cases the la round cells budded, forming equally large vacuola daughter cells, and their descendants gradually beca normal. In contradistinction to the original pasty m the drop-culture contained a large number of amœba- forms, which constantly changed their shape, but did possess much power of changing their position, some these forms were observed to contain nuclei. By observ the transition stages it was found that the amœba- forms were the products of the round and broad for the cell walls of the latter became very thin in pla then ruptured, and the plasma, still living, emerged in form of amœba. Whilst the large round cells lived for several days the amœba forms died in less than two days. The formation and study of all these forms is closely dependent on the extent of dilution; when the pasty yeast mass is diluted with water these forms cannot be observed: even wort is not favourable to their development if much of it be used. When a large dilution is desired for accurate observation it is necessary to employ the albuminous liquid decanted off from yeast which has been liquefied by digestion at 48° C. for 24 hours.—J. F. B.

Yeast; Testing the Homogeneity of ——. P. Lindner. Woch. f. Brau., 1904, **21**, 621–622.

When a sample of yeast is thoroughly homogeneous, all the cells have approximately the same size and appearance, all belong to the same species and are in the same physiological condition. When a pure yeast is first started u the propagating apparatus, it very rarely presents a omogeneous appearance, the cells being in all the different tages of development; it is not surprising that such a yeast hould give different results in the fermentation tuns from . brewery stock yeast which has been in continuous use nd which is generally homogeneous. The process of ashing the pitching yeast eliminates the light, budding east, leaving the agglomerated heavy mother-yeast at the ottom. If the washing has not been thorough, the ppearance of the yeast will not be homogeneous. For sting whether the yeast is homogeneous, the author ecommends that it be suspended in beer and prepared in e form of droplet cultures ["Federstrich-Kultur"] each ontaining a definite small number of original cells. In ese droplets there should be observed how many of the lls are capable of further budding, the form of the budding hains, how many descendants are produced by each cell in efinite times, and whether the descendants of the various lls are alike or different. The droplet test also gives a quantative expression for the degree of infection by wild yeasts, d the form of the budding chains indicates whether a top rmentation yeast is contaminated with bottom yeast. In me cases the cultivation of the yeast in a thin layer of er-gelatin (Will's test) is more delicate. According to hether the colonies are mulberry-shaped or extend in treamers," it can be ascertained whether the original cells ere of the fermentative form or film-cells of the first or cond generation. A preponderance of these film-cells dicates an excessive exposure to air. All the above servations should be made in order to study the influence variations in the brewing conditions upon the homogeneity the yeast.—J. F. B.

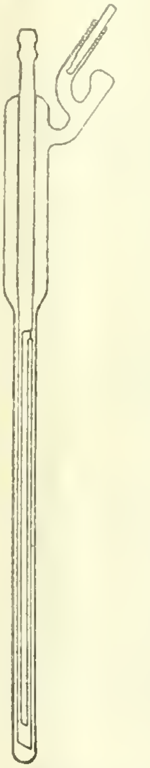
ymase and Endotryptase in Dead Yeast Cells; Activity of —— under various Conditions. T. Gromow and O. Grigoriew. Z. physiol. Chem., 1904, **42**, 299–329. Chem. Centr., 1904, **2**, 998.

e activity of the proteolytic enzyme (endotryptase) ntained in permanent yeast (zymase) prepared by means acetone (this J., 1902, 1033), is strongly diminished by no- and di-saccharides and polyhydric alcohols (glycerol, nnitol), the effect being greater, the stronger the concention of the added substances. Calcium chloride and tassium nitrate increase the activity of the endotryptase; ohol and quinine have an injurious effect. The amount of bon dioxide produced by zymase in the presence of fermentable substances (mannitol) is the same as that duced by autofermentation, therefore in both cases the mentation proceeds at the expense of the glycogen of the st. The cessation of the evolution of carbon dioxide is not to the exhaustion of the nutrient material, but to the haustion of the zymase. The concentration of the sugar tion and the percentage of oxygen in the surrounding osphere are without influence on the amount of carbon xide evolved. The amount of carbon dioxide is increased addition of quinine or alcohol, which injure the activity the tryptase and consequently allow of a longer life for zymase. Potassium nitrate and calcium chloride act in reverse manner, as they increase the activity of the teolytic enzyme. In almost all cases poisonous stances have directly opposite effects on zymase and tase. (See also this J., 1902, 60.)—A. S.

Brewery Wort; Simple Method for the Determination of the Degree of Infection of ——. F. Schönfeld. Woch. f. Brau., 1904, **21**, 622—623.

In order to control the sterility of the wort as it comes from the brewhouse or cooler, the author employs a glass plate, 15 cm. square, provided with 25 depressions, each capable of holding 0·4—0·5 c.c. of wort. This plate is sterilised and the hollows are filled with drops of wort delivered from a sterile pipette. Several of these plates are arranged in a wire cage, one above another, and the whole is covered with a sterilised bell jar in a moist atmosphere under aseptic conditions. Any germs present in the wort develop either in the form of concrete colonies or in the form of a turbidity. After a few days the plates are examined and the number of drops in which organisms have developed is counted. If the brewery conditions be good the number of infected drops will be very small. —J. F. B.

Beer Casks; Pressure Regulator for ——. F. Schönfeld. Woch. f. Brau., 1904, **21**, 623—624.



The author describes a new apparatus, invented at the Berlin Research Brewery, for maintaining a constant pressure in the beer-casks when bunged down for secondary fermentation. The apparatus, which is shown in the figure, consists of a narrow glass tube inserted in a wider tube, which is enlarged somewhat at the upper end. The narrow tube is connected by rubber tubing with the interior of the cask through the bung-hole, and carries inside it a still smaller vertical tube, which is fused on to an opening in the side of the inlet tube, and which serves for the discharge of the gases. The outermost tube carries a branch on its enlarged portion, which is provided with a trap of peculiar shape to prevent any loss of mercury by splashing, and this trap is connected with another branch, which carries the exit tube provided with a hole in its side. Mercury is placed in the apparatus in quantity sufficient to allow of the free discharge of the gases when a certain pressure is reached. The whole apparatus is enclosed in a wire cage and hung up above the cask.—J. F. B.

Denatured Spirits; Action of —— *upon Metals and upon Cement.* G. Heinzelmann. Z. Spiritusind., 1904, **27**, 399.

Strong spirit containing 95—96 per cent. of alcohol by volume both in the pure and in the denatured state is perfectly indifferent to any of the metals examined. But weaker spirit, such as that containing 90 per cent. by volume of alcohol has, when denatured, a considerable oxidising and solvent action upon many metals. In contact with cement, the spirit becomes yellow and the non-volatile residue increases to a very considerable extent, the lime salts of the lower members of the fatty acid series being found in solution. Cement linings for iron storage vessels containing spirits are therefore condemned. The 90 per cent. denatured spirit acts most powerfully upon zinc and lead, the liquid becoming opalescent and ultimately depositing white precipitates, and the non-volatile residue being increased owing to the solution of metallic salts. Its action upon iron is somewhat less, but a considerable formation of a brown deposit of oxide occurs a er some time; this deposit is, however, readily separated by filtration. The action upon copper and brass is not great, but the spirit acquires a greenish-blue colour, and copper salts are present in the non-volatile residue. Tin and tinned metals are absolutely unattacked by 90 per cent. denatured spirit, the tinned metals only being corroded in places where the layer of tin has been scratched. Vessels of tinned iron are the most satisfactory receptacles for denatured spirits. Whilst the presence of the water plays a certain part in the corrosion of metals by the spirit, the main cause is to be attributed to the crude methyl alcohol present in the denaturing agent; pyridine is without action upon metals. —J. F. B.

English Patents.

Yeast Extracts; Process for freeing —— from Bitter Principles. C. A. Jensen, London. From R. Deissler, Berlin. Eng. Pat. 24,294, Nov. 9, 1903.

The yeast extracts are treated, before or after the removal of the cell-residues and before or after concentration, with a suitable proportion of an oxidising agent, such as ozone or a peroxide. For instance, the extract may be concentrated to half its volume and treated with hydrogen peroxide in the proportion of 60—100 c.c. per kilo. of concentrated extract, then boiled and clarified.—J. F. B.

Brewing; Art of ——. J. Schneible, Weehawken, U.S.A. Eng. Pat. 14,028, June 21, 1904.

In this process, the peptonised malt mash is brought to a pre-determined converting temperature without permitting diastatic action at any other temperature. This is effected by thoroughly and immediately mixing the peptonised malt mash with either a heating medium or a cooked (unmalted cereal) mash at a higher temperature.—T. H. P.

Wine, Must, Beer, Beetroot Juice, and the like: Treatment [Concentration] of ——, and Apparatus therefor. E. Monti, Turin, Italy. Eng. Pat. 19,645, Sept. 11, 1903. Under Internat. Conv., Sept. 12, 1902.

See Fr. Pat. 324,474 of 1902; this J., 1903, 567.—T. F. B.

United States Patent.

Yeast. M. P. Davies and E. Wilding, London. U.S. Pat. 770,356, Sept. 20, 1904.

See Eng. Pat. 8771 of 1901; this J., 1902, 786.—T. F. B.

French Patents.

Malt: Drum for Germinating and Drying ——. Soc. Holst and Fleischer. Fr. Pat. 343,348, May 21, 1904.

See Eng. Pat. 11,752 of 1904; this J., 1904, 877.—T. F. B.

Yeast; Manufacture of ——. Maschinenbau Aktienges. Golzern-Grimma. Fr. Pat. 343,133, May 13, 1904.

Fermentation is assisted by adding nutrient organic or inorganic salts to the worts. The inorganic salts should contain especially potassium or ammonium phosphate; the organic salts may be obtained in the form of a decoction of waste yeast. The additions may be made either in the mash tun or in the fermenting vessel.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

English Patent.

Milk Powder; Manufacture of ——. J. Maggi, Paris. Eng. Pat. 9684, April, 27, 1904. Under Internat. Conv., April 1, 1904.

See Fr. Pat. 341,840 of 1904; this J., 1904, 909.—T. F. B.

United States Patents.

Fruit Juices; Process of Preserving ——. D. Sandmann, Berlin, and G. Eichelbaum, Charlottenburg, Germany. U.S. Pat. 770,658, Sept. 20, 1904.

See Fr. Pat. 325,811 of 1902; this J., 1903, 756.—T. F. B.

Condensing Milk; Process of ——. S. R. Kennedy, Philadelphia. U.S. Pat. 770,909, Sept. 27, 1904.

Claims are made for condensing milk and cream by separating the milk from the cream, condensing the milk, and recombining the condensed milk and fresh cream by spraying the two together through a high vacuum. —T. H. P.

French Patents.

Foodstuff [Casein] from Milk; Concentrated ——, and Process for making same. C. Lewis. Fr. Pat. 343,030, May 10, 1904.

See Eng. Pat. 11,094 of 1904; this J., 1904, 797.—T. F. B.

Candles, Lamp Oils, Edible Fats, Unguents or Pomades, Soaps, &c.; Manufacture of ——. C. Dreymann Fr. Pat. 343,158, May 14, 1904. XII., page 988.

(*B.*)—SANITATION; WATER PURIFICATION.

Bacterioscopic Examination of Water; Standardisation of Methods for the ——. XXIII., page 1002.

English Patent.

Water-purifying Apparatus. O. Walter, Halle on Saale Germany. Eng. Pat. 17,307, Aug. 8, 1904. Under Internat. Conv., Sept. 21, 1903.

In a water-softening plant the milk of lime is raised fro the dissolving vessel, which contains a stirring mechanism by means of a pump which lifts it through a pipe arrange in a closed circuit. At the upper part of the lift-pipe is valve, which is periodically opened by the water-measurin device, thereby withdrawing a certain quantity of milk o lime for the treatment. The pump is kept at work con tinuously, and when the draw-off valve is closed, th constant circulation prevents the deposition of solid matte in any part of the apparatus.—J. F. B.

French Patent.

Sewage and other Liquids; Process for Purifying —— and Apparatus therefor. W. O. Travis and E. Aul Fr. Pat. 343,150, May 14, 1904. Under Internat. Conv May 15, 1903.

See Eng. Pat. 11,073 of 1993; this J., 1904, 676.—T. F.

(*C.*)—DISINFECTANTS.

Nicotine in Presence of Pyridine [in Sheep Dips, &c.]; Determination of ——. J. A. Emery. XXIII., page 100

English Patent.

Antiseptics which are otherwise Insoluble, or not easi Soluble; Process for forming Solutions of ——. Kösters, Bremen, Germany. Eng. Pat. 19,837, Sept. 1903.

See Fr. Pat. 335,396 of 1903; this J., 1904, 201.—T. F.

United States Patent.

Antiseptic Compound, and Process of Making same. Endermann, New York. U. S. Pat. 770,275, Sept. 2 1904.

Rosin is treated with caustic alkali to convert it into ros size, and the latter is then subjected to the action of pe manganic acid. The oxidised product is soluble in h water and in alcohol, less soluble in ether and partia soluble in benzene and chloroform. It has a bitter tast and melts between 105° and 125° C.—J. F. B.

French Patent.

Vaporisation of various Substances [Disinfectants, &c. Apparatus for the ——. P. Castanet, Fr. Pat. 343,1 May 14, 1904.

The apparatus is intended for the vaporisation of substanc affecting the respiratory organs, and for disinfecting a scenting purposes. It consists of a hollow metal truncat cone or cylinder, perforated by a number of holes at the and bottom. Inside this metal vessel is placed a paraf burner, and on top of it a box containing a mixture magnesium carbonate, trioxymethylene, eucalyptus oil, a turpentine. The magnesium carbonate may be replac y talc, calcined magnesia, or some porous earth. Metal ubes are embedded in the mixture to assist the liberation of apours.—L. F. G.

XIX.—PAPER, PASTEBOARD, Etc.

English Patents.

aper Machines; Shower-pipes or Cleansing Apparatus for ——. F. W. Howarth, London. From The Sandusky Foundry and Machine Co., Ohio, U.S.A. Eng. Pat. 20,840, Sept. 28, 1903.

or cleaning the wire and rolls of the paper machine a hower pipe is provided having a line of discharge orifices. "longitudinal member" fits over the pipe and carries a ongitudinal plate projecting obliquely to the orifices. The prays of water issuing from the orifices impinge on the eflecting plate and are directed by the latter in the form of continuous sheet of water against the part of the machine o be cleansed. By duplicating the line of orifices, and aving a second deflecting plate on the "longitudinal ember," two sheets of water can be discharged in opposite irections from the same shower pipe.—J. F. B.

elluloid or the like; Method of Imparting Lustre to Objects made of ——. W. Homberger, Brugg, Switzerland. Eng. Pat. 17,232, Aug. 6, 1904.

he glacial acetic acid used for imparting lustre to celluloid bjects is replaced by acetic anhydride, alone or mixed ith acetic acid, and preferably mixed with benzene, toluene, hloroform, or similar organic solvent. A suitable mixture onsists of 2 parts of acetic anhydride, 2 parts of toluene, nd 1 part of glacial acetic acid.—T. F. B.

United States Patent.

ood; Method of Treating [Distilling], —— for the Production of Paper Pulp, Turpentine, &c. W. Hoskins. U.S. Pat. 770,463, Sept. 20, 1904. XIII. B., page 990.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Papaverine. M. Freund and H. Beck. Ber., 1904, **37**, 3321—3324.

y the electrolytic reduction of papaveraldine sulphate, mploying lead poles and a porous cell, the authors btained, with the elimination of the carbonyl oxygen, a econdary base having the formula $C_{20}H_{25}NO_4$. This ormula corresponds with that of tetrahydropapaverine, but e new compound is not identical with that body. The ew base has been termed provisionally *isotetrahydroapaverine*; it yields a crystalline nitroso-compound elting at 138° C., and its hydriodide crystallises in small hite columns, which begin to soften and turn yellow at 45° C. and melt at 255° C. The ethereal solution of the ase, when treated with methyl iodide, yields a yellowish-rown crystalline powder, which is apparently the hydriodide f the methylated base.—J. F. B.

erpenes and Essential Oils. O. Wallach. Annalen, 1904, **336**, 1—46. [68th and 69th Communications.]

he 68th communication deals with the behaviour of the itrites of some cyclic hydrocarbons (indene and methylindene). The 69th article treats of phellandrene, described s a hydrocarbon, $C_{10}H_{16}$, which in contact with nitrous nhydride, N_2O_3, in an indifferent anhydrous solvent ligroin) at a temperature below 0° C. yields immediately well characterised nitrate. The *d*-phellandrene prepared om elemi oil is chemically and physically identical with at from bitter fennel oil. The *l*-phellandrene present in ustralian eucalyptus oil is the optical antipode of the ove-mentioned *d*-phellandrene. The *d*-phellandrene of ater-fennel oil is chemically different from the *d*-phellandrene of elemi and bitter fennel oils. The name α-phellandrene is proposed for that modification present in elemi and itter fennel oils in the *d*-form, and in eucalyptus oil in the *l*-form; and β-phellandrene for the modification contained in water-fennel oil. The experimental work is described under the following headings:—I. α-Phellandrene: (1) its nitrite; (2) action of nitric acid on the nitrite; (3) action of hydrochloric acid on the nitrite; (4) action of sulphuric acid on the nitrite; (5) conversion of α-phellandrene into active carvotanacetone. II. β-Phellandrene.—A. S.

Lemon-grass Oil from Montserrat. Bull. Imp. Inst. (Suppl. to Bd. of Trade J.), 1904, **2**, 166—167.

The sample of oil examined, was obtained from *Andropogon nardus* L., var. *genuinus* Hack, which is commonly known as the true lemon grass. It was soluble to the extent of about 97 per cent. in 70 per cent. alcohol. On distillation it yielded about 25 per cent. between 180 and 220° C., and 50 per cent., consisting chiefly of citral, between 220 and 230° C. The results obtained on examination of the oil are given in the following table, together with the corresponding figures for commercial lemon-grass oil distilled in India from *Andropogon citratus*.

——	Montserrat Lemon-grass Oil.	East Indian Lemon-grass Oil.
Sp. gr. at 15° C.	0·906	0·899—0·903
Optical rotation in 100 mm. tube.	− 0° 10′	+ 1° 25′ to 3° 5′
Percentage of citral (by sodium bisulphite method).	74·6	70—75

The East Indian oil is completely soluble in 70 per cent. alcohol. The Montserrat oil is valued at 5*d*.—6*d*. per ounce.—A. S.

Gymnema Leaves: Chemical Examination of ——. F. B. Power and F. Tutin. Brit. Pharm. Conf., Aug. 1904. Pharm. J., 1904, **73**, 234—239.

From an alcoholic extract of the leaves of *Gymnema sylvestre* there was precipitated by the addition of water, a quantity of soft, dark-coloured resinous matter, of an acid nature. The greater part of the precipitate was soluble in petroleum spirit, and from the extract after treatment with an alcoholic solution of potassium hydroxide, hentriacontane, $C_{31}H_{64}$, m. pt. 68° C. was isolated by shaking out with ether (yield 0·05 per cent. on the weight of the leaves). The alkaline solution when acidified and distilled, yielded formic acid and a butyric acid. The filtrate from the precipitated resinous matter yielded, when acidified with sulphuric acid, a quantity of dark-coloured resinous matter, the "gymnemic acid" of Hooper (Chem. News, 1889, **59**, 159). The authors find, however, that this precipitate is an impure and complex mixture of substances. By treatment with ethyl acetate about 35 per cent. of it was extracted, and this portion possessed the property characteristic of gymnema leaves of destroying the sense of taste for sweet substances. The name "gymnemic acid" is retained for this portion soluble in ethyl acetate, which is also readily soluble in alcohol, but insoluble in ether, chloroform, benzene, and water. It is not a glucoside, but has very weak acidic properties. When fused with potassium hydroxide, it yielded acetic acid and a molecular compound of protocatechuic and *p*-hydroxybenzoic acids. The portion of the resinous matter insoluble in ethyl acetate was readily soluble in alcohol. It is of an acidic nature, but has no anti-saccharine property. When fused with potassium hydroxide it yielded formic acid, and apparently a small amount of acetic acid, together with the molecular compound of protocatechuic and *p*-hydroxybenzoic acids previously mentioned. The original aqueous solution from which the preceding substances had been separated contained a *l*-quercitol (see this J., 1904, 797) associated with optically inactive glucose. No evidence could be obtained of the presence in the leaves of *Gymnema sylvestre* of a cyanogenetic compound, such as was observed by Greshoff in the leaves of *G. latifolium* (this J., 1891, 268). Neither gymnemic acid nor the resin insoluble in ethyl acetate possess toxic properties. The fruits of *Gymnema sylvestre* appear to have the same constituents as the leaves, but no quercitol could be obtained from them.—A. S.

Nux Vomica Extract: Official Process for —— in the Forthcoming [French] Codex. E. Bourquelot. J. Pharm. Chim., 1904, **20**, 289—293.

In view of the decision of the Brussels Internat. Pharm. Conf. in 1902, the official extract of nux vomica of the Codex is to be standardised to contain 16 per cent. of total alkaloids. The drug is directed to be extracted by the macero-percolation method with 70 per cent. alcohol; the percolate, after distilling off the alcohol, is concentrated by evaporation to about 150 grms. for every 1,000 grms. of drug used, diluted with 50 c.c. of water, and fat removed by shaking out with three successive 50 c.c. of ether. The mixed ethereal extracts are distilled, and the oily residue is washed free from alkaloids with 15 c.c. of boiling water rendered acid with acetic acid. This acid solution is then added to the aqueous ether-washed extract, and the whole is evaporated to about 200 grms., or until all trace of ether has been driven off. The amount of dry extractive and of total alkaloids are then determined in aliquot portions of the liquid.

Determination of the Alkaloids.—Four grms. of the liquid are treated in a separator with 20 c.c. of a mixture of 95 per cent. alcohol, 2 vols.; solution of ammonia (sp. gr. 0·960) 1 vol.; distilled water, 1 vol. After thorough agitation, the mixture is shaken out first with 20 c.c. then with two successive 15 c.c. of chloroform. The combined chloroformic extracts are evaporated to dryness, and the dry alkaloidal residue is taken up with 20 c.c. of N/10 sulphuric acid and 50 c.c. of distilled water, the whole being heated for 15 minutes on the water-bath to effect solution. The acid liquid is filtered, the filter washed, and the final volume of filtrate adjusted to 200 c.c. 50 c.c. of this (equivalent to 1 grm. of the original extract) are then titrated back, in the presence of 20 c.c. of ether, with N/100 sodium hydroxide solution, using 5 drops of a 0·2 per cent. solution of Iodeosin as indicator. The number of c.c. of N/100 alkali used is divided by 10; 5 is subtracted from the result, the product multiplied by 0·0364 (the mean equivalent of brucine and strychnine) gives the percentage of total alkaloid in the original liquid. From these data, and the amount of dry extractive found, the quantity of milk sugar to be added to give a dry extract containing 16 per cent. of total alkaloids, is calculated. This amount having been added, the whole is evaporated to dryness, powdered, and preserved in well closed vessels.

—J. O. B.

Nan-ta-yok or Burmese Storax; Properties of ——. D. Hooper. XIII. B., page 990.

Arsenic; Report and Recommendations with Reference to the Tests for the Detection of —— in the Drugs of the British Pharmacopœia. Presented to the Pharmacopœia Committee of the General Medical Council, May 1904. W. R. Dunstan and H. H. Robinson. XXIII., page 999.

English Patent.

Rufigallic Acid Alkyl Ethers; Manufacture of Acidyl Derivatives of ——. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 22,163, Oct. 14, 1903.

See U.S. Pat. 751,216 of 1904; this J., 1904, 267.—T. F. B.

United States Patents.

Dialkylbarbituric Acids; Process of Making ——. E. Fischer, Berlin, Assignor to the Firm of E. Merck, Darmstadt, Germany. U.S. Pat. 770,743, Sept. 27, 1904.

See Fr. Pat. 338,183 of 1903; this J., 1904, 622.—T. F. B.

Camphor [from Isoborneol]: Process of Making ——. K. Stephan and P. Hunsalz, Assignors to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 770,940, Sept. 27, 1904.

See Fr. Pat. 341,514 of 1904; this J., 1904, 881.—T. F. B.

French Patents.

Chlorostyrolene; Process of Making ——. M. Dinesmann. Fr. Pat. 338,904, July 4, 1903.

Phenyldichloro-acetaldehyde, obtained by condensing chloral with benzene in presence of aluminium chloride, is converted, by treatment with zinc dust and acids, into monochlorostyrolene. By replacing the benzene in the condensation with homologues of benzene, the corresponding homologues of chlorostyrolene are obtained. These latter, as well as chlorostyrolene itself, are applicable in perfumery.—T. F. B.

Hydroxybenzaldehydes and Hydroxybenzoic Acids; Production of Sulphonic Ethers of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 338,908, July 4, 1903.

See Eng. Pat. 17,347 of 1903; this J., 1904, 798.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographs in Natural Colours by the Three-Colour Process; Use of Leuco-bases for the Preparation of ——. E. König. Ges. deutsch. Naturforscher u. Ärzte, Sept. 1904. Z. angew. Chem., 1904, **17**, 1513—1514.

Leuco-bases when exposed to light are oxidised to the corresponding dyestuffs in a more or less short time. In applying this property to the preparation of coloured photographs, a collodion-emulsion gives the best results, the oxidation of the leuco-bases in this medium, especially in presence of quinoline, proceeding very rapidly, probably by the action of the nitro groups of the nitrocellulose. In carrying out the process a suitable support is coated with a film of a collodion-emulsion containing a dissolved leuco-base of a blue dyestuff and some quinoline. This is covered with the negative of the photograph to be printed, exposed, and the image fixed by treatment with chloro-acetic acid. These operations are repeated after applying (1) an emulsion containing a leuco-base of a red dyestuff and (2) one containing a leuco-base of a yellow dyestuff.—A. S.

Wood: Action of —— on a Photographic Plate in the Dark. W. J. Russell. Proc. Roy. Soc., 1904, **74**, 131—134.

All woods are found to possess the property of producing images of themselves on a photographic plate in the dark. The wood has to be in contact with, or a short distance from, the plate for from half an hour to 18 hours, at a temperature not above 55° C. The wood of the conifers is very active, and this activity is thought to be largely due to the resinous substances present; in most cases the light rings of the wood are active, but in the case of the Scotch fir the effect is caused by the darker portions. Oak, beech, Spanish chestnut, and sycamore woods are also very active, whilst ash, elm, horse chestnut, and plane are but slightly so. The active constituents of the wood appear to be the resinous substances, and it was found to be extremely difficult to remove them so completely that the wood becomes inactive. If a portion of the wood be exposed to bright sunlight the activity was greatly increased: comparatively inactive woods, such as elm, showed considerable activity after such exposure. Exposure to red or green light gave little or no increase in activity, but the action of blue light was almost as great as that of white light in increasing the activity of the wood. Resin, guaiacum, copal, and turpentine showed a similar increase in activity under blue light. (See also von Aubel, this J., 1904, 560.)—T. F. B.

English Patent.

Pigment Photographic Process. H. Schmidt, Berlin. Eng. Pat. 17,610, Aug. 12, 1904.

Bichromated pigment paper is pressed while wet on a thin transparent sheet of mica, celluloid, or similar material, dried, and a print made on it through the transparent "carrier." Development is carried out as usual, the transparent sheet forming the temporary support, from which the picture is easily detachable. The degree of adhesion between the gelatin and the support can be modified by previously treating the support with wax, varnish, rubber, or other suitable substance.—T. F. B.

United States Patents.

Pictures or the like; Reproducing —— [by Catalysis]. W. Ostwald and O. Gros, Leipzig, Germany. U.S. Pat. 770,533, Sept. 20, 1904.

See Eng. Pat. 22,841 of 1901; this J., 1903, 380.—T. F. B.

Developing Catalytic Pictures. W. Ostwald and O. Gros, Leipzig, Germany. U.S. Pat. 770,534, Sept. 20, 1904.

See Eng. Pat. 13,920 of 1903; this J., 1903, 1015.—T. F. B.

French Patent.

Cyanines [for Photographic Purposes]; Process for Making new ——. Act. Ges. f. Anilinfabrikation. Fr. Pat. 342,656. April 26, 1904.

Unlike the α-naphthoquinaldine derivatives, β-naphthoquinaldine alkyl halides react with the alkyl halides of quinoline or *m*- or *p*-toluquinoline in presence of alkali hydroxide in aqueous solution to form Cyanines. Naphthoquinaldines will not react in a similar way with naphthoquinolines, but the alkyl halides of both α- and β-naphthoquinolines form Cyanines with quinaldine or with *m*- or *p*-toluquinaldine in the usual manner. The Cyanines thus prepared, containing the naphthalene nucleus, are of great value for colour-sensitising photographic emulsions, giving greater sensitiveness for orange and red than other known Cyanines, and at the same time causing no diminution of sensitiveness for the colours at the other end of the spectrum.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

English Patent.

Explosives. E. Steele, Berlin. Eng. Pat. 11,000, May 12, 1904.

See Fr. Pat. 336,783 of 1903; this J., 1904, 386.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUALITATIVE.

Nickel Salts; Reaction of Potassium Nitrite with ——. C. Reichard. Chem.-Zeit., 1904, **28**, 885—886 and 912.

The triple nitrites of nickel, potassium, and alkaline earth metals (this J., 1904, 683) are readily distinguished from potassium cobalt nitrite by their greenish or dingy-yellow colour, and by their behaviour with boiling water, in which the cobalt salt dissolves with a red, the nickel salt with a green colour. Again, whilst the presence of acetic acid is necessary for the precipitation of the cobalt salt, it absolutely prevents that of the nickel compounds. This difference may perhaps be made use of in the technological separation of nickel, along with barium, strontium, or calcium, from cobalt. The after separation of nickel from he alkaline-earth metal is an easy matter. For the preparation of these nickel compounds pure potassium nitrite should be used; but if a commercial nitrite containing hydroxide be used, the triple salt can be freed from coprecipitated nickel hydroxide by dissolving in boiling water, iltering, and cooling; repetitions of this will also purify it rom excess of potassium nitrite or of alkaline-earth, though here is considerable loss from the solubility of the compound n cold water. All of these compounds are destroyed by acids, even by acetic acid. Alkalis act but slowly on them in the cold, more rapidly when heated; the precipitate ormed by sodium hydroxide is nickelous hydroxide, while that formed from potassium cobalt nitrite is obaltic hydroxide—so that the nickel compounds are ltogether different in constitution from the cobalt salt. Analysis shows that these compounds have the formula $Ni.(NO_2)_2.M(NO_2)_2.2KNO_2$, where M = Ba, Sr, or Ca. —J. T. D.

Arsenic; Reports and Recommendations with reference to the Tests for Detection of —— in the Drugs of the British Pharmacopœia. Presented to the Pharmacopœia Committee of the General Medical Council. May 1904. W. R. Dunstan and H. H. Robinson.

Proposed Tests.—The freedom of any drug from arsenium (As) is to be proved by comparing the stain yielded when it is submitted to one of the following tests, with that given by a known volume of *Liquor Arsenici Hydrochloricus* suitably diluted, submitted to the same test.

Test A.—An aqueous solution of 4 grms., or the prescribed quantity, of the drug to which 5 c.c. or more of hydrochloric acid have been added, is diluted to 25 c.c. with water, and introduced into a test-tube having a diameter of about 18 mm. and a length of 18 to 20 cm. Granulated zinc, sufficient to reach about two-thirds of the height of the liquid is then added. Immediately, a small plug of cotton wool, and then another plug of cotton wool which has been soaked in lead acetate solution and dried are inserted, so as to leave a short space between the two plugs; a closely fitting cap formed of two pieces of filter-paper which have been soaked in mercuric chloride solution and dried, is then fitted over the mouth of the test tube. The test must be allowed to continue for 2 hours at least; the test paper is then examined, in daylight, for a yellow stain. The test should be performed in a place protected from strong light. Ten c.c. of the *Liquor Arsenici Hydrochloricus* are diluted to 75 c.c. when 1 c.c. of the solution contains 0·001 grm. of arsenium. Four c.c. of this solution diluted to 1000 c.c. afford the standard solution, each c.c. of which contains 0·004 mgrm. of arsenium and is equivalent, for purposes of comparison with 4 grms. of the drug, to 1 part per 1,000,000. Therefore the yellow stain from 4 grms. of the drug should be paler than the yellow stain from 3 c.c. of this solution mixed with water and with 5 c.c. or a suitable quantity, of hydrochloric acid, diluted to 25 c.c. and tested in a similar manner and at the same time. The dilute arsenical standard solution should be freshly prepared.

When the drug cannot be conveniently dissolved in 25 c.c. of liquid or when frothing occurs, the test may be conducted in a small flask, the stain being compared with the standard stain obtained under similar conditions.

The yellow stain due to sulphur is soluble in less than 10 minutes in a few c.c. of hydrochloric acid, whereas that due to arsenium changes to an orange colour and persists for one or two hours. The zinc employed should first be washed for a few seconds with hydrochloric acid, and then with water, shortly before use, to remove any adherent sulphur compounds.

Test B.—Four grms. of the drug are introduced into a 60 c.c. distillation flask, with 2 grms. of potassium metasulphite, and 22 c.c. of a mixture of hydrochloric acid and water in such proportions that, after reaction, "there shall be hydrochloric acid solution approximately of the constant boiling strength, that is, 20 parts of free hydrochloric acid to 80 parts of water." The flask is then attached to a condenser the internal tube of which should not exceed 8 mm. and heated gently for one hour to reduce any arsenic compounds. It is then distilled until three-fourths have passed over; the distillate is partially neutralised with strong solution of ammonia, so as to leave unsaturated about 4 c.c. of the 20 per cent. hydrochloric acid (1 c.c. of strong solution of ammonia neutralises 2·8 c.c. of 20 per cent. hydrochloric acid). Some distillates, especially those from antimony and bismuth compounds, effervesce with zinc more violently than the solutions of other substances, so that in these less than 4 c.c. of acid should be left un-neutralised. The sulphur dioxide in the distillate is then removed by means of bromine solution until the red colour is permanent, on warming for a minute or two. Excess of bromine is then removed with solution of hydroxylamine hydrochloride until the liquid is colourless. The liquid is then diluted to 25 c.c. with water, and the process completed as described under Test A. When effervescence has ceased, a further addition of hydrochloric acid should be made to ensure that all the arsenium has been evolved. The stain obtained is compared with that from 3 c.c. of the dilute standard solution submitted to the same process.

Methods for particular Drugs.—Modifications of the above tests to meet the special requirements of the case are given in minute detail.

Proposed Limits.—Those drugs which are directed not to yield any characteristic reaction with the tests for arsenium should contain less than 3 of arsenium : 1,000,000, equivalent to 4 of arsenious anhydride : 1,000,000, except in the case of citric and tartaric acids, which should contain less than 1 of arsenium : 1,000,000; of hydrochloric, nitric, and sulphuric acids, which should contain less than 0·3 : 1,000,000; and of stronger solution of ammonia, which should contain less than 0·1 of arsenium : 1,000,000.

Suggested Additions to the List of Drugs which should give no characteristic Reaction for Arsenium :—

Acidum boricum ; Acidum citricum ; Acidum salicylicum ; Adeps lanæ (lanoline) ; Alumen ; Ammonii bromidum ; Ammonii carbonas ; Calcii carbonas præcipitatus ; Calcii chloridum ; Calcii hydras ; Calx ; Ferri sulphas ; Ferrum ; Ferrum redactum ; Gelatinum ; Glusidum (saccharin) Iodum ; Liquor hydrogenii peroxidum ; Magnesia levis ; Magnesia ponderosa ; Magnesii carbonas levis ; Magnesii carbonas ponderosus ; Magnesii sulphas ; Phenacetinum ; Phenazonum (antipyrine) ; Potassii carbonas ; Potassii chloras ; Potassii citras ; Potassii tartras ; Potassii tartras acidus ; Quininæ hydrochloridum ; Quininæ hydrochloridum acidum ; Quininæ sulphas ; Sapo animalis ; Sapo durus ; Soda tartarata ; Sodii bicarbonas ; Sodii carbonas ; Sodii hypophosphis ; Sodii phosphas ; Sodii sulphas ; Sulphonal ; Syrupus glucosi.

Test B. or a modification thereof is employed in the case of antimony, bismuth, copper, iron, and lead salts, gelatin, and quinine salts. The remaining drugs are to be tested by Test A. unless they contain iron, when Test B. must be substituted.—J. O. B.

INORGANIC—QUANTITATIVE.

Sulphur; Photometric Determination of —— in Coal. S. W. Parr and C. H. McClure. S. Amer. Chem. Soc., 1904, 26, 1139—1143.

The coal is burnt in a bomb with sodium peroxide, and after dissolving the residue, the sulphuric acid is precipitated as barium sulphate, and the amount of the latter determined "photometrically." To obtain concordant results, 100 c.c. of the slightly acid solution are treated with the requisite amount of the barium salt, *e.g.*, chloride, in crystals, and when these have dissolved, the whole is heated to 70° C., allowed to stand for half an hour, cooled, and then examined "photometrically." The apparatus consists of a tube, graduated in millimetres, with a carefully blown round bottom, ground on the outside. The tube stands in a flask containing water, which rests on a glass plate placed upon a carbon plate about $\frac{5}{8}$ in. thick, having a $\frac{1}{4}$-in. hole in the centre. An ordinary candle is arranged about 10 ins. vertically below the hole in the carbon plate. The liquid containing the precipitated barium sulphate is filled into the graduated tube until the light from the candle-flame, as observed through the column of liquid, is extinguished. A table is given showing the relation of sulphur content to height of column of liquid through which the light can no longer be seen; but operators are advised to check or replace it for themselves, using a standard solution of potassium sulphate.—W. A. C.

Sodium Water-Glass; Analysis of ——. P. Heermann. Chem.-Zeit., 1904, 28, 879—880 and 883—884.

The free alkali in water-glass may be determined after precipitation of the silicate by (1) salt solution and alcohol, or (2) barium chloride. (1) A mixture of 10 grms. of water-glass, 100 c.c. of water, and 20 c.c. of saturated salt solution is made up to 250 c.c. by the addition of neutralised alcohol. The solution is then filtered, and 100 c.c. of the filtrate are titrated with N/10 acid and phenolphthalein. (2) This very old method has fallen into disuse largely because the conditions necessary for accuracy were only imperfectly understood. The most important source of error lies in the solubility of freshly-formed hydrated barium silicate which is perceptibly soluble in cold, much more so in hot, water and very much less so in alcohol, sodium chloride solution, or barium chloride solution. By working in the cold with a minimum volume of liquid, and adding a considerable excess of barium chloride, satisfactory results are obtained, as follows : To 10 grms. of water-glass add 100 c.c. of water, then, in a slow stream and with constant agitation, 100 c.c. of barium chloride solution, containing at least 10 grms. of the anhydrous salt. Make up to 250 c.c., shake well, filter at once through a dry paper, throw away the first 20—30 c.c., and titrate 100 c.c. of the filtrate with N/10 acid and phenolphthalein. On the whole the author regards this method as preferable to that given under (1). A high alkalinity in water-glass has both advantages and disadvantages as regards its use in the treatment of silk. The more alkaline it is the more stable in presence of acid reagents; the more acid (*i.e.*, the higher in silica) the more readily is it decomposed, but the more silica does it deposit in the fibre. As the substance is very cheap, and the bath can be readily renewed, a high silica-content is most advantageous, but this must not be carried so far as to render the product viscous or unfilterable. In practice, the ratio $SiO_2 : Na_2O = 3·1—3·2 : 1$ is most usual, equivalent to a "basicity-number ($SiO_2 : Na$)" of at least 4. A *résumé* of the usual methods for determining total alkali, silica, and neutral salts concludes the paper.—J. T. D.

Ozone; Quantitative Precipitations and Separations by means of —— [Determination of Manganese]. P. Jannasch and W. Gottschalk. Ber., 1904, 37, 3111.

A preliminary communication. By leading ozonised oxygen through a solution of ammonium-manganese sulphate rendered acid with acetic acid, manganese peroxide was precipitated, yielding Mn_3O_4 equivalent to 19·28 per cent. of the substance taken, against 19·50 per cent. calculated. In the filtrate no manganese could be detected by any of the usual reagents.—J. T. D.

Phosphorus in Solutions; Quantitative Determination of ——. A. C. Christomanos. Z. anorg. Chem., 1904, 41, 305—314.

In determining phosphorus in ether or benzene solutions, the solution containing the phosphorus, it is proposed, shall be weighed in a tared glass flask, shaken for some minutes with excess of a 10 per cent. solution of copper nitrate, and the ether or benzene expelled by heating on a water-bath for 15—20 minutes. Bromine is then added gradually, with shaking, to the warm liquid, till the whole of the black copper phosphide is decomposed. The excess of bromine is now expelled and the phosphorus compounds oxidised to phosphoric acid by heating with excess of concentrated nitric acid. Ammonia is added till the light-blue copper hydroxide which separates is re-dissolved, and the phosphoric acid is determined in the usual way as magnesium pyrophosphate.—A. S.

Lead [in Brass, Bronze, &c.]; Determination of ——. E. J. Ericson. J. Amer. Chem. Soc., 1904, 26, 1135—1139.

The author modifies the method of Walters and Affelder (this J., 1903, 927) by leaving the iron, which must not be excessive, together with the lead, and by substituting a permanganate titration for the iodometric one. In a bronze analysis, 25 c.c. of strong ammonia are added to the filtrate from tin, then gradually 3—4 grms. of ammonium persulphate; the liquid is boiled for five minutes, the precipitate allowed to settle, and collected on a filter; it consists of lead peroxide and ferric hydroxide; this is then washed with dilute ammonia (1:5) until free from copper and then 4—5 times with hot water. The precipitate and filter are returned to the beaker and agitated with 25 c.c. of hydrogen peroxide reagent (900 c.c. of water, 50 c.c. of concentrated nitric acid, 15 c.c. of hydrogen peroxide U.S.P.). After reaction 20 c.c. of nitric acid (sp. gr. 1·28) and 150 c.c. of water are added, the liquid again agitated, and titrated with permanganate of such strength that 1 c.c. = 0·002 grm. of iron = 0·00381 grm. of lead.

—W. A. C.

Copper; Electrolytic Assay of ——. G. L. Heath. J. Amer. Chem. Soc., 1904, **26**, 1120—1124.

In carrying out the following processes for the exact determination of copper, the weighing out of large quantities of substance, up to 5 grms., is advocated. The figures given, however, refer to 1 grm. of substance. For metal containing arsenic and antimony, but less than 0·01 per cent. of nickel, cobalt, and zinc together, dissolve in 10 c.c. of nitric acid, evaporate with 10 c.c. of concentrated sulphuric acid until the residue is white, take up with 70 c.c. of water, add 1 c.c. of nitric acid and just enough ammonia to redissolve, and electrolyse. For metal containing much selenium and tellurium, but only traces of antimony, and less than 0·02 per cent. of arsenic, treat with nitric and sulphuric acids as above, dissolve in 60 c.c. of water, heat nearly to boiling, pass in pure sulphur dioxide for 10 minutes, settle overnight, filter, and boil off the sulphurous acid. Ignite the filter, dissolve the ash in 1·5 c.c. of nitric acid, add to bulk of liquid, and electrolyse. For metal containing over 0·01 per cent. of antimony and other elements, heat with nitric and sulphuric acids, dissolve in 70 c.c. of water, add 1 c.c. of ferric nitrate solution (1 c.c. = 0·01 grm. of iron), boil, precipitate with ammonia, filter, and wash. Dissolve in dilute sulphuric acid and re-precipitate, adding filtrate to bulk. Redissolve and pass sulphuretted hydrogen, extract the precipitate with a little hot dilute sodium sulphide, ignite, dissolve in 1·5 c.c. of concentrated nitric acid, and add to bulk. Acidify the collected liquors with sulphuric acid, concentrate to a suitable volume, and electrolyse. For metal containing much arsenic, but at most 0·01 per cent. of antimony, dissolve 5 grms. of the copper in nitric acid, dilute to 50 c.c. and add 3 c.c. of concentrated sulphuric acid. Add ammonia until a slight permanent precipitate forms, redissolve by 1 c.c. of sulphuric acid (sp. gr. 1·84), and stir in dry powdered ammonium nitrate to saturation, and electrolyse.

—W. A. C.

ORGANIC—QUALITATIVE.

Fatty Oils; Colour Reactions of —— [Lignin Reaction]. H. Kreis. Chem.-Zeit., 1904, **28**, 956—957.

An account is given of further experiments with the phenoloid substance, sesamol (this J., 1903, 575, 1210). Sesamé oil thoroughly shaken with successive portions of cold alcohol did not give the characteristic colour reaction with diazonaphthionic acid (termed by the author the "sesazo reaction") nor did it give the green coloration with nitric acid (sp. gr. 1·4), though it still reacted with resorcinol (after about one minute), and with stannous chloride, phosphomolybdic acid, and solution of vanadic acid in sulphuric acid. On distillation of the alcoholic extract a dark brown oily liquid consisting in the main of fatty acids was left. The fatty acids were converted into calcium salts and filtered off, and the filtrate shaken with ether. The ethereal extract on evaporation left about 0·5 c.c. of a viscous dark brown oil (from 1·5 kilos. of sesamé oil) which could not be distilled under reduced pressure. It gave the following reactions in addition to those already described (*loc. cit.*). (1) It was soluble in concentrated sulphuric acid, yielding a dark green solution. (2) An ethereal solution of sesamol shaken with seed oils and nitric acid (sp. gr. 1·4) gave a green coloration which speedily disappeared. (3) A pinewood chip impregnated with sesamol and then dipped into hydrochloric acid (sp. gr. 1·19) gave an intense green coloration. This new reaction of lignin could also be obtained directly with sesamé oil. There appears to be a close relationship between the lignin reaction and Kreis's reaction for fats that have been exposed to light. In both cases the reaction is to be attributed to the action of phenols on aldehydes in the presence of strong hydrochloric acid. The colorations given by different phenols in the two reactions show a close agreement, except in the case of naphthoresorcinol. The analogy between the two reactions even extends to aniline, for on shaking cottonseed oil (after exposure to light) with a drop of aniline and hydrochloric acid of sp. gr. 1·19, a perceptible yellow coloration was produced. (See this J., 1899, 1158; 1904, 194.)

—C. A. M.

——	Lignin Reaction.	Kreis's Reaction.
Resorcinol	Violet	Violet
Phloroglucinol	Red	Red
Pyrogallol	Violet	Violet
Hydroxyhydroquinone	Green	Green
Naphthoresorcinol	Violet	Green
Sesamol	Green	Green

Wool-Fat Oleines [Detection of Mineral and Rosin Oils in ——]. J. Marcusson. Mitt. königl. Materialprüfungsamt, 1904, **22**, 96—110. Chem. Zeit., 1904, **28**, Rep. 283.

The insoluble residue left after boiling the unsaponifiable constituents of wool-fat oleines (see this J., 1903, 825) with acetic anhydride, gave the Hager-Salkowski and Liebermann's reactions, and would thus appear to contain higher alcohols or their derivatives (see Lewkowitsch, this J., 1892, 131). The residue resembles the cholesterilenes in that (1) it gives the two colour reactions mentioned, (2) it rotates the plane of polarisation from + 18° to + 28°, and (3) it absorbs considerable quantities of iodine (iodine value, 59—79). These properties clearly differentiate it from mineral oil; moreover, analysis showed that it contains 4·28 per cent. of oxygen.

Detection of Mineral Oil.—Mineral oil has seldom an iodine value higher than 14, and its rotatory power is at the most $[\alpha]_D = + 3\cdot1°$. If, therefore, the insoluble residue left after boiling the unsaponifiable matter with acetic anhydride has an iodine value much lower than 60, and a rotatory power less than + 18°, the presence of mineral oil is to be suspected.

Detection of Rosin Oil.—The presence of rosin oil in the residue insoluble in acetic anhydride can be recognised by: (1) its characteristic odour; (2) increased specific gravity (rosin oil, 0·97—0·98; wool-fat residue, 0·905—0·912); (3) increased solubility in alcohol; and (4) determination of the refractive index of the portion dissolved by an equal volume of 96 per cent. alcohol. With wool-fat residue, the refractive index would be from 1·5 to 1·53, but in presence of rosin oil, higher figures would be obtained.

—R. L. J.

Keto-Hexoses; Reaction for ——. H. J. H. Fenton. Brit. Assoc., 1904. Chem. News, 1904, **90**, 182.

The author finds that if levulose, cane-sugar, inulin, or sorbose be oxidised in presence of ferrous iron at 90—100° C., and the resulting solution be heated with phenylhydrazine-*p*-sulphonic acid, a compound is obtained which dyes silk a fast, brownish-pink colour. It is stated that the reaction appears to be characteristic of keto-hexoses or substances which yield them on hydrolysis, and is given only to a limited extent or not at all by dextrose, milk-sugar, maltose, or starch.—A. S.

Methylfurfural and its Derivatives; Colour Reaction for ——. H. J. H. Fenton and J. P. Millington. Brit. Assoc., 1904. Chem. News, 1904, **90**, 182.

Methylfurfural and its bromo-, chloro-, iodo-, or acetoxy-derivatives give an intensely blue-coloured compound when heated with dimethylaniline and a dehydrating agent, such as phosphorus oxychloride, zinc chloride, or anhydrous oxalic acid. The reaction is stated to be an extremely sensitive one.—A. S.

Picrates of Unsaturated Compounds. G. Bruni and E. Tornani. Atti R. Accad. dei Lincei Roma, 1904, **13**, [2], 184—187. Chem. Centr., 1904, **2**, 954—955.

Experiments with methyl- and isomethyleugenol, safrol and isosafrol, apiol and iso-apiol, and asarone, showed that the behaviour towards picric acid affords a simple means of determining whether an unsaturated aromatic compound contains an allyl or a propenyl group in the side chain. Unsaturated compounds containing an allyl ($.CH:CH_2$) group in the side chain (methyleugenol, safrol, apiol) do not combine with picric acid. Compounds containing a propenyl ($.CH:CHCH_3$) group in the side chain, on the other hand, react readily, a red to reddish-brown coloration being produced when their solutions are treated with picric acid. Compounds containing a dioxymethylene (.CH_2O_2.) group (isosafrol and iso-apiol) yield well-crystallised relatively stable picrates, which may be used for their isolation and identification. Isomethyleugenol and asarone give less stable and badly-crystallising picrates. The following compounds were isolated and examined:—Isomethyleugenol picrate, $C_{17}H_{17}O_9N_3$, reddish-brown needles, m. pt. 40°—45° C.; it rapidly decomposes. Asarone picrate, $C_{18}H_{19}O_{10}N_3$, dark-brown needles, m. pt. 81°—82° C. Isosafrol picrate, $C_{16}H_{13}O_9N_3$ glistening red needles, m. pt. 73° C. Iso-apiol picrate, $C_{18}H_{17}O_{11}N_3$, fine reddish-brown needles, m. pt. 89°—90° C. Anethiso-apiol, $C_{18}H_{17}O_{11}N_3$, red, needle-shaped prisms, m. pt. 81° C.—A. S.

ORGANIC—QUANTITATIVE.

Bacterioscopic Examination of Water; Standardisation of Methods for the ——. Report of the Committee appointed at the Congress of the Royal Inst. of Public Health, July, 1903. J. of State Medicine, Aug., 1904. Chem. News, 1904, **90**, 177—179.

The committee recommend that there should be undertaken in all cases:—(*a*) Enumeration of the bacteria present on a medium incubated at room temperature (18°—22° C.). (*b*) Search for *B. coli* and identification and enumeration of this organism if present. The majority of the committee recommend in addition:—(*c*) Enumeration of the bacteria present on a medium incubated at blood heat (36°—38° C.). (*d*) Search for and enumeration of streptococci. In special cases it may also be advisable to search for *B. enteritidis sporogenes.* *Collection of the Sample.*—The sample should be collected in the usual manner in sterile stoppered bottles having a minimal capacity of 60 c.c. If not examined within three hours of the time of collection, the bottles must be packed in ice.

Media to be Employed for Enumeration.—For enumeration at room temperature, distilled water gelatin, nutrient gelatin, distilled water agar, gelatin agar, or nutrient agar may be employed, but for enumeration at blood-heat an agar or gelatin agar must be used. When gelatin only is employed, this should be nutrient gelatin, but the use of distilled water gelatin also is to be preferred.

Preparation and Reaction of Media for Enumeration.—(*a*) *Distilled Water Gelatin.*—A 10 per cent. solution of gelatin in distilled water, brought to a reaction of + 10 (Eyre's scale). (*b*) *Nutrient Gelatin.*—A 10 per cent. solution of gelatin, containing meat (beef) infusion and Witte's peptone and brought to a reaction of + 10. (*c*) For enumeration at blood heat, the use of nutrient agar is recommended; it is prepared in the same manner as nutrient gelatin, except that 1·5 per cent. of powdered agar is substituted for the gelatin. (*d*) *Distilled Water Agar.*—A 1·5 per cent. solution of agar in distilled water, brought to a reaction of + 10.

Amounts to be Plated, Size of Dishes, &c., Gelatin.—For an ordinary water, amounts of 0·2, 0·3, and 0·5 c.c. may be "plated" in Petri dishes of not less than 10 cm. diameter. It is recommended to make duplicates in all cases. *Agar.*—Two plates may be made with 0·1 and 1·0 c.c. of the water respectively. The amount of the medium in a plate should be 10 c.c.

Counting.—Counting should be done with the naked eye, preferably in daylight, any doubtful colony being determined with the aid of a lens or low-power objective. Gelatin cultures should be counted at the end of 72 hours, or earlier if necessary on account of liquefaction; agar cultures incubated at blood-heat should be counted after 40—48 hours.

Search for Bacillus Coli.—Either the glucose formate broth method of Pakes or the bile salt broth method of McConkey is recommended, with anaerobic incubation at 42° C. Fifty c.c. should be the minimal quantity of water examined for the presence of *B. coli*, separate quantities from a minimum of 0·1 c.c. to a maximum of 25 c.c. being added directly to the tubes of culture media, without previous filtration through a porcelain filter. If indications of the presence of *B. coli* be obtained, the organism must be isolated by making surface cultures on litmus lactose agar of reaction + 10, bile salt agar, nutrient gelatin, or Conradi and Drigalski's nutrose agar, preferably the last-named: and then identified by making sub-cultures on surface agar at 37° C., in gelatin (stab and surface cultures), in litmus milk incubated at 37° C., in glucose litmus medium, in lactose litmus medium, and in peptone water (for indole reaction). The typical *B. colis* must conform to the following description and tests. It is a small, motile, non-sporing bacillus, growing at 37° C. as well as at room temperature. The motility is well observed in a young culture in a fluid glucose medium. It is decolorised by Gram's method of staining. It never liquefies gelatin; the gelatin cultures should be kept for at least 10 days in order to exclude liquefying bacilli. It forms smooth, thin surface growths and colonies on gelatin, not corrugated, and growing well to the bottom of the stab (facultative anaerobe). It produces permanent acidity in milk, which latter is curdled within seven days at 37° C. It ferments glucose and lactose, with the production both of acid and gas.

Streptococci.—It is advantageous to search for streptococci by making hanging-drop preparations of the fluid media employed for the preliminary cultivation of *B. coli.* Any streptococci detected should be isolated on nutrose agar plates and their characters determined.—A. S.

Nicotine; Determination of —— in presence of Pyridine [*in Sheep Dips, &c.*]. J. A. Emery. J. Amer. Chem. Soc., 1904, **26**, 1113—1119.

A weighed quantity (2·5 grms.) of the sheep-dip, tobacco-extract, tobacco powder, &c. is placed in a 300 c.c. flask with 50 c.c. of N/10 caustic soda and 150 c.c. of distilled water and distilled in a current of steam, in the usual way, until 10—20 c.c. of liquid remain. The distillate is made up to 500 c.c. and a portion examined in a 40 cm. tube and a polariscope reading taken. Each – 1° on the sugar scale represents 0·112 per cent. of nicotine in the distillate.

—W. A. C.

Nux Vomica Extract; Official Process for ——, in the forthcoming [*French*] *Codex.* E. Bourquelot. XX., page 998.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Zinc Sulphide; Phosphorescent ——. H. Grüne. Ber., 1904, **37**, 3076—3077.

To prepare Sidot's blende the author has tried the method of Henry (Comptes rend., **115**, 505:—A neutral solution of zinc chloride is precipitated with ammonia, the precipitate re-dissolved in excess, and exactly precipitated with hydrogen sulphide. The zinc sulphide is washed, dried, heated to whiteness in a fire-clay crucible inside a charcoal-lined graphite crucible.) Henry lays stress on the purity of the zinc chloride used, but the author obtained most variable results, and concluded that the brilliancy of the phosphorescence was probably due to minute traces of impurities. By purposely adding traces of other metals, he was able to prepare strongly phosphorescent sulphide with certainty. Copper, to the extent of 0·01 per cent., was the metal which gave best results, but good phosphorescence was obtained by adding silver, lead, bismuth, tin, uranium, or cadmium: none by adding iron, nickel, cobalt, or chromium. In the case of manganese, the sulphide produced gave a yellowish-red phosphorescence after illumination; but rubbing or scratching produced an extraordinarily brilliant light, visible even in daylight. Certain natural blendes have been found to phosphoresce on scratching, no doubt because of containing small proportions of manganese. The property of causing this phosphorescence in zinc sulphide is possessed by other metals, such as copper and uranium, but in much lower degree than by manganese.

—J. T. D.

Phosphorescent Substances. K. A. Hofmann and W. Ducca. Ber., 1904, **37**, 3407—3411.

In preparing Sidot's blende the authors found that, following Henry's method, they could obtain no phosphorescent product from pure materials, though the zinc chloride of commerce yielded very satisfactory products. As the result of their investigation into the influence of various impurities on the phosphorescence, they give the following method for preparing a blende with intense yellowish green phosphorescence. To the solution in 400 c.c. of water, slightly acidified with sulphuric acid, of 20 grms. of zinc ammonium sulphate, 5 grms. of sodium chloride, and 0·2—0·5 grm. of crystallised magnesium chloride, add 100 c.c. of 8 per cent. ammonia; allow to stand 24 hours, filter, saturate with hydrogen sulphide, filter, drain the filter, and precipitate (without washing) on porous tiles, and dry at 100° C. Powder finely and heat to whiteness in a covered porcelain crucible contained in an outer fire-clay crucible. The product is very sensitive both to light (though exposure to red light extinguishes its phosphorescence) and to *α*-radio-active substances. Neither magnesium compounds nor potassium compounds alone give a sensitive product. Of other impurities, iron, nickel, cobalt, bismuth, chromium, and copper were objectionable; but tin, selenium, manganese, and cadmium give sensitive products. In especial, the addition to the ammoniacal filtrate above obtained, before precipitation, of manganese chloride equal in weight to 1/1000 of the zinc ammonium sulphate gave a product with brilliant golden-yellow phosphorescence. None of the phosphorescent blendes prepared by the authors emitted any *α*- or *β*-Becquerel rays. (Compare preceding abstract.)—J. T. D.

Sidot's Blende; Phosphorescence of ——, under the influence of Ozone. R. Schenck and F. Mihr. Ber., 1904, **37**, 3464—3467.

Sidot's blende was found to be very weakly luminous, and to give feeble scintillations, in the dark. The passage over it of a stream of ozonised oxygen caused not only a great increase in the homogeneous luminosity, but also an increase in the intensity of the scintillations. Exposure to weak light, such as that of a lucifer match, also increases the intensity of scintillation. Other investigations have shown that the scintillation is influenced by other circumstances, and it would seem that any cause which increases the intensity of the homogeneous illumination also increases that of the scintillation. Increase of intensity of the scintillation of Sidot's blende is therefore not to be taken without caution as evidence of the presence of radio-active substances. Blende which has been often exposed to ozone ceases to show homogeneous luminosity, but still shows scintillation clearly. (Compare the two preceding abstracts.)—J. T. D.

Cinnabar; Radio-active ——. S. M. Losanitsch. Ber., 1904, **37**, 2904—2906.

Samples of Servian cinnabar (from Avala and Bare) were found to affect a photographic plate when placed upon it for three or four days in a lead box with a paper bottom. Some of the Idrian cinnabar, especially the variety known as "Ziegelerz," was found to exhibit similar activity, but all other specimens examined were inactive. The activity was much less marked than that of pitchblende; it was proved not to be due to metallic mercury contained in the cinnabar, nor to the barium compounds associated with it. From the latter circumstance the author concludes that it is not due to radium (which would have been with the barium compounds rather than with the cinnabar), and attributes it to "radiomercury" a hypothetical element of higher atomic weight than mercury in the zinc-cadmium-mercury homologous series. He considers that all of these homologous series of elements end in radio-active elements, but that the radio-activity of the upper elements diminishes in intensity as the series become less electro-positive.

—J. T. D.

Petroleum; Radio-active Gas from Crude ——. E. F. Burton. Phil. Mag., 1904, **8**, 498—508.

By drawing a current of air though heated crude petroleum (obtained from wells in Petrolia, Ontario), a strongly radio-active gas was obtained, very similar in its rate of decay, and also in the rate of decay of the induced radio-activity which it produces, to the emanations from radium, mercury, and from certain natural mineral waters. The radio-activity of this gas diminishes according to an exponential law, and falling to half value in 3·125 days, whilst the induced radio-activity which it produces falls to half value in about 35 minutes. Indications were also obtained of the existence in crude petroleum of traces of a radio-active substance more persistent than the radium emanations; it is thought that this substance may possibly be radium itself.

—T. F. B.

Rays of Short Wave-Length; Chemical Action of —— on Gaseous Bodies. E. Warburg and E. Regener. Sitzungsber. Kgl. pr. Akad. Wiss. Berlin, 1904, 1228—1231. Chem. Centr., 1904, **2**, 873.

It has been previously shown (Ann. der Physik, **13**, 464) that the formation of ozone by means of the silent electric discharge, is not an electrolytic but a photo- and cathodo-chemical action. The fact that rays of short wave-length can cause the formation of ozone, led the authors to examine their influence in other chemical processes. It was found that rays of short wave length can also exercise a de-ozonising action. The curves showing the ozonisation and de-ozonisation intersected at a point representing an ozonisation of 2·2 per cent., but this point of equilibrium varied with the permeability of the quartz-glass used, for the ozonising and de-ozonising rays. Rays of short wave-length can also effect the decomposition of ammonia, nitric oxide (into nitrous oxide and oxygen) and nitrous oxide (formation of nitrogen peroxide); in an experiment with ammonia, 10 per cent. was decomposed in 80 minutes.—A. S.

Platinic Sulphate; Analysis of Margules' ——. L. Staehlik. Ber., 1904, **37**, 2913—2915.

Margules, by the action of alternating currents, dissolved platinum in strong sulphuric acid (this J., 1899, 376), and has since succeeded in crystallising the substance formed, which he assumed to be platinic sulphate. The author has analysed Margules' recrystallised substance, reducing the platinum by passing hydrogen through the solution, filtering, and determining the sulphuric acid in the filtrate. The results showed a considerable excess of sulphuric acid: but by two or three recrystallisations crystals were obtained agreeing closely in composition with the formula $Pt(SO_4)_2.4H_2O$. These orange-yellow crystals readily lose water at the ordinary temperature *in vacuo* over sulphuric acid, darkening in colour, whilst the salt with excess of sulphuric acid loses but little even at 100° C. Both the hydrated and the anhydrous salts are very soluble in water; from the dark-coloured solution of the anhydrous salt sulphuric acid precipitates yellow crystals, probably of the hydrated salt.—J. T. D.

Light; Chemical Action of ——. F. Sachs and S. Hilpert. Ber., 1904, **37**, 3425—3431.

As a general rule, it is found that aromatic compounds which have a nitro-group in the ortho-position to a CH group are sensitive to light. It has already been shown (this J., 1904, 341, and Ber. 1902, 2704) that *o*-nitrobenzaldehyde and *o*-nitrobenzalaniline are converted, on exposure to light, into *o*-nitrosobenzoic acid and *o*-nitrosobenzanilide respectively. In the other reactions studied, the nitro-group was always reduced to a nitroso group. On exposing a benzene solution of *o*-nitrobenzyl alcohol to light, a green coloration soon appeared, and a yellow precipitate formed; this had the empirical composition $C_6H_4.CHNO_2$, but it had a high molecular weight, and has not been identified: that a nitroso compound was formed during the reaction was proved by the evolution of nitrogen when *o*-nitrobenzyl alcohol and phenylhydrazine were exposed to the action of light in acetic acid solution. Similarly, *o*-nitrobenzaldehyde cyanhydrin gave an unstable intermediate nitroso compound, which decomposed into hydrocyanic acid and *o*-nitrosobenzoic acid. *o*-Nitrophenyllactic acid ketone, *o*-nitrobenzylaniline derivatives, *o*-nitrobenzyl acetate, *o*-nitrobenzyl chloride, and even *o*-nitrotoluene to a small extent, decomposed under the influence of light, the green colour of the resulting solutions indicating the probable formation of nitroso compounds.—T. F. B.

Sugars; Acyl-Hydrazones of ——. R. Kahl. Z. Vereins deutsch. Zuckerind., 1904, 1091—1119.

The hydrazones obtained by acting on sugars with acylhydrazides have the advantage over osazones of permitting the sugar to be regenerated (by means of benzaldehyde or formaldehyde) and over the simpler hydrazones of being less soluble and therefore easily isolated. To the five examples prepared by Radenhausen and by Herzfeld, the author adds eleven new ones, applying *p*-bromobenzhydrazide, *p*-chlorobenzhydrazide, salicylhydrazide, and β-naphthylsulphonic-hydrazide. Ketoses do not form hydrazones of this kind and can thus be separated from aldoses. Only those hydrazides seem to react which have the CO.NH.NHR radical attached directly to the benzene ring. Several semicarbazones of sugars are also described, and it is shown that semicarbazide fails to react with ketoses.—W. A. C.

Saponarin: a Glucoside coloured Blue by Iodine. G. Barger. Brit. Assoc., 1904. Chem. News, 1904, **90**, 183—184.

The author isolated the glucoside *saponarin*, known to botanists as "soluble starch," from *Saponaria officinalis*. It was obtained in minute needles by crystallising from mixtures of pyridine and water. It is insoluble in water and in most organic solvents, but readily soluble in dilute alkalis and in pyridine: it melts at 231° C. with decomposition. When its yellow solution in alkali is acidified, the substance remains for a long time in a state of pseudo-solution, and in this condition it gives an intense blue or violet coloration with iodine dissolved in potassium iodide solution. Air-dried crystals of saponarin lose water when heated or when left *in vacuo* over sulphuric acid; the anhydrous substance is extremely hygroscopic. By hydrolysis with mineral acids, glucose is produced, together with a second substance, *saponaretin*, which separates from strong solutions as a thick yellow oil, and from dilute solutions either in the amorphous condition, or crystallised. Saponaretin appears to be closely allied to the flavones. When fused with caustic potash, it yields *p*-hydroxybenzoic acid, and a red solution which gives the phloroglucinol reaction with "pinewood."—A. S.

Lactase; Occurrence of —— in Plants. A. Brachin. J. Pharm. Chim., 1904, **20**, 300—308.

Lactase is found to be present in a large number of plants, those examined including members of the natural orders Rosaceæ, Cruciferæ, Cornaceæ, and Rutaceæ. It is not found in certain individuals, such as *Evonymus europæus, Capporis spinosa, Berberis vulgaris*, nor in the mould *Aspergillus niger*, nor in *B. coli communis*. The specific nature of the ferment, as recorded by Bourquelot and Hérissey, is confirmed. It is destroyed at 75° to 80° C., a temperature 10° C. lower than is fatal to emulsin. The presence of 0·24 per cent. of acetic acid is sufficient to arrest its action, whilst emulsin requires the presence of 1·25 per cent. of that acid to arrest its fermentative activity. Sulphuric acid in the proportion of 0·09 to 0·10 grm. per litre arrests the action of lactase, and oxalic acid is almost as energetic in this direction: it requires, however, about 7·5 grm. per litre of tartaric acid to arrest lactic fermentation. Lactase behaves differently from myrosin in that it has no action on potassium myronate.
—J. O. B.

New Books.

L'Ozone et ses Applications Industrielles. Par H. de la Coux, Inspecteur de l'Enseignement tech. au Ministère du Commerce, Expert près le Conseil de Préfecture de la Seine, &c. Vve. Ch. Dunod, 49, Quai des Grands-Augustins, 49, Paris. 1904. Price 15 fr.

Large 8vo volume, containing 515 pages of subject-matter, with 159 illustrations. The subject in this work is treated under the following heads:—I. The Physical and Physiological Properties of Ozone. (i) The Phenomena of Oxidation in Nature, and the Chemical Activity of Ozone in relation to the Industries. (ii) Nature of Ozone, and its Physical Properties. (iii) Ozone in the Air. (iv) Action of Ozone on the Organism. (v) Therapeutic Action of Ozone. II. Production of Ozone. (i) Preparation of Ozone by Gentle Oxidation, Heat, and Radio-active Salts. (ii) By Chemical Processes. (iii) By Electro-chemical Methods. (iv) By the Electric Discharge. III. Industrial Applications of Ozone: its Chemical and Microbiological Action. (i) Chemical Action of Ozone, and its Utilisation in the Manufacture of Chemical Products. (ii) Action of Ozone on the Air; Disinfection and Sterilisation. (iii) Sterilising and other Action of Ozone on Water. (iv) Action on Organic Products of Animal Origin, and their Preservation. (v) Action in Purifying and Maturing Alcoholic Products, Brandies and Spirits. (vi) Action in Improving and Maturing Wines. (vii to xi) Ozone in the Manufacture and Preservation of Vinegar, in Brewing, in Cider Making, in the Distillery, in Sugar Manufacture. (xii) Ozone in Bleaching. (xiii to xxii) In Starch and Dextrin Making; in the Manufacture of Oils and Fats, Soaps, Drying Oils, Varnishes, &c., Dyestuffs, Artificial Perfumes, Maturing Wood, Sericulture, Bleaching, Disinfection, Photography, &c. IV. Analysis. (i) Testing Ozone with Reagents and Test Papers. (ii) Determination of Ozone by Volumetric Methods. (iii) Determining Ozone by Physical Methods.

The Electric Furnace. By Henri Moissan. Translated by A. T. de Mouilpied, Ph.D. Edw. Arnold, 41 and 43, Maddox Street, Bond Street, London, W. 1904. Price 10*s.* 6*d.*

8vo volume, containing preface, translator's notes, introduction, 303 pages of subject-matter, with 42 illustrations, and the alphabetical index. The following are the leading themes, in the treatment of this subject:—I. The Different Types of Electric Furnace. Crystallisation of Metallic Oxides. Fusion and Volatilisation of some Refractory Substances. II. Researches on the Different Varieties of Carbon. III. Preparation of Various Elements in the Electric Furnace. IV. Study of Carbides, Silicides, Borides, Phosphides, and Arsenides. V. Recent Researches on Carbides, Silicides, and Borides: (*a*) Carbides of Neodymium and Praseodymium and Samarium. (*b*) Silicides of Vanadium and Cerium. (*c*) Borides of Silicon.

Laboratory Studies for Brewing Students. A Systematic Course of Practical Work in the Scientific Principles Underlying the Processes of Malting and Brewing. By Adrian J. Brown, M.Sc., Professor of the Biology and Chemistry of Fermentation in the University of Birmingham, &c. Longmans, Green, and Co., 39, Paternoster Row, London; New York and Bombay. 1904. Price 7*s.* 6*d.*

This volume, 8vo size, contains preface, 186 pages of subject-matter, 36 illustrations, and six tables. The whole subject is treated under the following sections:—I. Barley and Malting. II. Principles of the Mashing Process. III. Fermentation. IV. The Hop.

The Analysts' Laboratory Companion. A Collection of Tables and Data for the Use of Public and General Analysts, Agricultural, Brewers', and Works' Chemists and Students; together with numerous examples of Chemical Calculations and Concise Descriptions of several Analytical Processes. By Alfred E. Johnson, B.Sc. Third Edition. J. and A. Churchill, 7, Great Marlborough Street, London. 1904. Price 6*s.* 6*d.*

Small 8vo volume, with preface, 146 pages of data, tables, methods, formulæ, &c., interleaved with ruled, blank sheets for notes. At the end of the volume there is an alphabetical index. Among the tables, &c. are the following, as examples:—Atomic Weights and Logarithmic Tables. Multipliers and their Logarithms required in Gravimetric Analysis. Factors required in Volumetric Analysis. Nitrometer Analysis, &c. Notes on Indicators. Precipitating Powers of Common Reagents. Density Tables. Table of Freezing Mixtures. Percentage Conversion, into cwts., qrs., lb. per ton, &c., and the reverse. Barometric Tables. Specific Gravity and Hydrometer Tables. Water and Beer Analysis Tables. Alcohol, Phosphate, Ammonia. Albuminoid, Kjeldahl, and Electro-Chemical Equivalents

Tables. Tables of Constants of Oils, Fats, and Waxes. Calculation of Results of Milk Analysis. Variations in Reichert - Wollny Number, &c. of Butter and Margarine. Physical and Chemical Criteria in the Analysis of Butter-Fat. Table of Electro - chemical Equivalents, Thermometric Tables, and Scale Conversions, &c.

Tables for Qualitative Chemical Analysis, arranged for the Use of Students. By A. Liversidge, M.A., LL.D., F.R.S., Professor of Chemistry in the University of Sydney. Second Edition. Macmillan and Co., Ltd., London. 1904. Price 4*s.* 6*d.* net.

Large 8vo volume, containing introduction and 110 pages of tabulated analytical matter, an appendix of 13 pages, and an alphabetical index. It may be pointed out that qualitative methods in this work are extended to organic substances and compounds not usually included under ordinary qualitative analysis. Thus the alcohols, aldehydes, acetone, chloroform, and glycerol are included. Also the carbohydrates, glucosides, and certain aromatic compounds and volatile bases.

Trade Report.

I.—GENERAL.

Tunis; Export Trade of —— in 1903.

Foreign Office Annual Series, No. 3295.

The following figures give the quantity and value of the exports of certain articles from Tunis during 1902 and 1903; the figures for 1902 are given in brackets :—

Lead, 13,405 tons, 43,583*l.* (14,343 tons, 46,631*l.*); olive oil, 4872 tons, 113,708*l.* (4064 tons, 102,404*l.*); phosphates, 353,835 tons, 359,496*l.* (257,546 tons, 261,667*l.*); soap, 326 tons, 5304*l.* (917 tons, 11,913*l.*); tan, 4574 tons, 55,778*l.* (5620 tons, 68,526*l.*); raw wax, 67 tons, 4788*l.* (79 tons, 5626*l.*); zinc ore, 24,061 tons, 97,784*l.* (37,466 tons, 152,264*l.*).

Peru; Trade of ——.

Foreign Office Annual Series, No. 3231.

The subjoined table gives details of certain exports from Peru during the Years 1901—1903 :—

Articles.	Quantity.			Character of Trade.
	1901.	1902.	1903.	
	Tons.	Tons.	Tons.	
Calcium borate	4,094	4,975	2,282	Exnorted principally to United Kingdom.
Coca	601	919	1,026	Chiefly to Germany and United States.
	ton cwt.	ton cwt.	ton cwt.	
Cocaine.......	10 10	8 3	7 14	Exported almost entirely to Germany.
	Tons.	Tons.	Tons.	
Cotton seed ...	1,735	4,305	5,264	Exported to United Kingdom and Germany.
Cotton-seed oil cakes.	1,171	2,301	2,212	Chiefly to United Kingdom.
Guano........	29,920	52,994	21,356	The whole exported on British account and the bulk shipped to United Kingdom.
Hides and skins.	2,218	2,064	2,683	Chiefly to France, Germany, and United States.
Ores, sulphides, and matte.	46,192	40.702	37,086	Principally to United Kingdom.
Rubber.......	1,723	1,674	2,075	Exported chiefly to United Kingdom and France.
	ton cwt.	ton cwt.	ton cwt.	
Silver bars	77 0	35 16	106 10	Principally to United Kingdom and France.
	Galls.	Galls.	Galls.	
Spirits	149,157	293,146	368,380	Almost entirely to Bolivia and Chile.
	Tons.	Tons.	Tons.	
Sugar	112,942	115.513	125,662	Chiefly to United Kingdom, Chile, and United States.

The subjoined table shows the value of certain imports into Peru through Pacific Ports during the years 1902 and 1903 :—

Articles.	Value.		Character of Trade.
	1902.	1903.	
	£	£	
Bone, horn, and celluloid articles.	17,118	4,001	Chiefly from United Kingdom and Germany.
Candles, wax, and stearine	25,912	43,374	Chiefly from Belgium and United Kingdom.
Cardboard and its manufactures.	7.839	4,075	Principally from Germany.
Coal	92,961	122,712	From United Kingdom, Australia, and United States.
Cement................	14,195	21,603	From Germany, Belgium, United States, and Chile.
Drugs, chemical products, mineral waters, and surgical instruments.	105,065	126,888	The bulk comes from United Kingdom, France, Germany, and United States.
Dyeing and tanning stuffs.	23,813	28.741	From United Kingdom, Germany, Belgium, and Chile.
Earthen and stone wares, porcelain, glassware, fire - bricks, bottles, marble, alabaster, glass, and manufactures thereof.	76,360	81.760	Principally from United Kingdom, Germany, United States, and Belgium.
Explosives.............	39,119	27,936	Chiefly from Germany and United States.
Metals and manufactures thereof.	114,049	938,731	Principally from United Kingdom, Germany, France, and United States.
Oils of all kinds.........	44,960	56,846	United Kingdom, United States, and Italy.
Paint and varnishes	14,868	15,868	Chiefly from United Kingdom and Germany.
Perfumery.............	14,365	19,962	Comes principally from United Kingdom, France, Germany, and United States.
Soap....................	3,845	5,673	Chiefly from France, Germany, and United Kingdom.

Crete; Trade of —— during 1903.

Foreign Office Annual Series, No. 3282.

The subjoined table gives details of trade in Crete during 1902 and 1903 in certain articles :—

Articles.	Exports.		Imports.	
	1902.	1903.	1902.	1903.
	£	£	£	£
Olives and products of olives	106,685	*208,396	1,558	2,525
Timber and wood products	882	712	19,899	24,219
Vegetable dyes, &c.	9,956	11,796	2,352	2,542
Raw minerals and metals	1,990	2,785	23,004	20,750
Drugs and chemicals...	32,594	37,159	14,164	15,404
Prepared skins	426	320	29,797	37,980
Sugar, sweetmeats, &c..	65	58	16,255	17,515
Wines and liquors.	16,914	21,795	5,834	7,569
Pottery and glassware .	26	15	9,634	1,012

* Includes olive oil, 40,500*l.*

Orange River Colony; Trade of ——.

Chem. and Druggist, Oct. 1, 1904.

Among articles imported into the colony during the year ending June 30, 1904, were the following, the figures in parentheses referring to those of 1902–3 :—Acetic acid, 140*l.* (132*l.*); drugs and chemicals, 23,095*l.* (22,342*l.*); extracts and essences, 2,036*l.* (2,197*l.*); essential and perfumed oils, 170*l.* (91*l.*); all other descriptions of oils, 17,805*l.* (10,764*l.*); paints, colours, turpentine, and varnish, 14,879*l.* (8,467*l.*); common soap, 19,970*l.* (15,288*l.*): imported spirits, 38,212*l.* (48,517*l.*); and spirits manufactured in Cape Colony, 14,900*l.* (13,582*l.*).

BRAZIL; EXPORT TRADE OF ——.

Foreign Office Annual Series, No. 3283.

The subjoined table gives quantity and value of certain exports from Brazil during the years 1902—1903 :—

Articles.	Quantity.		Value.	
	1902.	1903.	1902.	1903.
	Met. Tons.	Met. Tons.	£	£
Monazite sands	1,265	3,239	53,661	74,139
Sugar................	136,757	21,889	955,865	198,549
Castor seed	2,387	4,045	19,436	50,998
Rubber—				
Mangabeira.......	350	661	45,751	96,335
Manicoba	807	1,721	132,465	327,836
Seringa	27,474	29,228	7,115,297	9,308,870
Cotton seed	30,386	35,535	92,791	116,707
	Galls	Galls.		
Para nuts...........	3,262,620	3,473,910	161,811	190,014
	Met. Tons.	Met. Tons.		
Carnauba wax	1,517	1,925	84,077	131,906
Hides—				
Wet and salted ...	20,354	20,868	707,879	805,769
Dry...............	6,592	7,439	197,606	485,357
Medicinal herbs and roots..............	632	580	29,095	25,894
Manganese..........	157,295	161,926	221,262	248,010
	Oz.	Oz.		
Gold, bar............	127,670	138,305	432,706	468,591
Stones, precious.....	..	..	110,540	113,582
	Met. Tons.	Met Tons.		
Skins	1,936	2,328	413,847	529,355

CHINA; CHEMICAL EXPORTS OF —— IN 1902.

Foreign Office Annual Series, No. 3280.

The values of certain Chinese produce shipped abroad in 1903 were as follows :—

Hides, 621,704*l.*; paper, 460,716*l.*; oils (vegetable), 428,273*l.*; chinaware, 290,383*l.*; sesamum seed, 267,492*l.*; tallow, 213,040*l.*; sugar, 130,185*l.*; nutgalls, 100,131*l.*; musk, 67,668*l.*; glassware, 64,960*l.*; oils (essential), 41,435*l.*; white wax, 27,187*l.*

IV.—COLOURING MATTERS AND DYESTUFFS.

DYESTUFFS IN INDIA.

Chem. and Druggist, Oct. 1, 1904.

According to the *Indian Agriculturist*, the imports of aniline and alizarin dyes into India during 1903 were unusually heavy, and surpassed those of any previous year. The quantity of 12,182,600 lb. is one-third as much again as in 1902–3, but owing to a considerable fall in the average price of aniline dyes the value Rs. 82,67,610, was only 26 per cent. higher. The prices of the cheaper alizarin dyestuffs show a very slight decline, and with an increase of nearly 39 per cent. the quantity imported exceeded that of other dyestuffs by 1,216,000 lb. About four-fifths of the trade is with Bombay, and almost the same proportion is recorded as the joint share of Belgium and Holland; but most of this comes through those countries in transit from Germany, which exported to India, in 1902, 2,198,000 kilos. of alizarin, valued at 2,990,900 m., and 1,214,800 kilos. of other coal-tar dyestuffs, valued at 3,766,000 m. This accounts for practically the whole of the alizarin and about 60 per cent. of the remainder.

VII.—ACIDS, ALKALIS, Etc.

POTASH SYNDICATE (GERMANY).

Foreign Office Annual Series, No. 3287.

The Potash Syndicate was renewed on June 30 for a term of five years viz., from January 1, 1905, to December 31, 1909. The syndicate was originally formed in 1879, and renewed from time to time for periods of five years. From 1879 till the end of 1903, the sales amounted in all to 4,100,000 tons of potash (about 8 tons of kainite and 11¼ tons of carnallite being reckoned equal to 1 ton of potash); sales steadily increased, the five quinquennial periods participating with 9·4, 10·5, 16·6, 24·6, 38·9 per cent. of the total respectively. Of this quantity, 1,300,000 tons served for industrial and 2,800,000 tons for agricultural purposes.

The syndicate now embraces 27 works, the two largest being in the possession of the Prussian and the Anhalt Governments.

The scheme for providing a syndicate fund of 250,000*l.*, with the object of enabling the syndicate to meet outside competition effectively, was abandoned owing to the opposition of the younger works, but it is reported that the older works will raise this fund amongst themselves.

The new agreement of the syndicate divides the products into five groups :—Group I. includes chloritic products containing more than 42 per cent. of potassium, and the so-called 38 per cent. calcined potash manure. Group II.—Sulphate products containing more than 21·5 per cent. of potassium. Group III.—Products of 42—20 per cent. potassium, exclusive of 38 per cent. potash manure, and the sulphate products of Group II. Group IV.—Non-carnallite crude potassic salts containing 19·9 to 12·4 per cent. of potassium. Group V.—Potassic salts, including kieserite.

SALT PRODUCTION; THE WORLD'S ——.

Eng. and Mining J., Sept. 22, 1904.

The world produced 13,769,201 short tons of salt in 1902, of which the United States contributed 24·3 per cent.; Great Britain, 15·4 per cent.; Germany, 12·7 per cent.; and India, 8·5 per cent. The balance of 39·1 per cent. was credited to numerous other countries.

BORAX PRODUCTION OF THE UNITED STATES.

Eng. and Mining J., Sept. 22, 1904.

According to the report of the Geological Survey, the amount of crude borax produced in the United States in 1903 was 34,430 short tons, valued at 661,400 dols. The value given is much lower than the total reported for 1902, due to the fact that it is calculated for crude product, whereas last year the valuation was partly for refined borax.

FELSPAR PRODUCTION OF THE UNITED STATES.

Eng. and Mining J., Sept. 22, 1904.

The production in 1903, according to the United States Geological Survey, was 13,432 short tons of crude, valued at 51,036 dols., and 28,459 tons ground felspar, valued at 256,733 dols. In 1902 the output was 21,870 tons crude, valued at 55,501 dols., and 23,417 tons ground felspar, valued at 191,923 dols. Five States were producers—Connecticut, Maine, Maryland, New York, and Pennsylvania.

GRAPHITE PRODUCTION OF THE UNITED STATES.

Eng. and Mining J., Sept. 22, 1904.

In the report of the United States Geological Survey, the production of graphite in the United States during 1903 is given as 37,758 short tons, valued at 1,598,589 dols. Crystalline graphite, the most valuable of the natural varieties, was mined in Essex and Washington counties, N.Y., Chester county, Pa., and Coosa and Clay counties, Ala. The output was 4,538,155 lb., valued at 154,170 dols. The production of amorphous graphite, which amounted to 16,591 short tons, valued at 71,384 dols., came from Georgia, Wisconsin, Michigan, Rhode Island, South Carolina, California, Nevada, and North Carolina. Of artificial graphite there was manufactured a total of 2,620,000 lb., valued at 178,670 dols., all of it made by the International Acheson Graphite Company, of Niagara Falls, New York.

IX.—*BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.*

Cement Industry of Germany.

Foreign Office Annual Series, No. 3287.

After several years of ruinous competition the efforts aiming at a general understanding in the cement industry seem to have good prospects of ultimate success. Conventions between several local associations have already been effected or are nearing completion. However, there are still important interests outside the local syndicates which stand in the way of a comprehensive and universal organisation. The local syndicates embrace Silesia, Pomerania, South Germany, and a group of 15 works in Rhenish-Westphalia. The Hanoverian works are contemplating the formation of an association. Negotiations towards an understanding between the Rhenish-Westphalian group, the South German syndicate, the Hanoverian works and a Belgian syndicate are being carried on at present. The so-called Middle-German Works (in Thuringia and elsewhere) are ready to co-operate in a general organisation; it is in Hanover and in the Lower Elbe region that the idea of a general syndicate meets with opposition from some of the large works, which maintain that a fruitful organisation of the whole industry must be preceded by the stoppage of the small works.

Below are given the imports and exports of cement of all kinds during the half-year, January to June :—

—	1902.	1903.	1904.
	Tons.	Tons.	Tons.
Imports	26,588	25,950	28,090
Exports	244,603	374,381	282,592
Excess of exports	218,015	348,431	254,502

The decrease of the exports is principally due to reduced shipments to the United States of America.

X.—*METALLURGY.*

Victoria; Mineral Production of ——.

Bd. of Trade J., Oct. 6, 1904.

The annual report of the Secretary of Mines and Water Supply for Victoria contains statistics and reports on water supply, geological survey, and the inspection of mines, and dredging, and the progress of mining and boring operations, &c., in that State during the year 1903, from which the following particulars have been taken :—

Gold.—The yield for the year under review was 822,424 oz., as compared with 777,738 oz. for the previous year, thus showing the substantial increase of 44,686 oz. The value of the gold won during 1903 was 3,259,482*l.*, as compared with 3,062,028*l.* Dredging is making steady progress year by year, owing to the facility with which ground intended to be operated on by dredges can be thoroughly and inexpensively tested beforehand, enabling a near approximation of its value being arrived at before large sums of money are expended in machinery, &c., which might eventually not be required. The total quantity of material treated during 1903 by dredge mining and hydraulic sluicing by gravitation was 7,963,927 cubic yards as compared with 6,911,697 cubic yards for the previous year. The gold obtained showed an increase of 8,937 oz., being 42,066 oz., as compared with 33,109 oz. In all, 51 dredge-mining plants, comprising 15 bucket dredges, 23 pump hydraulic sluices, 10 jet elevators, and 3 rotary hydraulic plants, were in operation, as well as 14 hydraulic sluicing by gravitation plants, and at the end of the year 14 other plants were in course of construction.

Coal.—There was a great falling off in the year's output of coal, owing to the strike of miners, which lasted for practically the whole of the year. The amount obtained was 64,200 tons, or a little more than a quarter of that for the previous year, which was 225,164 tons. The total output of coal in Victoria to the end of 1903 now stands at 2,237,257 tons, valued at the pit's mouth at 1,239,026*l.*

Metals and Minerals, other than Gold and Coal.—The output of tin ore was 33 tons. Silver to the extent of 28,800 oz. was extracted from gold at the mint, and 5 tons of antimony ore were obtained at Heathcote for testing purposes, and 3,590 tons of gypsum from the Mallee, principally in the neighbourhood of Boort.

Pig-Iron Production of Germany.

Foreign Office Annual Series, No. 3287.

While the production of pig iron in the first half of 1903 showed an increase of upwards of 20 per cent. over the corresponding period of the previous year, in the period under review the output of pig iron increased only by 64,800 tons, or 1·3 per cent. The subjoined table gives the amounts of pig iron, in thousands of tons, produced by the various processes during the first half of the years 1902—1904 :—

Articles.	1902.	1903.	1904.
Puddle iron	596·5	451	411·4
Spiegel iron		376·7	293·8
Bessemer iron	191	209·7	220·9
Thomas pig iron	2,436·1	3,013·4	3,174·4
Foundry pig iron	790·2	883·8	898·9
Total	4,013·8	4,934·6	4,999·4

Manganese Ore; Output of Russian ——.

Gluckauf; through Eng. and Mining J., Sept. 29, 1904.

The output of manganese ore in Russia during 1903 amounted to 25,266,150 poods, or 413,860 metric tons. This shows a further decline in the industry, due to the continuance of the depression which began in 1901. The output is but little more than half of the total recorded in 1900, and falls considerably short of the production for the previous year, which was 28,648,635 poods. As usual, the Caucasus district contributed most of the supply, its output amounting to 22,974,603 poods. There were 251 mines under exploitation in this district, and the total number of employees was 2,004, as compared with 3,702 in 1902.

Open Hearth Steel Production of the United States.

Eng. and Mining J., Sept. 29, 1904.

The total production of open-hearth steel ingots and castings in the United States in 1903, was 5,837,789 gross tons, against 5,687,729 tons in 1902 (an increase of 2·6 per cent.), and 2,230,292 tons in 1898.

In 1902, 4,496,533 tons of open-hearth steel were made by the basic process, and 1,191,196 tons were made by the acid process, while in 1903 the production by the basic process amounted to 4,741,913 tons, and by the acid process to 1,095,876 tons.

There was a decrease in the production of acid steel in 1903, as compared with 1902, of 95,320 tons, or a little over 8 per cent., but an increase in the production of basic steel of 245,380 tons, or almost 5·5 per cent.

China; Mining in ——.

Foreign Office Annual Series, No. 3280.

Antimony continues to be mined in considerable quantities at Hunan: the production of metal in 1903 was 3435 tons, and of ore, 3234 tons (in 1902 the figures were 6740 tons and 3624 tons respectively). Japan took 1095 tons, and a large proportion was shipped to the United States. An installation, under German management, has been put up at Wuch'ang, to concentrate lead and zinc ores, capable of working 75 tons of ore daily. The iron mines at Ta-yeh shipped 50,000 tons of ore (2,000 tons more than in 1902) to Japan, and, as the ironworks at Hanyang increased their output of pig iron from 75 to 120 tons a day, they must have been supplied with 30,000 additional tons of ore and limestone. In return for a loan of 3,000,000 yen at 6 per cent., these mines have now been mortgaged to a Japanese syndicate for a period of 30 years. A Japanese engineer is to be engaged, and the Imperial Iron Foundry undertakes to purchase 70,000 to 100,000 tons of ore annually at a price which, from now till August 1915, shall be at the rate of 3 gold yen per ton for first-class ore and 2 yen 20 sen for second-class.

At the end of 1902 the Provincial Government granted exclusive mining rights in the north-west of Fukien to certain Chinese and French concessionnaires, and a French mining engineer of high repute, who has been prospecting there during 1903, has obtained a careful survey of the gold-fields in the Shao-wu Prefecture. These are described as very valuble and worth working, and it is proposed to form a company with a capital of 1,250,000 dols. to commence operations.

XIV.—TANNING; LEATHER; GLUE, Etc.

Lentisk Leaves in Tunis.

Foreign Office Annual Series, No. 3295.

The lentisk tree resembles a small shrub, grows wild, is very abundant in the whole Regency and produces a small, oval, thin, green leaf, which is gathered by the natives and brought to the market. Its prices in Tunis vary from 8 to 9 frs. per 100 kilos., or 80 to 90 frs. per metric ton. This includes the price of sacks in which the leaves are exported. The freight to the United Kingdom averages from 12*s.* to 15*s.* per ton. The lentisk leaves alone are not a powerful colouring agent, and this necessitates their mixture with sumac leaves, which are chiefly imported from Sicily. The lentisk leaves are said to contain about 10 to 12 per cent. of tannin, and the sumac from 40 per cent. upwards. British firms seem to prefer the leaves ground, so that most of the quantity intended for the United Kingdom is shipped to Italy and thence re-shipped in the ground state.

The exports of lentisk leaves were, during 1901, 3865 tons (value 7435*l.*); 1902, 4126 tons (value 7263*l.*); 1903, 7307 tons (value 16,421*l.*). The quantities coming to England are increasing, having been 251 tons in 1901, 364 tons in 1902, and 752 tons in 1903.

XVII.—BREWING, WINES, SPIRITS, Etc.

Spirit; Imports and Consumption of Foreign and Colonial —— in Great Britain.

47th Report of Commissioners of Inland Revenue.

The following table gives the imports and consumption of foreign and colonial spirits in Great Britain during the last three financial years:—

Year.	——	Consumption.	Total Imports.
		Proof Galls.	Proof Galls.
1901-2	Not for methylating ...	10,536,809	12,418,057
	For methylating.......	627,410	
1902-3	Not for methylating ...	10,723,837	13,130,182
	For methylating.......	1,212,001	
1903-4	Not for methylating ...	8,116,120	9,959,864
	For methylating.......	334,110	

XVIII. B.—SANITATION.

Gaseous Poisoning: Home Office Memorandum.

The following memorandum, "As to the Use of Water Gas and other Gases in Factories," was issued on Oct. 3 by the Chief Inspector of Factories:—

Carbonic Oxide Poisoning.—In recent years there has been great extension of the manufacture and use of water gas and other gases of a similar nature (Dowson gas, Mond gas, power gas, producer gas, blast furnace gas, &c.) for heating furnaces and boilers in factories, driving gas engines, welding, and many other industrial purposes. The particular danger associated with all these gases is that of poisoning by carbonic oxide (carbon monoxide, CO), which is also a constituent of ordinary coal gas. But whereas the proportion in coal gas varies from 4 to 12 per cent., in carburetted water gas it reaches 30 per cent., and in uncarburetted water gas 50 per cent. The other gases named above usually contain from 10 to 25 per cent.

The use of these gases was the subject of an enquiry in 1899 by a Departmental Committee,* who recommended in their report that the manufacture and distribution for heating and lighting purposes of any poisonous gas which does not contain a distinct and pungent smell should be prohibited, and that regulations should be made limiting the proportion of carbonic oxide. In recent Acts authorising companies and local authorities to manufacture and supply Mond or similar gas for motive or heating purposes, it is required that (1) the quantity of carbonic oxide in the gas shall be limited to 14 per cent.; and (2) the gas shall be strongly scented. It is made the duty of H.M. Inspectors of Factories to enforce these provisions as regards factories and workshops to which the gas is distributed.

The annual reports of the Factory Department during the five years 1899 to 1903 contain references to at least 51 cases, including 17 deaths, of poisoning by carbonic oxide on manufacturing premises: 43 were due to one or other of the gases named above. These casualties were traced to several causes, among which may be mentioned:—(1) leakage from joints or taps in pipes or flues conveying gas; (2) gradual escape of the gas into a confined atmosphere, as into a small engine-room or the siphon-pit of the Dowson apparatus; (3) cleaning of tanks or flues before a sufficient time has been allowed for the gas to escape; (4) underground situation of flues; (5) inodorous nature of the gas; (6) ignorance of the danger from the gas and of the earliest symptoms produced by it; (7) working alone; (8) lack of rescue appliances; (9) incomplete combustion of gas in defective gas ironing machines.

Carbonic oxide poisoning may occur in other ways without inhalation of the particular gases named. Thus danger of this kind may arise in laundries from the use of gas irons, and in workrooms from defective gas fittings and from gas stoves, especially when no provision is made for the products of combustion to be carried away by a flue or chimney. The absence of a chimney in a room greatly increases the risk. Carbonic oxide is found also in lime kilns, cement works, and where braziers and coke fires are used in confined spaces.

Symptoms of carbonic oxide poisoning begin with throbbing of the blood vessels of the head, giddiness, palpitation of the heart, and weakness of the limbs. These become greatly aggravated after any exertion. Owing to their insidious onset and the cumulative effect of the gas, the weakness of the limbs may come on without attracting notice, so that the person affected is unable to make good his escape from the poisonous atmosphere.

Headache, anæmia, and defective nutrition may result from the long continued breathing of the gas in amount too small to produce immediate effects, such as might occur from defective gas fittings in work rooms.

The appropriate remedies for poisoning by carbonic oxide are—fresh air, artificial respiration, administration of oxygen, and the application of warmth.

Preventive measures.—The precautionary measures to be considered must vary somewhat according to the different manner in which the gas is manufactured and used in one and another factory, but the following are of general application:—

(1) Notices should be posted up stating the deadly nature of the gas, the symptoms produced by its inhalation, and the best means of rendering aid to those who are "gassed."

(2) Persons in charge of any engine worked by the gas, or of any apparatus in which it is stored, or otherwise exposed to risk of inhaling carbonic oxide, should be free from any disease of the heart or lungs. Employers would do well to cause such persons to be examined and certified by a medical man.

(3) No engine in which the gas is used should be in a confined space.

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* Report of Water Gas Committee, 1899, on the Manufacture and Use of Gases containing a large proportion of Carbonic Oxide. C. 9164. Eyre and Spottiswoode. Price 1*s.* 2*d.*, by post 1*s.* 5*d.*

(4) A competent and responsible person should, at stated short intervals, inspect all valves and connections, to see that there is no escape of gas; and a signed record with the dates of such inspections should be kept.

(5) The openings giving access to any part of the gas circuit should be few, and in positions as safe as possible, and opened only in cases of real need, and by responsible persons.

(6) No workman should enter, or approach when opened, the holder or other part of the gas circuit until the gas has been well flushed out by fresh air.

(7) A cylinder of compressed oxygen, fitted with a piece of rubber gas-tubing and a mouthpiece, should be kept in constant readiness. Such cylinders can be obtained fitted also with a reducing valve.

(8) Medical aid should be summoned immediately, but in view of the importance of losing no time in commencing treatment, the workmen employed should be instructed by a medical man in the manner of administering the oxygen and of performing artificial respiration. They should be especially warned of the danger of exposing the patient to cold.

Respirators are of no avail as a protection against carbonic oxide poisoning.

When, for purposes of rescue, it becomes necessary to enter an atmosphere charged with the gas, the rescuer must protect himself by tying a rope securely round his waist, the free end being held by persons outside, or, preferably, by the use of one or other of the special rescue appliances designed for such work. The principle underlying them is that the rescuer is made to breathe air, or a mixture of air and oxygen, which renders him independent of the poisonous atmosphere immediately surrounding him. Reference to such appliances, which are now kept in many chemical works, &c., will be found in the annual report of the Chief Inspector of Factories for the year 1895,* p. 47, and for the year 1896,† p. 31.

In towns where the public gas supply is largely charged with water-gas, attention to gas fittings in factories and workshops becomes a matter of increased moment.

The following notice, which has been drawn up by the Power Gas Corporation, Ltd., in consultation with the Medical Inspector of Factories, to be posted up near the place where danger arises, may serve as a model:—

Danger of Gassing.—Breathing of producer gas should be avoided. It is dangerous when breathed in quantity.

The first symptoms produced by breathing the gas are giddiness, weakness in the legs, and palpitation of the heart.

If a man feels these symptoms, he should at once move into fresh warm air, when, in slight cases, they will quickly disappear.

Exposure to cold should be avoided, as it aggravates the symptoms.

A man should not walk home too soon after recovery, as muscular exertion, when affected by the gas, is to be avoided.

If a man should be found insensible or seriously ill from the gas, he should at once be removed into fresh warm air, and immediate information be sent to the oxygen administrator, a medical man being sent for at the same time.

No man should work alone on any work which would be likely to involve exposure to the gas. Should the nature of the work cause the man to enter a culvert or hole, he should have a rope tied securely round his waist, held at the other end by his mate standing outside.

Use of the Oxygen Cylinder.—The cylinder should be provided with a lever key, nipple and union, together with a rubber tube at the end of which is a mouthpiece. It is also advisable to have a small pressure gauge attached to the cylinder, so that loss of oxygen may be observed and the cylinder kept in working order.

Open the valve gradually by tapping the lever key (fully extended) with the wrist until the oxygen flows in a gentle stream from the mouthpiece in the patient's mouth, and allow the oxygen to be breathed until relief is obtained. The lips should not be closed round the mouthpiece, as it is important to allow free egress for surplus oxygen. The nostrils should be closed during inspiration or inflation of the lungs, and opened during expiration or deflation of the lungs, so that the oxygen may be inhaled as pure as possible through the mouth.

If the teeth are set, close the lips and one nostril. Let the conical end of the mouthpiece slightly enter the other nostril during inspiration and remove it for expiration.

Artificial Respiration.—Artificial respiration is sometimes necessary, in addition to the oxygen inhalation, if the oxygen does not appear to act quickly.

Place the patient on his back, slightly raising the shoulders with a folded coat; remove everything tight about the chest and neck; draw the tongue forward and maintain it in that position. Grasp the arms just above the elbows, and draw them steadily above the head, keeping them on the stretch for two seconds and then folding them and pressing them against the chest for the same length of time. Repeat these movements about 15 times a minute for at least half an hour, or until natural breathing has been initiated, when the oxygen inhalation alone will suffice.

After recovery, oxygen inhalation at intervals should be continued as desired.

Further detail may be needed in connection with particular branches of industry. Thus, in consequence of the constant danger of carbonic oxide poisoning in cement works, the Associated Portland Cement Manufacturers (1900), Ltd., have adopted the following notice, in addition to somewhat similar instructions to those given above:—

"Regular inspection of kilns must be made on opening after being burnt off, to see that they are safe for men to work in.

"Under normal conditions the kiln is partly and sometimes entirely drawn before the chamber is cool enough to enter to clear for re-loading, and inspection must cover safety, not only as to heat, but as to gases. The eye in front of kiln and back eye of chamber must be opened when drawing is commenced, and entrance to a chamber must be made cautiously. Should there be the slightest indication of gas, a paper torch must be thrown into the kiln and seen to burn out properly before work therein is commenced. If after several attempts it is clearly shown that a paper torch will not burn freely, the men must not be allowed to enter, and the matter must be at once reported to the manager. This applies more particularly where there is a kiln burning next to one that is being drawn, but in any case the dampers of the kiln being drawn must be down tight, and precautions taken generally to see that fumes from a burning kiln on the same flue cannot get back into a kiln in which men are at work, and this applies not only to the work of clearing or drawing, but to repair or any kind of work done in or about kilns.

"In case of a kiln which has lain cold for a long period, all the above-named precautions must be observed, and, in addition, before men enter the pan or chamber, the drawing eye of the kiln must be opened, and thoroughly freed below so that the air may pass into the charge. Employees are especially warned against adopting the means employed by many persons ignorant of the first principles of resuscitation, *viz.*, placing men on their faces with mouth over a hole in the ground. All such means are strictly forbidden. The administration of stimulants in any form is most dangerous, and is also strictly forbidden."

XX.—FINE CHEMICALS, Etc.

Quinine, Italian.

Chem. and Druggist, *Oct.* 1, 1904.

The Italian Government are now making quinine dihydrochloride as well as hydrochloride, sulphate, and disulphate. The State sales of quinine amounted to 8,000 kilos. in 1903, with a net profit of 180,000 lire, against 3,000 kilos. in 1902.

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* Annual Report of Chief Inspector of Factories, Part I. C. 8067. Price 5*s.* 1*d.*, by post 5*s.* 5*d.*

† Annual Report of Chief Inspector of Factories, 1896. C. 8561. Price 5*s.* 1*d.*, by post 5*s.* 6*d.*

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 21,394. Stark. Method and apparatus for varying the temperature of fluids. Oct. 5.
,, 21,418. Newton. Filters. Oct. 6.
,, 21,458. Mitchell. Centrifugal apparatus for separating liquids from steam or other vapours or gases. Oct. 6.
,, 21,469. Walker. Drying machines. Oct. 6.
,, 21,644. Howatson and Boby. Filters. Oct. 8.
,, 21,775. Marton. *See under* II.
,, 21,945. Black. Means for and method of filtering liquids. Oct. 12.
,, 22,267. Szek. *See under* II.
[C.S.] 24,931 (1993). Huillard. Apparatus for drying pasty and fluid substances. Oct. 12.
,, 26,575 (1903). Arnold. *See under* XXII.
,, 28,279 (1903). Samuelson and Hawdon. Blast furnaces. Oct. 19.
2291 (1904). Pfeiffer. Method of and apparatus for evacuating air. Oct. 19.
,, 12,541 (1904). Montlaur. *See under* XI.

II.—FUEL, GAS, AND LIGHT.

[A.] 21,317. Payens. Plants for making water-gas. [Ger. Appl., Oct. 6, 1903].* Oct. 4.
,, 21,318. Neuman. Combined double gas producers and steam generators for producing water-gas and producer gas, and generating steam by the heat of such gases. [Ger. Appl., Oct. 20, 1903.]* Oct. 4.
,, 21,408. Perrier. Production of a combustible gas obtained by the combination of compressed air with petroleum. Oct. 5.
,, 21,494. Lion. Means for utilising naphthalene vapours for producing heat and motive power. [Fr. Appl., Oct. 7, 1903].* Oct. 6.
,, 21,538. Sablin. Apparatus for cleaning blast furnace and like gases. Oct. 7.
,, 21,676. Carolan (Gen. Electric Co.). Electrodes specially applicable to electric arc lamps. Oct. 8.
,, 21,677. Carolan (Gen. Electric Co.). Electrodes specially applicable to electric arc lamps. Oct. 8.
,, 21,755. Márton. Manufacture of fuel and other briquettes. Oct. 10.
,, 21,790. Goode, Mitchell, and The Briquette Co., Ltd. Composition for briquetting. Oct. 10.
,, 22,002. Hennebutte. Manufacture of coke. Oct. 12.
,, 22,050. Ransford (Yacono). Treating smoke and apparatus therefor. Oct. 13.
,, 22,092. Robson. Gas producers.* Oct. 14.
,, 22,267. Szek. Manufacture of briquettes. Oct. 15.
[C.S.] 21,316 (1903). Goode, Mitchell, and Oakley. Binding material for coal dust or other finely-divided substances. Oct. 12.
,, 23,771 (1903). Lymn. Gas-testing apparatus. Oct. 12.
,, 17,712 (1904). Nash. Gas producers. Oct. 12.
[C.S.] 18,364 (1904). Verdier and Teulon. Gas retorts. Oct. 12.
,, 18,487 (1904). Junkers. Method of and apparatus for determining the heating value of gaseous and liquid fuels. Oct. 12.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 21,494. Lion. *See under* II.
,, 22.238. Koellner. *See under* XII.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 21,638. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters and intermediate products. Oct. 8.
,, 21 856. Cain. Manufacture of diazo compounds and of azo colouring matters therefrom. Oct. 11.
[C.S.] 26,700 (1903). Naef and Levinstein. Manufacture of new sulphurised dyestuffs. Oct. 19.
,, 28,563 (1903). Newton (Bayer and Co.). Manufacture of new azo colouring matters and of colour lakes therefrom. Oct. 12.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 21,397. Cadgène. Dyeing materials in the piece.* Oct. 5.
,, 21,634. Könitzer. Production of oxidation black on animal fibres, mixtures of animal and vegetable fibres, and fabrics made from the same.* Oct. 8.
,, 21,793. Hofmann. Machines for printing yarn in several colours.* Oct. 10.
,, 21,822. Markus and The Barnwell Machine Co., Ltd. Machine for coating fabrics with finely comminuted materials. Oct. 11.
,, 21,934. Barnes. Warp sizing and drying machinery. Oct. 12.
,, 21.988. Imray (Meister, Lucius, und Brüning). Manufacture of silk-like threads and films. Oct. 12.
,, 22,098. Davies. Production of ornamental patterns or effects on velvets, velveteens, and other pile fabrics. Oct. 14.
[C.S.] 20,959 (1903). Naeyer. Apparatus for dyeing, bleaching, degreasing, and mercerising textile materials. Oct. 12.
,, 21.595 (1903). Mather. Fabric printing machinery. Oct. 19.
,, 25,460 (1903). Donisthorpe, White, and Ellis. Dyeing of yarns and fabrics produced therefrom. Oct. 19.
,, 25,611 (1903). Donisthorpe and White. Production of parti-coloured yarns. Oct. 19.
,, 26,521 (1903). Wakefield. Bleaching of textile fabrics and fibres. Oct. 12.
,, 27,202 (1903). Velvril Co., Ltd., and Howkins. Spreading machine for coating fabrics, &c. Oct. 19.
,, 13,178 (1904). Smith. Multiple-ply woven fabrics and process for treating the same. Oct. 19.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 21,387. Jaubert. Preparation of substances containing easily liberated oxygen. [Fr. Appl., Oct. 14, 1903.]* Oct. 5.
,, 21,393. Souheur. Preparation of briquettes of arsenious acid. [Fr. Appl., Oct. 6, 1903.]* Oct. 5.
,, 22,004. Johnson (Deutsche Gold und Silber-Scheid-Anstalt vorm. Rössler). Manufacture of sodium perborate. Oct. 12.

[A.] 22,216. Hall and Anson. Separating oxygen from nitrogen. Oct. 15.

„ 22,228. Craig. Apparatus for manufacturing and extracting ozone from atmospheric air. Oct. 15.

[C.S.] 19,196 (1903). Parker. Production of sodium and potassium. Oct. 12.

„ 21,382 (1903). Brookes (Chem. Werke Hansa). *See under* XX.

„ 21,392 (1903). Schulze. Manufacture of porous barium oxide. Oct. 12.

„ 25,972 (1903). Atkins, and Oxychlorides, Ltd. Means of preserving the strength and keeping powers of solutions of alkaline chlorides and oxychlorides. Oct. 19.

„ 26,996 (1903). Davis. Constraction of ammonia stills. Oct. 19.

„ 6846 (1904). Lake (Soc. Anon. Ing. L. Vogel per la fabr. di concimi chimici). Manufacture of sulphuric acid. Oct. 19.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 21,395. Stark. Ceramic products. Oct. 5.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 21,232. Reavell. Manufacture of artificial stone.* Oct. 4.

„ 22,023. Caddick and Oliver. Method of making building materials. Oct. 13.

„ 22,056. Castle. Manufacture of cement. Oct. 13.

„ 22,169. Perkin, and Whipp Bros. and Todd, Ltd. Treatment of wood for rendering it fireproof. Oct. 14.

[C.S.] 21,316 (1903). Goode, Mitchell, and Oakley. *See under* II.

„ 21,578 (1903). Reichel. Method of preserving wood. Oct. 19.

„ 22,042 (1903). Weaver. Paving blocks made from towns' refuse. Oct. 19.

„ 15,142 (1904). Muller. Manufacture of bricks and products with a facing of carborundum. Oct. 12.

„ 15,176 (1904). Steenbock. Manufacture of vitreous cement. Oct. 19.

X.—METALLURGICAL.

[A.] 21,238. Wild. Method for extracting precious metals from telluride and sulphotelluride ores, tailings, concentrates, and the like. Oct. 4.

„ 21,322. Strecker and Strecker. *See under* XI.

„ 21,566. Cowper-Coles, and The Metals Corporation, Ltd. *See under* XI.

„ 21,657. Cokayne (Zamora). Recovery of copper from its ores, and apparatus therefor. Oct. 8.

„ 21,661. Utehmann. Means for protecting copper from destruction by sea water. [Ger. Appl., Oct. 10, 1903.]* Oct. 8.

„ 21,669. Quennell (Miller). Treatment of refractory ores. Oct. 8.

„ 21,766. Siemens und Halske Act.-Ges. Process for purifying tantalum metal. [Ger. Appl., Oct. 15, 1903.]* Oct. 10.

„ 21,768. Sayer and Spiers. Extraction and recovery of gold. Oct. 10.

„ 22,133. Atkinson. Treating ores. Oct. 14.

„ 22,195. Beyer. Hardening or tempering iron or steel. Oct. 15.

[C.S.] 21,287 (1903). Dejey. Process for engraving and etching metal. Oct. 12.

„ 26,391 (1903). Ogle, and Rapid Cyanide Treatment, Ltd. Extraction of metals from their ores. Oct. 19.

[C.S.] 1767 (1904). Ganelin, and Accumulatoren Fabr., A.-G. Process for extracting metals, such as lead and silver, from ores. Oct. 19.

„ 16,396 (1904). Abel (Siemens und Halske A.-G.). *See under* XI.

„ 18,568 (1904). Herzog. Composition for uniting or soldering cast iron. Oct. 10.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 21,211. Kieseritzky. Regenerating negative accumulator plates of diminished capacity and avoiding the diminution in capacity of new plates. Oct. 3.

„ 21,310. Moseley. Smelting furnaces and electric stoves. Oct. 4.

„ 21,322. Strecker and Strecker. Etching metal plates by the aid of electrolysis.* Oct. 4.

„ 21,402. Jungner. Electrodes for accumulators with invariable electrolyte. [Appl. in Sweden, Oct. 7, 1903.*] Oct. 5.

„ 21,403. Jungner. Method of increasing the activity in electrode masses of badly conductive metallic oxides or hydrates in accumulators with invariable electrolyte. [Appl. in Sweden, Oct. 31, 1903.*] Oct. 5.

„ 21,553. Strickland. Galvanic dry cells. Oct. 7.

„ 21,562. Koopman (Townsend). Electrolytic method of producing white lead. Oct. 7.

„ 21,566. Cowper-Coles, and The Metals Corporation, Ltd. Electro-deposition of copper and other metals. Oct. 7.

„ 21,672. Lake (Soc. Anon. la Carbone). Electric batteries. Oct. 8.

„ 21,894. Gregory. Regenerative dry batteries.* Oct. 11.

„ 21,911. Narino. Electric batteries, electrolytic apparatus, &c. Oct. 11.

„ 21,913. Ziegenberg. Manufacture of galvanic cells.* Oct. 11.

„ 22,210. Stead. Dry voltaic cells. Oct. 15.

[C.S.] 24,472 (1903). Ruhstrat and Grimmer. Electric furnaces. Oct. 12.

„ 8365 (1904). Fairweather (Vesta Storage Battery Co.). Storage batteries. Oct. 19.

„ 12,541 (1904). Montlaur. Production of chemical reactions in gases and vapours by electric discharges. Oct. 12.

„ 14,059 (1904). Potthoff. Apparatus for electro-galvanising. Oct. 12.

„ 16,396 (1904). Abel (Siemens and Halske Act.-Ges.). Method of producing zinc from sulphate solutions by electrolysis. Oct. 19.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 21,514. Seidler and Paul. Process for deodorising fish oils, train oils, and products of similar origin. Oct. 7.

„ 21,596. Bedford, Bedford, and Crowther. Process and apparatus for the preparation of soap. Oct. 8.

„ 22,238. Koellner. Apparatus for purifying oil and the like.* Oct. 15.

[C.S.] 27,019 (1903). Powell. Manufacture of fancy soaps. Oct. 12.

„ 16,836 (1904). Riviere. Obtaining glycerine and other products from distillers' wash and other industrial liquids. Oct. 19.

„ 17,866 (1904). Lausen. Method of rendering plastic substances of fatty nature that are hard at ordinary temperatures. Oct. 19.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—Pigments, Paints.

[A.] 21,562. Koopman (Townsend). *See under* XI.

[C.S.] 26,951 (1903). Rosenhain. Ink. Oct. 12.

,, 28,563 (1903). Newton (Bayer and Co). *See under* IV.

(B.)—Resins, Varnishes.

[A.] 21,196. Kronstein. Process for treating varnishes, lacquers or the like to make them dry quickly. Oct. 3.

(C.)—India-Rubber.

[A.] 21,234. Betty. *See under* XIV.

,, 21,899. Frost. Vulcanising apparatus. Oct. 11.

XIV.—TANNING; LEATHER, GLUE, SIZE, Etc.

[A.] 21,234. Betty. Leather and rubber waterproof and preserver. Oct. 4.

,, 21,865. Hatmaker. *See under* XVIII. A.

[C.S.] 18,691 (1904). Jerrett, Graham, and Blair. Leather-dressing composition. Oct. 12.

XV.—MANURES, Etc.

[C.S.] 19,068 (1904). Jenkner, Jenkner, and Pleyl. *See under* XVIII. C.

XVI.—SUGAR, STARCH, GUM, Etc.

[A.] 21,636. Youles and Nightingale. Method of and apparatus for the production of caramel. Oct. 8.

,, 21,865. Hatmaker. *See under* XVIII. A.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 21,380. Friswell. The maturing of potable spirituous liquids. Oct. 5.

,, 21,389. Hewer. The process of brewing. Oct. 5.

[C.S.] 28,630 (1903). Brackenbury. Malt kilns. Oct. 12.

,, 16,836 (1904). Riviere. *See under* XII.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(A.)—Foods.

[A.] 21,549. Heritte. Preservation of organic substances. Oct. 7.

,, 21,865. Hatmaker. Process of obtaining milk sugar and casein from milk. Oct. 11.

,, 21,866. Hatmaker. Clotted milk, cheese, and cheese making. Oct. 11.

,, 22,030. Posternak. Production of soluble earthy-alkaline and metallic salts of the organic phosphorus compound contained in vegetable foodstuffs.* Oct. 13.

[C.S.] 12,113 (1904). Schröder. Sterilisation of food and other substances. Oct. 19.

,, 18,441 (1904). Lake (Belmont). Manufacture of coffee substitutes. Oct. 12.

(B.)—Sanitation; Water Purification.

[A.] 22,215. Fiddian. Apparatus for use in distributing liquid sewage or sewage effluent on a filter bed. Oct. 15.

,, 22,235. Wicks and Dodd. Distribution of sewage effluent or other liquids over bacteria or filter beds.* Oct. 15.

[C.S.] 22,042 (1903). Weaver. *See under* IX.

,, 23,837 (1903). Declercq. Apparatus for purifying water. Oct. 12.

,, 24,838 (1903). Alliott and Scott-Moncrieff. Apparatus for distributing sewage and other liquid. Oct. 12.

,, 25,480 (1903). Barwise. Filtering and purifying sewage. Oct. 19.

(C.)—Disinfectants.

[C.S.] 17,607 (1904). Endemann. Antiseptic preparations, and process for producing the same. Oct. 12.

,, 19,068 (1904). Jenkner, Jenkner, and Pleyl. Insect killer adapted for use as a manure. Oct. 19.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 22,179. Perkins. Manufacture of paper for decorative purposes.* Oct. 14.

,, 22,245. Didier. Manufacture and application of celluloid paste in imitation of horn, tortoiseshell, ivory, &c. [Fr. Appl., Nov. 3, 1903.]* Oct. 15.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 22,064. Meister, Lucius und Brüning. Manufacture of phenylmethylamidochloropyrazole. [German Appl., Nov. 11, 1903.]* Oct. 13.

,, 22,126. Merck. Preparation of pyrimidines. [German Appl., Jan. 28, 1904].* Oct. 14.

,, 22,127. Merck. Preparation of pyrimidines. [German Appl., Jan. 28, 1904.]* Oct. 14.

,, 22,128. Merck. Preparation of pyrimidines. [German Appl., Nov. 14, 1903.]* Oct. 14.

,, 22,129. Merck. Preparation of pyrimidines. [German Appl., Nov. 12, 1903.]* Oct. 14.

[C.S.] 21,382 (1903). Brookes (Chem. Werke Hansa). Manufacture of soluble compounds containing iron and arsenic. Oct. 12.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 21,208. Brasseur. Carbon transfer paper. Oct. 3.

,, 21,210. Brasseur. Polychrome photographs. Oct. 3.

[C.S.] 18,183 (1904). Gaedicke. Production of silver emulsions for use in photography. Oct. 12.

,, 18,890 (1904). Garainow-Trauttenberg and Fabian. Production of photographic paper and the like. Oct. 12.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 21,204. Soc. de la Poudre Peigne et des Brevets J. Luciani. Manufacture of gunpowder. [Fr. Appl., Feb. 17, 1904.]* Oct. 3.

[C.S.] 26,575 (1903). Arnold. Apparatus for weighing substances such as nitroglycerine. Oct. 12.

* * *

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Notices.

ST. LOUIS EXHIBITION AWARDS.

The following is a list of the awards at the St. Louis International Exhibition in Applied Chemistry, Electro-Chemistry, Metallurgy, and kindred industries. These effectively demonstrate the success of this country's participation in the enterprise, and are a proof of the general excellence of the British Exhibits.

The total number of Grand Prizes gained by Great Britain is 121, while 238 Gold Medals, 162 Silver Medals, and 132 Bronze Medals have been awarded to British Exhibitors, making 653 awards in all.

Group 20.—Medicine and Surgery.—Grand Prize : Wellecme Physiological Research Laboratories; Burroughs, Wellcome, and Co. *Bronze Medal :* Joseph W. Lovibond; John J. Griffin and Sons (Limited). *Awards to Collaborators.—Gold Medal :* Dr. Walter Dowson (Wellcome Physiological Research Laboratories). *Silver Medal :* A. G. Vernon Harcourt (John J. Griffin and Sons (Limited).

Group 23.—Chemical and Pharmaceutical Arts.—Grand Prize : Low Temperature Research Exhibit of the British Royal Commission; British Cyanides Company (Limited); Burroughs, Wellcome, and Co.; Edward Cook and Co. (Limited); Doulton and Co. (Limited); Joseph Crosfield and Sons (Limited); J. C. and J. Field (Limited); Evans, Sons, Lescher, and Webb (Limited); Gas Light and Coke Company; Hopkin and Williams (Limited), and Howards and Sons (Limited); Levinstein (Limited); Nobel's Explosives Company (Limited), and The Birmingham Metal and Munitions Company; Price's Patent Candle Company (Limited); Professor Sir William Ramsay, K.C.B., D.Sc., LL.D., F.R.S.; United Alkali Company (Limited); Peter Spence and Sons (Limited). *Gold Medal :* Allen and Hanburys (Limited); Stafford Allen and Sons (Limited); Anglo-Sicilian Sulphur Company (Limited); Baird and Tatlock (Limited) (London); Brooke, Simpson, and Spiller (Limited); Brunner, Mond, and Co. (Limited); Burmah Oil Company (Limited); the Cassel Gold Extracting Company (Limited); The Castner-Kellner Alkali Company (Limited); Chance and Hunt (Limited); Spencer Chapman and Messel (Limited); Corbyn, Stacey, and Co. (Limited); John J. Griffin and Sons (Limited); Hemingway and Co., and Hemingway's London Purple Company (Limited); McDougall Brothers; May and Baker (Limited); Dr. Ludwig Mond, F.R.S.; T. Morson and Son; The Owens College; James Pain and Sons; Royal College of Science, London; South Metropolitan Gas Company; Townson and Mercer; Thomas Tyrer and Co. (Limited); John and James White; Wood and Bedford. *Silver Medal :* Assam Oil Company (Limited); Lewis Berger and Sons (Limited); A. Boake, Roberts, and Co. (Limited); Walter Carson and Sons; J. M. Collett and Co.; R. and J. Garroway; The Glasgow and West of Scotland Technical College; Professor W. N. Hartley, D.Sc., F.R.S.; F. Kendall and Son (Limited); John Bennet Lawes and Co. (Limited); Joseph W. Lovibond; Dr. Allan Macfadyen; William Martindale: the Mond Nickel Company (Limited): Morris, Little, and Son (Limited); B. E. R. Newlands, F.I.C., F.C.S.; Newton, Chambers, and Co. (Limited); Parkin, Ness, and Co.; W. Pearce and Sons (Limited); Sharon Chemical Company (Limited); Sheppey Glue and Chemical Works (Limited); J. W. Swan, D.Sc., F.R.S., and J. A. Keudall; William Warren (Hooper and Co.). *Bronze Medal :* J. B. Aitken; P. and J. Arnold: John Austen; E. C. C. Baly; Battley and Watts; F. W. Berk and Co. (Limited); The Bone Phosphate and Chemical Company (Limited); Cerebos (1903) (Limited); George Clark and Son (Limited); Cornwall Arsenic Company; H. C. Fairlie and Co.; Daniel Davison; The Grove Chemical Company (Limited): W. H. Francis; W. J. Fraser and Co.; F. C. Hills and Co.; Kemball, Bishop, and Co. (Limited); The Society of Apothecaries of London; Stone and Tinson; John and E. Sturge; Alfred White and Sons. *Awards to Collaborators.—Gold Medal :* Professor Sir James Dewar, M.A., LL.D., D.Sc., F.R.S. (Low Temperature Research Exhibit); T. Wilton (the Gas Light and Coke Company); Dr. Andrew Ross Garrick (the United Alkali Company, Limited). *Silver Medal :* J. E Petavel (Low Temperature Research Exhibit); Dr. Radol Messel (Spencer Chapman and Messel, Limited); Julius Lewkowitsch, Ph.D. *Bronze Medal :* Dr. Carl Langer (th Mond Nickel Company, Limited); C. T. Tyrer (Thomas Tyrer and Co., Limited); Hugh Ramage (Professor W. N. Hartley).

Group 52.—Plant and Processes for Finishing Textiles —Gold Medal : Daniel Lee and Co.; William Liddell an Co. (Limited); John S. Browo and Sons.

Group 68.—Electro-Chemistry.—Gold Medal : Unite Alkali Company (Limited). *Silver Medal :* Sherar Cowper-Coles and Co. (Limited). *Awards to Collaborators.—Silver Medal :* Dr. Andrew Ross Garrick (Unite Alkali Company, Limited).

Group 80.—Fertilisers.—Gold Medal : The Aberdee Comb Works Company (Limited); Sheppey Glue an Chemical Works (Limited). *Silver Medal :* The Grov Chemical Company (Limited).

Group 86.—Equipment and Methods for Preparin Foods.—Grand Prize : Joseph Baker and Sons (Limited) *Gold Medal :* A. Boake, Roberts, and Co. (Limited). I Kendall and Son (Limited).

Group 87.—Farinaceous Products and their Derivative —Gold Medal : Burroughs, Wellcome, and Co. *Bronz Medal :* Joseph Edmunds.

Group 90.—Sugar and Confectionery.—Grand Prize J. A. Sharwood and Co. (Limited); A. Boake, Robert and Co. (Limited); Joseph Edmunds. *Gold Medal :* I P. Seton and Co.; Evans Sons, Lescher, and Web (Limited); F. Kendall and Son (Limited).

Group 95.—Inedible Agricultural Products.—Gran Prize : The Wellcome Chemical Research Laboratorie *Gold Medal :* A. S. Mackertich and Co.

Group 96.—Insects and their Products.—Gold Meda McDougall Brothers.

Group 114.—Appliances for Gathering Wild Crops.— Gold Medal : The Wellcome Chemical Research Laboratories.

Group 118.—Metallurgy.—Grand Prize : Birmingha Metal and Munitions Company. *Gold Medal :* Shera Cowper-Coles and Co. (Limited); the Lilleshall Com pany (Limited); the Monk Bridge Iron and Steel Compan (Limited); the Farnley Iron Company (Limited). *Sil Medal :* The Anglo-French Nickel Company (Limited Sheepbridge Coal and Iron Company (Limited); Unit Alkali Company (Limited). *Bronze Medal :* Joseph Lovibond.

THE JOURNAL.

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The Secretary is awaiting the receipt of particulars of other photographs taken from time to time.

RARE MINERALS FOR RESEARCH.

Mr. A. B. Frenzel, of 1540, Sherman Avenue, Denver, Colo., U.S.A., Commissioner of Rare Minerals for Colorado at the St. Louis Exposition, and a member of this Society, will give to any member of the Society, for research work, or for demonstrating purposes in any institution of learning, any reasonable quantities of ores containing uranium, vanadium, tungsten, or molybdenum, free on board, Denver, Colorado. Members should communicate direct with Mr. Frenzel.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

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Warnes, A. R., l/o Calcutta; c/o T. W. Willson, 117, Boyson Road, Camberwell Gate, S.E.

Wigg, Chas. E., l/o Merstham; c/o The Hull and Liverpool Red Oxide Co., Peasley Cross, St. Helens, Lancashire. Delete "Electrical Engineer."

Young, Dr. Geo., l/o Sheffield; Lauraville, Bladda, Port Erin, Isle of Man.

Death.

Ekman, C. D., at 23, Pier Road, Gravesend, Kent. Nov. 3.

CHANGES OF STYLE.

His Majesty the King has been pleased to confer the honour of a Baronetcy of the United Kingdom on Michael B. Nairn, Esq., and the honour of Knighthood on Dr. Joseph Wilson Swan, F.R.S.

Annual General Meeting,

NEW YORK, 1901.

PHILADELPHIA, Monday, Sept. 12th.

Reception Committee.

Wm. Weightman, Hon. Chairman.
Samuel P. Sadtler, Chairman.

Theo. Armstrong.
H. R. Baltz.
Daniel Baugh.
Edward T. Beale.
Wm. H. Bower.
Chas. Heber Clark.
Walton Clark.
Pierre S. Du Pont.
Howard B. French.
Thos S. Harrison.
Jas. F. Hope.
Harry W. Jayne.
H. F. Keller.
M. N. Kline.
John B. Lennig.
Robt. W. Lesley.
J. Merritt Matthews.
R. V. Mattison.
Geo. McNeely.
Geo. D. Rosengarten.
Pedro G. Salom.
E. F. Smith.
D. K. Tuttle.
Joseph Wharton.

On reaching Philadelphia at 10.10 a.m. the party was met by a deputation of the committee, accompanied by several ladies, among whom may be mentioned Mrs. Matthews, Mrs. Clark, Miss Sadtler, and Mrs. Rosengarten, and driven to Independence Hall, where they were received by Mr. J. Weaver, the first English-born mayor of Philadelphia, in the famous room where the Declaration of Independence was signed. They were then driven to the University of Pennsylvania, and, after an inspection of the laboratories, &c., were entertained at luncheon by the University authorities in the Howard Houston Hall. This hall is a club-house for the use of the students of the University, and provides a place where all may meet on common ground and have every facility for passing their leisure hours in healthy recreation. The equipment of the hall includes a reading room, furnished with periodicals and newspapers, smoking rooms, billiard and pool tables, bowling alleys, a bath room and a swimming pool, athletic trophy rooms, a large auditorium with grand organ, rooms for the University papers, dark room for photographers, and many others

The University of Pennsylvania, founded in 1740 by the efforts of Benjamin Franklin, has to-day 2700 students, with 275 professors and instructors.

Visits were then paid to the Baldwin Locomotive Works, the Petroleum Refinery, the Varnish Works, and the United States Mint. The New Mint at Philadelphia is the finest building ever constructed for coining purposes. In the numismatic room are gathered for public inspection a valuable collection of the world's representative coins. From the corridors surrounding this department may be seen, from on high, through large plate-glass windows, the workrooms with the work of minting going on. First comes the room where the bullion is received, weighed, and deposited; next, the room of the refiner, where the pure metal is separated out; then the room where the metal is melted, alloyed, and cast into ingots; next, the room of the assayer; then, the room where the metal which has stood the test is rolled into long ribbons, from which the blanks or planchets are stamped; next, the room where the blanks are weighed and adjusted, and where those found to be of legal weight are raised round the edge and cleaned; then, the room where the blanks are stamped into coin; and, finally, the rooms where the coins are weighed counted, and packed into bags.

The party then drove through Fairmount Park, passing by the magnificent Washington statue and the site of the great exhibition, some of the pavilions of which still serve as boat clubs on the bank of the Schuylkill. Thence up the Wissahickon Drive and past the celebrated Fish House. The piece of marsh land on which the Fish House stands, some two acres in extent, is known as the "State in Schuylkill," and possesses a governor and legislature.

Dr. Samuel P. Sadtler, at a banquet—or second annual dinner—given at the Germantown Cricket Club, said, in proposing the health of the President, that Philadelphia chemists, whether manufacturers or professional men, felt a peculiar pleasure in welcoming their fellow members of the Society. They were glad to have that opportunity of showing that they appreciated the importance of the object for which their Society was founded, *viz.*, the exchange of information and views on the application of chemistry to the manufacturing arts by means of sectional meetings and the publication of a journal. They were also delighted to meet face to face the distinguished representatives of chemical science who had honoured them with their presence.

The Society was not one with which Philadelphia had but a recent acquaintance. In the first year of its existence, already, it enrolled several Philadelphians among its members, and when he himself joined it, early in 1884, there were already eight other Philadelphians on the register. Now there were in the city and its suburbs about 60 members of the Society. It was true that they were enrolled each year in the published list of members of the New York Section, but that was only an illustration of the methods of "benevolent assimilation" on the part of their friends in the borough of Manhattan, to which they had become quite accustomed, and did not resent in the least. On the contrary, they had availed themselves of this membership to attend the New York meetings, and the Chemists' Club had always given them a royal welcome.

Turning to the chemical industries of the city, Dr. Sadtler said that the exigencies of the War of the Revolution led to the erection, in 1770, of large saltpetre works in Market Street. The firm of Christopher and Charles Marshall, sons and successors of Charles Marshall, an early druggist and so-called "fighting Quaker of Philadelphia," in 1786 manufactured extensively "muriate of ammonia" and "Glauber's salt." The manufacture of white lead was commenced by Samuel Wetherill, another druggist, about 1789, and rapidly developed. This business is still continued by the Wetherills. John Harrison, a druggist, about 1793, was the first to produce sulphuric acid on a commercial scale, and may be called a leader in the establishment of chemical industries in America. The firm of Farr and Kunzi engaged in the manufacture of sulphuric acid about 1812 and general chemicals in 1818. In 1838 the firm became Farr, Powers, and Weightman, and in 1841 Powers and Weightman. George D. Rosengarten began the manufacture of chemicals under the name of Rosengarten and Zeither in 1822, and the name "Rosengarten and Sons" still continued with one of the sons and several grandsons of the founder still in control. Charles Lennig founded another important firm of chemical manufacturers about 1831. There were twenty-four works within the city engaged in chemical industry, while fifteen were engaged in the preparation of drugs.

In conclusion, Dr. Sadtler stated that Philadelphia was the leading city of the United States for the production of carpets and rugs, woollen goods, hosiery and knit goods, leather, chemicals, and dyeing and finishing textiles. It produced one-eighth of the chemical output of the country. He regretted that the shortness of the Society's stay in Philadelphia would not allow of their visiting many of the industrial establishments of the city. They would, however, receive a warm welcome at a future time when possibly they might have more leisure.

The party then left the club to rejoin the train for Washington.

WASHINGTON, TUESDAY, SEPT. 13TH.

RECEPTION COMMITTEE.

H. W. Wiley, Chairman.

Eugene A. Byrnes.
T. M. Chatard.
David T. Day.
Fred. P. Dewey.
A. W. Dow.
Edwin C. Eckel.
Wm. S. Ferris.
Max Georgii.
John J. Griffin.
W. H. Heileman.
Lyman F. Kebler.
Jas. B. Littlewood.
Chas. E. Munroe.
R. Outwater.
Harry J. Patterson.
E. Richards.
Henry N. Stokes.
Samuel S. Voorhees.

Marcus Benjamin, Secretary.

The Committee is subdivided as follows:—

Executive Committee.

H. W. Wiley, Chairman.

Marcus Benjamin.
Chas. E. Munroe.
Samuel S. Voorhees.

Finance Committee, Washington.

Chas. E. Munroe, Chairman.

T. M. Chatard.
A. W. Dow.

Finance Committee, Baltimore.

H. Burrough, jun.
A. R. L. Dohme.
Chas. Glaser.

Entertainment Committee, Washington.

Samuel S. Voorhees, Chairman.

Fred. P. Dewey.
Eugene A. Byrnes.

Entertainment Committee, Baltimore.

V. G. Bloede.

Press Committee.

Marcus Benjamin.

Ladies' Committee.

Mrs. Chas. E. Munroe.
Mrs. Marcus Benjamin.
Mrs. V. G. Bloede.
Mrs. T. M. Chatard.
Mrs. A. W. Dow.
Mrs. Samuel S. Voorhees.

Assisted by the wives of other members of the local committee.

On reaching Washington, the visiting members and ladi were met at the station by a committee of Washingt members led by Dr. H. W. Wiley, and, after breakfa proceeded to "see Washington" on electric cars, a gui on each describing the points of interest. Then they pr ceeded to Heurich's Brewery, where they were entertained luncheon. Mr. Christian Heurich led the members throu the large building and explained the working of the pla which is an unusually fine one.

The members were then taken to "Cabin John's Bridge seven miles from Georgetown, which forms part of t aqueduct system, and carries two 7-ft. pipes. The brid is 120 ft. in length, and the arch, with a span of 220 ft., w long reputed to be the largest stone arch in existence.

In the evening there was a reception and supper at "Rauscher's," where three couples of negroes, led by a master of the ceremonies, all amateurs, performed a cake-walk.

Wednesday, Sept. 14th.

Wednesday morning was spent in visiting the public buildings. At the Capitol were shown the Senate House and House of Representatives. These occupy wings right and left of the old Senate House, now the Supreme Court Room, and the old House of Representatives, now the National Statuary Hall. The Library of Congress, which may fairly be called the National Library, and contains about a million and a quarter of books, was shown by Dr. Herbert Putnam, the Chief Librarian, assisted by Mr. Bernard Green, C.E., superintendent of buildings and inventor of the bookstands and automatic transporting machinery used in the Library, Mr. Hutchinson, who is in charge of the Reading Room, and fourteen other guides specially detailed by the Chief for this purpose.

The White House, the Smithsonian Institution, the Navy Yard, and the Washington Monument were also visited, and on each occasion there was the same personal courtesy and guidance from the chiefs of Departments, while many things not ordinarily shown were freely placed before the members.

The Navy Yard, with its gun shops, where great lathes perform the turning, boring, and rifling of the steel breech-loading guns of the U.S. Navy, some of which weigh more than sixty tons, and its historic relics and trophies of former wars, was found to be of great interest to many.

The three publications of the Smithsonian Institute, "Contributions to Knowledge," "Miscellaneous Collections" and "Annual Reports" are known wherever science flourishes. Its famous Hodgkins medal and prize of 2000*l.* were bestowed in 1895 on Lord Rayleigh and Sir William Ramsay for their discovery of Argon.

The National Museum, which is under the care of the Secretary of the Smithsonian Institution, occupies a building adjacent to the parent institution, and contains precious relics of famous citizens, notably those of Washington, Lincoln, and Grant. This museum is also particularly rich in specimens illustrating the customs, arts, and industries of the North American Indians and the aborigines of North-western America.

The Bureau of Engraving and Printing is a branch of the Treasury Department, and there were shown the printing of the Government bonds, and the national currency or "greenbacks," as well as the postage and revenue stamps, military, naval, and diplomatic commissions, passports, &c. In this building there are fourteen departments and 1400 employees; each piece of work passes through the hands of thirty different persons.

The Bureau of Chemistry attached to the United States Department of Agriculture is divided into ten sections, according to the nature of the question to be investigated. The *Division of Foods* (chief, W. D. Bigelow) is charged with the inspection and examination of imported foodstuffs, and also the effect of preservatives on nutrition. In addition to these, the analytical methods necessary for the examination of food are studied. The *Division of Tests* (chief, L. W. Page) has for its object the testing of road materials, clays, cements, and concretes. The *Sugar Laboratory*, which is under the personal supervision of Dr. H. W. Wiley, chief of the bureau, is largely occupied with the study of sugar-beets grown in collaboration with the agricultural experiment stations under various conditions. The laboratory is also engaged in controlling the polarisation of imported sugars for dutiable purposes. In the *Dairy Laboratory* samples of dairy produce of every description are analysed. The *Insecticide and Agricultural Water Laboratory* studies the composition and effect of the various insecticides on the market, and examines the irrigation waters of the west and south-west; an examination of the leading mineral waters of the United States is also in progress. The examination of all kinds of medicinal remedies and crude drugs is undertaken in the *Drug Laboratory*, with especial reference to the analytical methods employed for such work. The *Contracts Laboratory* was organised for the purpose of examining all kinds of materials to be purchased by the United States Department of Agriculture. Fertilisers and their effects, and also the constitution of plants are investigated in the *Plant Laboratory*. The *Microchemical Laboratory* is charged with the microscopical and microchemical study of foods, drugs, cattle-food, paper and textiles, miscellaneous agricultural products, &c., especial attention being paid to the histological study of fruits, spices, cereals, starches, &c. Examinations are also made of the urine and blood in connection with the work on the effect of preservatives on nutrition. The *Leather and Paper Laboratory* conducts investigations on tannins, tanning materials, and leather production; also on papers, as regards their fitness for use in various Government departments, and on the raw materials used in paper manufacture. Among other work which has been taken up by the bureau may be mentioned a study on the influence of environment on the composition of certain agricultural products, and an investigation in œnological technology, with especial reference to alcoholic ferments and the composition of fruits and fruit juices and their fermented products.

In the afternoon a party, smaller than it would have been but for the inclemency of the weather, went by electric "trolley car" to visit Mount Vernon, the home of General Washington. This mansion overlooks the Potomac River, and is built of wood, cut and painted to resemble stone.

The visitors were shown the mansion, with its historic relics, by the Superintendent, Mr. Dodge, who explained in detail the significance of each object. With bowed and uncovered heads the visitors stood before the tomb of Washington, thus paying a silent tribute to the worth of this great man. They were much interested in the young tree planted by the British Ambassador by special order of his Majesty, King Edward, to take the place of the one planted by him when as Prince he visited the tomb of Washington in 1864. The tree planted by the young Prince unfortunately died. The domain is well cared for by the "Ladies' Mount Vernon Association."

The party then returned to Washington. In the evening, the visitors were entertained by Mr. and Mrs. V. G. Bloede, of Baltimore, at a vaudeville performance at Chase's theatre. The return to the hotel and the subsequent ride to the railway station were achieved under difficulties, owing to the flooding of the city by a violent thunderstorm.

The Cosmos Club, the science club of Washington, extended courtesies to the gentlemen, while the Washington Club, through the kindness of the Ladies' Committee, extended its privileges to the ladies.

(*To be continued.*)

New York Section.

Meeting held at the Chemists' Club, on Friday, October 21st, 1904.

MR. R. W. MOORE IN THE CHAIR.

CHAIRMAN'S ADDRESS.

CHEMISTRY IN CUSTOMS ADMINISTRATION.

BY RUSSELL W. MOORE.

The science of chemistry has so many ramifications in the industry of a country that many of the spheres in which its influence is felt receive occasional attention only. Thus at times the transportation of chemicals is discussed and valuable facts brought to light, showing that from want of knowledge of the character of various chemicals, many incongruities in freight rates occur. Chemicals as a class are popularly considered dangerous, hence insurance rates are often unnecessarily and sometimes arbitrarily high. Better knowledge will bring about better conditions, but since these matters are but a detail of chemical industry, they will probably never receive any united attention from manufacturers and consumers, but will have to depend largely on occasional effort for improvement. I have chosen as my subject a phase of chemistry which, as far as I can learn, has, in America, never been the subject of either book or pamphlet, and of but one paper. The files of chemical literature are silent; only occasionally, almost lost to chemists in legal reports, are to be found reports of Customs cases in which much chemical evidence is contained, and in which the judicial decision was largely based on the chemical facts established. Nevertheless, chemistry has an important influence on the administration of the United States Customs laws, and without its aid many irregularities and injustices would arise which would seriously be felt by chemical manufacturers and dealers. A few figures will show the great volume of merchandise which is handled in the customs houses of the United States.

The imports amounted, at the close of the fiscal year ending June 30, 1904, to 991,090,978 dols., of which 45·82 per cent. were free of duty. The duties collected amounted to 262,013,079 dols. The value of chemicals, drugs, and dyes imported during the same period was 65,272,176 dols., while oils of all kinds and paints, pigments, and colours amounted to 12,853,461 dols. Of these imports, merchandise of the value of 25,696,934 dols., of which 12,268,535 dols. is dutiable, was again exported to other countries. Of this volume of imports, about 70 per cent. is handled at the port of New York, while other ports constantly refer samples of merchandise to New York for information regarding the proper rate of duty and value.

The part that chemistry plays is to furnish all possible chemical data and facts to arrive at a correct tariff classification and value, and to aid in the collection of the proper amount of duty. A coal-tar dyestuff may be taken as an instance. The tariff assesses no duty on dyestuffs derived from alizarin or anthracene, but places a duty of 30 per cent. on all other coal-tar colours. The reason for this is apparent. Anthracene is not extensively produced in the United States, nor are alizarin dyestuffs, while other coal-tar colours are produced in considerable quantity. New dyestuffs are constantly being introduced, and must be examined chemically to determine their constitution. Often the question is a very narrow one, as in the case of condensation products from anthracene and toluidine. Simpler instances are argols (where the duty is levied according to certain limits of potassium bitartrate), borate of lime (where the percentage of anhydrous boric acid is the basis of the rate of duty), and still wines, which pay 40 cents per gallon if containing 14 per cent. of alcohol, and 50 cents per gallon if more. The function of the chemist is obvious. Of great importance is the assessment of duty on imported raw sugar, which, beginning with a polariscopic test of 75°, levies a duty of 0·035 cent. on each additional degree. This test was applied to sugar valued at 71,409,639 dols. in the year ending June 30, 1904. It must be remembered that the tariff is not a scientific paper, though it makes use of scientific terms, and that tariff distinctions are not necessarily scientific distinctions. Often a very simple examination suffices to determine the tariff description of a chemical, while to thoroughly identify it would be a great labour.

One of the most important cases under the present law hinged on the meaning of the term "derived from alizarin" or "from anthracene" as applied to dyes. The chemical view would include all the numerous derivatives. The position of the Government was, that the word was used in the ordinary sense of obtained or made from alizarin, and such was the final decision of the court.

The variety of samples analysed calls, in the first place, for a number of chemists with differing specialties. This is further required for the reason that in Custom matters one individual must be responsible for the report. No divided responsibility or work is possible, since the report may be used as evidence in a Customs suit, in which case the chemist may be called as a witness. Hence all chemists signing reports are on the same official basis; and a large Customs laboratory is in fact a collection of small laboratories, and not an organisation founded on the principle of division of labour. The most prominent requisite for Customs analyses is rapidity, combined, of course, with reasonable accuracy. Thus volumetric methods are followed whenever the amount of work renders them advantageous. The work bears the same relation to research analysis that journalism bears to literature. It must be clear, definite, and to the point. Problems do, however, arise in which not much aid can be derived from published methods, and research is necessary. Recently a case arose in which the quantitative analysis of a sample of a mixture of three fatty oils was required. These were identified as castor and olive oils and oleic acid. The chemist finally devised a method and reported a result, which the importer admitted was within 2 per cent. of his formula. I cannot refrain from saying that much difficult and laborious work is avoided by the readiness of the importers and manufacturers to furnish the Customs authorities with all necessary facts and data regarding their goods, so that a complicated research is often made a comparatively simple verification. While contests on the construction of the tariff are frequent, contests between Customs chemists and importers' chemists are almost unknown, as I am glad to say that both appear equally anxious to arrive at the truth.

Broadly speaking, a knowledge of chemical technology is of equal value to chemical knowledge in Customs matters; the origin, manufacture, and uses of various articles often determine their dutiable character quite as clearly as their chemical constitution. Here we are indebted to the Journal of the Society of Chemical Industry for a complete compendium of technical information, and all the more valuable for being recent.

When the importer is dissatisfied with the duty levied upon his goods, he can by protest or appeal obtain a new consideration of his case by the Board of General Appraisers. Here any chemical features that may arise are again carefully considered. Samples are again analysed if necessary, and any new chemical facts can be brought out. The Customs chemical report is subjected to scrutiny, and any error which may be detected duly allowed for. From this Board an appeal may be taken to the United States Courts, and frequently the United States district attorney avails himself of the services of the Customs chemist. It will be noted that at every step in this procedure the importer has ample opportunity to present both facts and arguments, and all chemical statements submitted are weighed and examined with care and skill.

Most of the Customs chemical work is performed in the laboratory attached to the office of the United States Appraiser at New York. The strictly chemical work is accomplished by two chemists occupied with metal ores and metallurgical products, one with merchandise containing alcohol, one with miscellaneous articles, including chemicals, fats, oils, paints, and drugs, one in estimating sugar in confectionery, preserved fruits, &c., and two with organic articles, together with a chemist in charge. During the last calendar year 38,751 samples of raw sugar were tested by the polariscope, and 7513 samples were chemically tested. In a note previously published in this Journal, April 30, 1900, I gave a rough classification of the samples received for analysis. The character, as well as the number of samples changes so much from year to year that a classification of this kind has only a temporary value. Nothing but actual experience will give a correct idea of the character of chemical work called for.

A similar rough classification of samples for the first six months of 1903 gives:—Asphalt, 4; chemicals, 174; Chinese wines, 62; coal-tar dyestuffs, 30; coal-tar preparations, 33; condensed milk, 17; confectionery, crackers, &c., 181; drugs, 14; dyewood extracts, 11; earths, stone, coal, and minerals, 52; fats, oils, waxes, and soap, 483; fertilisers, 21; fruit in sugar, 175; fruit in spirits, 23; fruit juice, 197; glycerin, 33; lead bullion and metallurgical products, 128; lead in cables, foil, and sheets, 106; metals and alloys, 193; medicinal preparations, 99; medicinal preparations, alcoholic, 131; miscellaneous, 278; paints and colours, 186; resins, 7; spirits, 27; vinegar, 167; wine, 346; wood-pulp, 332. Total, 3510.

It is not to be understood that samples from every importation of merchandise are tested chemically. The function of the Customs chemist is to supply the necessary knowledge to enable Customs officials to act correctly in cases of doubt or incomplete chemical evidence. The identity of a chemical once established, only occasional tests are required. I do not think that it is an over-statement to say that the Customs revenue is as much indebted to chemistry for the proper collection of duties on many articles as the manufacturer is indebted to his chemist for their production and quality.

While in no sense occupying a judicial position, the customs chemist is often called upon to furnish the facts which point irresistibly to a legal conclusion, and it is not saying too much to state that the chemical evidence in many cases requires to be as carefully weighed by the chemist as the legal evidence. Often judicial decisions are founded directly on the chemist's report. While this places a great responsibility on the chemist, it also furnishes him with a high ideal—to aid in administering the law of his country, not according to any policy, but with all the aid that a noble science can command in the interest of justice and ight.

CONSTANTS OF COCOANUT OIL.

BY N. J. LANE.

—	Method employed.		
	Hubl.	Hanus.	Wijs.
odine value found	8·08	7·68	7·94
odine value calculated on results from "cold ether" solution of lead soap.	7·11	7·00	7·65
odine value calculated on results from "hot ether" solution of lead soap.	7·76	7·94	7·53

Liquid Acids.

—	Volumetric.	Gravimetric.
	Per Cent.	Per Cent.
ead soap treated with cold ether	48·95	34·50
" " " hot ether.	53·45	37·45

—	From Volumetric Determination of Liquid Acids.			From Gravimetric Determination of Liquid Acids.		
	Hubl.	Hanus.	Wijs.	Hubl.	Hanus.	Wijs.
odine value, cold ethereal solution of lead soap.	14·53	14·30	15·63	20·62	20·28	22·17
odine value, hot ethereal solution of lead soap.	14·50	15·10	14·04	20·68	21·16	19·52

In the "cold ether method" the lead soap was digested with cold ether, the solution diluted to 500 c.c. in a specially-made graduated tube, and an aliquot portion drawn off through a filter after the precipitate had settled. In the "hot ether method," the ethereal solution of the lead soaps was boiled before dilution.

Obituary.

HUGH SALVIN PATTINSON, Ph.D.

MEMBER OF THE SOCIETY OF CHEMICAL INDUSTRY, &c.

Hugh Salvin Pattinson, son of Mr. John Pattinson, public analyst for Newcastle-on-Tyne, received his early educational training at the Newcastle College of Physical Science, afterwards proceeding to Zürich, where, in 1877, he studied in the Polytechnikum, under Victor Meyer and G. Lunge, ultimately taking the Ph.D. degree. So enthusiastically did he enter into this course of study and research, that it is feared he overtaxed his strength, and thus, unfortunately, laid the foundation of much subsequent weakness and suffering. Returning to England about the year 1883, he worked for some time in his father's laboratory, afterwards becoming a partner with him. In this position he not only shared in the general work of the firm of J. and H. S. Pattinson, but also acted as joint public analyst with his father for the city of Newcastle and neighbouring towns. He was also, for some years, and so long as his other duties and health would allow, a most effective abstractor for the columns of this Journal. The following are amongst the more important of his scientific and analytical papers:—In conjunction with Dr. W. Michler, of Zürich, "*Zur Kenntniss der Diphenyl- und Ditolylverbindungen*," Ber., 1881, **14**, 2161 *b*; and "*Ueber Tetramethylbenzidin*," Ber., 1884, **17**, 115. Also, in conjunction with his father, "*Determination of Arsenic and Phosphorus in Iron Ores*," this J., 1893, 119; "*Preparation of Samples of Rich Argentiferous Lead for Assay*," this J., 1892, 321; *Determination of Manganese in its Ores and Alloys*," this J., 1891, 333; "*Determination of Phosphorus in Iron*," this J., 1895, 443; and "*Determination of Tin*," this J., 1898, 214. Though enthusiasm in all that he undertook carried him far, yet his work was greatly hampered by his very delicate health, which necessitated at times prolonged periods of total rest and retirement. Amongst friends and more intimate associates alike, his constant cheerfulness in the face of terribly adverse conditions, was not only a continual source of wonder, but also of inspiration. After a few days' illness, he died at his home in Tynemouth on October 26, at the early age of 47.

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I.—PLANT, APPARATUS AND MACHINERY.

English Patents.

Filtering Apparatus. R. Mechwart, Milan. Eng. Pat. 28,525, Dec. 28, 1903. Under Internat. Conv., Jan. 16, 1903.

The filter—which is of the closed type with exchangeable filtering medium, and in which the filtering part is arranged without an outer chamber, and is almost directly impinged upon by the liquid to be filtered—has its filtering medium covered with a thin sheet of filtering paper, pressed close to the surface, in order to protect it from the jet or current of liquid to be filtered, which is under pressure.—W. H. C.

Filtering Apparatus. A. Forbes, Philadelphia. Eng. Pat. 17,772, Aug. 16, 1904.

A number of filtering chambers are arranged vertically around a standard which carries the supply and delivery pipes. Each filtering chamber consists of two hollow cones clamped together, carrying the filtering medium. Means for connecting and disconnecting the chambers with the supply and delivery pipes are provided.—W. H. C.

Drying Apparatus; New or Improved ——. E. Tobler and Rheinische Webstuhl und Appreturmaschinenfabrik G. m. b. H., Dülken, Germany. Eng. Pat. 17,957, Aug. 18, 1904.

The drying chambers, of which there are several, forming sectors of a vertical cylinder, are so arranged that the heated air passes through them successively. The order in which they receive the air current may be altered, either by rotating the body of the cylinder while the cover is fixed, or by rotating the cover and adjusting suitable slides, the general direction of the air current remaining unaltered. —W. H. C.

United States Patents.

Temperature; Means for Obtaining Liquid at a Desired ——. M. Treves, Turin, Italy. U.S. Pat. 771,512, Oct. 4, 1904.

A portion of the liquid is heated and is then mixed with another portion which has not been heated. Means are provided for maintaining the pressure on the liquid, for adjusting the proportions in which the two portions are mixed, for regulating the heat, and for indicating the temperature of the mixture by means of a scale and pointer. —W. H. C.

Condenser. F. J. Weiss, Basle, Switzerland. U.S. Pat. 771,515, Oct. 4, 1904.

Means are provided for exhausting the air of a vacuum condenser independently of the cold water supply which enters its upper part. A trough or series of troughs is arranged in the condenser to catch the water, which is conveyed by a pipe to a tank or series of tanks, and returned, by means of another pipe, to the condenser at a lower level. Thus the same water is used as spray several times.—W. H. C.

Crucible-Furnace and Crucible. G. L. Smith, Newport News, Va. U.S. Pat. 771,675, Oct. 4, 1904.

A crucible having a bottom lateral discharge pipe, clos by a plug at the end next the crucible, is arranged in furnace. The furnace has a spiral passage formed aroun the crucible, and a series of gas burners, disposed tange tially to the crucible. The air fed to the burners is pr heated, by the waste heat, in a heater-box situated in th flue.—W. H. C.

French Patents.

Re-heating of Liquids; Process for the ——. G. Tauc Fr. Pat. 338,972, Aug. 7, 1903.

The liquid to be heated is divided into two parts. On part flows into a vessel divided into two compartments b a plate, over which the liquid must flow to reach the oth compartment, from whence it is drawn off through a pip The other part of the liquid passes through a heatin jacket, and issues through perforations in a pipe lyin along the bottom of the above vessel, where it mingles wi the cold liquid flowing over the plate, heating it.—L. F. G

Heating Liquids; Apparatus for ——. G. Tauer. Fr. Pat. 338,973, Aug. 8, 1903.

The apparatus is built up of a number of units, consistin of two end chambers connected by a bundle of jackete tubes, through which the liquid to be heated flows. Th various units are either inclined to the horizontal, or vertica and are joined to each other in zig-zag fashion. Each un is provided with separate blow-off and draw-off cocks, an each heating jacket is connected by a separate tube to th main heat supply.—L. F. G.

Water-Bath for Heating Liquids, or Liquids Mixed wit Solids. P. P. A. Andrieu. Fr. Pat. 343,321, May 2 1904.

The apparatus serves either for heating grapes to a tem perature of 55° C., and also for heating must or oth sugared liquors, and for sterilising liquors containing veg table or animal matter. It consists of a hollow cylind jacketed by another cylinder, the space between being fille with hot water. Pipes traverse the inner cylinder, and th materials to be treated are passed through these, suitabl inlet and outlet pipes being provided.—L. F. G.

Drying Apparatus for all Kinds of Materials. H. Diedric First Addition, dated June 2, 1904, to Fr. Pat. 342,41 of April 18, 1904.

The material to be dried passes through a rotating hollo cylinder, and falls through holes situated at one end in another cylinder, concentric with the first. While traversin the cylinders the material is exposed to the action of current of hot gases, part of which passes through th cylinders, and part around the exterior of the outsid cylinder.—L. F. G.

Filtering Element. Filter- und Brautechn.-Maschinen Fabr. Act.-Ges. vorm. L. A. Enzinger. Fr. Pat. 313,37 May 21, 1904.

Each element consists of two cylindrical plates placed on inside the other, the plates being pierced by conical hole the bases of which are situated on the inner sides of the plates. The filtering material is pressed into the annular space between the two plates till of the consistency of cardboard. The liquid to be filtered is admitted into the inner cylinder, and the plates are suitably fixed at their upper and lower extremities.—L. F. G.

II.—FUEL, GAS, AND LIGHT.

English Patents.

Coke Ovens. H. Koppers, Essen-on-the-Ruhr, Germany. Eng. Pat. 18,262, Aug. 23, 1904.

In this coke oven the heating flues are constricted at the point where they pass into the upper horizontal passage, by projections of the bond courses or by similar means, so that the constrictions are narrow next to the chimney draught, and wider further away, the width of these openings being adjustable by means of slides. The heating flues contain an arrangement of nozzles for supplying air and gas so as to mix in a helical column, as is described in Eng. Pat. 17,283 of 1903. (See U.S. Pat. 753,146 of 1904; this J., 1904, 365.)—L. F. G.

Fuel; Artificial ——, and the Manufacture thereof. J. J. Shedlock, Colchester. Eng. Pat. 21,300, Oct. 3, 1904.

See Fr. Pat. 340,981 of 1904; this J., 1904, 816.—T. F. B.

Coal Gas; Manufacture of ——. T. Settle and W. A. Padfield, Exeter. Eng. Pat. 24,588, Nov. 12, 1903.

The tar produced on condensing the gas is pumped back continuously, in limited quantities, on to the coal in the retorts, where it forms coke and volatile hydrocarbons. The process is applicable to the vertical retorts described in Eng. Pat. 12,552 of 1902 (this J., 1903, 789).—H. B.

Combustible Gas from Carbonaceous Liquids; Process and Apparatus for Generating a ——. F. Cotton, Hornsby, N.S.W. Eng. Pat. 18,291, Aug. 23, 1904.

A carbonaceous liquid, such as the residuum of petroleum, is forced, along with steam, into a cylindrical vessel which acts as a mixing chamber, the steam used having been superheated to such a degree that the temperature within the chamber is about 300° F. The mixture passes through a pipe, closed at the ends but having lateral perforations, into a second cylindrical vessel, arranged coaxially with the first, but insulated from it by means of asbestos or the like. This vessel, which serves as a retort and is maintained at about 800° F., has an outlet nozzle for the combustible gas produced; it is kept at the required temperature preferably by arranging it to project more or less into the combustion chamber of the furnace in which the gas is burned. (See Eng. Pat. 20,234 of 1902; this J., 1903, 485.) —H. B.

United States Patents.

Gas; Apparatus for the Manufacture of ——. C. H. Claudel, Argenteuil, Assignor to Cie. du Carburateur Claudel, Paris. U.S. Pat. 772,131, Oct. 11, 1904.

See Fr. Pat. 331,372 of 1903; this J., 1903, 1122.—T. F. B.

Gas Purifier. R. B. Brown, Milwaukee, Wis. U.S. Pat. 771,414, Oct. 4, 1904.

The gas purifier, which contains the usual grid for supporting the purifying material, is provided with a removable vertical discharge-tube for the spent material, the tube consisting of a number of tube lengths telescoped one within the other and extending down through the purifying material to the covered discharge-opening at the bottom. —H. B.

Electric Heating; Apparatus for —— [Carbide Production]. W. S. Horry. U.S. Pats. 771,249 and 771,250, Oct. 4, 1904. XI. A., page 1034.

French Patents.

Briquettes and Agglomerated Combustibles; Manufacture of ——. A. A. Chevalier. Fr. Pat. 343,248, May 17, 1904.

A new agglutinant, "carbo-cellulose," to which may be added a little sodium nitrate and common salt, is used in the manufacture of briquettes. The "carbo-cellulose" is prepared by treating all sorts of vegetable refuse, such as fibres, wood-shavings, chiffons, straw, or dried herbs, in a lead-lined chamber through which a lead-covered mixing-screw passes, with sulphuric anhydride for 50 minutes, or with sulphuric acid of 60° B. The cellulose is thereby converted into a black mass, which on moistening becomes viscid and colloidal. A suitable mixture for the briquettes consists of 93·2 parts of anthracitic coal, 5 parts of "carbo-cellulose," 1 part of sodium chloride, and 0·8 part of sodium nitrate.—L. F. G.

Combustible; Manufacture of a —— for Heating the Contents of all kinds of Vessels. M. Bamberger and F. Böck. Fr. Pat. 343,724, June 6, 1904.

The combustible consists of finely-divided metals, such as iron, copper, or zinc, mixed with substances containing oxygen or sulphur, and some indifferent material, such as clay, to retard the combustion. Suitable proportions are: 3 parts of potassium permanganate, 4 parts of iron filings, and 2 parts of dried plaster. The mixture is formed into balls or plates, and can be hardened by first moistening with water, and then drying.—L. F. G.

Siemens Regenerative Furnaces; Process for Avoiding the Loss of Gas in ——. A. Kurzwernhart. Addition, dated April 13, 1904, to Fr. Pat. 340,332, Jan. 25, 1904.

See Eng. Pat. 8311 of 1904; this J., 1904, 816.—T. F. B.

Gas and Air; Process and Apparatus for Preparing Mixtures of ——. Selas Ges. m. b. H. Fr. Pat. 338,967, Aug. 19, 1903.

See Eng. Pat. 17,788 of 1903; this J., 1904, 859.—T. F. B.

Gas Generator [for Weak Gas]. L. Genty and Soc. Nouvelle des Établissements de l'Horme et de la Buire. Fr. Pat. 343,010, May 9, 1904.

The apparatus comprises a generator, a recuperator, a scrubber, purifiers, and a blower. Low-grade, bituminous fuel is fed into the generator, and descends first through a shoot or retort, and then over a conical deflector into the combustion chamber. Whilst in the retort, the tarry matters are distilled off and are driven, by means of a fan, down a pipe which discharges them into the incandescent zone of the fuel. The gas produced circulates round a steam generator arranged at the top of the apparatus, and then passes in succession through the recuperator, scrubber, and purifiers. The air-supply for the fuel is drawn in over the water in the steam generator, and the mixture of air and steam formed, after passing through the recuperator, enters the combustion chamber. The latter is provided with pokers and movable fire-bars for breaking up the clinker. —H. B.

Generator for Gas, Vapours, or for Supplying Liquids from Closed Vessels. R. Desouches. Fr. Pat. 343,390, May 24, 1904.

The apparatus is intended for distributing gas for driving motors or automobiles, hot liquids, or melted substances, and consists of a series of closed vessels connected to a common supply pipe. Each vessel is a separate unit and is provided with charging and discharging valves, and with an independent heating arrangement, which may be electric. —L. F. G.

Gas Retorts. E. Derval. Fr. Pat. 343,699, June 4, 1904.

A slight inward curvature is given to the bottom of the retort, for the purpose of sending the coal to the sides and diminishing the thickness of the charge along the middle line. A longitudinal vertical rib may also be provided, for the same purpose, along the interior side of the bottom.

Transverse ribs are fixed at intervals across the exterior of the bottom, to increase the heating surface of the latter; whilst the top of the retort is made thicker than usual, in order to prevent excessive heating of the gas evolved.
—H. B.

Mineralised Carbons for Arc Lamps. H. Mercier. Fr. Pat. 343,698, June 4, 1904.

In addition to the usual ingredients employed in the manufacture of mineralised carbon electrodes there is added zinc, or antimony, or a mixture of the two, either in the metallic state or in the form of compounds, such as zinc borate and tartar emetic. These are said to increase the luminosity and steadiness of the arc.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM AND MINERAL WAXES.

Petroleum; The Hydrocarbons in Ohio Trenton Limestone ——, with Boiling Points above 213° *C.* C. F. Mabery and O. R. Palm. Proc. Amer. Acad. Arts and Sc., 1904, **40**, 323—334. (See this J., 1897, 727.)

A large representative sample of Ohio crude oil, having the sp. gr. 0·8367 at 20° C., and the percentage composition C = 85·46 per cent., H = 13·91 per cent. S = 0·48 per cent., was distilled under ordinary pressure, to remove the fractions boiling below 200° C. The remainder was repeatedly fractionated under a pressure of 30 mm. and furnished the following hydrocarbons:—

Series.	Symbol.	Boiling Point.	Still Pressure.	Sp. Gr. at 20° C.
		° C.		
C_nH_{2n}	$C_{12}H_{24}$	211—213	Atmos. press.	0·7970
	$C_{13}H_{26}$	223—225	„	0·8055
	$C_{14}H_{28}$	138—140	30 mm.	0·8129
	$C_{15}H_{30}$	152—154	„	0·8204
	$C_{16}H_{32}$	164—168	„	0·8254
	$C_{17}H_{34}$	177—179	„	0·8335
C_nH_{2n-2}	$C_{19}H_{36}$	198—202	„	0·8364
	$C_{21}H_{40}$	213—217	„	0·8417
	$C_{22}H_{42}$	224—227	„	0·8614
	$C_{24}H_{46}$	237—240	„	0·8639
C_nH_{2n-4}	$C_{23}H_{42}$	253—255	„	0·8842
	$C_{24}H_{44}$	263—265	„	0·8864
	$C_{25}H_{46}$	275—278	„	0·8912

None of the fractions showed evidence of decomposition. The lower-boiling ones were liquid, but that distilling at 213°—217° C. was nearly solid at ordinary temperatures, and the higher distillates were quite solid owing to their high paraffin content (33—50 per cent.). In refining the heavy distillates, gasoline was used as a solvent, the oils otherwise forming a persistent emulsion under the acid treatment. The above composition of the fractions explains the high specific gravity of the crude oil and distillates. The C_nH_{2n} series is probably composed of the methylene hydrocarbons, perhaps with complex side chains; and the series still poorer in hydrogen may contain two or more methylene rings.—C. S.

Petroleum; The Hydrocarbons in Canadian ——, with High Boiling Points. C. F. Mabery and E. T. Numsen. Proc. Amer. Acad. Arts. and Sc., 1904, **40**, 334—340.

Hydrocarbons of the series C_nH_{2n}, from $C_{12}H_{24}$ to $C_{15}H_{30}$ were isolated from the fractions boiling above 216° C., a lower member of the series, *viz.*, $C_{11}H_{22}$, boiling at 196° C., having been obtained previously; whereas in Pennsylvania oil the series begins with $C_{17}H_{34}$, and in Ohio oil with $C_{12}H_{24}$ (see preceding abstract). The prevalence of this series, and of others still poorer in hydrogen, accounts for the higher sp. gr. of Canadian crude and refined oils.—C. S.

[*Petroleum*] *Crude Oil; Hydrocarbons in Santa Barbara ——.* C. F. Mabery and C. Y. Zoul. Proc. Amer. Acad. Arts and Sc., 1904, **40**, 340—346.

The specimen of oil examined was from a submarine well. It was of the consistency of heavy tar, with the sp. gr. 0·9845 at 20° C., and contained 0·84 per cent. of sulphur, 1·25 per cent. of nitrogen, 86·32 per cent. of carbon, and 11·70 per cent. of hydrogen, a composition indicating the prevalence of hydrocarbons poor in hydrogen. When distilled under a pressure of 60 mm., only small quantities passed over below 175° C. A residue of 10 per cent. of the original quantity remained behind at 365° C. The following hydrocarbons were isolated:—

——	Boiling Point at 60 mm. Pressure.	Sp. gr. at 20° C.
	° C.	
$C_{13}H_{24}$	150—155	0·8621
$C_{16}H_{30}$	175—180	0·8808
$C_{17}H_{30}$	190—185	0·8919
$C_{18}H_{32}$	210—215	0·8996
$C_{24}H_{44}$	250—255	0·9299
$C_{27}H_{46}$	310—315	0·9451
$C_{29}H_{50}$	340—345	0·9778

The presence of these hydrocarbons explains the peculiar character of the oil, which is unlike any other examined by the authors, and affords an explanation of the conversion of petroleum, by slow evaporation, into natural tars and asphaltums.—C. S.

Paraffin Hydrocarbons; Separation of Solid —— from Petroleum without Distillation. C. F. Mabery and O. J. Siepleio. Proc. Amer. Acad. Arts and Sc., 1904, **40**, 346—349.

By exposing 3 kilos. of Pennsylvania crude oil, in a shallow pan, to a powerful current of air for 30 days, 66·67 per cent. volatilised, the amount of residue being equal in quantity to that left on distillation up to 300° C. No further loss occurred on prolonging the exposure for a year. The crude oil contained 75·51 per cent. of carbon and 14·18 per cent. of hydrogen, whilst the residue contained 86·16 per cent. of carbon and 13·69 per cent. of hydrogen. The residue solidified when cooled by ice, and it furnished on distillation 28 per cent. of a fraction passing over below 300° C., 6 per cent. at 300°—360° C., and a residue of 66 per cent. at the latter temperature. The solid hydrocarbons were determined by the Zaloziecki method: extracting the residue with fusel oil, precipitating with alcohol, washing with a mixture of the two agents, extraction with benzene, and heating to 140° C. for an hour to expel the last traces of fusel oil. This treatment furnished 39·6 per cent. of a greenish-black solid melting at 32° C. Treatment with fusel oil and alcohol gave a light-brown solid melting at 57° C., which, after purification with ether and alcohol, yielded a white product melting at 61° C. and having the sp. gr. 0·7966 at 70° C. The percentage composition was: carbon, 85·37 per cent.; hydrogen, 14·69 per cent. These results show that solid paraffin hydrocarbons are present in Pennsylvania crude oil, as natural constituents and that they are not distillation products. Any decomposition during distillation results in an elimination of hydrogen and the conversion of the hydrocarbons into a lower series.
—C. S.

[*Petroleum*] *Paraffin Hydrocarbons; Solid —— that Collect in certain Oil Wells in Pennsylvania.* C. F. Mabery. Proc. Amer. Acad. Arts and Sc., 1904, **40**, 349—355.

In certain of the Pennsylvania oil wells, especially those around Coreopolis, a light-yellow pasty mass is found in considerable quantities, and is utilised for the production of vaseline, &c. No solid matter can be separated from the mass by filtration or pressure; and it evidently consists of an emulsion and partial solution of heavy oil fractions and solid hydrocarbons, left by evaporation of the lighter constituents. The sample examined had the sp. gr. 0·8345 at 60° C., and furnished distillates passing over between 195° and 342° C. (50 mm.), leaving a residue of about 31 per cent. of the original mass. The separation of the solids in the cooled distillates was effected by solution in alcohol-ether, followed by re-cooling and filtration; and by this means the following solid hydrocarbons were identified :—

Hydrocarbon.	Symbol.	Melting Point.	Sp. Gr.
Tetracosane.......	$C_{24}H_{50}$	50°—51° C.	0·7900 at 60° C.
Hentricontane....	$C_{31}H_{64}$	68° C.	0·7997 at 70° C.
Dotricontane	$C_{32}H_{66}$	67°—68° C.	0·8005 at 75° C.
Tetratricontane...	$C_{34}H_{70}$	71°—72° C.	0·8009 at 80° C.
Pentatricontane ..	$C_{35}H_{72}$	76° C.	0·8952 at 80° C.

The oils separated by filtering the distillate seem to belong chiefly to the series C_nH_{2n-2}, with small amounts of hydrocarbons of a series still poorer in hydrogen. It is pointed out that the freezing point of benzene cannot be relied on for molecular weight determinations of solids much above $C_{20}H_{42}$, and even at its boiling point this solvent becomes uncertain with hydrocarbons in the vicinity of $C_{30}H_{62}$. Other solvents are equally uncertain, and naphthalene is unreliable for substances with melting points approximating to its own. —C. S.

Paraffin ; Composition of Commercial ——. C. F. Mabery and H. R. Payne. Proc. Amer. Acad. Arts and Sc., 1904, **40**, 355—360 (see this J., 1902, 1271).

To determine whether the hydrocarbons of commercial paraffin are identical with the solid constituents of the oils yielding that substance, a sample of commercial paraffin was distilled under a pressure of 40 mm., care being taken to prevent decomposition by precluding the admission of air. The first fraction collected below 250° C.; and the final slightly brown residue, remaining at 350° C., weighed only 2 per cent. of the total substance (1,500 grms.). The distillates collected in larger quantities at temperatures corresponding to those of hydrocarbons separated from crude oil, *viz.*, 256°—258° C., 90 grms.; 272°—274° C., 45 grms.; 282°—284° C., 70 grms.; 292°—294° C., 30 grms.; 316°—318° C., 35 grms.; 332°—334° C., 20 grms.; 346°—348° C., 40 grms. In addition to the hydrocarbons previously identified in paraffin by one of the authors (*loc. cit.*) nonocosane was found; but the melting points exhibit certain differences, *viz.*, tricosane, 48° C. (instead of 45° C.); tetracosane, 50°—51° C. (48° C.): pentacosane, 53°—54° C. (no change); hexacosane, 55°—56° C. (58° C.); octacosane, 60° C. (no change); nonacosane, 62°—63° C. The solid hydrocarbons forming the bulk of commercial paraffin are evidently members of the series C_nH_{2n+2}, and none of them, capable of being distilled, contain oxygen; nor is it reasonable to assume that they have been formed by "cracking," this operation furnishing hydrocarbons of lower molecular weights.—C. S.

Vaseline, Cosmoline, and similar Products; Composition of Commercial ——. C. F. Mabery. Proc. Amer. Acad. Arts and Sc., 1904, **40**, 361—362.

One hundred grms. of vaseline distilled under a pressure of 15 mm. furnished 14 grms. of distillate up to 250° C., 22 grms. at 250°—275° C., 14 grms. at 275°—300° C., 18 grms. at 300°—325° C., 7 grms. at 325°—350° C., 20 grms. at 350°—360° C., and 6 grms. of residue. All the distillates were pale yellow, with a slight fluorescence when melted. The first fraction was a heavy viscous liquid, the others semi-solid, and the residue brown. By treating the second and final fractions with ether and alcohol, solid hydrocarbons, melting at 70° C. and 77°—78° C. respectively, were obtained, resembling the solid paraffin hydrocarbons. Vaseline therefore consists of heavy oils of the series C_nH_{2n}, C_nH_{2n-2}, and C_nH_{2n-4}, with solid paraffin hydrocarbons, the latter being sufficient in quantity to saturate the former and produce an emulsion. Refinery "scale" paraffin consists of solid hydrocarbons of the series C_nH_{2n+2}, and heavy oils of the above-named series, n which they are more soluble than in the lighter oils of heir own series.—C. S.

Indophenine Reaction. F. W. Bauer. XXIII., page 1047.

United States Patents.

Wood; Process of Destructive Distillation of Resinous ——. C. E. Broughton, Savannah, Ga. U.S. Pat. 771,706, Oct. 4, 1904.

Resinous wood is treated in a retort with superheated steam under pressure, at a temperature of about 300° F., whereby the light turpentine oils are removed "without being rendered empyreumatic"; the temperature is now raised to 450°—500° F. by application of external heat, steam being still injected, and the distillate is collected in suitable fractions. When no further distillation occurs, the heating is continued by external means alone, at a temperature of about 800° F.: the creosote and tar oils are collected, as before, in suitable fractions; and the tar is drawn off from time to time, thus leaving pure charcoal in the retort at the completion of the process.—T. F. B.

Ammonium Sulphate; Saturating Apparatus for Recovering ——. K. Zimpell, Stettin, Germany. U.S. Pat. 772,390, Oct. 18, 1904.

See Eng. Pat. 6891 of 1904; this J., 1904, 660.—T. F. B.

French Patent.

Tarring or Asphalting Roads; Product for ——, *and Process for its Manufacture.* L. Préaubert and G. A. Thubé. Fr. Pat. 342,898, May 5, 1904. IX., page 1029.

IV.—COLOURING MATTERS AND DYESTUFFS.

Trinitroxylenol; Symmetrical ——. E. Knecht and E. Hibbert. Ber., 1904, **37**, 3477—3479.

Five grms. of pure symmetrical xylenol were dissolved in 50 c.c. of equal parts of ordinary and of 20 per cent. fuming sulphuric acid, and warmed for 15 minutes on the water-bath. After cooling, 11·6 grms. of nitric acid of sp. gr. 1·415 were added, and the whole warmed on the water-bath after standing for some time. It was then poured into 300 c.c. of water. The precipitate was filtered, washed, and dissolved in boiling water, there being a slight insoluble residue. On adding potassium chloride in excess to the hot solution, the potassium salt of trinitroxylenol crystallised out in brownish-yellow crystals, from which the free acid was liberated by boiling dilute hydrochloric acid, and recrystallised from water. It is less soluble in water than picric acid, and dyes wool in redder shades in contrast to the corresponding trinitrocresol, which gives very greenish-yellow dyeings. It gives no reaction with potassium cyanide, whereas picric acid gives the isopurpuric acid reaction and trinitrocresol an orange-red coloration. —E. F.

Phenyldiazoaminobenzene; Substituted Derivatives of ——. L. Vignon and Simouet. Comptes rend., 1904, **139**, 569—571.

Substituted derivatives of phenyldiazoaminobenzene were easily obtained by combining substituted phenyldiazonium chlorides with diphenylamine in alcoholic solution in presence of sodium carbonate at 4°—5° C. Descriptions are given of the substances obtained from the diazo derivatives of the following amines :—*o*-, *m*-, and *p*-nitraniline; *o*-, *m*-, and *p*-chloraniline; 1.2.4-dichloraniline; 1.2.4.6-trichloraniline; *o*-, *m*-, and *p*-bromaniline; 1.2.6-dibromaniline; 1.2.4.6-tribromaniline; *p*-iodoaniline; 1.2.4-di-iodoaniline; *o*- and *p*-anisidine. All these compounds possess the general properties of diazo-amino compounds. In general, they are unstable, the stability apparently increasing with the number of substituent groups. —T. F. B.

p-Phenylenediamine; Oxidation Products of ——. E. Erdmann. Ber., 1904, **37**, 2906—2913. (See this J., 1904, 885.)

Hydrogen peroxide solution acts on a dilute aqueous solution of *p*-phenylenediamine to form a substance of the formula $(C_6H_6N_2)_x$, which was found to be identical with

Baudrowski's base. The reaction thus proceeds according to the equation: $3C_6H_4(NH_2)_2 + 3H_2O_2 = C_{18}H_{18}N_6 + 6H_2O$. The formula of Baudrowski's base is probably—

$$(NH_2)_2C_6H_3.N:C_6H_4:N.C_6H_3(NH_2)_2.$$

On oxidising *p*-phenylenediamine solution with hydrogen peroxide whilst boiling, ammonia is formed, and also a volatile substance, causing coughing, which was found to be quinone-di-imide. When very dilute solutions of *p*-phenylenediamine are treated with 1 molecule of lead peroxide paste below 12° C., quinone di-imide is formed. The solution is yellow, turns brown when spotted on paper, gives a green coloration with dilute acids, and gives the indamine reaction with aniline hydrochloride. After standing for some time, the indamine reaction can no longer be obtained, and on acidification and evaporation, a safranine-coloured liquid is obtained, from which, after evaporation almost to dryness, alcohol extracts a yellowish-red fluorescent dyestuff with the properties of phenosafranine. The solution of quinone-di-imide obtained from *p*-phenylenediamine solution and lead peroxide yields quinone on pouring into dilute sulphuric acid, and *p*-phenylenediaminesulphonic acid with sodium bisulphite solution. Quinone-di-imide irritates the respiratory organs strongly, and is also a strong poison. It therefore demands care in handling, especially as it is volatile.—E. F.

Hydroxyfuchsones. F. Sachs and R. Thonet. Ber., 1904, **37**, 3327—3334.

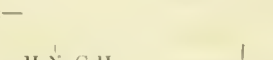
Benzophenone chloride was condensed with pyrocatechol in presence of concentrated sulphuric acid, 3.4-dihydroxytriphenylcarbinol $(C_6H_5)_2.C(OH)C_6H_3(OH)_2$ being thus formed. On heating, for two hours, to 80°—105° C., this substance loses 1 molecule of water, and forms the quin-2-hydroxyfuchsone $(C_6H_5)_2C:C_6H_3(OH):O$, a dark-orange powder. This compound dyes wool in yellowish-brown shades, intensified by subsequent treatment with copper sulphate or potassium bichromate. It dyes brown on alumina mordant, brownish-black on chrome, and violet-black on iron mordant; it also dyes on zinc, uranium, cerium, nickel, cobalt, zirconium, and yttrium mordants. Benzoylveratrol was condensed with pyrocatechol in presence of aluminium chloride, to form 3.4-dihydroxy-3′.4′-dimethoxytriphenylcarbinol $(C_6H_5)(OH)C[C_6H_3(OH)_2][C_6H_3(OCH_3)_2]$, which is very similar in properties to the nonmethoxylated carbinol. It dyes on mordants, and loses water at 80° C., forming the fuchsone. Michler's ketone was converted into the corresponding chloride, and condensed with pyrocatechol in presence of strong sulphuric acid. Liebermann's Proto-blue $[(CH_3)_2N.C_6H_4]_2C.[C_6H_3(OH)_2]OH$ was thus formed.—E. F.

Triphenylmethane Dyestuffs; Nature of the Bases of ——. A. Hantzsch. Ber., 1904, **37**, 3434—3440.

The author criticises Baeyer and Villiger's views as to the nature of the bases of triphenylmethane dyestuffs (this J., 1904, 862), and points out that the electrical conductivity of solutions of salts of these dyestuffs to which caustic soda solution has been added indicates the presence of true ammonium bases of the type $R_2:C:C_6H_4:NH_2OH$. These gradually split off water to form anhydrides $R_2:C:C_6H_4:NH$, the so-called "bases" of Baeyer and Villiger. According to the modern dissociation theory a true base must contain a hydroxyl group which is dissociated in aqueous solution to form a hydroxyl ion.—E. F.

Rosaniline Salts; Constitution of —— *and the Mechanism of their Formation.* J. Schmidlin. Comptes rend., 1904, **139**, 602—604.

In place of the quinonoid formula proposed by Fischer and Nietzki for rosaniline mono-acid salts, the author suggests the following:—



$$\begin{array}{l} H_3N.C_6H_4 \\ H_3N.C_6H_4 \end{array} > C:C_6H_4:NCl$$

where the three nitrogen atoms are united in a so-called "triazine chain." By the use of this formula, the mechanism of the transformation of these salts into the unstable tri-acid salts, and then to the stable, colourless salts of tetrahydroxycyclohexanerosaniline with excess of acid, and also the transformation of rosaniline carbinol in presence of acetic acid into the colourless salt and then into the coloured rosaniline salt, are easily explained (see this J., 1901, 979).
—T. F. B.

Naphthol Yellow S. E. Knecht and E. Hibbert. Ber., 1904, **37**, 3475—3477.

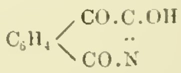
Dinitro-α-naphtholsulphonic acid was recrystallised repeatedly from concentrated hydrochloric acid. As so obtained the free acid contains 3 mols. of water of crystallisation. It is very soluble in water and in alcohol. The normal potassium salt has the formula $C_{10}H_4(OK)(SO_3K)(NO_2)_2 + 1\frac{1}{2}H_2O$, and is much more soluble in water than the technical product. It was not found possible to obtain a monopotassium salt. The sodium salt crystallises with 3 mols. of water, and is much more soluble than the potassium salt. The ammonium, calcium, magnesium, silver, aniline, and *p*-nitraniline salts were also prepared and are described.—E. F.

Immedial Pure Blue. R. Gnehm and F. Kaufler. Ber., 1904, **37**, 3032—3033.

In a previous communication (this J., 1904, 781) the authors described a substance obtained by brominating Immedial Pure Blue, which they concluded to be tetrabromodimethylaminothiazone. They have now obtained the same substance, with identical properties, by brominating Bernthsen's Methylene Violet, which is dimethylaminothiazone, obtained by treating Methylene Blue with silver oxide. This result confirms the authors' previous conclusions.—E. F.

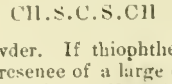
Indophenines; Some New ——. H. Oster. Ber., 1904, **37**, 3348—3352.

Nitro-indophenine $(C_8H_3[NO_2]NO)(C_4H_3S)$ was obtained in the usual manner from nitro-isatin and thiophen. It is a dark-blue powder, soluble in concentrated sulphuric acid with a pure blue colour, and almost insoluble in other media. Carbindophenine $(C_9H_4NO_2).(C_4H_3S)$ was made by condensing thiophen with phthalone-imide—



$$C_6H_4\begin{cases} CO.C.OH \\ \quad\;\;\, \ddot{} \\ CO.N \end{cases}$$

the oxidation-product of carbindigo. It is deep blue and has very similar properties to nitro-indophenine. Mono-isatin-indophthenine $(C_8H_4NO)(C_6H_3S_2)$ was obtained by condensing equimolecular amounts of isatin and thiophthen—

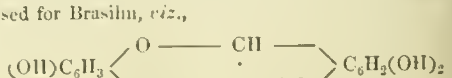


$$\begin{array}{c} CH - C - CH \\ \ddot{C}H.S.\ddot{C}.S.\ddot{C}H \end{array}$$

It forms a grey powder. If thiophthen is condensed with excess of isatin in presence of a large quantity of sulphuric acid, di-isatinindophthenine $(C_8H_4NO)_2(C_6H_3S_2)$ is formed; it is a dark-blue powder. Monobromo-indophthenine, from monobromo-isatin and thiophthen, and carbindophthenine, from phthalone-imide and thiophthen, were also prepared. Phenanthraquinone was also condensed with both thiophen and thiophthen. The products are green powders, soluble in concentrated sulphuric acid to a dirty-green solution, instead of the bright blue of the indophenines.—E. F.

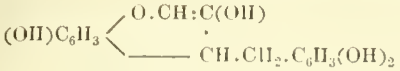
Brasilin and Hæmatoxylin. J. Herzig and J. Pollak. Monatsh. Chem., 1904, **25**, 871—893.

The authors discuss the different formulæ which have been proposed for Brasilin, *viz.*,

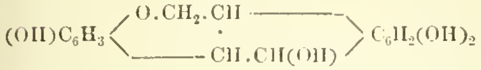


$$(OH)C_6H_3\begin{cases} O \text{———} CH \text{——} \\ \qquad\quad\;\; \cdot \\ CH(OH).CH.CH_2 \end{cases} C_6H_2(OH)_2$$

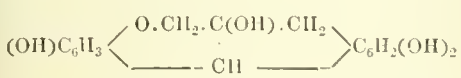
by Perkin (this J., 1902, 110),



or



by Kostanecki (this J., 1899, 677, and Ber., 1902, **35**, 1667), and



by Werner and Pfeiffer (Chem.-Zeits., 1904, **3**, 390, 420). None of these formulæ are considered by the authors to be satisfactory, but they think that there is a possibility of numerous tautomeric and also of stereoisomeric forms. They criticise Kostanecki and Lloyd's statement that the two isomers $C_{16}H_6O(OH)_4$ cannot be stereoisomers, because they behave differently on reduction and oxidation (see this J., 1903, 902). With cold concentrated sulphuric acid trimethylbrasilone yields an isomer which contains a very acid hydroxyl group, is partially precipitated from alkaline solution by carbon dioxide, and does not react with hydroxylamine hydrochloride to form an oxime. It is very readily alkylated. The monomethyl ether does not split off water with acetic anhydride and sodium acetate, and can be readily saponified by alkali, with formation of its mother-substance. The corresponding products from tetramethylhæmatoxylin are very similar in properties.—E. F.

Chromophors; Ionisation of ——. H. Decker.
Ber., 1904, **37**, 2938—2941.

Certain ammonium-, oxonium-, and thionium-iodides and bromides are coloured in the solid state, but are decolorised by solution in a large quantity of water, owing to dissociation into colourless ions. In these cases iodine and bromine form chromophoric groups with pentavalent nitrogen or quadrivalent sulphur or oxygen. A chromophoric group is only formed if the nitrogen itself forms part of an aromatic ring. Thus the aliphatic ammonium iodides and dimethyldiphenylammonium iodide are colourless, whereas pyridiniummethyl iodide is yellow. The iodo-alkylates of quinoline and isoquinoline are still more strongly coloured. The colour is intensified by the introduction of bromine- and nitro-groups into the aromatic nucleus, orange to garnet-red bodies being thus formed. 6.8-Dinitroquinolinemethyl iodide forms reddish-black needles which give a colourless solution in water. 5-Nitroquinolinemethyl iodide forms a red solution in alcohol or in a small amount of water. If portions of such a solution are diluted to an equal extent with alcohol and with water, it is found that the water causes decolorisation, whereas the alcohol only does so to a small extent, showing that its power of ionising the substance is very much smaller. A solution of the same compound in chloroform is raspberry-red in colour, and the colour is unchanged on addition of more chloroform, but is completely destroyed by shaking up with water, which dissolves and ionises the iodide. The corresponding compounds of the acridinium series are still more highly coloured, even the ion of methylacridinium possessing a yellow colour. The highly-coloured salts in this case show on dissociation the pale-yellow colour of the ion. The introduction of phenyl groups increases the intensity of the colour. Thus *ms*-phenylacridine is slightly coloured. Its tertiary and quaternary salts are strongly yellow in colour, and the latter dye animal fibres.—E. F.

Rosaniline and Pararosaniline; Method of Rapidly Distinguishing between ——. R. Lambrecht and H. Weil. XXIII., page 1047.

Magnesium Amalgam as a Reducing Agent. T. Evans and W. C. Fetsch. XX., page 1041.

English Patents.

o-Nitro-o-amido-p-acetamidophenol, and Dyestuffs [Azo-dyestuffs] therefrom; Manufacture of ——. R. B. Ransford, Upper Norwood. From L. Cassella and Co., Frankfort-on-Maine, Germany. Eng. Pat. 24,409, Nov. 10, 1903.

p-Acetaminophenol is energetically nitrated in strong sulphuric acid solution. Dinitroacetaminophenol ($OH:NO_2:NHCOCH_3:NO_2 = 1:2:4:6$) is thus formed. On reduction with suitable reagents, such as alkali sulphides, this compound yields o-nitro-o-amino-*p*-acetaminophenol. On diazotisation this latter compound is transformed into an orange-yellow diazo-compound, which combines with the sulphonic acids of aminonaphthols and dihydroxynaphthalenes to form dyestuffs which dye wool in even blue shades, changing to bluish-green on subsequent chroming, these latter shades being very fast to washing, milling, and light.—E. F.

Oxyanthraquinones [Erythrohydroxy-anthraquinone, Anthrarufin, and Chrysazin]; Manufacture of ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat 25,541, Nov. 23, 1903.

See Fr. Pat. 336,867 of 1903; this J., 1904, 438.—T. F. B.

Azo Colouring Matters; Manufacture of New ——, *and of Colour Lakes therefrom.* H. E. Newton, London. From Farbenfabr. vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 28,563, Dec. 29, 1903.

See Fr. Pat. 337,942 of 1903; this J., 1904, 543.—T. F. B.

Ink. W. Rosenhain, Birmingham. Eng. Pat. 26,951, Dec. 9, 1903.

An ink, suitable for writing upon very smooth surfaces, is prepared by adding the necessary colouring matter (preferably in the form of a metallic oxide) to a solution containing sodium aluminate and sodium silicate. This solution is best prepared by adding 40 grms. of a 2·5 per cent. solution of sodium aluminate to 150 grms. of strong commercial sodium silicate solution and 20 cc. of water.
—T. F. B.

United States Patent.

Anthracene Dyestuff. R. Bohn, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. U.S. Pat. 767,259, Aug. 9, 1904.

By melting with alkali hydroxide, diaminoanthraquinones, or their sulphonic acids, dyestuffs are obtained very similar in properties to Indanthrene, which dye brown shades, turning grey on exposure to air, from hydrosulphite solutions in presence of alkali; the shades obtainable are very fast; the dyestuffs from 1.5- and 1.8-diamino-anthraquinones give reddish-grey shades, whilst those from the 1.3-, 2.6-, and 2.7-derivatives give greenish-grey shades.
—T. F. B.

French Patents.

Acetyldiaminophenolsulphonic Acid and a Bluish-Black [Azo] Dyestuff for Wool, susceptible to Chroming, derived therefrom; Process for Producing an ——. Manuf. Lyon. Mat. Col. First Addition, dated July 20, 1903, to Fr. Pat. 337,011, Feb. 4, 1903.

See Eng. Pat. 17,792 of 1903; this J., 1904, 782.—T. F. B.

Acetyldiaminophenolsulphonic Acid and a Bluish-Black [Azo] Dyestuff for Wool, susceptible to Chroming, derived therefrom; Process for Producing an ——. Manuf. Lyon. Mat. Col. Second Addition, dated July 24, 1903, to Fr. Pat. 337,011, Feb. 4, 1903.

See Eng. Pat. 3182 of 1903; this J., 1904, 56.—T. F. B.

Monoazo Dyestuffs susceptible to Chroming on the Fibre; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 338,960, July 30, 1903.

See Eng. Pat. 16,995 of 1903; this J., 1904, 712.—T. F. B.

o-Hydroxyazo Dyestuffs [*Azo Dyestuffs*] *capable of being Chromed on the Fibre; Production of* ——. Soc. Badische Anilin und Soda Fabrik. First Addition, dated Feb. 26, 1904, to Fr. Pat. 338.819, Dec. 17, 1903.

In the process described in the main patent (this J., 1904, 820) an α-naphthylaminedi- or trisulphonic acid is diazotised and the diazo compound converted into an *o*-hydroxydiazo compound by standing in neutral, weakly acid or weakly alkaline solution. In this process sulphurous acid is liberated which partially prevents the o-hydroxydiazo compound from combining to form azo dyestuffs. This is avoided, according to the present additional patent, by effecting the change in presence of chlorine or an alkali hypochlorite, or by acting on the diazosulphonic acid with these reagents. The resulting hydroxydiazo compound is then treated in the usual manner.—E. F.

Dyestuffs of the Anthracene Series [*Anthracene Dyestuffs*]; *Production of* ——. Soc. Anon. des Prods. F. Bayer et Cie. Fr. Pat. 343,608, March 29, 1904.

1-AMINO-2-HALOGENO-ANTHRAQUINONE, 2-amino-1-halogenoanthraquinone, or their derivatives, are treated with a metallic salts, such as cupric or zinc chloride, in presence of solvents or diluting agents. The presence of weakly basic compounds such as sodium acetate is advantageous. The products, which are the derived hydrazines of anthraquinone, are transformed by alkaline reducing agents into hydrogenated products, which are used for printing and dyeing cotton by the same methods as are used in the case of indigo. Bright and fast blue to green shades are so obtained.

Dyestuff obtained with—	Shade on Unmordanted Cotton.
1-Amino-2-bromoanthraquinone.	Blue.
1-Methylamino-2-bromoanthraquinone.	Pure blue.
1.4-Diamino-2-bromoanthraquinone.	Olive-green.
1.4-Diamino-2.3-dibromoanthraquinone.	Green.
1-Amino-2 bromo-5-nitroanthraquinone.	Bluish-grey.
1-Amino-2-bromo-4-*p*-toluidoanthraquinone.	Olive-green.
1.3-Dibromo-2-aminoanthraquinone.	Greenish-blue.

—E. F.

Black Dyestuff [*Sulphide Dyestuff*] *for Cotton; Production of* ——. M. K. Oehler. Fr. Pat. 343,282, May 18, 1904.

4-AMINO-3-CHLORO-2′.4′-DINITRODIPHENYLAMINE, obtained by condensing chloro-*p*-phenylenediamine with 1-chloro-2.4-dinitrobenzene, is melted with sulphur and sodium sulphide. The dyestuff so obtained dyes wool in very fast shades which become brighter and bluer by treatment with oxidising agents on the fibre.—E. F.

Green Sulphide Dyestuffs; Preparation of ——. Fabr. de Prods. Chim. ci-d. Sandoz. Fr. Pat. 343,377, May 21, 1904.

1 - ALPHYL - 4 - *p* - HYDROXYALPHYLNAPHTHYLENEDIAMINE sulphonic acids are heated with sulphur and sodium sulphide with or without the addition of copper or of copper salts. It is found that the most suitable compounds to use are the leuco-compounds of sulphonated indophenols formed by the simultaneous oxidation of *p*-aminophenol or chloro-*p*-aminophenol and phenylated or tolylated 1-naphthylamine-6, 7, or 8 monosulphonic acids. The employment of alphylated derivatives containing chlorine or methyl groups is not advantageous. The products dissolve in water forming bluish-green to yellowish-green solutions, from which they are precipitated both by acids and by excess of alkali hydroxide. They dissolve in concentrated sulphuric acid, to form steel-blue solutions. The products obtained from 1-*p*-hydroxyphenyl-4-naphthylenediamine-8-sulphonic acid dyes cotton in bright bluish-green, that from 1-*p*-hydroxyphenyl-4-naphthylenediamine-6 (or 7-) -sulphonic acid in yellowish-green shades.—E. F.

Lakes [*from Azo Dyestuffs*]; *Process for Preparing New* ——. Soc Anon. Prod. F. Bayer et Cie. Fr. Pat. 343,631, June 1, 1904. XIII. A., page 1036.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

ENGLISH PATENTS.

Dyeing Vats [*for Bobbins*]. T. de Naeyer, Alost, Belgium. Eng. Pat. 20,942, Sept. 29, 1903. Under Internat. Conv., Oct. 7, 1902.

THE principal feature of the vat is that the dye-bath is admitted to it on a surface considerably larger than the outer one, so that, by circulating the liquid by means of a force pump, pressure is produced. The bobbins are packed horizontally in the vat, which is preferably of conical form, and which is provided with a lid or cover, openings in which serve for the introduction of the dyeing liquid; this cover is also provided with a flat, perforated plate, so as to ensure even distribution of the liquid in the vat, the bottom of which is also in the form of a perforated plate. The liquid is contained in a jacketed boiler, over which the vat is mounted, the joints being made air tight. The force pump abstracts the hot liquid from a tube in the bottom of this boiler. This ensures that the dye-bath is not diluted by steam. The interstices between the bobbins in the vat are filled by means of "partial diaphragms" of special form, which are the subject of one of the claims of this specification. (Compare Fr. Pat. 334,828 of 1903; this J., 1904, 185.)

—T. F. B.

Dyeing, Bleaching, Degreasing, and Mercerising Textile Materials; Apparatus for ——. T. de Naeyer, Alost, Belgium. Eng. Pat. 20,959, Sept. 30, 1903. Under Internat. Conv., Dec. 31, 1902.

THE apparatus is similar in principle and form to that described in Eng. Pat. 20,942 of 1903 (see preceding abstract). In addition to the various features therein described, the discharge aperture of the vat is provided with an automatic valve or cock, which, by means of a lever and weight, maintains the aperture closed until the desired pressure is reached, when the valve is opened, and the pressure is reduced, in order to obtain normal circulation of the liquid, thus ensuring uniform treatment. Pressure gauges, water level, and thermometers are also provided for facilitating the control of the process.—T. F. B.

Bleaching Textile Fabrics and Fibres. J. Wakefield, Cockermouth, Cumberland. Eng. Pat. 26,521, Dec. 4, 1903.

VEGETABLE fibres or fabrics are bleached by treatment, first in a bath containing bleaching powder and alkali permanganate, and then in an acidified solution of sodium bisulphite.—T. F. B.

UNITED STATES PATENTS.

Dyeing Cops; Apparatus for ——. R. Rawson and E. Lodge, Huddersfield. U.S. Pat. 772,581, Oct. 18, 1904.

SEE Eng. Pat. 10,035 of 1903; this J., 1904, 543.—T. F. B.

Printing with Indanthrene. P. Jeanmaire, Mülhausen, and R. Bohn, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 772,237, Oct. 11, 1904.

SEE Fr. Pat. 313,772 of 1901; this J., 1902, 342.—T. F. B.

Orthonitrophenyllactoketone; Printing Compounds of ——. S. Eichhart, St. Fons, Assignor to Soc. Chim. Usines du Rhône, Ancien. Gilliard, P. Monnet et Cartier, Lyons France. U.S. Pat. 772,560, Oct. 18, 1904.

SEE Eng. Pat. 9336 of 1902; this J., 1903, 362.—T. F. B.

Oxidising Sulphur Dye [*Sulphide Dyestuffs on the Fibre*] H. J. Cooke, New York, Assignor to A. Klipstein and Co., East Orange, N.J. U.S. Pat. 769,059, Aug. 30, 1904.

SULPHIDE dyestuffs are oxidised on the fibre by means of ozone, produced by the action of air on essential oils, such as turpentine oil, pine oil, cedar oil, &c. The dyed yarn or fabric is preferably supported in a closed chamber maintained at a temperature of about 60° C.; cotton wool saturated with the oil (*e.g.*, turpentine) is contained in a small adjoining chamber, and a current of steam or air is blown through it, towards the large chamber; the oil thus condenses on the fabric, and the dyestuff is oxidised by the ozone produced. The current of steam or air is preferably stopped when the fabric has received about 1 per cent. of its weight of the oil.—T. F. B.

Waterproofing Fabrics; Compound for ——. W. M. Mackintosh, Liverpool. U.S. Pat. 771,257, Oct. 4, 1904.

See Eng. Pat. 213 of 1903; this J., 1904, 184.—T. F. B.

French Patents.

Fulling Woollen Fabrics and other Substances adapted to be Felted. A. Elosegui. Fr. Pat. 343,819, June 9, 1904. Under Internat. Conv., April 11, 1904.

See Eng. Pat. 13,090 of 1904; this J., 1904, 898.—T. F. B.

Decolorising all Kinds of Fabric, Hair, and Skin. C. Ferry and S. Coguet. Fr. Pat. 343,642, June 2, 1904.

Imperfectly dyed fabrics, hair, skins, &c., are, it is stated, decolorised, restored to more perfect colours by immersing them in a boiling bath consisting of water, 100 litres; soap, 200 grms.; potassium carbonate, 500 grms.; carbon bisulphide, 500 grms.; hydrogen peroxide, 3 kilos.; sodium silicate, 2 kilos. The material is dried without washing, and is then ready for any subsequent treatment. Should the original material have been dyed with some "more or less fast" colour, it is treated in a solution of hydrogen peroxide and sodium silicate, or in a bath of soap, potassium carbonate, and carbon bisulphide.—T. F. B.

Blue and Blue-Black Shades [on Wool] Fast to Fulling and Light; Production of ——. Badische Anilin und Soda Fabrik. Addition, dated May 20, 1904, to Fr. Pat. 342,026, April 8, 1904. Under Internat. Conv., April 28, 1904.

Fast blue or blue-black shades are obtained on wool by dyeing with a mixture of Acid Alizarin R (diazotised *o*-nitro-*o*-aminophenol-*p*-sulphonic acid coupled with β-naphthol) and Acid or Alkaline Violet, and subsequently chroming, instead of using, with one of the latter dyestuffs, any of the *o*-hydroxyazo dyestuffs mentioned in the principal patent (see this J., 1904, 899).—T. F. B.

Waterproof Fabric for Wrapping, &c. Bourdu & Co. Fr. Pat. 343,240, May 17, 1904.

The fabric to be rendered waterproof is first coated with gum and passed between cylinders, and then immersed in a composition of rosin and rosin oil, 70 parts; "heavy oil," 15 parts; and gum benzoin, 15 parts; and dried in the open air.—T. F. B.

Sizing Apparatus for Warps, of Large Output. C. Vandamme. Fr. Pat. 343,801, June 8, 1904.

The essential feature of this apparatus is that it contains at least 30 heating tubes and eight ventilators or air distributors, these being found to be the smallest numbers necessary for an apparatus which can have a large output of material.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Sodium Hydroxide; Preparation of Pure —— for Laboratory Purposes. F. W. Küster. Z. anorg. Chem., 1904, **41**, 474—476.

A large glass or porcelain dish, (diameter, say 50 cm.,) with a flat bottom, is filled to a height of a few centimetres with water. In the middle of the dish is placed a shallow wide-necked bottle (crucible) of platinum, silver, or nickel of 500—1000 c.c. capacity, and above this a large funnel, closed below, formed of commercial nickel wire gauze. The funnel is mounted on a tripod, so that its point is a few centimetres above the mouth of the bottle or crucible. Pieces of bright metallic sodium (several hundred grms.) are placed in the wire funnel, and a large bell jar is placed over funnel and bottle. The bell jar is only slightly less in diameter than the outer dish, and it rests on pieces of glass rod, the water forming a seal. The sodium immediately begins to deliquesce, and the sodium hydroxide formed, drops as a concentrated (about 40 per cent.) oily solution into the bottle. The solution may be preserved in bottles made of pure nickel.—A. S.

Arsenious Acid; Action of —— on "freshly-precipitated" Ferric Hydroxide. W. Biltz. Ber., 1904, **37**, 3138—3150.

The fact that freshly-precipitated ferric hydroxide is capable of taking up arsenious acid from its solutions, was discovered in 1834 by Bunsen, who considered this due to the formation of a basic ferric arsenite, $4Fe_2O_3.As_2O_3.5H_2O$. The author prepared a hydrogel of ferric oxide, obtained by precipitating an oxidised boiling solution of ferrous sulphate with ammonia, and washing the precipitate for five days by decantation with hot water. 10 c.c. of this hydrogel (containing about 1·1 grm. of ferric oxide) were then mixed under different conditions with equal volumes (180 c.c.) of aqueous solutions of arsenious acid of different degrees of concentration, and after the action was complete, the amounts of arsenious acid remaining in solution were determined. The results, given in tables and curve-diagrams, can, according to the author, only be satisfactorily explained on the assumption that the fixing of the arsenious acid is an adsorption process. This view also affords an explanation of the great influence of the physical condition of the ferric hydroxide on the amount of arsenious acid taken up. Increase of temperature has little influence on the adsorptive power of the ferric hydroxide, but accelerates the rate at which the arsenious acid is taken up. The author, in conclusion, discusses some bearings of this adsorption process on the action of antitoxins on the toxins of blood serum.—A. S.

Selenium and Tellurium; Use of Phosphorous Acid in the Quantitative Determination of ——. A. Gutbier. XXIII., page 1046.

Potassium Acetate; Electrolysis of ——. H. Hofer and M. Moest. XI. A., page 1034.

Graphite from Wood Charcoal; Preparation of ——. J. Weckbecker. XI. A., page 1034.

Nitrogen; Oxidation of ——, by the Electric Flame. F. v. Lepel. XI. A., page 1033.

Carbonic Acid; Reduction of Combined Solid —— to Carbon, &c. F. Haber and St. Tolloczka. XI. A., page 1033.

English Patents.

Barium Oxide; Manufacture of Porous ——. H. Schulze, Bernburg, Germany. Eng. Pat. 21,392, Oct. 5, 1903.

See Fr. Pat. 335,677 of 1903; this J., 1904, 253.—T. F. B.

Metal Sulphates or other Salts; Producing —— from Metal Sulphides and Sulphide Ores containing Iron. O. Meurer, Cologne, Germany. Eng. Pat. 26,668, Dec. 5, 1903.

See U.S. Pat. 733,590 of 1903; this J., 1903, 908.—T. F. B.

United States Patents.

[Lime-]Kiln. D. H. Gibson, Seattle, Wash. U.S. Pat. 771,623, Oct. 4, 1904.

A kiln for burning lime has an external annular gas chamber around its lower part, connected with a producer furnace and having adjustable openings or ports into the kiln. A distributor is arranged within the kiln so as to leave an annular space between it and the wall of the kiln. Air is led into the kiln through a central vertical channel in the distributor, having radial ports or openings into the annular space.—W. H. C.

Metals [and Caustic Soda]; [Electrolytic] Process of Obtaining ——. F von Kügelgen and H. Danneel. U.S. Pat 771,646, Oct. 4, 1904. XI. B., page 1035.

French Patents.

Barium and Strontium Hydroxides; Manufacturing —— by the aid of their Sulphides. C. M. Joseph, known as C. Limb. Fr. Pat. 338,958, July 30, 1903.

Barium or strontium sulphide solution is treated with the hydroxide of a heavy metal, preferably of zinc. On filtering the boiling solution from the precipitated zinc sulphide, crystals of barium or strontium hydroxide separate from the filtrate on cooling. The heavy metal hydroxide is prepared by adding milk of lime to solution of the chloride, and separating the precipitate. The zinc sulphide (or other metal sulphide) formed in decomposing barium sulphide as described, is dissolved in hydrochloric acid to reconstitute the chloride.—E. S.

Permanganic Sulphate derived from Manganese Dioxide; Production of a ——. Badische Anilin und Soda Fabrik. Fr. Pat. 338,961, July 30, 1903.

See Eng. Pat. 17,981 of 1903; this J., 1904, 749.—T. F. B.

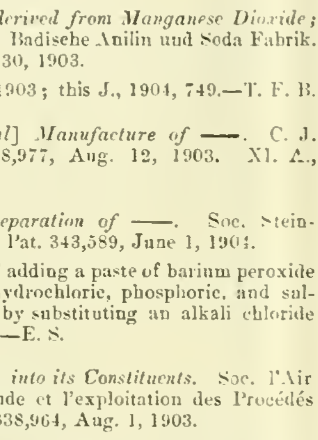
Zinc Oxide; [Electrical] Manufacture of ——. C. J. Barbier. Fr. Pat. 338,977, Aug. 12, 1903. XI. A., page 1034.

Oxygenated Water; Preparation of ——. Soc. Steinfelner and Co. Fr. Pat. 343,589, June 1, 1904.

The customary process of adding a paste of barium peroxide to a dilute mixture of hydrochloric, phosphoric, and sulphuric acids, is modified by substituting an alkali chloride for the hydrochloric acid.—E. S.

Air; Separation of —— into its Constituents. Soc. l'Air Liquide (Soc. p. l'étude et l'exploitation des Procédés G. Claude). Fr. Pat. 338,964, Aug. 1, 1903.

In the apparatus shown (see figure) the column Q is divided by the partition M into the two compartments I and II, which communicate by the overflow pipe L, the bottom of which reaches nearly to the bottom of the compartment H. Distillation and fractionation of the vapours from the liquid air are simultaneously effected in the compartment I, and the liquefied gas which collects at the bottom and overflows through the pipe L into the chamber H, consists of oxygen, more or less pure. In that chamber the oxygen volatilises and passes through the exit K, to a series of temperature-exchangers, and thence to apparatus for utilisation. The liquefying system is represented by the vessel B, into which previously cooled air enters through the inlet A, the adjuncts to which are the liquefying coil F, and the pipe C, D, E, terminating in a sprayer. The air ascending the coil becomes gradually liquefied as it ascends, the liquid formed becoming continuously poorer in oxygen. The liquefied portions trickle downwards into the vessel B, from which they pass through the tube and issue from the spreader, upon fragments of coke or the like, surrounding the coil, with which the chamber is packed, and which ensure even distribution. The nitrogen, in a more or less pure state, resulting from the fractionation of the gases volatilised from the liquid, escapes through the outlet to the coil O, on its way to the exchangers. Compare Fr. Pats. 296,211 (4th add.), 1904, and 338,842, 1903; this J., 1904, 816 and 823.—E. S.



VIII.—GLASS, POTTERY, ENAMELS.

English Patents.

Glazes, Enamels, or Bodying Material; Process and Apparatus for Applying —— to Bricks, Tiles, or other like Goods. R. Stanley and E. Jeffcote, Nuneaton. Eng. Pat. 25,686, Nov. 24, 1903.

The process consists in allowing a stream of the glaze, enamel, &c., to flow from an outlet, and spraying the same on to bricks, tiles, and other goods by means of jets of air, steam, or gas. The articles are placed on a travelling belt, and the glaze, &c., is contained in tanks, the outlets of which are near the articles on the belt; the spraying nozzles are arranged close to the outlets. A sloping roof is provided above the belt, and shields along each of its sides, whereby surplus material is collected and returned to troughs.—W. C. H.

French Patents.

Silica Glass; Manufacture of —— with Quartz Sand, Silicious Earth, &c. J. Bredel. Fr. Pat. 343,845, June 10, 1904.

Quartz sand, silicious earth, &c., is fused at a suitable temperature, and broken into small pieces, which are afterwards heated to 1,000° C., and rapidly plunged into cold water. By this means, it is claimed, the product acquires insensibility to variations of temperature, and the formation of air bubbles during the fusion is avoided.—W. C. H.

Enamels, Coloured Transparent; Process for obtaining in the Cold —— on a Metal Foundation. A. Westphal and H. Maillard. Fr. Pat. 343,602, June 1, 1904.

Substances which cannot be heated without injury, such as wood, iron, zinc, stone, &c., are first coated with thin metal foil, on which is then poured a mixture of a colouring matter with sodium silicate solution or varnish. After drying, the surface is polished. Two or more colours may be used to give different effects.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Lime-Sand Bricks; Effect of Infiltrated Water on ——. Thoniud. Z., 1904, **28**, 1441.

A number of different kinds of lime-sand bricks were soaked with carbonated water for a month, by luting glass cylinders on to the bricks and filling the former with water saturated with carbon dioxide. To ensure comparable results the bricks were cut in two, one half of each being treated as above, the other left dry. The crushing-strength test gave the following results:—

Dry Bricks.	Soaked Bricks.
Kilos. per Sq. Cm.	Kilos. per Sq. Cm.
187	154
213	194
265	251
313	253

thus indicating the inadvisability of using lime-sand bricks in places where they are liable to infiltration of water charged with carbon dioxide.—C. S.

English Patents.

Impregnating Wood or other Porous Materials to Protect against Damp, Fungus, or Insects, or for Colouring. W. R. Hodgkinson, London. Eng. Pat. 26,115, Nov. 30, 1093.

The materials to be treated are placed in a vessel from which gases or liquids may be extracted by a suitable pump, and any desired vacuum maintained. Impregnating substances, dissolved in suitable volatile solvents, are then admitted into the vessel, and the solutions driven into the pores of the materials by atmospheric pressure, the volatile solvents being finally removed preferably by again exhausting the vessel. Impregnating substances suggested are dyes, waxes, resins or extracts, such as the acetone solution of the waxy and oily constituents of teak wood.—W. C. H.

Works of Art [Imitation Marble] and the like; Process for Manufacturing ——. H. J. P. Dumas, London. Eng. Pat. 26,568, Dec. 1, 1903.

The process consists in mixing lime, prepared from white marble, with finely-ground or larger pieces of white or coloured marble, with or without the addition of pigments such as graphite, or metallic oxides, and making the whole into a stiff mass with water, and casting it in moulds. As a binding agent a cement-like body may be used, in which the silica and alumina are replaced by scrap marble ground to fine powder.—W. C. H.

Bricks, Paving Flags, Artificial Stone; Manufacture of Various Articles, such as ——. S. F. Prest, London. Eng. Pat. 17,968, Aug. 18, 1904.

The slag from Bessemer converters or Siemens's furnaces is ground or crushed, and the magnetic particles are separated from the non-magnetic. Slaked lime is then added to the latter, the whole is moulded under pressure and then subjected in a closed chamber to the action of steam under pressure. A red colour may be imparted to the grey product by adding hæmatite iron ore.—A. G. L.

United States Patent.

Bricks; Coating ——, *and Apparatus therefor.* M. Perkiewicz, Ludwigsberg, Germany. U.S. Pat. 771,443, Oct. 4, 1904.

See Eng. Pat. 3760 of 1904; this J., 1904, 662.—T. F. B.

French Patents.

Marble and Stone, Artificial; Manufacture of ——. L. Torno. Fr. Pat. 343,479, March 8, 1904.

The artificial marble is made by mixing 100 kilos. of finely-ground porcelain waste, twice-burnt clay, lime burnt three imes, aluminium silicate, and powdered pebbles, 10 kilos. f marble dust, 1 kilo. of mica, 2 kilos. of gum arabic or ther gum, 100 grms. of glue, 300 grms. of agar-agar, 50 rms. of borax, 25 grms. of saponin, and 100 litres of vater. Colouring matter may also be added. The whole s allowed to remain in a mould for eight to ten hours, after vhich it is suspended by threads placed in the mixture for ight days in order to dry. When thoroughly dry, the nass is plunged into a liquid of the following composition, reviously heated to 100° C.: 1 kilo. of gum arabic, 100 rms. of glue, 300 grms. of agar-agar, 50 grms. of borax, 5 grms. of saponin, and 100 litres of water. After emoving from this solution the mass may be polished. —A. G. L.

Tarring or Asphalting Roads; Product for —— and Process for its Manufacture. L. Préaubert and G. A. Thubé. Fr. Pat. 342,898, May 5, 1904.

HE product for preventing the formation of dust on road-ays, &c., consists of a mixture of a solution of casein, nd of bitumen, asphalt, tar, or other bituminous body, reviously softened by heat, the mixture being diluted with suitable quantity of water, with or without the addition f fatty substances, antiseptics, and colouring or decoloring materials. See also Fr. Pat. 331,805 of 1903; this J., 003, 1200.—W. C. H.

Building Material; Artificial ——. L. E. Colomiès. Fr. Pat. 343,223, May 17, 1904.

PRODUCT called "calsibonarite massive" is obtained by ixing 45 parts of river sand or clay, 45 of limestone, 3 of on or copper sulphate, 3 of salt, 2 of alum, and 2 of borax, moulding and subjecting the mixture to a temperature of 1100° to 1200° C. After cooling, the mass presents a brilliant and polished surface. Another product called "calsibonarite vitrifiée" is made from 42·5 parts of river sand or clay, 42·5 of limestone, 4 of copper or iron sulphate, 5 of salt, 3 of alum, and 3 of borax. The mixture is fused at 1100° to 1200° C., and used for making paving-stones, facings, &c.—A. G. L.

Cement; Process for Making a Vitreous —— which can be used as a Mastic. P. Steenbock. Fr. Pat. 343,860, June 10, 1904.

See Eng. Pat. 15,181 of 1904; this J., 1904, 901.—T. F. B.

Substance [Cement] which Hardens under the Action of Phosphoric Acids or their Acid Salts; Process for Making a ——. P. Steenbock. Fr. Pat. 343,861, June 10, 1904.

See Eng. Pat. 15,181 of 1904; this J., 1904, 901.—T. F. B.

X.—METALLURGY.

Acid Open-Hearth Manipulation. A. McWilliam and W. H. Hadfield. Iron and Steel Inst., Oct. 1904.

The opinion is generally prevalent that to increase the silicon in the metal in the open-hearth furnace an abnormally high temperature is necessary. The authors still uphold their view that, though a high temperature may accelerate the reduction of silica by carbon, the main determinant of the amount of silicon in the steel is the composition of the slag, especially with regard to its acidity. They quote many instances in support of their view, but especially one experiment in which at a certain period they added to the charge 8 cwt. of old red bricks containing 79 per cent. of silica. Though the effect of this was obviously to lower the temperature, yet the silicon in the metal, which had been gradually going down, at once began to rise. Another experiment showed the effect of lime: the slag was allowed to thicken for nearly an hour, when $3\frac{1}{2}$ cwts. of limestone were added: the slag rapidly thinned, but though the percentage of silica in the slag was thus reduced from $55\frac{1}{2}$ to $53\frac{1}{2}$, and that of lime increased from 2 to 6, the silicon in the metal continued (though at a decreasing rate) to increase. Magnesia (3 cwts. of magnesite) in another experiment behaved very similarly; but 4 cwts. of peroxide of manganese, while it thinned the slag and made it less silicious, caused also a rapid drop in the silicon in the metal. The difference in behaviour between oxidising and non-oxidising "bases" is clearly shown by these experiments. In the last experiment the slag afterwards thickened and became much more silicious, at the cost, as was seen after the termination of the experiment, of the bottom of the furnace. Brinell has found (paper read by Wahlberg at May meeting of Iron and Steel Inst.) that, giving aluminium and silicon certain relative values in terms of manganese, calculating all out to manganese and taking the total, a number is obtained which is termed the "density-quotient," such that for the same "density-quotient" the same type of ingot is yielded, and the higher the "density-quotient" the fewer blowholes in the ingot. The authors' general experience agrees with that of Brinell; but they also find that the longer the time given for thickening of the slag, the lower is the "density-quotient" needed for the same type of ingot, or the fewer are the blowholes in ingots of the same "density-quotient"; ingots made (1) by ordinary treatment, (2) by giving $1\frac{1}{2}$ hours' and (3) $2\frac{1}{2}$ hours' thickening, and having "density-quotients" of 1·35, 1·00, and 0·814 respectively, were all three alike as to their freedom from blow-holes. —J. T. D.

Steel; Temperatures of Transformation of ——. G. Charpy and L. Grenet. Comptes rend., 1904, **139**, 567—568.

The temperatures of transformation of specimens of steel containing varying amounts of carbon were determined (*a*) by the electric resistance, (*b*) by the "thermo-electric" method, (*c*) by the expansion. The results were as follows:—

Temperature of Transformation.

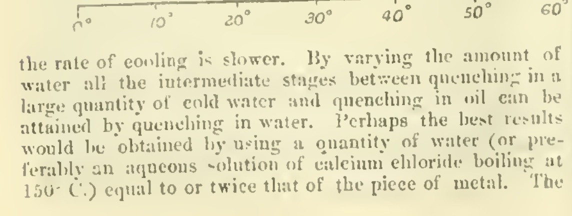
Carbon.	Resistance Method.		Expansion Method.	
	Start.	Finish.	Start.	Finish.
Per Cent.	°C.	°C.	°C.	°C.
0·82	730	760	735	745
1·06	730	760	740	750
1·15	739	739	735	740
1·38	750	750	735	755

Carbon.	Thermo-electric Method.		Expansion Method.	
	$\frac{dE}{dt}$	$\frac{dE}{dt}$	Start.	Finish.
Per Cent.	Max.	Min.	°C.	°C.
0·28	720	840	720	820
0·62	700	760	743	760
0·92	700	800	737	760
1·14	700	780	747	760
1·30	680	740	725	740

It thus appears that the resistance method and the expansion method give fairly concordant results, but the results obtained by the "thermo-electric" method do not agree well, except in the case of very low carbon steels.
—T. F. B.

Steel; Studies on the Quenching of ——. H. Le Chatelier. Bull. Soc. Encourag., 1904, **106**, Rev. Metall., 473—491.

The author determined the rate of cooling of test pieces of iron and steel in different liquids. The length of time occupied in cooling from 700° to 100° C. by a piece of iron or steel 18 mm. long and 18 mm. diam. quenched at 900° C. in a large volume of water, was found to be 6—8 seconds. The cooling proceeds at the same rate in different aqueous solutions, *e.g.*, solutions of sodium chloride, sulphuric acid, and sodium carbonate, as in pure water. Agitation of the cooling liquid has no notable influence on the rate of cooling, but is advantageous in that the metal is cooled uniformly. By raising the temperature of the water used for quenching, the rate of cooling is retarded, the retardation being greater the nearer the temperature of the water approaches 100° C. The rate of cooling is much slower when the quenching is effected in metal baths (mercury, molten lead, &c.), showing that the conductivity of the quenching liquid is of less importance than its specific heat. Quenching in fresh colza oil gives about the same results as quenching in boiling water, but with oil which has been used several times, and which has thickened, the rate of cooling is slower. By varying the amount of water all the intermediate stages between quenching in a large quantity of cold water and quenching in oil can be attained by quenching in water. Perhaps the best results would be obtained by using a quantity of water (or preferably an aqueous solution of calcium chloride boiling at 150° C.) equal to or twice that of the piece of metal. The curve given, shows the rate of cooling of a piece of metal from 700° C. when quenched respectively in a large quantity of cold water; in three times its weight of water (1) (see figure), twice its weight of water (2), 1½ times its weight of water (3), and in oil.—A. S.



Molybdenum Steels. L. Guillet. Comptes rend., 1904, **139**, 540—542.

Like the tungsten steels (this J., 1904, 663) these steels are divisible into two classes — those showing a perlitic structure (below 2 per cent. of molybdenum when the carbon is 0·2 per cent., below 1 per cent. of molybdenum when the carbon is 0·8 per cent.), and those containing a double carbide (with more molybdenum than 2 or 1 per cent. as the carbon is 0·2 or 0·8 per cent.). The latter constituent appears as extremely fine white filaments, left white by picric acid, but blackened by alkaline sodium picrate. The effect of molybdenum even in small quantity is greatly to increase the breaking stress without rendering the metal brittle. In the case of the perlitic steels, the breaking stress and elastic limit rise with increase of molybdenum; the elongation is fair, the reduction of area good, the resistance to shock high, and the hardness medium. The carbide steels have very high breaking stress and elastic limit, and are extremely hard, but they are very brittle. Their behaviour under tempering and annealing is similar to that of tungsten steels. Indeed, the effect of molybdenum is in general similar to that of tungsten, but a much smaller amount of molybdenum than of tungsten is needed to produce the same result. Bearing this in mind, molybdenum steels are probably not more expensive than tungsten steels, and may frequently, the author thinks, be substituted for them with advantage.—J. T. D.

Tin Steels. L. Guillet. Bull. Soc. d'Encourag., 1904, **106**, Rev. Metall., 499—505.

The author examined two series of tin steels with from 1·79 to 9·98 per cent. of tin containing:—(1) 0·100 to 0·204 per cent. of carbon; and (2) 0·665 to 0·767 per cent. of carbon. The results showed that tin makes the steel very hard and brittle. The tin dissolves in the iron and appears to form a compound with it. In tin steels containing not more than 10 per cent. of tin all the carbon is in the form of pearlite. Tin steels thus resemble titanium steels (see following abstract) more closely than they do silicon steels, in that the whole of the carbon contained in them occurs in the form of iron carbide.—A. S.

Titanium Steels. L. Guillet. Bull. Soc. d'Encourag., 1904, **106**, Rev. Metall., 506—510.

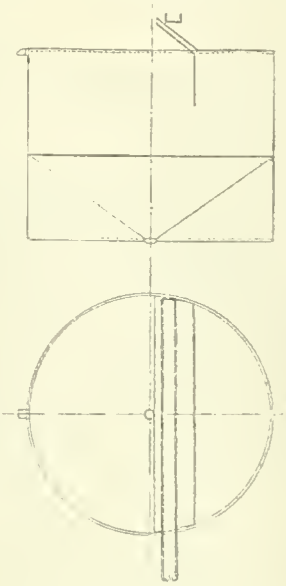
Two series of steels were examined, containing:—(1) from 0·112 to 0·137 per cent. of carbon and from 0·415 to 2·57 per cent. of titanium, and (2) from 0·611 to 0·760 per cent. of carbon and from 0·325 to 8·71 per cent. of titanium. The results of both the micrographic examination and of mechanical tests of the alloys shows that titanium has practically no influence on the properties of carbon steels.—A. S.

Gold Ore; Regrinding of —— for Cyaniding, &c. C. Butters and E. M. Hamilton. Inst. of Min. and Met., Oct. 20, 1904.

Many ores which have proved very refractory under other methods of treatment will yield excellent results by the cyanide process when reduced to a very fine state of division. The best method of effecting this seems to be to stamp through a screen of 30 to 35 mesh and then regrind the coarser particles in a tube-mill or some similar machine. The grade of sand to be reground should be all that will not pass a 200-mesh screen. When No. 35 screens were in use at the El Oro mill, Mexico, this amounted to 51 per cent. of the pulp issuing from the mortar boxes. The regrinding resulted in about 50 per cent. of the total ore in the battery bins being rendered capable of treatment by agitation, the remainder leaching freely; the extra recovery of gold and silver amounted to about 16*s.* 6*d.* per ton of sand reground and an extra profit of 14*s.* 4½*d.* With a view of recovering more of the silver, many tests were made on the slimes, such as mechanical agitation of the solution, addition of potassium permanganate, addition of mercuric chloride, roasting the dried slime, &c. On the whole, the use of mercuric chloride seems to give the best results at the least cost. The only drawback to its use is the possible effect it may have on the steel tanks and iron piping.—J. H. C.

Slimes [*Gold*] *Treatment; Impts. in* ——. M. Torrente. J. Chem., Metall. and Mining Soc., S. Africa, 1904, 5, 46—49.

The improvements relate to the settling and separation of the slime from the washing solutions, after extraction of the gold. The separator consists of a tank (see figure) with a conical bottom. A vertical partition extends downwards to about two-thirds of the depth of the cylindrical portion of the tank, whilst above the tank it is connected to an inclined plane. A number of these tanks are connected together. They are filled with water or cyanide solution, and the slime-pulp is delivered slowly on to the inclined plane above the first tank of the series. The solid matter passes down into the conical bottom, where it is run off, mixed with water or cyanide solution, and passed through the second separator, and so on. The clear solution containing the dissolved gold, runs off at the top of the tank and passes to the precipitating boxes. Figures are given showing the satisfactory results which are obtainable by this method of treatment.—A. S.



"*White Precipitate*" *of the Precipitating Boxes in Cyanide Works.* A. Prister. J. Chem., Metall. and Mining Soc., S. Africa, 1904, 5, 62—63.

The author gives the following analyses of "a medium solution" before and after passing through the zinc precipitating box, and claims that the results confirm his view that he "white precipitate" consists mainly of zinc ferroyanide and not of zinc oxide.

——	Before contact with Zinc.	After passing through the Zinc Box.
xygen	0·61	0·49 per cent. by volume.
itrogen	1·84	1·56 „ „
otassium ferrocyanide	0·147	0·0276 per cent.
hiocyanate	0·0232	0·0247 „
lkalinity	0·23	0·254 „
otassium cyanide	0·110	0·045 „

It appears therefore that over 81 per cent. of the ferroyanide present in the original solution remained in the zinc ox "in the form of white precipitate"; the reduction in the mount of potassium cyanide would also favour the precipiation of zinc ferrocyanide. The increase in the alkalinity f the solution would be unfavourable to the separation of inc oxide, which is soluble in alkalis.—A. S.

opper in Potassium Cyanide; Examination of Solutions of ——. F. Kunschert. XI., page 1034.

Chromium and Iron [*in Ores and Alloys*]; *Volumetric etermination of* ——. R. Glasmann. XXIII., page 1046.

English Patents.

Iron Ore or Iron Wastes or Natural Iron Sands; Converting Powdered —— *into Briquettes or Lumps.* T. Rouse and H. Cohn, London. Eng. Pat. 25,248, Nov. 19, 1903.

Powdered iron ore, iron waste, or natural iron sand is wetted with a weak solution of alum, and moulded into briquettes or lumps, which, if intended for transport, may be hardened by heating them to about 700° C.—E. S.

Manganese Steel; Manufacture of ——. R. A. Hadfield, Sheffield. Eng. Pat. 25,794, Nov. 26, 1903.

An alloy of manganese and iron containing from 70 to 90 per cent. of manganese and less than 3 per cent. of carbon, such as is produced in the electric furnace, is added, preferably in a molten condition, to molten decarburised iron in lieu of the ferro manganese ordinarily used. In this way it is possible to produce a low-carbon manganese steel which is much less liable to fracture than that heretofore produced.—J. H. C.

Gold Ores; Extraction of Gold from ——. J. W. Worsey and E. Hoal, St. Helens, Lancs. Eng. Pat. 14,398, June 29, 1903.

To the powdered ore, freed as much as possible from aluminous silicates, chlorates and bromides of alkalis or alkaline earths are added together with acid, whereby nascent "bromide of chlorine" is produced, which, after the temperature of the mass has been raised to the boiling point, is stated to dissolve the gold. The gold solution is separated by decantation and leaching, a lead salt is added, then sulphuretted hydrogen, and finally air is blown through, thus precipitating the gold and lead as sulphides which may be reduced in any known way. Any gold remaining in the residues may be dissolved out with a weak solution of "double or single ferro-prussiate of ammonium and soda or potash."—J. H. C.

Magnetic Separators for Ores, &c. J. T. Dawes, Prestatyn, Wales. Eng. Pat. 21,324, Oct. 5, 1903.

The ore to be treated, is finely powdered and fed upon open-ended rotatable non-magnetic drums having surfaces sufficiently rough to carry the ore beneath rotating non-magnetic discs. By means of electro-magnets placed within the drums and above the discs, strong magnetic fields are produced passing through the discs and drums. By the rotation of the drums, the ore is carried forward through these fields, the magnetisable particles being attracted to the lower surfaces of the discs and carried out of the fields, when they fall into hoppers, the non-magnetisable particles remaining upon the drums until they too are carried through the fields and fall into hoppers.—J. H. C.

Magnetic Separators for Ores or like Materials. J. M. Moss, Heaton Chapel, Lancashire. Eng. Pat. 23,353, Oct. 28, 1903.

The powdered ore is fed from a hopper upon an endless travelling belt, which is supported on pulleys to pass below, and in contact with, a polygonal drum, provided with electro-magnets, and having projections or anti-friction rollers at the junctions of the faces, so arranged as to depress a portion of the belt as the drum revolves. There is also a movable roller to maintain the tension on the belt.—E. S.

Fused Metals and Alloys; Process and Apparatus for Granulating or Pulverising ——. L. Fink-Huguenot, Paris. Eng. Pat. 16,449, July 25, 1904. Under Internat. Conv., Jan. 7, 1904.

Metals or alloys which fuse below 1,472° F. are fed, in a molten condition, into the upper part of a vertical closed cylindrical vessel. The fused metal flows out through a horizontal side-passage near the bottom of the vessel and is ejected, by means of gas or steam under pressure, into a truncated cone in the form of spray. The spray passes through a central opening in the truncated cone, and is collected in a suitable receptacle in the form of a metallic

powder. The excess of gas or steam which does not escape through the discharge opening of the cone, returns through pipes to the top of the closed cylindrical vessel.
—A. S.

United States Patents.

Steel Alloy. C. E. Manby, Carnegie, Pa. U.S. Pat. 771,559, Oct. 4, 1904.

Claims are made for steel containing nickel and ferrovanadium; or ferrovanadium, nickel, and ferromanganese; and for a steel alloy composed of iron, carbon, nickel, manganese, and ferrovanadium.—E. S.

Metals or Alloys; Method of Decarbonising ——. F. von Kügelgen and G. O. Seward, Holcombe Rock, Va., Assignors to the Willson Aluminium Co., New York. U.S. Pat. 771,645, Oct. 4, 1904.

The ore is smelted under such conditions as to give a maximum yield of metal, independent of the proportion of carbon introduced or present, and the molten product is then decarburised by bringing it "into contact with calcium."—E. S.

Steel; Furnace for the Manufacture of ——. G. Gin, Paris. U.S. Pat. 771,872, Oct. 11, 1904.

See Fr. Pat. 342,101 of 1904; this J., 1904, 904.—T. F. B.

Iron; Process of Dechromising ——. O. Massenez, Wiesbaden, Germany. U.S. Pat. 772,164, Oct. 11, 1904.

See addition, dated July 1, 1903, to Fr. Pat. 329,132 of 1903; this J., 1903, 1353.—T. F. B.

Gold; Apparatus for Extracting —— from Auriferous Sand, &c. R. Blake, Assignor to Eliza Blake, Madison, N.J. U.S. Pat. 771,454, Oct. 4, 1904.

In an amalgamating tank a horizontal revolving cylinder is set transversely to the feed of ore, its lower part being immersed in mercury. Circular guards are secured to the inner sides of the tank, each having an annular horizontal flange overhanging, and closely embracing, the contiguous end portion of the cylinder. A revolving wiper is provided for dislodging the material carried upon the cylinder. A pivotally suspended arm depends within the upper portion of the tank, between the cylinder and the discharge aperture, and is provided with several alternating series of teeth extending transversely across the tank. Means are provided for oscillating the arm, so that the teeth move backward and forward in the path of an arc above the surface of the mercury.—E. S.

Ores; Process of Concentrating ——. Alice H. Schwarz, New York, Assignor to Schwarz Ore Treating Co., of Arizona. U.S. Pat. 771,277, Oct. 4, 1904.

Paraffin or some fatty substance which is solid at the ordinary temperature, is melted, and mixed with the powdered ore in a vessel provided with a mechanical agitator, and with means for introducing and discharging fluids. Cold water is introduced during agitation of the charge, and separation is effected between the valuable constituents entrained by the fatty matter and the gangue. The fatty matter is then liquefied to obtain the "values."
—E. S.

French Patents.

Cast-Iron; Process and Installation of Furnaces for the Production of —— by Reduction and Fusion of the Ores in Separate Furnaces. Georgs-Marien-Bergwerks and Hütten-Ver. Akt.-Ges. Fr. Pat. 343,548, May 30, 1904.

A blast furnace in which previously reduced iron ore is smelted with coke and lime, and is provided with an exit conduit for the gases (chiefly carbon monoxide) at about the upper limit of the zone of fusion. This conduit leads to near the bottom of one or more cupola furnaces in which the raw ore is reduced solely by the action of the reducing gases.—E. S.

Iron; Manufacture of ——. E. Fleischer. Fr. Pat. 343,701, June 4, 1904.

The finely-powdered iron ore, mixed with any required flux, is delivered into the upper end of an inclined rotating cylinder, the lower end of which is adapted to a second rotating cylinder, placed at a greater inclination than the first. The ore descending the first cylinder is met by a strongly reducing flame of relatively low temperature, issuing from the junction of the two cylinders, and the reduced and spongy iron produced, is fused in the second cylinder by encountering there a flame of high temperature, but of neutral or feeble reducing effect. In another form of the apparatus, a single rotating cylinder is used, having operating within it a specially devised burner for giving the reducing flame, whilst the hotter flame meets the ore at the end.—E. S.

Copper, Zinc, Cadmium, Silver, Nickel, Cobalt, and Tungsten; Obtaining Hydroxides of ——, in the Wet Way, by Direct Extraction. D. Lance. Fr. Pat. 342,865, May 4, 1904.

A "massive" filter press, in which the usual intermediate plates are replaced by a cylinder, is used in obtaining saturated solutions from finely-powdered ores of the metals named in the title, the solution being aided by the presence of ammonia or an amine, or a mixture of these. Simple or complex silicate ores are prepared for the specified treatment by a previous attack with a strong acid. From the solutions obtained, the hydroxides are fractionally precipitated by the aid of heat, assisted or not by a vacuum, the precipitation occurring in the following order:—zinc, cadmium, cobalt, nickel, copper, silver. The ammoniacal saline combinations of the dissolved metals are, when required, decomposed by the use of baryta or lime, in case it is required to fix sulphuric acid; or if it be required to retain carbon dioxide in combination, calcined dolomite may be used.—E. S.

Ores; Process and Apparatus for the Treatment of ——. J. E. Goldschmid. Fr. Pat. 343,313, May 19, 1904.

Powdered iron ore is charged from a hopper into one end of a horizontal revolving cylinder, into the opposite end of which a pipe passes conveying water-gas. Within the gas-pipe, and reaching beyond its end (at which the gas is ignited) is a tube conveying air to support combustion. The ore is successively dried, oxidised, and reduced, as it travels towards the flame at the exit end. A U-tube for passage of gaseous products is adapted to one end of the cylinder, in which tube condensation of vapours is effected by water spray. The apparatus is specially adapted for the preliminary treatment of pyrites cinders, &c., but is also available generally in treating matters which, owing to being pulverulent, are otherwise difficult to treat. Such matters are the residual products of the aniline manufacturer, or the residues of the treatment of copper ores.
—E. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Zinc Salts: Study of Complex ——. F. Kunschert. Z. anorg. Chem., 1904, **41**, 337—358.

The author investigated the condition of zinc in solutions of its complex salts, by electro-chemical means and by solubility determinations.

Zinc in Alkali Oxalate Solutions.—In concentrated solutions of zinc oxalate in ammonium and potassium oxalates, the zinc is in the form of the complex ions $Zn(C_2O_4)_3''''$, but on dilution, the latter split up, in part, into $Zn(C_2O_4)_2''$ and free oxalate ions. A somewhat higher E.M F. is required to separate zinc from alkali oxalate solutions, then from solutions of its sulphate, but the deposit obtained from the oxalate solutions is more adherent. Further, in the electrolysis of sulphate solutions, sulphuric acid is set free, and thus the concentration of the hydrogen ions becomes greater and the discharge potential of the same less, so that the proportion of the current energy consumed in the evolution of hydrogen increases continuously. In the electrolysis of oxalate solutions, on the other hand, whilst the tendency to the evolution of hydrogen is greater at first than in the sulphate solutions, it remains nearly constant throughout the course of the electrolysis.

Zinc in Sodium Hydroxide Solutions.—The zinc exists chiefly in the form of ZnO_2'' ions, which, however, are hydrolysed, in part, to $HZnO_2'$ and hydroxyl ions. Both the compounds, Na_2ZnO_2 and $NaHZnO_2$, are stable only in the presence of excess of sodium hydroxide. In electrolysing with insoluble anodes, the E.M.F. required for the separation of zinc is 1·488 volts from N/1-alkali solution, and 1·528 volts from a neutral solution. In general, the employment of neutral solutions gives the more satisfactory results.

Zinc in Potassium Cyanide Solutions.—The zinc exists partly in the form of $Zn(CN)_4''$ ions and partly in the form of $Zn(CN)_3'$ ions. In a solution of zinc in potassium cyanide, according to the concentration, from 10 to 20 per cent. of the salt $K_2Zn(CN)_4$ is decomposed into potassium cyanide and the salt $KZn(CN)_3$. If the potassium cyanide produced be fixed, *e.g.*, by addition of silver nitrate, the decomposition proceeds further, until finally the whole of the double salt is decomposed, according to the equation: $K_2Zn(CN)_4 + 2AgNO_3 = 2KAg(CN)_2 + Zn(NO_3)_2$. The total cyanogen in the zinc double cyanide can thus be determined by titration with silver nitrate solution, and the statement of Bettel (Chem. News, 1895, **72**, 286 and 298) that in the titration of cyanide solutions containing zinc, only 7·9 per cent. of the cyanogen in the zinc double salt reacts with the silver nitrate, is incorrect. In the titration of strong solutions, indeed, a turbidity is produced before the whole of the theoretical quantity of silver nitrate solution has been added, but this turbidity consists not of silver cyanide, but of zinc cyanide, and its formation can be prevented by strongly diluting the cyanide solution before titrating. The formation of free potassium cyanide in solutions of the zinc double salt also accounts for the solvent action of such solutions on gold, and explains the possibility of regenerating the potassium cyanide by soluble sulphides. The potassium cyanide cannot, on the other hand, be regenerated by addition of alkali, since the ionic concentration of the zinc is greater in alkaline than in cyanide solutions; indeed, zinc in alkaline solution can be converted into the zinc double cyanide by addition of potassium cyanide. Zinc dissolves, with evolution of hydrogen, in potassium cyanide solutions of strengths such as are used in gold extraction. The rate of solution is accelerated by the presence of foreign metals such as platinum and gold, and by excess of oxygen.—A. S.

Nitrogen; Oxidation of —— by the Electric Flame. F. v. Lepel. Ber., 1904, **37**, 3470—3474. (See also this J., 1904, 376.)

In the course of some experiments in which currents of high potential were conducted by the aid of a rotating distributor simultaneously through several discharge-tubes, it was observed that, *e.g.*, with a current of about 6 ampères and 14 volts, the yield of acid (nitrogen oxide) from each of two discharge tubes arranged in parallel, with fixed electrodes, was approximately the same as from one tube by itself. With this arrangement, however, strong sparking was observed, indicating loss of energy, when the rotating distributor was passing over from one cathodic conducting wire to the other. Experiments were then made in which division of the electric flame was effected in a single discharge-tube by the use of a fork-shaped anode, the points of which could be made to rapidly rotate on the broad cathode plate. With a large apparatus of this form (capacity, 60 litres), and a current of air of 1800—2030 c.c. per minute, a yield of 2·419 grms. of acid was obtained in seven hours by using a current of 12 ampères and 70 volts. With two such apparatus, however, and using a rotating distributor, the yields were relatively much smaller; for example, with a current of 12 ampères and 65 volts the yield of acid was 2·4 grms. per hour from one tube alone, and 1·5 grms. from the other tube alone, whilst from the two tubes together the maximum yield was 1·5 grms. per hour. The cause of the relatively small yield in the large apparatus in comparison with the yield obtained in the preliminary experiments with a small apparatus with divided current is to be explained by the need of determining with each different size of apparatus, the most suitable values for (1) the amount of electric energy; (2) amount of air; (3) rate of rotation of anode. The experiments, however, show that rotation of the anode and division of the electric flame are advantageous.—A. S.

Carbonic Acid; Reduction of Combined Solid —— to Carbon, and Electro-Chemical Reactions with Solid Substances. F. Haber and St. Tolloczko. Z. anorg. Chem., 1904, **41**, 407—441.

The authors have investigated the electrolysis of solid substances at temperatures below their melting points.

Electrolysis of Solid Caustic Soda.—Metallic sodium was produced by the electrolysis of caustic soda below its melting point, with a current-yield of from 39 to 46 per cent., but this was not a true case of electrolysis of a solid compound, since it could be proved that in the electrolyte small pasty particles were present, which would of course act as conductors for the current.

Reduction of Combined Carbonic Acid to Carbon.—Experiments were made with mixtures of barium chloride and carbonate, the electrolyte being contained in a nickel crucible which served as anode; the cathode was of iron, platinum, or artificial graphite. The crucible was heated in a Hempel's gas furnace or in an electric furnace. The theoretical current-yield of carbon was obtained. The formation of the carbon is due to the action of the barium set free at the cathode on the barium carbonate.

Reactions between Chlorides and Flue Gases.—In an attempt to electrolyse pure solid barium chloride in a nickel crucible heated in a Hempel's gas furnace, the separation of carbon in amount equivalent to 34 per cent. of the theoretical current-yield was effected. This was found to be due to the formation of barium carbonate from the barium chloride by the action of the products of combustion of the gas, according to the equation: $BaCl_2 + CO_2 + O = BaCO_3 + Cl_2$. Experiments showed that calcium chloride and sodium chloride are acted upon in a similar manner. The following are some of the results obtained by heating the substances named in a Hempel's gas furnace:—

Substance.	Time.	Temperature.	Percentage of Chloride converted into Carbonate.
	Mins.	°C.	
6·935 grms. of calcium chloride.	55	780	8·22
10·2215 grms. of barium chloride	55	1000	3·06
12·283 grms. of sodium chloride.	40	900	0·184

In the attempt to electrolyse barium chloride, a small amount of barium sulphate was formed in a similar manner by the action of the sulphur dioxide or trioxide in the products of combustion of the gas.

Electrolysis of Pure Barium Chloride.—Quantitative current-yields of barium subchloride were obtained by electrolysing pure barium chloride at a temperature below its melting point, in a nickel crucible heated in an electric furnace. Metallic barium is first separated, and this reacts with the barium chloride, forming the subchloride.

Solid Daniel Cells.—Two solid Daniel cells were prepared. In the one, some lead chloride was fused in a U-tube of refractory glass and then allowed to solidify. In one limb of the tube a layer of molten lead was introduced above the lead chloride and a rod of lead inserted in the fused metal to serve as electrode. In the other limb was inserted a silver wire, which carried on its end a lump of silver chloride (prepared by repeatedly dipping the wire in fused silver chloride). This limb was then heated with a small flame until the silver chloride and lead chloride were in good contact. In the second cell, cuprous chloride and copper were substituted for the lead chloride and lead. The E.M.F. of each of these cells was quite measurable, and corresponded well with the value calculated according to Thomson's law.—A. S.

Graphite from Wood Charcoal; Preparation of ——. J. Weckbecker. Metallurgie, 1904, **1**, 137—142. Z. Elektrochem., 1904, **10**, 837.

Rods formed from a mixture of charcoal and alumina, in different proportions, were inserted as a resistance between massive carbon electrodes. By passage of the electric current they were brought to a sufficiently high temperature to dissociate the aluminium carbide, which is first formed, and to volatilise practically all the aluminium. The amount of graphite in the rod was determined by decomposing the amorphous carbon with fuming nitric acid. When the heating was carried out at 2000°—2490° C., a mixture containing 5 per cent. of alumina gave 68 per cent. of graphite, a mixture containing 30 per cent. of alumina, 97 per cent. of graphite. Furnaces are described for the continuous treatment of the mixture with production of graphite. The power required in these furnaces was 19 k.w. hours per kilo. of graphite.—R. S. H.

Potassium Acetate; Electrolysis of ——. H. Hofer and M. Moest. Z. Elektrochem., 1904, **10**, 833—834.

The authors offer some criticism of the recent paper by F. Foerster and A. Piquet (see this J., 1904, 940), and point out that methyl alcohol is a very important secondary product in the electrolysis of potassium acetate. The view that the various products of electrolysis are due to the mutual reaction of the separating anions is preferred to that ascribing them to anodic oxidation of acetic acid. —R. S. H.

English Patents.

Insulating Material for Electric Conductors. British Thomson-Houston Co., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 25,853, Nov. 26, 1903.

The insulating material is formed by firing together a mixture of ground soapstone, a refractory substance such as clay, and cryolite or other fluxing agent which melts at a sufficiently low temperature to leave the soapstone in a soft condition, so that it may be drilled or machined.—R. S. H.

Peroxides of Magnesium and Zinc; Process for the Electrolytic Manufacture of ——. F. Hinz, Berlin. Eng. Pat. 24,806, Nov. 14, 1903.

See Fr. Pat. 337,285 of 1903; this J., 1904, 549.—T. F. B.

Copper Sulphate and Caustic Alkalies; Process and Apparatus for the Manufacture of —— by the Electrolysis of Alkaline Chlorides. H. M. Granier, Villemonble, France. Eng. Pat. 4187, Feb. 23, 1904. Under Internat. Conv., April 6, 1903.

See Fr. Pat. 330,963 of 1903; this J., 1903, 1086.—T. F. B.

Gases and Vapours; Production of Chemical Reactions in —— by Electric Discharges. A. de Montlaur, Paris. Eng. Pat. 12,541, June 2, 1904. Under Internat. Conv., June 3, 1903.

See Fr. Pat. 332,744 of 1903; this J., 1903, 1298.—T. F. B.

United States Patents.

Electric Heating; Apparatus for ——. [*Carbide Production.*] W. S. Horry, Assignor to Union Carbide Co., Niagara Falls, N.Y. U.S. Pat. 771,249, Oct. 4, 1904.

The electric furnace described is arranged so that terminals connected to a source of polyphase current are placed in contact with a conducting body. Different phases of the current are caused to flow along paths which converge to a common point within the body, which thus becomes heated up to any required temperature. The conducting material may consist of a mixture of "a compound and a reducing agent" or of carbide-forming materials. Means are provided for tapping off the product. (See this J., 1904, 548.) —R. S. H.

Electric Heating; Apparatus for ——. [*Carbide Production.*] W. S. Horry, Assignor to Union Carbide Co., Niagara Falls, N.Y. U.S. Pat. 771,250, Oct. 4, 1904.

As in the furnace described in the preceding abstract, polyphase currents are employed, but the connections are so arranged that the current flows along paths which cross each other through the material to be heated. (See this J., 1904, 548.)—R. S. H.

Peat; [Electrical] Apparatus for, and Process of Removing Water from ——. B. Kittler, Memel, Germany. U.S. Pats. 772,717 and 772,891, Oct. 18, 1904.

See Eng. Pat. 126 of 1904; this J., 1904, 326.—T. F. B.

French Patents.

Zinc Oxide; Manufacturing [Electrical] ——. C. J. Barbier. Fr. Pat. 338,977, Aug. 12, 1903.

Plates of carbon and of zinc are suspended alternately side by side in a bath of pure water. The plates are sufficiently apart to permit the free falling down of the zinc oxide which forms on the zinc plates when these are connected to the positive pole of a source of electricity, the carbon plates being connected to the negative pole. The oxide as it falls may be caught in a screen suitably supported for agitation; or the process may be made continuous by withdrawing the water charged with zinc oxide to a filter as fresh water flows into the bath.—E. S.

Electric Resistance Materials; Manufacture of ——. Chemisch-Elektrische Fabrik "Prometheus." Fr. Pat. 343,731, June 6, 1904.

The resistance bodies are formed from carbides of silicon or boron, or from other suitable material, by transforming the finely-divided material into a coherent mass by heating it to a temperature below its melting point. One method of carrying this out is to add boric acid to the finely-pulverised carbide, to strongly compress the mixture, and then to bake it at about 1200° C.—R. S. H.

(*B.*)—ELECTRO-METALLURGY.

Nickel Matte; Electrolytic Treatment of ——. E. Günther. Metallurgie, 1904, **1**, 77—81. Z. Elektrochem., 1904, **10**, 836—837.

The author has been successful in the direct electrolytic treatment of a nickel matte low in copper. The solution of the material at the anode was satisfactory. Using slightly-acid nickel sulphate as electrolyte, at first 92 per cent. of the current efficiency was attained, which, only much later, fell to 80 per cent. At the cathode, nickel of 99·27 per cent. purity was deposited in an excellent form.—R. S. H.

Copper in Potassium Cyanide; Examination of Solutions of ——. F. Kunschert. Z. anorg. Chem., 1904, **41**, 359—376.

The author finds by electro-chemical methods that in potassium cyanide solutions the copper exists in the form of $Cu(CN)_4'''$ ions, and to a lesser extent, of $Cu(CN)_3''$ ions. The results of the author's experiments afford an explanation of the necessity of using a somewhat high current-density in electrolytic brass-plating. With a very small current-density and a potassium cyanide solution of moderate strength, the copper, in consequence of its lower discharge potential, separates before the zinc. With a higher current-density the separation of brass takes place, the discharge potential of the zinc being so reduced that the metal becomes capable of forming compounds and solid solutions with the copper. The concentration of cuprous ions in a potassium cyanide solution is very small, and this accounts for the difficulty of precipitating cuprous sulphide from such solutions by hydrogen sulphide. Since if the concentration of the cyanogen ions were increased tenfold, the concentration of the cuprous ions would be diminished to $\frac{1}{10000}$ of its original value, the non-precipitation of cuprous sulphide by hydrogen sulphide in presence of a small excess of potassium cyanide is explicable, without assuming the formation of any particular complex ions (see Treadwell and Girsewald, this J., 1904, 61). The fact that precipitation may occur on diluting the cyanide solution can be explained by means of the law of mass action, since in the reaction $2Cu(CN)_4''' + H_2S = Cu_2S + 2HCN + 6(CN)'$, eight dissolved molecules or ions are formed from three, and a reaction by which the osmotic pressure is increased is always favoured by dilution.—A. S.

English Patents.

Sodium and Potassium; Production of ——. T. Parker, Wolverhampton. Eng. Pat. 19,196, Sept. 7, 1903.

Aluminate of soda or potash is mixed with carbon in suitable proportions, and calcined in an electric furnace, whereby the alkali metals are volatilised, and alumina remains behind. Similarly, the alkali silicates can be employed, and carbide of silicon (carborundum) obtained as a secondary product. The same processes can be employed, if nitrogen is introduced, for the production of cyanides.—R. S. H.

Electric Furnaces. E. Ruhstrat and W. E. Grimmer, Göttingen, Germany. Eng. Pat. 24,472, Nov. 18, 1903.

The furnaces described are of cylindrical or other shape, and are characterised by having a helix of carbon which serves as the heating resistance. The helix may be cut out from a solid carbon article, and the spirals of the helix may be separated by porous carbon having a very high resistance, which serves to strengthen them. Applications of the furnaces to the fusion of refractory materials are described. —R. S. H.

Electric Furnaces, and Extraction of Zinc by means of same. A. Edelmann and N. Wallin, Charlottenburg, Germany. Eng. Pat. 16,205, July 21, 1904. Under Internat. Conv., July 23, 1903.

The electric furnace comprises a vertical bell-shaped upper electrode and an annular lower electrode, with a central cavity in which is situated a condensing tube, connecting with condensing chambers. The shaft for the raw material surrounds the upper electrode. In the application to the extraction of zinc, the carbonic oxide and zinc vapours formed by the decomposition of the ore are prevented from escaping directly into the air by the charge filling the shaft. They consequently pass under and into the bell-shaped electrode, which serves as a heat interchanger and pressure equaliser, thence through the condensing tube to the chambers where the zinc is collected, and finally, through a shaft filled with coke, into the air.—R. S. H.

United States Patents.

Furnace; Electric ——. H. Harmet, St. Etienne, France. U.S. Pat. 772,354, Oct. 18, 1904.

See Fr. Pat. 318,283 of 1902; this J., 1902, 1459.—T. F. B.

Metals; [Electrolytic] Process of Obtaining ——. F. von Kügelgen, Holcombe Rock, Va., and H. Danneel, Breslau, Germany, Assignors to the Willson Aluminium Co., New York. U.S. Pat. 771,646, Oct. 4, 1904.

A metallic oxide is introduced into the cathode chamber of an electrolytic cell, in which the electrolyte is a solution of a haloid compound of an alkali metal. The oxide is reduced to metal, and alkali hydroxide is formed and is withdrawn from the cathode chamber. The strength of the electrolyte is maintained by additions of the haloid salt to the anode chamber. The process is applied to obtain metallic tin, sodium hydroxide and chlorine, from tin oxide and sodium chloride.—E. S.

French Patents.

Electric Induction Furnace with Air-Blast. A. Fauchon-Villeplée. Fr. Pat. 338,985, Aug. 14, 1903.

An induction furnace is combined with arrangements for blowing air into the charge which is being heated in the furnace.—R. S. H.

Copper Matte in the Electric Furnace; Process for Treating ——. A. Fauchon-Villeplée. Fr. Pat. 338,986, Aug. 14, 1903.

Copper matte is treated in a furnace of the type described in the above specification; by means of the air-blast the sulphur and iron are oxidised.—R. S. H.

Steel-making in the Electric Furnace; Process of ——. A. Fauchon-Villeplée. Fr. Pat. 338,987, Aug. 14, 1903.

Molten cast iron is run into a furnace of the type mentioned in specification 338,985 above. By means of the induced currents the metal is heated, whilst the air-blast oxidises the carbon and other impurities.—R. S. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Olive-kernel Oil; Influence of —— *on Olive Oil.* N. Passerini. Staz. Sperim. Agrar. Ital., 1904, **37**, 600—610.

In order to test the accuracy of the widespread opinion that olive kernels contain oil that becomes rancid more readily than the pulp oil, virgin olive oil was mixed with varying proportions of the crushed stones or kernels and kept in flasks plugged with cotton wool for several months, after which the acidity was determined. It was found that in each case the kernels had caused a slight increase in the amount of free acid, which was greater in proportion to the quantity of kernels used. The author has arrived at the following conclusions:—(1) That olive oil becomes slightly acid when kept in prolonged contact with the kernels, the acidity increasing with the proportion of kernels. (2) That oil extracted from the kernels with ether has an acidity (1·84 per cent.) which at first differs but little from that of pulp oil (1·86 per cent.), but that in time the acidity increases considerably (*e.g.*, a sample kept for 18 months had an acidity of 10·18 per cent.). (3) That when the percentage of kernels does not exceed the normal amount in the fruit (12 per cent.) the pulp oil does not undergo any change in its organoleptic character, whilst the slight increase in the acidity is negligible. (4) That, in practice, no injurious effect need be feared from the short contact of the pulp oil with the crushed stones. (See also this J., 1898, 1055.) —C. A. M.

Carbon Dioxide in Seeds during Germination: Origin of ——. E. Urbain. XXIV., page 1047.

French Patents.

Liquids containing Glycerin; Treatment of ——. E. A. Barbet and L. Rivière. Fr. Pat. 338,962, July 31, 1903.

The liquid is treated with silicofluoric acid to precipitate the salts of potassium, sodium, &c., the precipitate is washed, and the glycerin separated from the filtrate and washings. The addition of alcohol before the filtration increases the insolubility of the silicofluorides. In the case of the products of alcoholic fermentation (Vinasses, &c.), the liquid is first concentrated to 10° or 12° B. in the presence of lime or calcium carbonate, and then filtered, and the filtrate treated with silicofluoric acid, the excess of which is neutralised with sodium or calcium carbonate. The liquid is next filtered, with or without the addition of alcohol (which is subsequently evaporated), the clear filtrate concentrated, and the residual crude glycerin purified, *e.g.*, by osmosis, as described in Fr. Pats. 323,373 and 330,939 (this J., 1903, 502, 1101).—C. A. M.

Soaps; Use of "Tangue" [Silicious Clay] in the Manufacture of ——. C. Sizaret. Fr. Pat. 343,398, May 24, 1904.

The soap is incorporated with about 25 per cent. of "tangue," an extremely fine silicious clay found principally on the sea coast.—C. A. M.

Soap; Manufacture of Hard Rosin —— [*for Paper Manufacture*]. E. Fischer. Fr. Pat. 343,617, May 11, 1904.

A HARD soap in solid form is prepared by mixing the required proportions of rosin and "soda" with the smallest possible amount of water which is continually renewed by condensation during the boiling, until the saponification is complete, after which the water is allowed to evaporate. Special apparatus claimed for this purpose consists of a boiler divided by means of a false bottom into two compartments, the upper of which is provided with means for condensing the evaporated water, and communicates by means of tubes, &c. with the lower compartment in which is the heating arrangement.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A*.)—PIGMENTS, PAINTS.

UNITED STATES PATENT.

Paint Composition. W. A. Hall, Bellows Falls, Vt. U.S. Pat. 771,241, Oct. 4, 1904.

SEE Eng. Pat. 26,903 of 1903; this J., 1904, 328.—T. F. B.

FRENCH PATENT.

Lakes [*from Azo Dyestuffs*]; *Process for Preparing New* ——. Soc. Anon. Prod. F. Bayer et Cie. Fr. Pat. 343,631, June 1, 1904.

LAKES of various shades of red, fast to light, are obtained by precipitating, on a suitable substratum, the azo dyestuffs formed by combining the diazo derivatives of 2-naphthylamine-1.6-disulphonic acid or of 2-naphthylamine-3.6-disulphonic acid with naphtholsulphonic acids. Bluish-red lakes are obtained, for example, by combining the diazo derivative of either acid with 2-naphthol-3.6-disulphonic acid; a yellowish-red lake is produced from the diazo derivative of the 3.6-acid with 2-naphthol-3.6.8-trisulphonic acid, whilst a brilliant red is obtained by combining the same diazo compound with 1-naphthol-3.6-disulphonic acid.—T. F. B.

(*B*.)—RESINS, VARNISHES.

UNITED STATES PATENT.

Wood; Process of Destructive Distillation of Resinous ——. C. E. Broughton. U.S. Pat. 771,706, Oct. 4, 1904. III., page 1023.

(*C*.)—INDIA-RUBBER, &c.

Castilloa Elastica; The Latex of ——. A. W. K. de Jong and W. R. Tromp de Haas. Ber., 1904, **37**, 3298—3301.

THE authors have examined a latex derived from 10-year-old rubber trees (*Castilloa Elastica*) grown in Java, but obtained originally from Kew. The results are much at variance with those described by C. O. Weber for a similar product (this J., 1903, 1200), and no support can be found by the author for Weber's theory of albumin-coagulation. The Java latex contained isolated particles and was of acid reaction. It was coagulable by methyl and ethyl alcohol, acetone, and glacial acetic acid, but not by albumin-coagulating agents, nor was an oxydase present. The latex was diluted with water, allowed to stand, and the cream collected. This was re-washed in a similar manner 12 times, but the cream still formed a white milky emulsion with water, like the original juice. After pasteurisation, the latex was coagulable by glacial acetic acid and acetone, but not by alcohol or by heating. By leaving *Castilloa* rubber in contact with ether, a thick syrup, unfilterable, except after addition of more ether, was obtained. After standing for 24 hours to settle, this liquid contained 8·7 to 9·3 per cent. of crude rubber. Also when the latex itself was extracted with ether, 7·9 to 8·2 per cent. of crude rubber was found in the filtered solution, so that the latex appears to contain rubber as such, and, moreover, rubber that is soluble in ether. As regards tannin, fresh latex was filtered, the liquid portion treated with lead acetate, and the precipitate decomposed with hydrogen sulphide. The resulting liquor when dried over sulphuric acid yielded a yellow brittle solid, which contained 30 per cent. of tannin by the hide-powder method (*cf.* Weber, *loc. cit.*).—R. L. J.

India-Rubber; Action of Radium Rays on ——. R. Ditmar. XXIV., page 1048.

ENGLISH PATENTS.

Rubber and Ebonite; Treatment and Utilisation of Waste Vulcanised ——. V. de Karavodine, Paris. Eng. Pat. 7795, April 2, 1904. Under Internat. Conv., July 25, 1903.

SEE Fr. Pat. 338,945 of 1903; this J., 1904, 991.—T. F. B.

Rubber Waste; Process for Devulcanising or Regenerating ——. R. B. Price, Chicago. Eng. Pat. 17,313, Aug. 8, 1904. Under Internat. Conv., May 26, 1904.

SEE U.S. Pat. 762,843 of 1904; this J., 1904, 719.—T. F. B.

FRENCH PATENT.

Rubber; Regeneration of ——. M. Pontio. First Addition, dated April 18, 1904, to Fr. Pat. 338,048 of Oct. 16, 1903 (this J., 1904, 615).

IF petroleum be used alone as the solvent, it should be the fraction which boils between 125° and 140° C. If, however, the b. pt. be somewhat higher, it may be lowered to the required degree by the addition of benzene or toluene. When necessary, amyl alcohol may be substituted for acetone or alcoholic soda to free the rubber from sulphur and traces of solvent.—F. D. T.

XIV.—TANNING; LEATHER, GLUE, SIZE.

UNITED STATES PATENT.

Leather Substitute; Manufacture of an Artificial ——. G. Ebert, Rixdorf, Assignor to R. Piesbergen, Berlin. U.S. Pat. 772,646, Oct. 18, 1904.

SEE Eng. Pat. 15,629 of 1904; this J., 1904, 906.—T. F. B.

FRENCH PATENTS.

Tannin; Cold Extraction of —— *under Reduced Pressure*. L. Castets. Fr. Pat. 343,679, June 3, 1904.

MECHANICAL details are given of a plant for the cold extraction of tannin under reduced pressure. The main features are a series of five closed cylindrical extraction vats, mounted on trunnions and in connection with a pump and reservoir, so arranged that the liquors, as they increase in strength, come in contact with materials richest in tannin, also a sixth similar vessel supplied with refrigerating apparatus for the deposition of resins and colouring matters. —R. L. J.

Artificial Leather: Process for the Manufacture of the same. J. B. Granjon and J. F. L. Berchet. Fr. Pat. 343,704, June 4, 1904.

ONE or more sheets of cardboard are covered with a mixture of asphalt, bitumen of Judæa, tar, and resin. The sheets thus treated are heated by steam to about 100° C., and are then passed between steam-heated rollers. If the leather be required for straps, strips of linen or metal may be placed between the sheets before rolling.—F. D. T.

XV.—MANURES, Etc.

Phosphoric Acid of Manures; Effect of Liming on ——. B. Schulze. Bied. Centr., 1904, **33**, 653—654; from Fühling's Landw. Zeit., 1904, **53**, 186, 216, and 261.

THE effect of the phosphoric acid of bone meal on soil poor in lime, may very nearly approach that of phosphoric acid soluble in citric acid. Liming has very little effect as regards water-soluble phosphoric acid, but more on citric acid-soluble phosphoric acid, and most of all on the phosphoric acid of bone meal. In the case of spring manuring with phosphoric acid, a simultaneous application of burnt lime is the most injurious. Autumn manuring with lime is less injurious, whilst the least effect is produced when the lime is applied in the form of carbonate in the autumn. The injurious effect of lime on the activity of phosphoric acid in the soil, especially the phosphoric acid of bone meal, is due to the neutralisation of the acid constituents of the soil. The formation and decomposition of organic substances in soils is of no small importance in the nutrition of crops with phosphoric acid.—N. H. J. M.

Calcium Cyanamide; Agricultural Employment of ——. M. Gerlach. Bied. Centr., 1904, **33**, 649—651; from Mitt. d. deutsch. landw. Ges., 1904, [8]. (See this J., 1903, 809.)

The results of pot experiments showed that calcium cyanamide was equal to ammonium salts and nitrate of soda. In field experiments lower results were obtained, due perhaps to loss of nitrogen in the form of ammonia. Calcium cyanamide can be readily converted into ammonium sulphate.—N. H. J. M.

French Patents.

Manure in Powder; Process for making —— *by means of Phosphorites and other Natural Phosphates.* W. Mathesius. Fr. Pat. 343,820, June 9, 1904. Under Internat. Conv., June 13, 1903.

See Eng. Pat. 13,361 of 1904; this J., 1904, 907.—T. F. B.

Humous Manures; Manufacture of ——. J. J. Boutan. Fr. Pat. 338,981, Aug. 13, 1903.

Peat, the humous basis of these manures, is treated with a concentrated solution of potassium salts, rich in the carbonate, such as may be derived from the charred waste of the vinous or molasses distilleries; or by a mixture of potassium sulphate and chalk, to obtain a "humo-potassic" manure. Or, a "humo-phosphatic" manure is prepared by incorporating peat previously rendered alkaline, with insoluble phosphates in which the phosphoric acid, or part of it, has been rendered soluble by humous matter, together with such alkaline salts as those named, or by acids. Sodium or ammonium salts may in some cases replace the potassium salts in the preparation of the manures.—E. S.

Sewage and Water; Precipitant for use in Purification of ——. [*Manure.*] J. M. Lallemand and A. Soutièrre. Addition to Fr. Pat. 323,900 of Aug. 14, 1902. XVIII. B., page 1040.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar Factories; Micro-organisms in the Juices of ——. *II.* A. Schöne. Z. Ver. deutsch. Zuckerind., 1904, 1060—1090. (See this J., 1901, 733.)

The author has made a careful study of the nature, properties, and conditions of growth of the various micro-organisms which he has isolated from the juices of beet-sugar factories. The organisms are dealt with according to the following groups, the nature of the acids produced by them being also noted:—Group 1. *Leuconostoc mesenteroïdes* ("frog-spawn fungus"), forming chiefly lactic acid; mucus-forming *coccus* I., producing acetic and succinic acids and a little lactic acid; mucus-forming *coccus* II., producing acetic and *d*-lactic acids. Group 2. Coli-like bacteria: A, producing a little formic acid, much succinic acid, *l*-lactic acid; B, producing acetic and *l*-lactic acids; C, producing acetic acid, much succinic acid, *l*-lactic acid; D, producing acetic acid, a little valeric acid, much succinic acid, *d*-lactic acid. Group 3. *Clostridium gelatinosum* Laxa, producing acetic and lactic acids; *B. mesentericus fuscus*, producing acetic acid and a little valeric acid; *B. subtilis*, producing little acid (?). Group 4. Indifferent and accidental organisms: An acid-forming *coccus* producing *d*-lactic acid and traces of volatile acids; rodlet bacteria, similar to lactic bacteria; yeasts and mould fungi. The author discusses the occurrence of the above organisms in nature, and the manner in which they enter the juice. The harm which these organisms effect in the sugar factories is due principally to the production of gelatinous and mucous carbohydrates at the expense of the sugar. This property is a very general one, and accounts for a considerable proportion of the losses during manufacture. Sugar is also lost by the formation of acids, alcohol, and gases under microbic influences and by the activity of the inverting enzymes secreted by the organisms. Many of these organisms are remarkably resistant to the influence of high temperatures and of most antiseptics: and the inverting enzymes secreted by them are still more resistant than the organisms themselves.—J. F. B.

Sugars; Semicarbazones of Reducing ——. Maquenne and Goodwin. Bull. Soc. Chim., 1904, **31**, 1075—1078.

The semicarbazones of arabinose, rhamnose, xylose, dextrose, mannose, galactose, lactose, and cellose are described, their melting points, solubility, and rotatory power being given. The semicarbazones of maltose and levulose could not be obtained in a pure state. All the semicarbazones exhibited multi-rotation, the rotatory power only becoming constant after the solution had stood for some days. The rotatory power was, except in the case of rhamnose semicarbazone, considerably lower than that of the original sugar. The substances had no sharp melting points, the change of physical state being always accompanied by an evolution of gas. These derivatives are not considered to possess any value for the identification of the sugars, as their physical constants are not sufficiently well defined.

—T. F. B.

Sugar in Molasses and Cane Sugar Factory Products; Determination of Crystallisable and Reducing ——. H. Pellet. XXIII., page 1047.

Sulphurous Acid in Molasses; Determination of ——. E. Pozzi-Escot. XXIII., page 1047.

English Patent.

Honey Substitute; Manufacture of a ——. A. Oetker, Bielefeld, Germany. Eng. Pat. 12,754, June 6, 1904.

500 grms. of cane sugar are mixed with 0·5 grm. of calcium formate and 0·5 grm. of tartaric acid, sufficient caramel to produce the desired colour being also added. 500 grms. of this mixture are heated to boiling with 125 grms. of water, then kept in a warm place for 30 minutes, and afterwards cooled.—W. P. S.

French Patents.

Diffusion [Sugar]; Continuous Process of ——. J. Galloo. Fr. Pat. 338,971, Aug. 7, 1903.

Rasped beetroot pulp is caused to travel through a diffusion vessel divided into several compartments. At the same time an extracting liquid is passed through the diffuser in the opposite direction. Each compartment of the vessel is provided with mixing rakes, which keep the pulp in suspension and facilitate the extraction of the sugar.—J. F. B.

Massecuite; Continuous Apparatus for Filtering and Washing ——. H. Roy. Fr. Pat. 343,194, May 16, 1904.

The apparatus consists essentially of a cylindrical vessel provided with a conical lower portion, around the walls of which a perforated filtering surface is arranged. The massecuite is forced in at the bottom of the vessel, and is agitated in contact with the filtering surface by means of stirring arms, whilst at the same time it is subjected to the action of compressed air introduced at the top of the apparatus. The syrup passes through the filtering surface, and drained sugar is discharged continuously from the upper portion of the vessel. By interposing one or more cylindrical sections provided with separate stirrers and filtering surfaces between the lower and upper portions of the vessel, the massecuite may be systematically washed in its upward course by means of "clairce" syrups introduced at various points.—J. F. B.

Starch Derivatives; Production of ——. J. Kantorowicz. Fr. Pat. 343,614, April 29, 1904.

Starch is treated in presence of water with liquids which are miscible with water, but which prevent the gelatinisation of the starch when caustic soda is subsequently added. For instance, 100 parts of potato starch are mixed with alcohol at a strength of 50—90 per cent., so as to produce a milky liquid in which the starch is held in suspension, and then 40 parts of a solution of caustic soda at 30° B. are added. The mass thickens, and is allowed to remain for one hour; it is then neutralised by acetic acid, and the resulting precipitate is filtered off and dried. The product yields a paste when mixed with 10 times its weight of water.—J. F. B.

Spirits, Cattle Food, and Glucose; Preparation of —— from Plants and Vegetable Refuse. Internat. Spiritus-Ind. Fr. Pat. 343,745, May 11, 1904. XVII., page 1039.

XVII.—BREWING, WINES, SPIRITS, Etc.

Malt; Relation between Moisture, Grist, and Yield in ——. K. Regensburger. Z. ges. Brauw., 1904, **27**, 649—651.

Four Bavarian malts were allowed to absorb moisture in a moderately damp place, and after definite periods of time, samples were crushed in a laboratory Seck mill set at 25°, and the moisture determined. The crushed malt was then classified on a Vogel sieve, the latter being shaken for 10 minutes, with the shaking apparatus working at 350 revolutions per minute. As the percentage of moisture in the malt increased, the proportion of grains also increased, mainly at the expense of the grist, but to a certain extent also at that of the fine meal. With an increase of 8—9 per cent. in the moisture, the proportion of grains increased to from four to five times the original amount. This is due to the toughness imparted to the corns by an increased moisture content, whereby not only do the grains resist crushing, but considerable amounts of the contents of the corns adhere to the husks, especially at the tips of the corns. With regard to the yield of extract, it was found that with imperfectly modified malts, an increased moisture content caused a distinct decrease (about 2·3 per cent.) in the yield calculated on the dry substance. With well-modified malts, the moisture content, so long as it was within the limits usually met in practice, viz., from 2 to 8 per cent., appeared to have little influence on the yield of extract, but with a very high content of moisture, *e.g.*, 9 per cent. and over, the decrease in yield of extract was as high as 1 per cent. In these experiments the extract was determined by an infusion method. Experiments with the decoction method showed that with the malts containing a low percentage of moisture, the yield of extract was increased by boiling the mash, but when the moisture content was high, boiling the mash had practically no influence on the yield of extract.—A. S.

Saccharomyces Saturnus Klöcker: A New Species of Saccharomyces with Characteristic Spores. A. Klöcker. Woch. f. Brau., 1904, **21**, 676—678.

The author describes a new species of *Saccharomyces* which belongs to the same group as *S. anomalus* (Hansen). It differs from the latter chiefly in the shape of its spores, and in its ability to invert and ferment cane sugar. It rapidly forms a white, wrinkled film on beer-wort and other saccharine media. The cells of the fresh films are spherical or oval in shape, with a diameter of 4—6 μ. In older films "giant" forms with thickened walls and chains containing elongated cells are observed. The cells of films grown on maltose-yeast-water media nearly always contain spores. The limits of temperature for budding lie between 2° and 37° C. The spores are lemon-shaped, more or less regular, and are surrounded at the centre by a protruding band (reminiscent of the planet Saturn). The dimensions of the spores from point to point are 3 μ; they contain a spherical, refractive corpuscule, probably of fat. Spores are produced on a gypsum block most readily at a temperature of about 25° C. This yeast ferments dextrose, fructose, raffinose, and cane sugar. Very little alcohol is formed during fermentation in beer wort, but an odour of fruity ethers, probably ethyl acetate, is developed. Maltose, lactose, and arabinose are not fermented. This species was first discovered in a sample of earth from the Himalayas; later the same or a very similar species has been found in samples of Danish and Italian earths.—J. F. B.

Schmitz Brewing Process; Remarks on the ——. C. Bleisch. Z. ges. Brauw., 1904, **27**, 681—683.

According to the Schmitz process, the malt, ground rather more finely than usual, is mashed and saccharified at any desired temperature in the mash-tun; the whole mash is then transferred to the mash-copper and boiled. The boiling mash is pumped into a special steam-jacketed clearing tun, the wort is run off, and the residue is sparged still at the boiling temperature. Since a further solution of the starch is effected by the boiling, the wort containing this residual starch is cooled by an arrangement in the bottom of the clearing tun, and subjected to a further saccharification by means of a diastatic extract reserved at the beginning of the mashing. The author has studied this process comparatively with the ordinary process. The advantages determined in favour of the Schmitz process included a considerable shortening of the time required for running off the wort and sparging, owing to the very high temperature employed, and a slight improvement in the yield. A question arises in connection with the possibility of the extraction of matters with an undesirable flavour from the grains by running off and sparging at the boiling temperature. Whether such a tendency is counteracted by the curtailment of the time of contact can only be determined by long practice. The increase of yield attributable to a better solution of the badly modified starch was surprisingly small, and the greater portion of the observed increase was due to the favourable conditions under which running off and sparging were effected. In comparison with a modern clearing tun of the best construction this increase of yield to the advantage of the Schmitz process would, however, tend to disappear.—J. F. B.

Beer; Causes and Prevention of Altered Flavour in —— with New Plant. H. Vogel. Ann. de la Brass., 1904, **7**, 368—372.

One cause of altered flavour in beer produced in new plant is the use of cheap shellac substitutes (impure pine resin, artificial turpentine, &c.) for varnishing the fermenting tuns and other vessels. To prevent this risk the varnish may be tested by pouring a little into a bottle, turning the latter upside down, and leaving the varnish to dry; the presence of any unpleasant smell will indicate that the varnish is not fit for use in the brewery. In coppers of more modern type the flues extend only about one-third up the sides, instead of half-way, and unless the mashing and boiling are modified accordingly, the beer will taste thin, as though from lower gravity wort. In steam coppers the lower initial temperature prolongs diastatic action, thus increasing the proportion of readily fermentable sugars, and consequently the attenuation. Unless coppers heated by steam coils be also provided with stirrers at the bottom, the beer will be liable to glutin haze and changed flavour. Excessive reduction of the individual area of the perforations in the false bottom may retard filtration, by the retention of air bubbles in the holes. This delay results in the extraction of flavouring matters from the grains, and affects the taste of the beer. It may be prevented by running in the sparging liquor from below, and thereby clearing out the holes. The vibration of a mashing machine will shake the grains into a compact mass and retard filtration. Dust produced by building operations is a fertile source of sarcina-sickness in beer, the altered flavour being then often erroneously attributed to the new plant. Wort may be boiled in an iron pan as well as in a copper vessel, any small quantity of iron dissolved in the former case being eliminated in cooling, or during fermentation; but an alteration in flavour will follow the introduction of iron into the finished beer. The water condensed in the dome of the copper should be discharged outside, for if the wort be boiled too briskly, hops and scum may adhere to the dome and scorch, and the materials extracted by the water of condensation will alter the flavour of the beer.
—C. S.

Beer; Behaviour of —— towards Metals. J. Brand.
Z. ges. Brauw., 1904, **27**, 713—716.

After commenting on the various notes which have appeared recently on this subject (see this J., 1904, 263, 332, 595, and 796), the author states that his experience does not confirm the conclusions as to the unsuitability of tin surfaces for contact with beer. He exposed iron plates, both black and polished, and tinned iron plates to the action of pale and dark beers. After 12 hours' exposure, the beers containing the unprotected iron plates had become very turbid and had completely changed in colour, whilst those containing the tinned plates were only slightly turbid and otherwise unchanged. After seven days the beers with the iron plates were no longer recognisable as beer, and contained 0·42 per cent. of dissolved iron per litre, whilst those in contact with the tinned plates were slightly turbid, but still drinkable. The author concludes that the evil effects of tin and tinned surfaces in contact with beer are quite inconsiderable in comparison with those brought about by plain iron, especially with regard to the injury to the flavour. It would be a mistake if tin and tin coating, which have done such good service hitherto in protecting iron vessels from the action of beer, were suddenly discarded.—J. F. B.

Fermentation Tuns: Effect of Chemicals employed for Removing Old Lacquer from —— upon the Wood and Subsequent Coat of Lacquer. F. Schönfeld. Woch. f. Brau., 1904, **21**, 667—668.

The experiments showed that solutions containing caustic alkalis, such as a 5 per cent. solution of caustic soda or a 10 per cent. solution of sodium carbonate mixed with 5 per cent. of lime, cannot be entirely eliminated even when the un is subsequently washed for two days with frequent changes of water. Consequently the new coat of lacquer does not adhere firmly to the wood, and in a very short time t begins to scale or to soften. In many cases also the outer ayers of the wood fibres are considerably damaged or destroyed. Milder alkalis, such as a 20 per cent. solution of sodium carbonate or a 5 per cent. solution of "antiformin" (see this J., 1904, 125), do not appear to affect he new coating of lacquer, provided the tun has been horoughly washed for two days. But if the washing be deficient, as may easily happen in practice, the new coat of acquer is certain to suffer. The author concludes that all chemical agents should be avoided, and that the old lacquer should be removed only by mechanical means. The experiments also indicate that "antiformin," which is a valuable antiseptic, should not be employed incautiously for the disinfection of lacquered fermentation tuns, owing to its powerful solvent action on the varnish.—J. F. B.

Fluorine in Wine and Beer; Determination of ——. F. P. Treadwell and A. A. Koch. XXIII., page 1046.

English Patents.

Malt-Kilns. J. Brackenbury, Burton-on-Trent.
Eng. Pat. 28,630, Dec. 30, 1903.

Kilns having a fire-shaft are constructed with an air-shaft urrounding the fire-shaft, both of which communicate with a mixing chamber situated below the drying-floor. The heat of the fire-gases induces an upward current of air hrough the air-shaft, the gases and air mixing in the hamber before reaching the drying-floor. Means for regulating the admission of air are provided.—W. H. C.

Alcohol and other Volatile Matters from Waste Products; Process for Recovering ——. C. Tuckfield and G. de F. Garland, East Molesey. Eng. Pat. 26,360, Dec. 2, 1903.

The wash or liquid to be treated is heated to a temperature few degrees higher than its atmospheric boiling point, g., under a pressure of 10—40 lb. per sq. in.; this may be ffected by providing a pressure valve on the worm before he point where the vapour passes into the condenser.
—J. F. B.

Rousers" for Mixing Purposes. A. Pidgeon, West Ham, Essex. Eng. Pat. 642, Jan. 11, 1904.

The invention relates especially to an improved form of rouser" or mixer for incorporating finings in ales and beers, or for blending wines or spirits. The "rouser" is constructed with a shoulder upon its length to prevent it touching the bottom of the vessel in which it is used. The top of the handle is made semi-spherical so that it can be "rolled around" in the palm of the operator's hand. The shoulder has a curved form, in order that every part of the the vessel may be reached, and the blade is made of a special section, two or three types of which are figured.
—W. H. C.

French Patents.

Yeast Extracts; Eliminating the Bitter Flavour from ——. M. Elb. Fr. Pat. 343,712, June 4, 1904.

Yeast-extracts are treated, after evaporation, with an oxidising agent, preferably hydrogen peroxide. The precipitated matters are removed either by filtration or clarification. (See also Eng. Pat. 24,294 of 1903; this J., 1904, 996.)—J. F. B.

Lees and other Residues of Wine; Drying and Extracting the Alcohol from ——. G. Grimard. Fr. Pat. 338,988, Aug. 17, 1903.

The lees and marcs are dried in a closed vessel under vacuum at any suitable temperature, and the alcoholic vapours which are evolved are condensed.—J. F. B.

Cream of Tartar; Extraction of White Refined —— from Marcs, before and after Distillation. G. Chiapetti. First Addition, dated April 22, 1904, to Fr. Pat. 330,951, April 6, 1903. (See this J., 1903, 1099.)

In the apparatus described in the original patent, refrigerators are interposed between each diffuser, in order to prevent the solution of tartaric and sulphurous acids, as it passes from one diffuser to the next, from being heated beyond a certain temperature by the hot marcs with which it comes in contact. In the distillation column, which is employed for the recovery of the alcohol from the marcs, the porcelain balls are replaced by plates having only one scrubbing-cap. The "head products" of distillation are collected separately from the "tailings" by means of two different receivers, above which is placed an inspection glass.—J. F. B.

Spirits; Apparatus for Continuous Rectification of ——. E. A. Barbet. Fr. Pat. 343,488, April 16, 1904.

Several improvements are described relative to apparatus for the continuous double rectification of alcohol, direct from the wines or from the phlegms. The new arrangements afford an accurate control of the analyser column and a certain auto-purification of the already purified phlegms; they do away with the passage of the vapour of the wine directly to the rectifying column, and supply this rectifier with a series of plates and a special condenser, in order to concentrate the "tail" products, the extraction of which facilitates rectification. An arrangement is interposed between the analyser and rectifier by which the phlegms may be purified by the admission of oxidising agents or other chemicals.—J. F. B.

Spirits, Cattle Food, and Dextrose; Preparation of —— from Plants and Vegetable Refuse. Internat. Spiritus-Ind. Fr. Pat. 343,745, May 11, 1904.

Wood, straw, or other vegetable matter is boiled under a pressure of 10 atmospheres with a dilute solution of caustic soda, the mass is diluted largely with water, and the cellulose is dissolved under a pressure of 20—24 atmospheres. The boiling mass is then treated under atmospheric pressure with ozonised oxygen or hydrogen peroxide. The saccharine solution so obtained may then be fermented with ordinary yeast or with "Koji," or may be evaporated to a syrup. (See also Fr. Pat. 342,555; this J., 1904, 944.)
—J. F. B.

Distillery Juices; Apparatus for Aerating and Decanting ——. A. Hochart. Fr. Pat. 343,627, June [illegible] 1904.

The saccharine juices coming hot from the presses or diffusers are delivered to the top of a cascade-refrigerator, consisting of tubes cooled internally by a current of water. As the juice traverses the refrigerator, air is blown across it by means of a ventilating fan. The cooled juice then passes through a series of decanting basins, arranged in the form of steps, in which the sediment and waste fine pulp are deposited. Arrangements are made for the inversion of the sugar by treatment with sulphuric acid. —J. F. B.

Liquids containing Glycerin; Treatment of ——. E. A. Barbet and L. Rivière. Fr. Pat. 338,962, July 31, 1903. XII., page 1035.

Water-Bath for Heating Liquids, or Liquids mixed with Solids. P. P. A. Andrieu. Fr. Pat. 343,321, May 21, 1904. I., page 1020.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

English Patent.

Eggs and other Alimentary Substances; Preserving Compound for ——. G. E. Greuard, Paris. Eng. Pat. 17,431, Aug. 10, 1904.

A mixture is made of sodium silicate (20 kilos.), sodium phosphate (0·2 kilo.), sugar (0·2 kilo.), and water (60 kilos.). To this mixture is added a 13 per cent. solution of hydrochloric acid (20 kilos.), and the whole is then poured over the eggs or other substances, so as to completely cover them. After a few minutes the mixture forms a firm gelatinous mass round the eggs, &c.—W. P. S.

French Patents.

Coffee Substitute [*Roasted Lupines*]; *Manufacture of a* ——. G. Doudieux and L. Jacotin. Fr. Pat. 343,485, April 8, 1904.

The substitute, which is said to possess the flavour of coffee, consists of roasted lupines which have been, either before or after roasting, treated with water, steam, and alcohol to remove substances objectionable to the taste.—W. P. S.

Food Product; Manufacture of a ——. R. Gross, Germany. Fr. Pat. 343,174, May 16, 1904.

White phosphorus is burnt and the products of combustion distilled, when it is stated that a yellow solid and an oily liquid are obtained. Reduced iron is then dissolved in the liquid portion and the mixture poured into boiling water. The product, a white powder, is mixed with other food substances, either alone or in combination with the "yellow solid" and "oily liquid."—W. P. S.

Flour, Corn, and other Cereals; Process and Apparatus for Bleaching and Improving ——. W. T. Mercier. Fr. Pat. 343,805, June 8, 1904.

The flour is subjected in a series of cylindrical chambers to the action of ozonised air mixed with a gas produced by the electrolysis of a solution of common salt or other suitable solution. The flour or other substance to be treated is previously air-dried.—W. P. S.

Spirits, Cattle Food, and Glucose; Preparation of —— *from Plants and Vegetable Refuse.* Internat. Spiritus-Ind. Fr. Pat. 343,745, May 11, 1904. XVII., page 1039.

Water-Bath for Heating Liquids, or Liquids mixed with Solids. P. P. A. Andrieu. Fr. Pat. 343,321, May 21, 1904. I., page 1020.

(*B.*)—SANITATION; WATER PURIFICATION.

English Patent.

Sprayer [*for Sewage Effluent*]; *Improved Construction of* ——. R. H. Reeves, London. Eng. Pat. 23,746, Nov. 2, 1903.

The sprayer, which is specially intended for spraying sewage effluent, is constructed with a socket and plug, having curved channels of irregular or spiral pitch, and is connected with the supply pipe by a straight reducing piece. The whole is arranged so as to revolve.—W. H. C.

French Patent.

Sewage and Water; Precipitant for Use in the Purification of ——. J. M. Lallemand and A. Goutièrre. Secon Addition, dated July 13, 1903, to Fr. Pat. 323,900, Aug 14, 1902 (this J., 1903, 563).

Aluminium phosphate "treated with hydrochloric or sulphuric acid" is added to the sewage. The sludge forme is rich in phosphoric acid and nitrogen, and is claimed as manure.—W. P. S.

(*C.*)—DISINFECTANTS.

Bacteria; Destroying —— *by Boiling under Reduce Pressure.* Schut. Z. Hyg.; through Brewers' J., 1904 40, 673.

The author finds that boiling the liquid in which bacteri or spores are suspended is more fatal to the micro-organism than merely heating the liquid to the boiling temperature By heating under diminished pressure, bacteria and spore may be killed without the physiological limits of temperature being exceeded. The use of saturated steam is more efficacious even than boiling. The powers of resistance possessed by micro-organisms vary considerably accordin to the temperature of cultivation and the medium in which the microbes are suspended; in the case of spores, th resistance decreases to a certain extent with the age of th culture. Heating at 60° C. for half an hour is sufficient t destroy the vegetative forms, especially of pathogenic germs —A. S.

English Patents.

Ozonising Air for Disinfecting Purposes; Apparatus fo ——. A. d'Arsonval, G. E. Gaiffe, and G. Gallot, Paris Eng. Pat. 27,358, Dec. 14, 1903.

See Fr. Pat. 337,531 of 1903; this J., 1904, 500.—T. F. B.

Antiseptic Preparations [*from Rosin*], *and Process fo Producing the same.* H. Endemann, Brooklyn, U.S.A Eng. Pat. 17,607, Aug. 12, 1904.

See U.S. Pat. 770,275 of 1904; this J., 1904, 996.—T. F. B

French Patent.

Insecticide. E. Maulouct. Fr. Pat. 343,829, June 9, 1904

This insecticide consists essentially of an emulsion o petroleum, fatty soap, potassium carbonate, and ethyl and amyl alcohols. It may be used for impregnating wood a well as for agricultural purposes.—T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

English Patents.

Beating or Triturating and Refining Pulp or like Fibrou Material; Apparatus for ——. J. H. Annandale, Polton Scotland. Eng. Pat. 26,012, Nov. 28, 1903,

A drum mounted on a rotating shaft has radially dispose cutter blades projecting from it. The drum is surrounded b a fixed casing, also having cutter blades, so fixed that the project into the spaces between the blades of the drum Means are provided for adjusting the spaces between th two sets of blades, for feeding and for withdrawing the pul continuously.—W. H. C.

Paper; Manufacture of Pressed or Gauffered ——. G Hennessen and P. Spix, München-Gladbach, Germany Eng. Pat. 14,149, June 27, 1904.

By heating the engraved rollers or moulds employed fo pressing patterns on paper or cardboard, the pressed portion of the product appear glossy, whilst the unpressed portion remain dull.—J. F. B.

Cornstalks, Sugar Cane, and Analogous Pithy Stalks Process of Manufacturing Products [*for Paper-making*] *from* ——. V. Drewsen, New York. Eng. Pat. 15,29 July 8, 1904.

See U.S. Pat. 731,290 of 1903; this J., 1903, 876.—T. F. I

Paper-making Machines; Impts. in ——. J. Bradley, Burnley. Eng. Pat. 18,117, Aug. 22, 1904.

n order to minimise the friction on the wire in passing ver the suction-box, the latter is divided longitudinally nto three compartments. The central compartment serves s the suction-box proper, whilst the two outer compartments each contain a roller capable of freely rotating herein, and of being adjusted slightly in a vertical direction. hese rollers revolve in troughs of water and project lightly above the level of the central suction-box. An ir-tight joint between the rollers and the edges of the entral compartment is made by means of compressible dia-rubber tubes. The end-plates of the suction-box roper are adjustable for any width of paper, and their tops re faced with plate-glass, over which the wire slides with he least possible friction.—J. F. B.

United States Patent.

Wood-Pulp or Cellulose; Means for Refining ——. A Wahlström, Honefos, Norway. U.S. Pat. 771,403, Oct. 4, 1904.

HE machine comprises a vertical rotary runner, having a lain peripheral grinding face, and a bedstone mounted eneath the runner and having a plain grinding surface ncompassing the greater portion of one-half of the grinding ace of the runner. Means are provided for adjusting the edstone vertically with regard to the runner.—J. F. B.

French Patents.

aper and Cardboard; Process of Sizing ——. F. Dobler. First Addition, dated April 29, 1903, to Fr. Pat. 328,178, Dec. 19, 1902. (See this J., 1904, 335.)

n the process for sizing paper described in the original pecification, the two separate sizing baths may be replaced y a single combined bath containing approximately: osin soap, 20—50 parts; gelatin, 20—50 parts; aluminium ulphate, 20—50 parts; water, 1,000 parts.—J. F. B.

oap; Manufacture of Hard Rosin —— [*for Paper Manufacture*]. E. Fischer. Fr. Pat. 343,617, May 11, 1904. XII., page 1036.

aper Coloured on One Side; Process and Apparatus for making ——. Leykam-Josefsthal Act.-Ges. f. Papier- und Druck-Ind. Fr. Pat. 343,186, May 16, 1904.

HE colour or other composition is applied to the web of he paper as it comes from the paper making machine, the urface of the paper is felted ("feutré") by pressure, and he colour is caused to adhere firmly to the paper by subequent drying. The apparatus consists of a tank with gitator for holding the colouring matter, which passes own a pipe provided with a cock and indicator, and disharges through a perforated tube into a small tank which verflows on to the surface of a cylinder; this cylinder is n contact with the paper, and revolves as the paper passes eneath it, thus applying the colour to the surface of the aper.—T. F. B.

apers with Designs of all kinds, Coloured Paper, &c.; Process for making Glossy ——. Soc. Hennessen et Jansen, and Soc. Spix et Lindermann. Fr. Pat. 343,856, June 10, 1904.

EE Eng. Pat. 14,449 of 1904, preceding these.—T. F. B.

apers of all kinds, Coloured Paper, &c., having at the same time a Glossy and Matte Effect; Process for making Pressed or Gauffered ——. Soc. Hennessen et Jansen and Soc. Spix et Lindermann. Fr. Pat. 343,857, June 10, 1904.

EE Eng. Pat. 14,449 of 1904, preceding these.—T. F. B.

honographic Records; Composition for ——. A. and L. Lumière. First Addition, dated June 16, 1903, to Fr Pat. 338,849, June 8, 1903.

A FLEXIBLE protective coating for phonographic records is omposed of nitrocellulose or acetylcellulose and a softeng agent, such as a salt of a fatty acid or paraffin wax, issolved in a common solvent.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Magnesium Amalgam as a Reducing Agent. [*Preparation of Absolute Alcohol.*] T. Evans and W. C. Fetsch. J. Amer. Chem. Soc., 1904, **26**, 1158—1161.

Preparation of the Amalgam. — Magnesium amalgam affords a convenient and economical means of effecting reduction of organic compounds. It is found that generally magnesium powder will amalgamate with mercury at ordinary temperatures, amalgamation starts slowly, but evolves heat, which causes the process to become more rapid. Some specimens of magnesium, however, refuse to amalgamate unless the process be aided by the employment of a warmed mortar. Amalgams containing 5 and 10 per cent. of magnesium were thus prepared; the latter were thickly fluid when first prepared, but set to a hard crystalline mass when cold.

Action of Magnesium Amalgam on Ethyl Alcohol.—Magnesium amalgam is without apparent action, in the cold, upon absolute ethyl alcohol, but readily reacts with alcohol containing a trace of water. It affords, therefore, a convenient means for the preparation and preservation of alcohol in an absolutely anhydrous condition.

Action of Magnesium Amalgam on Nitrobenzene.—By reducing a strong solution of nitrobenzene in ethyl alcohol with excess of 10 per cent. magnesium amalgam, starting the reaction with heat, and moderating it subsequently by cooling, finally continuing the process just below the boiling point of alcohol, a yield of 95·66 per cent. of the theoretical amount of azobenzene was obtained. —J. O. B.

Primula Camphor. H. Brunner. Schweiz Woch. Chem. Pharm., 1904, **42**, 305. Pharm. Centralh., 1904, **45**, 688.

By distilling 300 kilos. of the roots of *Primula veris* (equivalent to about 20,000 plants), and extracting the distillate with ether, 170 grms. of crude primula camphor were obtained. When freshly distilled it forms a colourless liquid, becoming yellow on exposure to the air; sp. gr. 1·2155; b. pt. 255° C. It was identified as the methyl ester of *m* methoxysalicylic acid, $C_6H_3.(1)COOCH_3(2)OH.(5)OCH_3$.—J. O. B.

Quinine Salts: Neutral Hydrochloride of Quinine. H. Carette. J. Pharm. Chim., 1904, **20**, 347—355.

"NEUTRAL" quinine hydrochloride [*Quininæ Hydrochloricum Acidum* P.B.] is obtained by dissolving one mol. of quinia in two mols. of hydrochloric acid in dilute aqueous solution, concentrating, and slowly cooling. The salt $C_{20}H_{24}N_2O_2.2HCl + 2\frac{1}{2}H_2O$ crystallises in radiating and nodular groups. It is hygroscopic, but only liquefies in a very moist atmosphere. It parts with a small amount of its water of crystallisation at 20° C. in dry air, and with the whole at 102° C., acquiring a yellowish tint, which disappears on cooling. It loses no hydrochloric acid during this drying. It begins to melt at 80° C., and remains partially melted at 215° C., when it begins to decompose. When the salt is crystallised from solutions containing ethyl alcohol, bulkier crystals than the above are obtained, which have the formula $C_{20}H_{24}N_2O_2.2HCl + 1\frac{1}{2}C_2H_6O$. In 95 per cent. alcohol, a supersaturated solution is formed from which large crystals are obtainable by sowing, or by rapid evaporation *in vacuo*. These crystals are stable when kept in a sealed tube. They part with the whole of the alcohol at 100° C. and with almost all at normal temperatures *in vacuo*. The same salt is obtained from solutions in absolute alcohol, and from 55 per cent. and 30 per cent. alcohol. The weaker alcohol more readily forms supersaturated solutions. The crystals obtained therefrom by sowing are very large, but do not keep so well in the sealed tube as those obtained from 95 per cent. alcohol, becoming dull and gradually opaque, and forming a fluid which is at first colourless, ultimately acquiring a reddish tint on exposure to light. Exposed to the air, they lose all the alcohol of crystallisation, absorbing water and being converted into the salt containing $2\frac{1}{2}$ mols. of water. When heated in the dark to constant weight at 35°—50° C. a perfectly white, stable salt is obtained, which has the formula $C_{20}H_{24}N_2O_2.2HCl + \frac{1}{2}H_2O$: the whole of the 1½ mols. of alcohol are given off, and ½ mol. of water is combined. This salt is much less hygroscopic than the anhydrous hydrochloride obtained by heating the salt containing alcohol to 102° C. No appreciable loss of hydrochloric acid occurs when the salt $C_{20}H_{24}N_2O_2.2HCl + 1\frac{1}{2}C_2H_6O$ is heated to 35° C., but at higher temperature this loss becomes considerable. The salt has no definite melting point.

Anhydrous "Neutral" Quinine Hydrochloride.—The anhydrous salt, obtained by drying either of the above to 102° C. or *in vacuo*, rapidly re-absorbs 2½ mols. of water on exposure to the air. If the atmosphere be very moist, it combines with another ½ mol., forming the salt $C_{20}H_{24}N_2O_2.2HCl + 3H_2O$. It completely liquefies in an atmosphere saturated with moisture. It becomes yellow when heated to 165°—170° C., and melts to a brownish fluid at 180°—185° C. Its aqueous solutions are strongly lævo-rotatory; the $[\alpha]_D = -233°$.—J. O. B.

Aconitine. H. Schulze. Apoth.-Zeit., 1904, **19**, 782—783. Chem. Centr., 1904, **2**, 1238—1239.

The empirical formula of aconitine has been given as $C_{33}H_{45}O_{12}N$ by Dunstan (this J., 1891, 477; 1892, 366) and as $C_{34}H_{47}O_{11}N$ by Freund and Beck (this J., 1894, 539, 540). In the author's experiments several specimens of pure aconitine (m. pt. 197°—198° C.), prepared by recrystallising the pure commercial alkaloid from methyl alcohol, were analysed. The results obtained agree equally well with the formula of Freund and Beck, or with one differing from it by two atoms of hydrogen, *viz.*, $C_{34}H_{45}O_{11}N$, but differ materially from the figures corresponding to Dunstan's formula. Aconitine hydrobromide, $C_{34}H_{47}O_{11}N.HBr$, or $C_{34}H_{45}O_{11}N.HBr$, separates from water in crystals containing 2½ mols. of water, slowly expelled on heating to 115°—120° C. From a mixture of alcohol and ether, the compound crystallises with ½ mol. of water, which is expelled at 110° C. The anhydrous salt and the compound with ½ mol. of water melt at 206°—207° C., and the compound with 2½ mols. of water at 160°—200° C. Aconine hydrochloride, $C_{25}H_{41}O_9N.HCl$, or $C_{25}H_{39}O_9N.HCl$, was prepared by heating aconitine with 20 times its weight of water in an autoclave under 6—7 atmospheres pressure, and treating the product according to Dunstan and Passmore's method (this J., 1892, 366). It forms crystals containing 2 mols. of water, m. pt. 175°—176° C. The salt loses its water of crystallisation only incompletely at 120° C., but rapidly becomes anhydrous at 100° C. *in vacuo.*—A. S.

Ledum Palustre; The Stearoptene of the Essential Oil of ——. Lomedse. Chem.-Zeit. Rep., 1903, 284; Pharm. Centralh., 1904, **45**, 590.

Distillation with live steam of the inflorescences and young shoots of *Ledum palustre* afforded 1·5 per cent. of essential oil in 1901 and 0·5 per cent. with the 1902 crop. The oil was a viscous fluid which deposited crystals on standing. The stearoptene was found to be only partially separable by cooling the alcoholic solution of the oil; it was therefore obtained, as a residue, by distillation *in vacuo* under 20 mm. pressure at 80° C. Recrystallised from alcohol, this residue furnished long, colourless, acicular crystals, m. pt. 104° C.; b. pt. 281° C. in an atmosphere of carbonic anhydride at 770 mm. pressure. It had the formula $C_{15}H_{26}O$.—J. O. B.

Otto of Rose. W. H. Simmons. Chem. and Druggist, 1904, **65**, 703.

The author has applied the iodine absorption method (see this J., 1904, 686) to several samples of this season's otto of rose, and finds that the results confirm the value of this test in judging of the purity of the oils. Of the samples examined, those which, according to their other constants as well as their odour, appeared to be genuine, gave iodine values well within the limits proposed (187—194), whilst those which, according to their other characters, might be regarded as suspicious or adulterated, gave values ranging from 199 to 210. The determination of the refractive index has been proposed by Parry and others as a means of detecting adulteration of otto of rose. The author determined this constant for 36 samples, 23 of which wer genuine, whilst the remaining 13 were of doubtful qualit The satisfactory samples gave an average refractive inde of 1·4626, a maximum of 1·4654, and a minimum of 1·4592 whilst the doubtful specimens gave values ranging fro 1·4615 to 1·4770. It appears from these results that th determination of the refractive index is of little value, a the generally accepted limits, 1·4600 to 1·4650 or 1·4670 would cover many adulterated samples, whilst where th refractive index was beyond the limit, the other character of the oil would also be abnormal.—A. S.

Orchella Lichens; Some Substances present in ——. Ronceray. Bull. Soc. Chim., 1904, **31**, 1097—1103.

The lichens *Rocella Montagnei* and *Dendrographa leucophæa* were found to contain erythrin, and *Rocella Tinctori* lecanoric acid as the chromogen. Orcinol in a free stat was detected in all the above varieties. New methods ar given for the preparation of pure lecanoric acid and erythri from the respective lichens; the melting points were found to be: lecanoric acid, 201° C.; erythrin, 164° C.—T. F. B.

Siberian Fir; Essential Oil of ——. J. Schindelmeiser. Apoth.-Zeit., 1904, **19**, 815—816.

Characters of Pure Oil of Siberian Fir.—Sp. gr. no under 0·918 at 17° C.; $\alpha_D - 39° 40'$ at 17° C.; esters a bornyl acetate not under 35 per cent.

Characters of Commercial Specimens of Siberian Fir Oil —Sp. gr. at 17° C., 0·911—0·915; $\alpha_D - 29° 18'$ to $-34° 30'$ a 17° C.; esters as bornyl acetate in the fractions boiling abov 190° C., 19·5 to 30 per cent. From the fraction containing the *l*-pinene and *l*-camphene, and having an optical rotatio of $\alpha_D = -24° 13'$ to $-26° 15'$ at 17° C., it is possible t isolate a small amount of a hydrocarbon boiling at 174°—180° C., and having $\alpha_D = -18° 28'$ at 17° C.; this fraction probably contains inactive dipentene. The commercial oils are probably adulterated with the cheaper pine-needle oil or with turpentine oil. Since the value of Siberian fir oil depends on its high percentage of lævo-bornyl acetate, which renders it valuable for the synthetic preparation of camphor, these figures are significant.—J. O. B.

Copaiba Balsam; Surinam ——. L. van Italie and C. H. Nieuwland. Pharm. Weekblad, 1904, [40]; Apoth.-Zeit., 1904, **19**, 816.

From the examination of seven commercial samples of Surinam copaiba balsam, it was found that two varieties occur, one thick like Maracaibo copaiba balsam, the other thin like Para balsam. The colour ranges from light yellow to brown; some specimens have a feeble fluorescence. The specific gravity ranges from 0·9096 to 0·9611; acid value from 14·65 to 59·19; ester value from 9·7 to 18·21; percentage of essential oil, from 41·0 to 71·6. Surinam copaiba balsam is not soluble in 5 volumes of absolute alcohol, nor in 20 volumes of 90 per cent. alcohol. It gives a slightly turbid solution with carbon bisulphide. Towards other solvents it behaves like South American balsams. On shaking with one-third of its volume of 10 per cent. ammonia solution it forms an emulsion from which oily drops separate out on standing. When agitated with chloral hydrate solution, the essential oil separates on standing, but the lower solution of resin has no characteristic colour such as is the case with gurjun balsam.

Characteristic Reaction for Surinam Copaiba Balsam.—A mixture of equal volumes of Surinam copaiba balsam and acetic anhydride gives a fine blue colour with a trace of sulphuric acid. Maracaibo balsam does not give this reaction.

Essential Oil of Surinam Copaiba Balsam.—The essential oil contains a sesquiterpene alcohol, $C_{15}H_{25}OH$, forming colourless and odourless crystals, m. pt. 113·5°—115° C., which begin to sublime at 80° C.; also two sesquiterpenes, one lævo-, the other dextro-rotatory, and a small quantity of cadinene.—J. O. B.

Active Oxygen in Organic Persulphates; Quantitative Determination of ——. A. Wolff and R. Wolffenstein. XXIII., page 1046.

Dinitro-aminophenol (Picramic Acid); New Method of Preparation of —— [and Determination of Potassium]. A. Frébault and J. Aloy. XXIII., page 1046.

Arsenic in "Reduced Iron"; Determination of ——. C. A. Hill and J. C. Umney. XXIII., page 1046.

English Patents.

ron and Arsenic; Process of Manufacturing Soluble Compounds containing ——. A. G. Brookes, London. From Chem. Werke Hansa, G. m. b. H., Hemelingen, Germany. Eng. Pat. 21,382, Oct. 5, 1903.

EE Fr. Pat. 336,127 of 1903; this J., 1904, 383. The ompounds may also be prepared by heating spathic iron re, or other natural ferrous carbonate, with glycerino-rsenic acid (arsenic acid dissolved in glycerin) out of ontact with air, until evolution of gas ceases. The solution filtered, and the filtrate evaporated under reduced presure, a feeble current of carbon dioxide being passed rough it.—T. F. B.

rotocatechuic Aldehyde; Manufacture of ——. A. J. Boult, London. From F. Fritzsche & Co., Hamburg. Eng. Pat. 15,784, July 15, 1904.

ROTOCATECHUIC aldehyde is prepared by heating heliopin with acid and water without exceeding a pressure of 2 atmospheres, or a temperature of 130° C. The reaction facilitated by using certain acid salts, especially sodium isulphite, in place of the acid. The reaction can also take lace in the presence of a solvent for heliotropin, such as a ydrocarbon or alcohol. (Compare Fr. Pat. 326,775 of 902; this J., 1903, 819.)—F. S.

yrocatechol Derivatives; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine, Germany. Eng. Pat. 26,480, Dec. 3, 1903.

ERIVATIVES of pyrocatechol, such as methylaminoacetorocatechol, $CH_3.NH.CH_2.CO.C_6H_3(OH)_2$, can be proiced by the interaction of a halogen-acetopyrocatechol d ammonia or a primary aliphatic amine. These keto rivatives can, if required, be reduced to the corresponding cohol bases.—F. S.

French Patent.

lcohols, Ethers, Acetic Acid, &c.; Process for making ——. Cie. Urbaine d'Eclairage par le Gaz Acétylène. Fr. Pat. 338,965, Aug. 3, 1903.

IE claims are for a continuous process for making ethyle, and converting it into ethyl hydrogen sulphate, which used as a starting point for making alcohol, ether, acetic id, &c. A suitable oxide, such as glucinum, lithium, or anganese oxide, is mixed with 50—60 per cent. of lime or ryta, and with coke, anthracite, pitch, or other suitable rbonaceous material, and the whole heated to form a rbide; this is decomposed with water in an ordinary etylene generator, and the ethylene formed, is absorbed by lphuric acid in an apparatus to which one of the claims lates.—T. F. B.

ethyl Groups of Aromatic Hydrocarbons; Oxidation of the ——. Badische Anilin und Soda Fabrik. Fr. Pat. 338,990, Aug. 17, 1903.

E Eng. Pat. 17,982 of 1903; this J., 1904, 910.—T. F. B.

rbituric Acid; Process for Transforming Iminobarbituric Acids into ——. Maison E. Merck. Fr. Pat. 343,673, June 3, 1904. Under Internat. Conv., July 11, 1903.

INOBARBITURIC acids are converted into barbituric acids heating with mineral acids. For example, iminodiethylbituric acid is boiled for some minutes with a solution of hydrochloric acid (1 : 3); diethylbarbituric acid results. The iminobarbituric acids result from the condensation of cyanoacetic esters with urea in presence of alkali alcoholates. —T. F. B.

Dialkylbarbituric Acids; Process for Preparing ——. Farbenfabr. vorm. F. Bayer & Co. Fr. Pat. 343,834, June 9, 1904. Under Internat. Conv., Sept. 25, 1903.

See Eng. Pat. 21,833 of 1903; this J., 1904, 76.—T. F. B.

Cream of Tartar; Extraction of White Refined —— from Marcs, before and after Distillation. G. Chiapetti. Addition to Fr. Pat. 330,951 of April 6, 1903. XVII., page 1039.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Mercuric Iodide; Two Emulsifiable Double Compounds of ——. Lüppo-Cramer. Eder's Jahrbuch, 1904, **18**, 12. Chem.-Zeit., 1904, **28**, Rep. 295.

When glass plates, coated with a gelatin emulsion containing gum arabic, copper sulphate, potassium iodide and potassium metasulphite, are immersed in a 0·4 per cent. solution of mercuric chloride, the emulsion passes from red and orange to a yellow colour; by exposing such a plate under a negative for two minutes in diffused daylight, a black image on a red ground is produced, which changes, on fixation, to a brownish-black image on a yellowish-grey ground. The same emulsified double salt is obtained by mixing emulsified copper iodide with emulsified mercuric iodide. The compound has the composition CuI, HgI_2, and is a red substance, turning dark brown on heating, and becoming red again on cooling.—T. F. B.

Silver Oxide and Ammoniacal Mercury Compounds; Sensitiveness —— of to Light. Lüppo-Cramer. Eder's Jahrbuch, 1904, **18**, 10. Chem-Zeit., 1904, **28**, Rep. 296.

A silver oxide emulsion was prepared by emulsifying the precipitate obtained by adding the calculated quantity of ammonia to a cold solution of silver nitrate and gum arabic: the emulsion blackens on gentle warming, owing to reduction. An acid solution of metol blackens it strongly, whether it has been exposed to light or not. No practical application appears possible owing to the rapid reduction of the silver oxide by the gelatin. An emulsion prepared from ammonio-mercuric oxide was found to be very slightly sensitive to light; it also darkens slowly on exposure. The compound $Hg_2(NH_2)OI$, obtained by digesting mercuric iodide with ammonia, could not be obtained pure in the form of emulsion in gum arabic solution; the yellow emulsion obtained by adding ammonia to emulsified mercuric iodide is slightly sensitive to light, and gives, after 10 minutes' exposure under a negative, an image which can be developed with metol and sodium carbonate.—T. F. B.

Silver Bromide; Studies on Unemulsified ——. K. Schaum. Eder's Jahrbuch, 1904, **18**, 74. Chem.-Zeit., 1904, **28**, Rep. 295—296.

The action of light on layers of silver bromide, obtained by precipitating concentrated silver solutions with a soluble bromide, gives an image which can easily be developed. Most developers produce the image very quickly: good gradation and freedom from fog result from the use of dilute developers. An image which can be developed also results from the action of light on a plate coated with grains of silver bromide separated by an organic medium (*e.g.* gelatin). The sensitiveness to light of unemulsified silver bromide appears to depend on the nature of the soluble bromide used; unemulsified silver bromide can also be "ripened" in the usual manner, and also exhibits "solarisation," showing that this is due, in ordinary emulsions, to an actual change in the silver bromide. Solarisation is completely prevented by immersion for 22 hours in a 5 per cent. solution of ammonium persulphate. Unemulsified silver bromide is also sensitive to Röntgen rays, and exhibits solarisation under their influence after 80 minutes' exposure. —T. F. B.

Development for the Production of Images of Fine Grain; Process of ——. A. and L. Lumière and A. Seyewetz. Brit. J. Phot., 1904, **51**, 866—867.

Two conditions are found to be necessary for producing images of fine grain, viz., slow development (effected either by dilution of the developer or by addition of "restrainers") and the presence of some solvent of silver bromide in the developer: the addition of ammonium chloride (15—20 grms.) to the developer (100 cc.) is found to fulfil both these conditions. In this process, the dissolved silver bromide is reduced by the developer, and the silver is deposited on the image, thus causing physical as well as chemical development. Two developers—viz., *p*-phenylenediamine and *o*-aminophenol—do not require the addition of a substance such as ammonium chloride, since they themselves have a slight solvent action on silver bromide. A suitable developer may be made by dissolving one grm. of *p*-phenylenediamine and six grms. of anhydrous sodium sulphite in 100 cc. of water; this is especially suited for obtaining negatives intended for enlarging, since it gives images of fine grain and normal intensity, and free from fog, on "rapid" plates. With slow emulsions the deposits obtained are of a fine brownish-violet colour especially adapted to transparency work.—T. F. B.

Silver Grain in Photography; Influence of Concentration of the Developer, and Time of Development, on the Size and Character of the ——. R. J. Wallace. Astrophys. J.; through Brit. J. Phot., 1904, **51**, 865—866.

THREE equally exposed plates were treated with developers of varying concentration, and squares of equal opacity from each negative were examined microscopically. That developed slowly, with dilute "rodinal," exhibited an irregular appearance, the grains having grouped together and giving a "coarse" result. By more rapid development with quinol, the irregularity was quite apparent, but less marked than in the previous case. The most uniform result was obtained by rapid development with a mixture of quinol, "metol" and "adurol": the grains of silver in this case only exhibited very little grouping. The actual size of the particles was also found to be considerably increased by prolonged development. Similar experiments were carried out on unexposed plates, with the result that the grains of reduced silver became larger and more numerous as the development was continued. Lumière and Seyewetz obtained results in contradiction of the above (see this J., 1904, 799), but the chief reason is considered to be that they examined the actual particles of silver, abstracted from the emulsion, and not the groups of particles as present in the developed negative.—T. F. B.

ENGLISH PATENTS.

Silver Emulsions for use in Photography; Process for the Production of ——. J. Gaedicke, Berlin. Eng. Pat. 18,183, Aug. 22, 1904.

HIGHLY sensitive emulsions of very fine grain, and of which the sensitiveness does not diminish on keeping, are produced in the following manner: an unripened gelatin emulsion is well washed, and mixed with about 20 times its weight of water; it is then heated to 40° C. with, for each litre, 1—5 c.c. of ammonia, or other substance having a maturing effect. The heating is continued for one to four hours, according to the degree of sensitiveness desired, and the ammonia in the emulsion is neutralised by addition of the calculated quantity of acid (sulphuric and citric acids are suitable), when the emulsion is ready for use.—T. F. B.

Photographic Paper and the like; Method of Production of ——. P. von Gerainow-Trauttenberg and M. L. Fabian, Brünn, Austria. Eng. Pat. 18,890, Sept. 1, 1904.

ACCORDING to this invention, paper is sensitised by a suitable substance, without employing any emulsion. "Direct copying" paper is prepared by immersing paper in a 5—10 per cent. solution of silver nitrate, drying, and toughening in a solution of oxalic acid 25 grms., citric acid 5—50 grms. (according to the desired hardness) in water, 1 litre. "Contact" paper is produced by treating paper first in a 2·5—5 per cent. solution of silver nitrate, and then in a 2—10 per cent. solution of oxalic acid. Negative paper is prepared in the same way as "contact" paper, except that it is further saturated with castor oil, &c., to render it translucent.—T. F. B.

FRENCH PATENTS.

Casein Emulsion [for Photography]. Soc. Protalbin-Werke Aktienges. Fr. Pat. 343,263, May 18, 1904.

CASEIN (50 kilos.) is agitated with N/1 sodium carbonate solution (500 litres), to a homogeneous mixture, which is filtered, then treated with concentrated acetic acid and allowed to stand several hours. The solid is separated, washed with cold water till nearly neutral, and allowed to stand under water some days, until a test sample is found to be soluble in dilute alcoholic solution of citric acid, when it is placed in a centrifugal machine and dried. This prepared casein is soluble in alkalis, alcoholic solution of acids and hydrated acids, and when mixed with the sensitising salts forms an emulsion without precipitation. Alum or formaldehyde may be added to increase the strength; soap, glycerin, or castor oil to add suppleness, and gelatin or colouring matters if desired.—R. L. J.

Manganic Salts; Process for Preparing Stable Solutions of —— [for Photographic Purposes]. O. Gros. Fr. Pat. 343,547, May 30, 1904. Under Internat. Conv., Aug. 22, 1903.

THE higher oxides of manganese, or compounds which, during the reaction, give rise to these, are treated with polyvalent organic acids, which also contain hydroxyl groups (*e.g.*, tartaric acid), or their salts. The solutions thus obtained are rendered quite stable by making them alkaline. For example, excess of tartaric acid is added to a solution of potassium permanganate, and the resulting solution is rendered just alkaline with sodium hydroxide; or the maximum quantity of the precipitate obtained by adding potassium permanganate solution to a solution of manganous sulphate, is dissolved in a saturated solution of sodium tartrate. Such solutions are especially applicable as oxidising agents in preparing photographs by the "catatype" process (see this J., 1903, 380, 963, and 1015). —T. F. B.

Silver [Photographic] Pictures; Process for converting —— into more Stable Catalytic Pictures. O. Gros. Fr. Pat. 343,583, May 31, 1904. Under Internat. Conv., Aug. 22, 1903.

SINCE "silver prints," when used for the "catatype" process, are rendered more or less useless for the purpose after a time, owing to the action of the hydrogen peroxide, particularly in presence of traces of acid, it is desirable to use some more stable form of print. It is found that silver prints can be rendered stable for this process by treating them with a solution of a manganic salt (see preceding abstract) to which potassium ferricyanide has been added; the prints are finished by immersion in an alkaline solution of potassium ferricyanide and washing. If these prints should lose their catalytic properties after a time, they can easily be "regenerated" by subjecting them to the action of ammonia.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

Explosives in Coal Mines Order. A. Akers-Douglas, one of H.M. Principal Secretaries of State, Sept. 6, 1904.

THE following have been added to the list of "Permitted Explosives":—

Colliery Cheddite.—Potassium chlorate (76·5—79·5 parts), mononitronaphthalene (14·5—15·5 parts), dinitrotoluene (1·5—2·5 parts), castor oil (4·5—5·5 parts), and moisture (0—1 part).

Nobel Ammonia Powder No. 1.—Ammonium nitrate (82—86 parts), nitroglycerin (7—9 parts), wood meal (6—8 parts), and moisture (0·5—2 parts).

Nobel Ammonia Powder No. 2.—Ammonium nitrate (78—82 parts), nitroglycerin (9—11 parts), wood meal (8—10 parts), and moisture (0·5—2·5 parts).

Phœnix Powder.—Nitroglycerin (28—31 parts), nitrocotton (0—1 part), potassium nitrate (30—34 parts), wood meal (33—37 parts), and moisture (2—6 parts).

Ammonal B.— Ammonium nitrate (94—96 parts), metallic aluminium (2·5—3·5 parts), charcoal (2—3 parts), and moisture (0—1 part).

Celtite. — Nitroglycerin (56 — 59 parts), nitrocotton (2·0—3·5 parts), potassium nitrate (17—21 parts), wood meal (8—9 parts), ammonium oxalate (11—13 parts), and moisture (0·5—1·5 parts).—G. W. McD.

English Patent.

Explosives [*Perchlorate*]. M. E. A. C. Yonck, Namur, Belgium. Eng. Pat. 24,511, Nov. 11, 1903.

The explosives have the following composition :—

——	1.	2.	3.	4.	5.
Ammonium perchlorate	51·2	37·4	47·7	53·24	48·4
Sodium nitrate	37·3	27·17	..	..	..
Ammonium nitrate	..	8·34	..	..	..
Naphthalene.....................	11·5	..	..	..	..
Trinitronaphthalene	..	27·09	..	14·46	..
Sodium oxalate	..	..	27·3	..	..
Ammonium picrate	..	..	25·0	..	..
Ammonium oxalate	..	..	..	32·3	..
Calcium oxalate................	..	..	..	..	33·8
Trinitrotoluene	..	..	..	..	17·8

Neither free chlorine nor hydrochloric acid are produced upon explosion, and these explosives can be safely used in fiery mines.—G. W. McD.

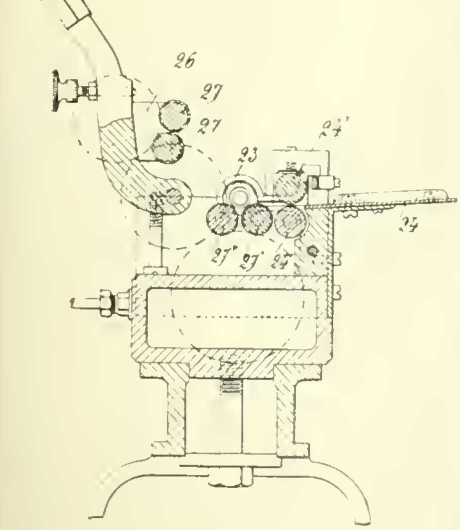
French Patents.

Nitroglycerin ; Process for Preparing ——. R. Möller. Fr. Pat. 343,760, June 6, 1904.

See Eng. Pat. 13,562 of 1904 ; this J., 1904, 882.—T. F. B.

Powder ; Automatic Machine to roll Charges of ——. Soc. de la Poudre Peigne et des Brevets. J. Luciani. Fr. Pat. 343,242, May 17, 1904.

By means of a system of six rollers geared together, sheets of powder are first rolled into cylinders of fairly large diameter. The distance between the rollers is then gradually reduced to produce cylinders of the desired diameter tightly compressed. The powder sheet passes through the guides (24) to the drawing rollers (24′), which carry it round the forming rings (23), thus producing the loose cylinder of large diameter. By bringing the rollers (27 and 27′) together by means of the handle, the compressed cylinder is produced. The rollers are recessed at a point opposite the forming rings.—G. W. McD.



XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Condenser and Distilling Column for Distillation in Vacuo, or under Normal Pressure ; New ——. H. Vigreux. Bull Soc. Chim., 1904, **31**, 1116—1119.

The inner tube of the condensers, which is about 22 mm. in diameter, is indented at a number of places, these indentations forming points in the interior of the tube (see Fig. 1) ; as these points are hollow, thus allowing water to fill them, very efficient condensation is obtained. The rectifying column is made on the same principle; the points are

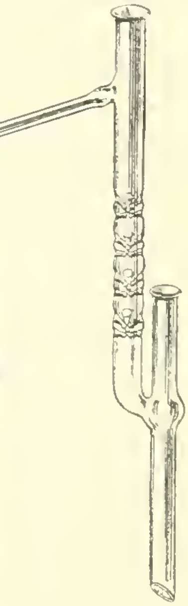


Fig. 3.


Fig. 1.


Fig. 2.

disposed in a number of horizontal planes round the interior of the tube, the sets of points being alternately horizontal and inclined downwards, thus forming a number of plates and inverted cones; as the drops of liquid fall from the cones, they are caught on the horizontal points before falling back into the liquid; the series of horizontal points thus play the same part as the platinum cones in the Le Bel columns (see Fig. 2). For distillation *in vacuo*, the column takes the form shown in Fig. 3, the projections not being so numerous as in the other forms. The side tube serves to hold a capillary tube for admitting air to the flask when necessary.—T. F. B.

INORGANIC—QUANTITATIVE.

Potassium as Picramate; Determination of ——; also Dinitro-aminophenol (Picramic Acid): New Method of Preparation. A Frébault and J. Aloy. J. Pharm. Chim., 1904, **20**, 245–247.

Preparation.—Zinc dust and solution of ammonia are added to a warm solution of picric acid in water or methyl alcohol, so as to obtain a distinct alkaline reaction. The mixture is boiled for an hour, with occasional addition of more ammonia. The boiling solution is filtered, excess of ammonia driven off by evaporation on the water-bath, and a slight excess of acetic acid added. Evaporation is then carried to dryness, the residue is redissolved in boiling water, filtered, and crystallised. Fine red crystals of picramic acid, m. pt. 165° C., are thus obtained.

Unrecorded Properties.—Picramic acid burns, but does not detonate, when suddenly heated. It does not precipitate albumin, albumoses, peptone, or alkaloids. Its alkali salts give solutions having a deep red colour, which becomes yellowish-green in the presence of acids. They are therefore available as indicators in alkalimetry.

Rapid Determination of Potassium as Picramate.—Potassium may be precipitated as picrate, converted into picramate, and its amount approximately determined colorimetrically as follows:—A few c.c. of the dilute solution containing potassium salts are treated with an equal volume of alcohol and precipitated with excess of sodium picrate. The potassium picrate is collected, washed with strong alcohol, dissolved in boiling water and converted into picramate by means of dextrose and ammonium carbonate. The colour is then matched with a standard solution of potassium picramate of known strength.
—J. O. B.

Selenium and Tellurium; Use of Phosphorous Acid in the Quantitative Determination of ——. A. Gutbier. Z. anorg. Chem., 1904, **41**, 448—451.

Compounds in which selenium and tellurium occur in the hexavalent condition, *e.g.*, selenic and telluric acids, are attacked with difficulty by phosphorous acid, and are not completely reduced. In the case of selenious and tellurous acids, however, reduction is effected rapidly and quantitatively by means of phosphorous acid. The best results are obtained by using a hydrochloric acid solution, and boiling after the addition of the phosphorous acid. In neutral and alkaline solutions, the reduced metal remains dissolved in the colloidal condition but a precipitate is produced on acidifying with hydrochloric acid.—A. S.

Active Oxygen in Organic Persulphates; Quantitative Determination of ——. A. Wolff and R. Wolffenstein. Ber., 1904, **37**, 3213—3214.

The organic persulphate is treated in an Erlenmeyer flask furnished with a Bunsen valve, with hydrochloric acid and a cold saturated solution of sulphurous acid, which has been previously treated with barium chloride solution, and filtered The reaction proceeds according to the equation:—$H_2S_2O_8 + SO_2 + 2H_2O = 3H_2SO_4$. The flask is heated till the excess of sulphur dioxide is expelled, the contents are then cooled and filtered, and the barium sulphate washed, dried, and weighed. Accurate results were obtained in test determinations with quinoline, quinaldine, acridine, and quinine persulphates.—A. S.

Chromium and Iron [in Ores and Alloys]; Volumetric Determination of ——. R. Glasmann. Z. anal. Chem., 1904, **43**, 506—508.

The solution containing a mixture of ferric and chromic salts (but not more than 0·05 grm. of chromic oxide on account of its colour) is treated in a flask, provided with a Bunsen's valve, with sulphurous acid, which reduces the ferric salt, leaving the chromic salt unaltered. The excess of sulphur dioxide is expelled by boiling, accompanied by the passage of a current of carbon dioxide, and the ferrous solution after cooling is titrated with permanganate. The oxidised solution is again reduced by heating with sulphuric acid and zinc according to Zimmermann's method, until it assumes an azure-blue colour. The ferrous and chromous salts are then again titrated with permanganate, the percentage of chromium being calculated from the difference between the two titrations.—J. F. B.

Fluorine in Wine and Beers; Determination of ——. F. P. Treadwell and A. A. Koch. Z. anal. Chem., 1904, **43**, 469—506.

The quantitative determination of fluorine, even in pure solution, in quantities of 5 mgrms. and less, is accompanied by serious errors; for larger quantities, a correction of 1·5 mgrms. of calcium fluoride may be added for every 100 c.c. of solution and washings to compensate for solubility. By Brand's qualitative etching test, a quantity of 0·5 mgrm. of fluorine in 100 c.c. of wine or beer can be detected with certainty.

Determination of Fluorine in Wine.—The authors advocate the following modification of Rose's method:—100 c.c. of wine are introduced into a 250 c.c. flask and made slightly alkaline with pure 2N-caustic soda solution; silver nitrate is added so long as a precipitate is formed and the liquid is shaken, made up to the mark and filtered. The first 5–10 c.c. of the filtrate having been discarded, 200 c.c. are measured into a 250 c.c. flask, sufficient sodium chloride is added, and the solution is diluted to 250 c.c. It is allowed to remain for 12—24 hours, the clear liquid is decanted off, filtered if necessary, and 175 c.c. (equal to 56 c.c. of wine) of the clear solution are boiled with 2—4 c.c. of 2N-sodium carbonate solution and precipitated with a large excess of calcium chloride, ebullition being subsequently continued for 5 minutes. The precipitate is filtered off, washed with hot water and dried. It is then incinerated and ignited at a dull-red heat for 10—20 minutes. The calcium salts are treated in the crucible with 2—4 c.c. of 1·5 N-acetic acid, and subsequently digested on the water-bath for 40 minutes. The liquid is then evaporated to dryness, the residue is moistened with two drops of acetic acid, extracted with water, and washed by decantation through a small filter After drying, the precipitate is returned to the crucible, the ash of the filter is added and the fluoride ignited for a few minutes. The extraction with acetic acid and subsequent operations are repeated until the further decrease in the weight of the calcium fluoride does not exceed 0·5 mgrm.

Determination of Fluorine in Beer.—The above method is not applicable in the case of beer, and the authors knew of no more exact method than is afforded by a modification of Penfield's process, which, however, only yields about 94 per cent. of the total fluorine present. 100 c.c. of beer are made alkaline with caustic potash, 2 c.c. of 2N-sodium carbonate are added, and the solution is precipitated with excess of calcium chloride at the boiling temperature. This precipitate always retains organic matter and must be ignited, and it is during this process that a large and somewhat variable loss of fluorine is liable to occur. The grey, calcined mass is mixed with 1·5 grm. of calcined quartz in an agate mortar, and is introduced together with 1·5 grm. of sea-sand into the Penfield apparatus, and there decomposed by sulphuric acid.—J. F. B.

Arsenic in "Reduced Iron"; Determination of ——. C. A. Hill and J. C. Umney. Pharm. J., 1904, **73**, 500—501.

Both the tests recommended by Dunstan (see this J., 1904, 899) and the German Pharmacopœia method are considered

quite accurate for determining arsenic in "reduced iron." The test of the U.S. Pharmacopœia is stated to be inaccurate, as the addition of the iron to hydrochloric acid in the absence of an oxidising agent causes evolution of hydrogen arsenide. The following test is recommended as the best to use: 0·1 grm. of potassium chlorate, and 1 c.c. of hydrochloric acid are added to 0·1 grm. of the reduced iron, and the mixture is warmed until the evolution of gas has ceased; 11 c.c. of hydrochloric acid, 7 c.c. of water, 2 grms. of potassium metasulphite, and 4 grms. of ferrous sulphate are now added and the mixture is heated on a water bath, under reflux condenser, for an hour, after which it is distilled; bromine is added to the first 17 c.c. of the distillate until a distinct coloration remains, and then the solution is decolorised with a solution of hydroxylamine hydrochloride. The arsenic, which is now present in the solution as arsenious acid, can be determined by any standard method. As to the limit of arsenic which should be allowed in "reduced iron," the suggestion of Dunstan (60 parts per million) is considered impracticable, and the matter is thought to call for further careful consideration.
—T. F. B.

Zinc Salts; Study of Complex ——. F. Kunschert.
XI., page 1032.

Sulphurous Acid in Molasses; Determination of ——. E. Pozzi-Escot. Bull. Assoc. Chim. Sucr. Dist., 1904, **22**, 231.

As the determination of sulphurous acid in molasses by direct oxidation with iodine in the presence of starch paste is not very exact, the author uses the following method which gives more accurate results: 500 c.c. of molasses rendered somewhat fluid with boiling water or 100 c.c. of wort, are introduced into a short-necked flask, a fragment (1 or 2 grms.) of chalk or marble added, and a few c.c. of hydrochloric acid. The flask is then connected to a condenser, and its contents boiled, the evolved sulphurous acid being received in an excess of iodine or bromine. When the distillation is finished, the distillate is heated to 90° C., acidified with hydrochloric acid, and precipitated with barium chloride.—L. J. de W.

ORGANIC—QUALITATIVE.

Indophenine Reaction. F. W. Bauer. Ber., 1904, **37**, 3128–3130.

In a former communication, the author stated that the indophenine reaction is not given by benzene containing thiophen, if chemically pure sulphuric acid be used (this J., 1901, 562) unless oxidising agents, such as ferric chloride or nitric acid be added. Storch (this J., 1901, 730) replied that the effect of the oxidising agents seemed to be entirely due to the heat evolved by them, and that the same effect could be produced by adding water, or by simply warming; whilst Liebermann and Pleus (this J., 1904, 768) deny the author's assertion. The author adheres to his first statements and does not find that warming, or adding water, promotes the reaction.—E. F.

Rosaniline and Pararosaniline; Method of rapidly Distinguishing between ——. R. Lambrecht and H. Weil. Ber. **37**, 1904, 3031.

Commercial rosaniline dissolves completely in 20 volumes of about 30 per cent. hydrochloric acid on warming. On cooling and standing, even for days, no precipitate is formed, whereas pararosaniline is almost completely precipitated under the same conditions in the form of a slightly soluble hydrochloride.—E. F.

ORGANIC—QUANTITATIVE.

Methylene Blue; Volumetric Determination of ——. L. Pelet and V. Garuti. Bull. Soc. Chem., 1904, **31**, 1094—1097.

This method depends on the formation of insoluble lakes by Methylene Blue with certain acid dyestuffs, an aqueous solution of which was run from a burette into an aqueous solution of Methylene Blue, until a drop of the solution, placed on unsized paper, showed that the dyestuff had been completely precipitated. It was necessary to use an acid dyestuff the aqueous solution of which was highly coloured, and which gave an insoluble lake: Ponceau, Carmine, Pyramine Orange, and Cotton Brown were all found to give good results; of these the authors recommend Ponceau as giving the most accurate results, as well as being very simple in use. One mol. of the Ponceau combines with 2 mols. of Methylene Blue. It was also found possible to determine the amount of Ponceau present by titration with a solution of Methylene Blue; in this case it was noticed that no lake formation commenced until one mol. of Methylene Blue had been added to the Ponceau solution.—T. F. B.

Sugar in Molasses and Cane Sugar Factory Products; Determination of Crystallisable and Reducing ——. H. Pellet. Bull. Assoc. Chim. Sucr. et Dist., 1904, **22**, 145—160.

The author states that normal lead acetate is the proper defecant for cane sugar products, but as it exerts only a slight decolorising action, sodium hypochlorite should be used with it to obtain solutions sufficiently decolorised for inversion and polarisation by the Clerget method. The polarisation is higher when basic lead acetate is used, except in some cases where molasses of light gravity (73°—78° apparent Brix) has been kept for some time, and the reducing sugars have become modified, and the sucrose transformed. It is essential to determine the water directly by desiccation in order to find the real purity, from which the apparent purity of molasses may differ by 7 to 13·5 per cent. In the determination of the reducing bodies of products of cane sugar factories, no defecating reagent should be used. In case the quantity of lime present is injurious, it may be precipitated by sodium carbonate, avoiding excess.

Bibliography.—(1) *Comptes rend.*, 1875, 181; (2) Note on the determination of crystallisable sugar in presence of dextrose, *Comptes rend.*, 1880, 303; (3) *J. Fabr. Sucre*, Jan. 28, 1877; (4) No. 20, 1877, and determination of crystallisable sugar in presence of pure dextrose, No. 27, 1877; (5) 1878, Nos. 15 and 21; (6) 1885, No. 35 (analysis of cane molasses); (7) 1886, No. 20; (8) 1889, No. 16; (9) 1891, No. 13; (10) Bull. Assoc. Chim. Sucr. et Dist; (11) On the determination of sugars, 1883, 176; (12) Analysis of molasses, 1890—1891, 439, 550, 615, 623; (13) On the determination of crystallisable sugar in presence of dextrose in cane molasses, 1895—1896, 836; (14) Experiments on the fermentation of cane molasses, &c. (with Barbet), 1895—1896, 948; (15) On the determination of invert sugar in presence of various reducing bodies, 1896-1897, 145; (16) On the determination of invert sugar, and reducing bodies in beetroot molasses, 1896—1897, 338; (17) Study of the reducing sugars of the cane, 1897—1898, 233; (18) 1897—1898, 293—299 (this J., 1897, 250, 1027); (19) Analysis of the molasses of beetroot and cane sugar factories, 1897—1898, 520, 605, 705, 793, 920 and 1120 (this J., 1898, 187, 498); (20) Analysis of cane molasses, 1898—1899, 1006, 1145; (21) 1899—1900, 52, 55, 62, 64, 65 (this J., 1899, 775); (22) Determination of reducing bodies in presence of sucrose, 1899—1900, 699; (23) Action of basic and normal lead acetate on reducing bodies, 1899—1900, 55; (24) Studies of the molasses of cane sugar factories, 1901—1902, 830 (this J., 1902, 428); (25) Nature of the reducing sugar of the cane, 1901—1992, 834 (this J., 1902, 416).—L. J. de W.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Carbon Dioxide in Seeds during Germination; Origin of ——. E. Urbain. Comptes rend., 1904 **139**, 606—608.

Connstein, Hoyer, and Wartenberg (this J., 1902, 1541), noticed that when castor seeds were treated with a 1 per cent. solution of chloral hydrate, no hydrolysis of the fats occurred until after some days. That this saponification is not due to atmospheric carbon dioxide, or to that formed by oxidation by atmospheric oxygen, is shown by the fact that it occurs equally well in the absence of air.

The following experiments show that the carbon dioxide is the result of decomposition of the albuminoid matter by the proteolytic enzymes present in castor seeds. Castor oil treated with cytoplasma (prepared from the seeds by the method of Nicloux (this J., 1904, 687) and chloral hydrate solution, *in vacuo*, showed practically no acidity after eight days; whilst, when aleurone (prepared by the same method) was added to the other substances, almost complete saponification of the fatty acids occurred after eight days. It would thus seem that this proteolytic decomposition was the first phase of germination, preceding the lipolytic action. —T. F. B.

India-Rubber; Action of Radium Rays on ——. R. Ditmar. Gummi-Zeit., 1904, **19**, 3—4.

Experiments with a weak radium-barium bromide preparation (10,000 times as strong as uranium pitchblende) showed that the γ-rays pass through both raw and vulcanised rubber, but through the former more readily than through the latter. Rubber which has been made radio-active by induction behaves differently from other solid bodies in a similar condition. In general, the induced radio-activity is dissipated to the extent of one-half in 28 minutes, when the substance is exposed to the air. In the case of rubber, however, the radio-activity persists for from 15—20 days.—J. K. B.

New Books.

Monographs on Applied Electrochemistry. Elektrolytisches Verfahren zur Herstellung parabolischer Spiegel. Von Sherard Cowper-Coles. Ins Deutsche übertragen von Dr. Emil Abel. 1904. Price M. 1.

Pamphlet, 8vo size, containing 17 pages of subject-matter, with 13 illustrations. The leading themes are the following:—

The Process of Cowper-Coles.—Preparation of the Glass Mould. Silvering the Mould. Description of the Electrolytic Bath. Raising the Mirror from the Mould, &c.

Properties of the Metallic Mirror.—Reflective power of Palladium and other Metals. Weight of the Metallic Mirror, its Hardness, and Optical Tests. Improvement of the Surface of the Mirror.

Artificial Graphite. By Francis A. J. Fitz-Gerald. Ins Deutsche übertragen von Dr. Max Huth. Verlag von Wilhelm Knapp, Halle a. S. 1904. Price M. 3.

Pamphlet like the foregoing, and containing 58 pages of subject-matter, one page of bibliographic notes, and an alphabetical index of authors. The text is illustrated with 14 wood-engravings and five tables. I. Historic Survey. II. Methods of Preparation: A. Castner's Anode for Electrolytic Processes. B. Process of Girard and Street. C. Process of Acheson. D. Process of Rudolph and Härden.

Ueber Herkommen und Chemie des Kautschuks. Von Dr. Ed. Marckwald und Dr. Fritz Frank. Steinkopff und Springer, Dresden, A. 21. 1904. Price M. 1.50.

Pamphlet of 8vo size, containing 68 pages of subject-matter.

Smoke Prevention and Fuel Economy. (Based on the German Work of E. Schmatolla.) By Wm. H. Booth and John B. C. Kershaw. A. Constable and Co., Ltd., 16, James Street, Haymarket, London. 1904. Price 6s.

8vo volume, containing 188 pages of subject-matter, with 75 illustrations, and an alphabetical index. The subject is subdivided into and treated under the following heads:—I. The Chemistry of the Combustion Process. II. Present Methods of Burning Fuels, and their defects. III. Improved Methods of Burning Fuel. IV. The Examination of the Waste Gases, and Control of the Combustion Process. The Appendix is a considerable one, and is subdivided into: I. Patent Abstracts, English, German, and U.S.A. II. Fuel Analyses, Losses and Costs. III. Miscellaneous Extracts.

A Scheme for the Detection of the more Common Classes of Carbon Compounds. By Frank E. Weston, B.Sc. Longmans, Green, and Co., 39, Paternoster Row, London; New York and Bombay. 1904. Price 2s.

8vo volume, containing 56 pages of subject-matter and eight illustrations. The methods apply under the following conditions:—I. Carbon and Hydrogen only present. II. Carbon, Hydrogen, and Halogen present. III. Carbon, Hydrogen, Oxygen, and Halogen present. IV. Carbon, Hydrogen, and Oxygen present. V. Carbon, Hydrogen, and Nitrogen present. VI. Carbon, Hydrogen, Nitrogen, and Oxygen present. VII. Carbon, Hydrogen, and Sulphur present. VIII. Carbon, Hydrogen, Sulphur, and Oxygen present. IX. Carbon, Hydrogen, Sulphur, and Nitrogen present. X. Carbon, Hydrogen, Sulphur, Oxygen, and Nitrogen, or Halogen present. XI. Special Reactions. XII. Solubility of Carbon Compounds.

St. Louis Exhibition, 1904. German Educational Exhibition. Chemistry. W. Büxenstein, Berlin. 1904. A. Asher and Co., 13, Bedford Street, Covent Garden, London, W.C. Price 2s.

8vo volume, containing preface and 135 pages of subject-matter, followed by indexes of names and subjects. In this descriptive catalogue the contents or characters of the different rooms are found given as follows:—I. Reading-room. II. Alchemistic Laboratory. III. The Liebig Laboratory. IV. General and Inorganic Chemistry. V. Pyrochemistry. VI. Scales and Balances. VII. Electro-Chemistry. VIII. Organic Chemistry. IX. Dyeing Laboratory. X. Shaking Apparatus and Bomb-tube Experiments. XI. Physiological and Fermentation Chemistry.

Trade Report.

I.—GENERAL.

Australian Imports in 1903.

Pharm. J., Oct. 29, 1904.

Although the Commonwealth official statistics have not been issued, figures have been published which show that Great Britain still retains her lead as principal exporter to Australia. The imports into the Federal States for 1903 run out at 36,551,542*l.*, and the exports at 29,046,206*l.* Adding exports and imports of specie and bullion, the total comes out at 85,981,025*l.*, an increase of nearly one and a half millions over 1902. The figures (which are extracted from *Commercial Intelligence*) for certain articles are as follows:—

——	Great Britain.	France.	Germany.	U.S.A.
	£	£	£	£
Boric, salicylic, and other acids	5,363	14	565	12
Aërated and mineral waters	5,162	28	1,981	407
Alkalis	73,639	28	126	1,969
Alum	626	..	54	..
Ammonium carbonate	2,044	..	10	6
Drugs and chemicals	315,285	86,510	47,321	4,281
Dyes	18,175	7,106	2,078	5,261
Filters	2,341	94	15,000	252
Instruments, scientific	17,628	255	2,415	1,394
Medicines	133,613	562	2,682	51,868
Perfumery	32,263	2,881	3,749	10,363
Photographic goods	31,630	83	855	344
Varnishes	42,051	22	381	4,899

France heads the list for tartaric acid and cream of tartar, but these represent her only success. Germany, on the other hand, leads with several commodities, the only one of chemical interest being calcium carbide.

NATAL; TRADE OF —— WITH THE UNITED KINGDOM.

Bd. of Trade J., Oct. 27, 1904.

The following figures are given, as supplementing those given in this J., 1904, 630, showing the value of certain British goods imported into Natal during 1903:—Ale and beer, 43,700*l.*; apothecary ware, 74,400*l.*; candles, 46,000*l.*; cement, 26,100*l.*; earthenware, 59,100*l.*; glass and glassware, 68,500*l.*; malt, 24,300*l.*; milk, condensed, 105,900*l.*; oils, other than paraffin and linseed, 32 000*l.*; painters' colours, 53,600*l.*; paper, printing, 31,000*l.*; paper, wrapping and brown, 7000*l.*; perfumery, 12,000*l.*; soap, 73,500*l.*; spirits, 224,700*l.*

II.—FUEL, GAS, AND LIGHT.

COAL PRODUCTION OF THE WORLD.

Eng. and Mining J., Oct. 13, 1904.

The world's production of coal and lignite in 1903 amounted to 877,755,053 metric tons, compared with 804,405,293 tons in 1902 and 787,179,967 tons in 1901. This great increase in coal output shows, as no other one factor, how rapidly industrial activity advanced in the years named. The United States easily led the world in developing fuel resources, in spite of the reduced anthracite production of Pennsylvania in 1902, owing to the long strike of the miners. The long-developed fields of Great Britain made a substantial gain in 1902 and 1903, and in 1903, Germany, France, and Belgium increased their production. In fact, four of the five leading coal-producing countries in 1903 surpassed all previous records of output. The figures for the three years are as follows, in metric tons:—

——	1901.	1902.	1903.
	Met. Tons.	Met. Tons.	Met. Tons.
United States	266,078,668	273,600,961	326,064,592
United Kingdom	222,614,981	230,728,563	234,009,484
Germany	152,628,931	150,600,214	162,619,934
Austria-Hungary	40,746,704	39,386,884	39,600,000
France	32,325,302	29,997,470	35,002,992

The stationary position of Austria-Hungary has been caused by labour difficulties and industrial depression.

In the other European countries, in Canada, in South Africa and in Australia, production increased during 1903, and some of the smaller countries, not reporting outputs, such as Mexico, made substantial gains. In fact, the activity of coal mines was a feature of the world's work in 1903.

III.—TAR PRODUCTS, PETROLEUM, Etc.

PETROLEUM PRODUCTION OF THE UNITED STATES IN 1903.

Bd. of Trade J., Oct. 27, 1904.

The annual report of the United States Geological Survey on the production of petroleum in the United States in 1903, states that the output reached the large total of 100,461,337 barrels, being larger than that of any previous year, and greater than that of 1902 by 11,694,421 barrels, or 13·17 per cent. The greatest part of the increase during 1903 was from the State of California, which produced in that year nearly one-fourth of the entire production. The total value of the oil produced in 1903 was 94,694,050 dols., as compared with 71,178,910 dols. in 1902.

VARNISH; BLACK —— : U.S. CUSTOMS DECISION.

Aug. 19, 1904.

A mixture of light coal tar oils and coal-tar pitch, drying and forming a coating when exposed to the air, was held to be dutiable at 20 per cent. *ad valorem,* under paragraph 15 of the present tariff, as a "preparation of coal tar, not a colour or dye." The assessment of duty at 35 per cent. *ad valorem,* under paragraph 53, was overruled.—R. W. M.

PETROLEUM IN ROUMANIA; PRODUCTION OF ——.

Eng. and Mining J., Oct. 13, 1904.

According to official statistics recently published in the *Petroleum Review*, the output of petroleum in Roumania during the first half of the present year was 213,702 metric tons. The Prahova district, as usual, contributed the greater part of the output. The figures indicate that the industry is growing steadily, and the product for 1904 will probably exceed previous records.

VII.—ACIDS, ALKALIS, Etc.

ARSENIC PRODUCTION IN 1903.

Chem. Trade J., Oct. 29, 1904.

The annual report of the U.S. Geological Survey states that that the production of arsenious oxide in the United States during 1903 amounted to 611 short tons, valued at 36,691 dols., as compared with 1353 tons in 1902 and 300 tons in 1901, the last-named year being the date of the inception of the white arsenic industry in the United States. The entire domestic product has been made at the plant of the Puget Sound Reduction Co., Everett, Wash., and the large increase in the domestic production during 1902 promised success to the undertaking. Owing to various commercial reasons, however, the by-product plant was operated at its full capacity only during the first quarter of the year 1903. It was shut down from March until September 1903, when, at the latter time, the works came under the control of the American Smelting and Refining Co. During the last three months of the year, the by-product plant was used only for roasting small quantities of arsenical lead ores, and no white arsenic was shipped to the market.

The arsenic ores treated at this plant consisted mainly of arsenical pyrites containing, on the average, about 14 per cent. of arsenic and 0·7 oz. of gold and 3 oz. of silver per ton. A part of the ore treated contained only 2 per cent. of sulphur, the arsenic being present chiefly in an oxidised form. The by-product plant for the condensation and collection of the white arsenic consists of a long brick flue, 20 ft. high, connecting the Wethey mechanical six-hearth 60-ton roasting furnace with the dust chamber, which latter is 5 ft. high and covers an area of about 125 to 150 ft. This chamber is built of 4-in. brick walls, and is divided into four equal parts, so arranged that by the use of valves or dampers any one section can be cut out from the other, and the condensation may thus be carried on continuously. The arsenical compounds in the ore are decomposed during the roasting, and are transformed chiefly into volatile arsenious oxide, which passes out with the waste gases of the furnace, and is subsequently condensed by their cooling and lessened velocity, and settles on the floor of the dust chamber or becomes attached to the sides and roof in beautiful festoons of pure white crystals resembling snow. At stated intervals each section is cut out from the system, and the accumulated deposit of white arsenic is shovelled into hand barrows and carried to storage bins until needed for subsequent refining in a small reverberatory furnace. After the arsenic has been expelled by the roasting, the ore is discharged from the furnace and treated with lead ore in a shaft furnace for the extraction of the gold and silver.

Despite the fact that the domestic output of arsenical compounds is not sufficient to supply more than one-quarter of the total consumption of the United States (large quantities being annually imported from Canada, Germany, and Spain), the development of this industry is of exceedingly slow growth. During 1903 there were imported from Canada, England, Germany, and Spain 1,211,299 lb. of arsenious acid, valued at 38,505 dols., and 7,146,362 lb. of arsenic sulphide and orpiment, valued at 256,097 dols., as compared with 1,385,700 lb. of arsenious oxide, valued at 42,424 dols., and 6,725,198 lb. of arsenic sulphide and orpiment, valued at 237,631 dols. in 1902.

A recently discovered deposit of arsenic is being exploited at Pilot Mountain, 17 miles from Christiansburg, Montgomery County, Va. The capacity of the plant, when completed, is placed at 140 tons of refined arsenic per month. The region is wild and mountainous.

The white-arsenic plant at Anaconda, Mont., was nearly completed on January 1st, 1904. Large brick settling chambers have been erected alongside of the flue of the Brunton roasting furnaces, in order to condense and collect the arsenical fumes formed during the roasting. The arsenic-refining department has been equipped with suitable reverberatory furnaces, in which the crude flue deposit will be refined and the purified product subsequently ground and packed for the market in air-tight barrels, each of a capacity of 400 lb. The daily capacity of the by-product plant is reported to be several tons of flake arsenic.

An interesting discovery of metallic arsenic was made during 1903 at Washington Camp, Santa Cruz County, Ariz. The deposit is in masses attached to the walls of small pockets in dolomitic limestone. The size of the masses is generally small, although in one instance a piece weighing 20 lb. was found.

The world's production of arsenic in 1903, so far as reported, was as follows:—Canada, 233 tons, value 15,420 dols.; Germany, 2768 tons, value 253,500 dols.; Spain, 1088 tons, value 87,040 dols.; United Kingdom, 917 tons, value not given; United States, 554 tons (611 short tons), value 36,691 dols. A relatively small quantity of arsenic is produced in Italy, Japan, Portugal, and Turkey, but the statistics of these countries are not yet available for 1903.

The significance of the importation of arsenic and its compounds for the manufacturing industries of the United States may be appreciated from the statistics given in the following table for the past five years, showing the imports of metallic arsenic, white arsenic (arsenious acid), and arsenic sulphides (orpiment and realgar):—

Year.	Quantity.	Value.
	Lb.	Dols.
1899	9,040,871	386,791
1900	5,765,559	265,500
1901	6,989,668	316,525
1902	8,110,898	280,055
1903	8,257,661	204,602

LIME; VIENNA ——: U.S. CUSTOMS DECISION.

Sept. 26, 1904.

Vienna lime was held to be dutiable at 20 per cent. *ad valorem* under section 6 of the present tariff, as a "manufactured article unenumerated." The assessment of duty at 35 per cent. *ad valorem* as an "article composed of mineral substances," under paragraph 97, was overruled.

—R. W. M.

IX.—BUILDING MATERIALS, Etc.

ASPHALT MASTIC: U.S. CUSTOMS DECISION.

Oct. 18, 1904.

It was decided that asphalt mastic was dutiable at 3 dols. per ton under paragraph 93 of the present tariff, overruling the claim of the importers that it was dutiable at 50 c. per ton as "crude asphalt" under the same paragraph.

—R. W. M.

CLAY MATERIALS; PRODUCTION OF —— IN 1903.

Eng. and Mining J., Oct. 13, 1904.

According to the United States Geological Survey, the total value of the various clay products manufactured in the United States last year was 130,962,618 dols. This total was made up of the following items:—Common brick, 50,532,075 dols; front brick, 5,308,908 dols.; paving brick, 6,453,849 dols.; fancy brick, 892,256 dols.; fire-brick, 14,062,369 dols.; drain-tile, 4,639,214 dols.; sewer pipe, 2,525,369 dols.; terra cotta, 4,672,028 dols.; fireproofing, 8,708,143 dols.; hollow blocks, 1,153,200 dols.; tile other than drain tile, 3,505,929 dols.; pottery, 25,136,052 dols.; miscellaneous, 3,073,856 dols. As compared with the output for 1902, there was an increase of 8,793,117 dols.

X.—METALLURGY.

MINERAL OUTPUT OF CALIFORNIA.

Eng. and Mining J., Sept. 22, 1904.

The mineral production of California during 1903, as compiled from reports made to the State Mining Bureau at San Francisco, is shown in the following table:—

——		Quantities.	Value.
			Dols.
Asphalt	Tons	41,670	503,659
Bituminous rock	"	21,944	53,106
Borax, crude	"	34,430	661,400
Cement	Bbl.	640,868	968,727
Chrome ore	Tons	150	2,250
Chrysoprase	..	..	500
Clay, brick	Million	214,403	1,999,546
Clay, pottery	Tons	90,972	99,907
Coal	"	93,026	265,383
Copper	Lb.	19,113,861	2,520,997
Fullers' earth	Tons	250	4,750
Gold	..	..	16,471,264
Granite	Cb. ft.	498,625	678,670
Gypsum	Tons	6,914	46,441
Infusorial earth	"	2,703	16,015
Lead	"	55	3,960
Lime and limestone	..	..	592,268
Lithia mica	Tons	700	27,300
Macadam	"	605,185	436,172
Magnesite	"	1,361	20,515
Manganese	"	1	25
Marble	Cb. ft.	84,624	97,354
Mica	Tons	50	3,800
Mineral paint	"	2,370	3,720
Mineral water	Galls.	2 056,340	558,201
Natural gas	M. Cb. ft.	120,134	75,237
Paving blocks	Million	4,834	134,642
Petroleum	Bbl.	24,340,839	7,313,271
Platinum	..	..	1,052
Pyrites	Tons	24,311	94,000
Quartz crystal	..	..	1,968
Quicksilver	Flasks	32,094	1,335,954
Rubble	Tons	1,610,440	1,237,419
Salt	Bbl.	102,895	211,365
Sand	Tons	7,725	7,725
Sandstone	Cb. ft.	353,002	585,309
Serpentine	"	99	800
Silver	..	..	517,444
Slate	Squares	10,000	70,000
Soapstone	Tons	219	10,124
Soda	"	18,000	27,000
Tourmaline	..	..	100,000
Turquoise	..	..	10,000
Total value		..	37,759,040

In the previous year the mineral production of the State was valued at 35,069,105 dols., showing an increase in 1903 of 2,689,935 dols.

LEAD; THE CANADIAN BOUNTY ON ——.

Eng. and Mining J., Oct. 13, 1904.

The text of the Canadian order in council, which permits the application to exported lead ores of any unappropriated portion of the bounty on lead is as follows:—

"Whereas by clause 3 of the Act 3 Edward VII. Chap. 31, intituled, 'An Act to provide for the payment of bounties on lead contained in lead-bearing ores mined in Canada,' it is provided that if at any time it appears to the satisfaction of the Governor-General in Council that the charges for transportation and treatment of lead ores in Canada are excessive, the Governor in Council may authorize the payment of bounty at such reduced rate as he deems just on the lead contained in ores mined in Canada, and exported for treatment abroad, and

"Whereas, it appears that the lead smelters in Canada are unable at present to treat the whole of the lead ores mined in Canada, except at an excessive rate:

"Therefore, the Governor-General in Council is pleased to order that, after the payment of the full amount of bounty payable under the Act above referred to and amendments thereto, upon lead ores mined and smelted in Canada, and dating from the 1st day of April, 1904, until the 30th day of June, 1905, a rate of 50 c. per 100 lb. of lead contained in lead-bearing ores mined in Canada, and exported for treatment to Europe, shall be paid, provided that the quantity of lead upon which such bounty shall be paid shall not exceed 11,000 tons, of 2000 lb., in any one fiscal year." (See also this J., 1904, 886.)

Lead in Ontario.

Eng. and Mining J., Oct. 13, 1904.

According to the *Canadian Mining Review*, the existence of ores of lead in Ontario, Quebec, and Nova Scotia has been known for more than 30 years, and various and spasmodic attempts have been made to work these ores. The deposits in Tudor, Ontario, occur in calcareous and micaceous schists, associated with limestones and dolomites of Silurian age. Some of these deposits occur associated with a gangue of barytes and calcspar, and are small in extent; others are from 18 in. to 24 in. in width, the ore appearing in bunches, and as disseminated grains in the gangue. Some larger masses of galena are occasionally found, but the characteristic of the region is a lack of continuity to the deposits.

In both Tudor and Lake townships there appear to be two distinct sets of deposits, one striking north-west, the other north-east, and where two veins cross each other there is usually an enlargement at the surface which does not continue in depth. There are, in addition, other veins, usually with a quartz gangue, which are somewhat larger, and which cut through the gneisses of Elzevir township.

The association of arsenical and antimonial ores with the galenas of this section is not infrequent; their values in silver are low, running from 3 to 8 oz. of silver to the ton of galena, and the majority of samples show no gold whatever.

Mines in Korea

Le Mercure, July 31, 1904. *U.S. Cons. Reps., No.* 2084, *Oct.* 18, 1904.

Korea possesses gold mines whose output has increased from 1,158,000 dols. in 1898 to 2,509,000 dols. in 1902. It has also mines of iron, silver, copper, coal, &c. The greater part of the gold is exported to Japan. Iron, although present in large quantities, can hardly be said to be exploited. As a matter of fact, iron used in Japanese foundries comes from China. Coal of medium quality is equally abundant, but it is hardly exploited. Copper is extracted in several districts. During the last two years 564,433 lb., valued at 51,044 dols., were mined.

Chrome Ore Supplies.

Eng. and Mining J., Oct. 6, 1904.

The rapid expansion of the chrome ore industry of New Caledonia recently has begun to have a very noticeable influence upon the general trade conditions. In fact, the competition from this source has become so sharp that some apprehension is felt that it may seriously affect the industry in other countries. So far, the most important result connected with the increased exports from New Caledonia has been a decline in the quotations of about 5 dols. per ton for 50 per cent. ore at New York.

For many years the trade in chrome ore has been practically controlled by the Turkish producers. The exports from this country have averaged 40,000 tons annually, which, up to 1903, about equalled the aggregate output from all other countries. The mines are situated in the European provinces of Salonica, Kossovo, and Monastir, and the Asiatic provinces of Aidin, Konia, Adana, Angora, Broussa, and Macri. Most of the product imported into the United States comes from Macri and Broussa, and is known under the trade names of "Macri" and "Daghardi," the latter being the largest mine in Broussa. The ores contain from 48 to 54 per cent. of Cr_2O_3; the Macri ore carries from 48 to 51 per cent., and the Daghardi ore up to 54 per cent. There has been some effort put forth to restrict the output within reasonable bounds, as the resources of the country are very extensive, and could be made to yield much more than the present output. The Turkish government exacts a royalty of 20 per cent. on the value of the ore mined, and also imposes a duty of 1 per cent. on the exports. In spite of this heavy burden, however, the cost of producing the Macri ore and delivering it at the seaboard is said to be only 35*s.* per ton.

The growing importance of New Caledonia as a producer of chrome ore is well shown by the statistics of exports, which have increased from 1042 metric tons in 1894 to 10,474 tons in 1900, and 21,437 tons in 1903. During the first four months of the present year the shipments amounted to 12,225 metric tons. The chromite is mined principally in the north-western and south-western portions of the island, the mineral occurring in association with serpentine, which also yields the nickel and cobalt ores. Some of the deposits are of great size; as much as 20,000 tons of ore have been taken from a single ore-body. The principal factor in the industry is the Société le Chrome, a combination of producing interests which came into existence in 1902. At present mining is most actively carried on at Tiepaghi, where the ore is especially rich. The Société le Chrome has leased the mining rights on this property to tributers, who paid the sum of 200,000 dols. for the privilege of working it for three years. It is said that the output for this period may reach 100,000 tons. The ore requires no mechanical concentration, and is shipped in large lots with an average content of 56 per cent. chromic oxide.

Aside from Turkey and New Caledonia, chromite is mined quite extensively in Canada, Newfoundland, Greece, Russia, India, and Australia. The deposits in the United States are of small importance at present, although they occur quite widely among the altered rocks of the Appalachians from Pennsylvania southward, and also in California. In recent years, the output has amounted to only a few hundred tons, most of which was mined in California and consumed locally. As to the other countries, Australia has come into some prominence lately, due to the fact that the ore is high grade and is exported to the United States as ballast in wool-laden ships, thus getting a very low transport rate. Important discoveries of ore have recently been reported from India, and it is now being offered in the American market. The Canadian chromite is obtained from the eastern townships of Quebec. According to J. Obalski, a good deal of development has been done lately, and an increased output may be expected from this region. The production in 1903 amounted to 3020 tons. Newfoundland is known to possess large deposits of concentrating ore, favourably situated as to transport, but so far they have not been very actively exploited.

The consumption of chromite in the United States at present is probably about 30,000 long tons per annum. The imports for the last three years have been as follows: 1901, 20,112 tons; 1902, 39,570 tons; 1903, 22 931 tons. There are three important applications to which the ore is put: the preparation of bichromates and other compounds of chromium, the manufacture of ferro-chromium, and in making linings for blasts and reverberatory furnaces. For the latter purpose it is sometimes used in the form of bricks. The Kalion Chemical Company, of Philadelphia, Pa., controls the manufacturing business in chromium compounds, while the Wilson Aluminium Company, of New York, is the principal manufacturer in this country of ferro-chrome. Chrome bricks are made by the Harbison-Walker Company, of Pittsburg.

Precious Metal Producton of the United States in 1903.

Eng. and Mining J., Oct. 6, 1904.

The corrected figures for the production of gold and silver in the United States during 1903 (see this J., 1904, 142) are as follows:—

Gold: 3,560,000 fine ounces, valued at 73,591,700 dols., a decrease of 6,408,300 dols., or 8 per cent., as compared with 1902.

Silver: 54,300,000 fine ounces, valued at 29,322,000 dols., an increase of 93,000 dols. over 1903, solely due to the higher average price of the metal.

Lead Production of United States.

Eng. and Mining J., Oct. 13, 1904.

The production of lead in the United States in 1903, from domestic ores, showed a slight decrease from that reported in the previous year. The total, as shown by the figures furnished for *The Mineral Industry* by producers, was 276,694 short tons, and the decrease from 1902 was 3830 tons, or 1·3 per cent. The decline in production was entirely in desilverised lead, the output of soft lead, chiefly from the Missouri mines, showing a gain of 11 per cent. During part of the year the smelters restricted their purchases of ore, and consequently the production of the metal.

In addition to the lead made from domestic ores, smelters and refineries turned out 92,794 tons of metal from foreign ores and base bullion, making the total lead put into merchantable form, at works in the United States, 369,488 short tons.

In the table below is given a statement of the imports, exports, &c., as shown by the reports of the Bureau of Statistics, the figures being in short tons:—

Foreign Lead in the United States.

Imports.	1902.	1903.
Lead, metallic	2.529	3,023
Lead in ores and base bullion	105,186	103,384
Total imports	107,715	106,407
Less re-exports of foreign	78,967	81,915
Less smelters' allowance on lead re-exported	7,897	8,192
Total deductions	86,864	90,107
Net imports	20,851	16,300
Add lead in bond, Jan. 1	16,622	23,939
Total supply	37,473	40,239
Deduct lead in bond, Dec. 31	23,939	10,694
Approximate consumption of foreign	13,534	29,545

By far the greater part of the lead imported last year—93,068 tons, or 87·5 per cent. of the total—came from Mexico, the quantity received from Canada having been comparatively small, only 9,600 tons. The Mexican lead comes chiefly in the form of base bullion, to be refined in bond.

The total supplies of lead for the year, and the disposition made of them, are shown in the following table, the figures being in short tons:—

Lead Production and Consumption.

——	1902.	1903.
Desilverised	199,615	188,913
Soft	70,424	78,298
Antimonial	10,485	9,453
Total production	280,524	276,694
Add stocks, Jan. 1	70,316	30,500
Add net foreign	13 534	29,545
Net total supplies	36,374	336,739
Domestic lead exported	3,271	56
Estimated consumption	330,603	315,683
Total	333,874	315,739

Iron Sand: U.S. Customs Decision.

Oct. 17, 1904.

Merchandise invoiced as "chilled iron," "diamond grit," and "steel grit" was assessed for duty at 45 per cent. *ad valorem* as "manufactures of metal" under paragraph 193 of the present tariff. Analysis having shown them to be iron, the claim of the importer that it was "steel," dutiable under paragraph 135, was overruled.—R. W. M.

XII.—FATS, FATTY OILS, Etc.

Wool Grease: U.S. Customs Decision.

The United States Circuit Court decided the wool grease, highly refined, but dealt in commercially as wool grease, is nevertheless "wool grease" and dutiable at ½ c. per lb. as such under paragraph 279 of the present tariff. The assessment of duty at 25 per cent. *ad valorem* as "rendered oil" under paragraph 3, was overruled.—R. W. M.

Recovered Grease: U.S. Customs Decision.

Aug. 10, 1904.

Grease recovered from wool, and consisting of wool grease, olive oil, and a small amount of petroleum, was held to be dutiable at ½ c. per lb., as "wool grease," under paragraph 279 of the present tariff. The assessment of duty at 25 per cent. *ad valorem* as an "expressed or rendered oil" was overruled.—R. W. M.

Bone Grease; U.S. Customs Decision.

Aug. 19, 1904.

Crude bone grease was held to be dutiable at 20 per cent. *ad valorem*, under section 6 of the present tariff, as a "manufactured article unenumerated." The claim of the importer for free entry, under paragraph 568, as "grease for stuffing or dressing leather, and fit only for such uses," was overruled on the ground that the exclusive use of bone grease for such a purpose was not established by the evidence.—R. W. M.

Sesamé and Peanut Oil: U.S. Customs Decision.

Sept. 26, 1904.

A mixture of sesamé and peanut oil, each of which is free of duty if imported separately, was held to be dutiable at 25 per cent. *ad valorem*, under paragraph 3 of the present tariff, as a "combination of expressed oils."
—R. W. M.

Oleine: U.S. Customs Decision.

Sept. 26, 1904.

It was decided that oleine, commercially known as red oil, and consisting of oleic acid, was dutiable at 25 per cent. *ad valorem* under paragraph 1 of the present tariff as an "acid not specially provided for." The claim of the importer for free entry under paragraph 568 was overruled on the ground that oleine is not exclusively used for soap making, but is also employed for oiling wool and as a constituent of certain polishing materials.—R. W. M.

XIII. B.—RESINS, VARNISHES, Etc.

Sealing Wax: U.S. Customs Decision.

Sept. 9, 1904.

Sealing wax, which on analysis was shown to have the following composition:—Volatile at 100° C., 1·68 per cent.; resins, 72·65 per cent.; ash (calcium sulphate), 8 per cent.; colouring matter, &c. (sulphide of mercury), 18·07 per cent., was held to be dutiable at 20 per cent. *ad valorem* as a "manufactured article unenumerated" under section 6 of the present tariff. The assessment of duty at 25 per cent. *ad valorem* under paragraph 448, as a "manufacture of wax," was overruled.—R. W. M.

XIV.—TANNING; LEATHER; GLUE, Etc.

Quebracho Extract: U.S. Customs Decision.

July 30, 1904.

"Quermos" extract was held to be dutiable at ½ c. per lb. as "quebracho extract," under paragraph 22 of the present tariff, and not at ⅞ c. per lb. as "bark extract," under the same paragraph.—R. W. M.

Bone Size Substitute: U.S. Customs Decision.

The United States Circuit Court decided that bone size substitute, consisting of starch, dextrin, magnesium chloride, and silica, was dutiable at 25 per cent. *ad valorem*, under paragraph 3 of the present tariff, overruling the assessment of duty at 1½ c. per lb., as a "preparation fit for use as starch," under paragraph 285.—R. W. M.

XV.—MANURES, Etc.

Potash in Agriculture.

U.S. Cons. Reps., No. 2083, *Oct.* 7, 1904.

Official statistics show that the German mines produced, in 1903, 1,557,243 tons of kainite, worth at current prices 5,208,154 dols., and 2,073,771 tons of other potash salts, valued at 4,979,912 dols. Of the kainite and sylvinite 501,385 tons were exported, and of this amount 275,302 tons, or more than 54 per cent., was taken by the United States, where it was used mainly in the manufacture of chemical fertilisers. The remainder, something over a million tons of crude mineral, was used for fertilising purposes in Germany with excellent results. Exact official records, in which only the percentage of potash contained in the raw minerals used is taken into account, show that the consumption of potash salts in German agriculture increased from 51,282 tons in 1892 to 150,000 in 1903. During this period there has been a steady advance in the yield of the staple farm crops, which corresponds closely from year to year to the amount of potash used. Thus, when the consumption declined from 64,103 tons in 1894 to 58,974 tons in 1895, there was a corresponding falling off in yield of all the spring crops planted and harvested that year.

XVII.—BREWING, WINES, SPIRITS, Etc.

Brewing Sugar; Method of Denaturing ——.

P. Petit. Ann. de la Brass., 1904, **7**, 363—364.

To enable sugar to be used in France free of duty, it is proposed to treat the sugar with half a litre of a 30 per cent. alcoholic hop extract per 100 kilos. by mixing the two for a few minutes in a hydro-extractor. The hop extract would be prepared under excise supervision, by treating hops with boiling 90 per cent. alcohol for at least 30 minutes, the quantity of solvent used being 3 litres per kilo. The product would be packed in sealed bottles.

The work of denaturing would be performed in specially authorised establishments, under excise supervision, the sugar being received in bond and supplied only to brewers. The latter would be empowered to use the sugar in the most convenient manner, without restriction.—C. S.

Spirit; Drawbacks of Excise on —— in Holland.

Bd. of Trade J., Oct. 27, 1904.

A Dutch Decree, dated the 29th August last, provides for the exemption from excise duty, subject to certain restrictions, of (1) spirit for use in vinegar factories and in public national, provincial, or communal institutions for instruction in natural sciences; and (2) spirit of a strength of at least 85 per cent., which by mixture with pyroligneous acid is rendered unfit for the preparation of beverages.

The Decree further provides that drawback of the excise duty paid on the spirit contained in sweet liqueurs, bitters, or other similar spirituous liquors, and in liquid perfumes, shall be allowed on the exportation of these articles to foreign countries, subject to compliance with the prescribed formalities.

XVIII. B.—SANITATION.

Pollution of German Waterways by Factories.

U.S. Cons. Reps., No. 2084. *Oct.* 18, 1904. *From Deutsche Industrie Zeitung, July* 29, 1904.

The industrial council of Düsseldorf deals in its last report with methods of preventing pollution of waterways by refuse from factories emptying into them, and proposes the erection of basins in which such matter can be purified before entering into the waterways. This plan has been approved by the minister of commerce and industry, who now asks the president of the government to report the matter to the inspectors, to be acted on by them.

The question of protecting rivers from pollution by refuse from factories is becoming more and more important, especially for large rivers like the Rhine. Since factories are subject to approval, the respective concession methods furnish a means to combat improper pollution of streams by prescribing suitable conditions before concessions to build are granted. Numerous experiences in this region, however, have shown that the fulfilling of such conditions, and especially the official supervision, are accompanied by almost insurmountable difficulties if at the beginning the conditions have not been studied thoroughly. In the case of large chemical factories, with independent branches emptying different kinds of refuse into large, deep canals, this official supervision is almost impossible, the more so since during different parts of the day different kinds of refuse are discharged. The best method to overcome the difficulty is the erection of reservoirs in which the refuse may be diluted by the addition of pure water.

XX.—FINE CHEMICALS, Etc.

Saccharin: U.S. Customs Decision.

Merchandise invoiced as sodium benzoic sulfinide and benzoic acid sulfinide was assessed for duty as "saccharin," at 1 dol. 50 c. per lb., and 10 per cent. *ad valorem* under paragraph 211 of the present tariff. The importers claimed it to be dutiable at 25 per cent. *ad valorem* under paragraph 1 as an "acid not specially provided for," at the same rate under paragraph 3 as a "chemical compound," or at 20 per cent. *ad valorem* as a "preparation of coal tar not a colour or dye," under paragraph 15. The Board of General Appraisers, after an exhaustive investigation, affirmed the assessment of duty.—R. W. M.

Bromofluorescic Acid: U.S. Customs Decision.

Aug. 3, 1904.

Bromofluorescic acid was held to be dutiable at 20 per cent. *ad valorem* as a "preparation of coal tar not a colour or dye," under paragraph 15 of the present tariff. This decision is based on the ground that the provision for coal-tar preparations is more specific than that for "chemical compounds" in paragraph 3, or for "acids not specially provided for" in paragraph 1.—R. W. M.

Methylpyrocatechin Carbonic Ester: U.S. Customs Decision.

July 30, 1904.

Merchandise invoiced as above, and in a crude state, unfit for administering as a medicine, was held to be dutiable as a "preparation of coal tar not a colour or dye" at 20 per cent. *ad valorem*, under paragraph 15 of the present tariff. The assessment of duty at 25 per cent. *ad valorem* as a "chemical compound" under paragraph 3 was overruled.
—R. W. M.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 22,633. Woolford. *See under* X.
„ 22,679. Ebers. Method of producing granular substances from molten materials. Oct. 20.
„ 22,794. Perks. Crucible furnaces and the like. Oct. 22.
„ 22,868. Michelbach. Condensers. Oct. 24.
„ 22,878. Salenius. Separating liquids.* Oct. 24.
„ 22,951. Gutensohn. Treatment of by-products. Oct. 25.

[A.] 23,066. Lake (Caspar). Apparatus for drying granular and like materials.* Oct. 26.

„ 23,070. Bamber. Centrifugal separators. Oct. 26.

„ 23,081. Kent. Furnaces.* Oct. 26.

„ 23,183. Wells. Drying apparatus.* Oct. 27.

„ 23,204. British Thomson-Houston Co., Ltd. (Gen. Electric Co.). *See under* XI.

„ 23,261. Wilson. Filters. Oct. 28.

„ 23,336. Burgess. Condensers. Oct. 29.

[C.S.] 22,559 (1903). Prinsep. Furnaces fired with powdered coal. Oct. 26.

„ 22,845 (1903). Boutcher and Boutcher. Means for discharging acids and other liquids from carboys and other receptacles by pneumatic pressure. Nov. 2.

„ 23,091 (1903). Austin. Centrifugal separators. Oct. 26.

„ 23,900 (1903). Paul. Apparatus for regulating temperature. Nov. 2.

„ 24,379 (1903). Schneller and Koeleman. Apparatus for bringing gas and liquid into intimate contact. Nov. 2.

„ 11,854 (1904). Kathol. Filters. Nov. 2.

„ 12,358 (1904). Soc. l'Air Liquide. *See under* VII.

„ 14,621 (1904). Bonnet. Apparatus for mixing, emulsifying, and homogenising liquids. Oct. 26.

„ 16,604 (1904). Smith. Funnels for liquids. Oct. 26.

„ 17,536 (1904). Steele. Furnaces. Oct. 26.

II.—FUEL, GAS, AND LIGHT.

[A.] 22,342. Körting und Mathiesen Act.-Ges. Arc lamp electrodes. [German Appl., Oct. 31, 1903.]* Oct. 17.

„ 22,470. Carolan (Whitney). Filaments of the kind used in incandescent electric lamps, and processes of manufacturing said filaments. Oct. 18.

„ 22,593. Brotherhood. Producer gas manufacturing apparatus. Oct. 20.

„ 22,815. Boult (Cie. pour le Fabr. des Compteurs et Matériel d'Usines à Gaz). Gas purifiers.* Oct. 22.

„ 22,843. Whitfield. Gas producers. Oct. 24.

„ 22,917. Oliphant and Scott. Apparatus for converting oil into gas. Oct. 25.

„ 23,184. Russell and Russell. Means for producing and utilising inflammable gas.* Oct. 27.

„ 23,352. Hellstern. Carbons for electric arc lamps. Oct. 29.

„ 23,386. De Lachomette. Coking ovens. Oct. 29.

[C.S.] 22,090 (1903). Cornaro. *See under* XI.

„ 23,616 (1903). Heenan. Apparatus for the manufacture of crude gas from coal and other material. Nov. 2.

„ 15,860 (1904). Derval. Retort benches for the manufacture of illuminating gas. Nov. 2.

„ 16,460 (1904). Clarke. Incandescent gas burners and mantles. Nov. 2.

„ 17,661 (1904). Redfern (Poetter and Co.). Coking ovens. Oct. 26.

„ 20,277 (1904). Abel (Siemens und Halske A.-G.). Manufacture of incandescence bodies for electric glow lamps. Oct. 26.

„ 20,371 (1904). Rincker and Wolter. Production of oil gas. Nov. 2.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 23,379. Zimpell. Sulphate of ammonia saturators. [German Appl., March 30, 1904.]* Oct. 29.

[C.S.] 22,091 (1903). Thompson (Ges. zur Verwerthung der Boleg'schen Wasserlöslichen Mineralöle u. Kohlenwasserstoffe). Production of water-soluble or easily and permanently emulsifiable hydrocarbon derivatives. Oct. 26.

„ 22,092 (1903). Thompson (Ges. zur Verwerthung der Boleg'schen Wasserlöslichen Mineralöle u. Kohlenwasserstoffe). Production of water-soluble or emulsifiable vaseline. Oct. 26.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 22,735. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matter. Oct. 21.

„ 23,072. Newton (Bayer and Co.). Manufacture of new tetrazo dyestuffs. Oct. 26.

„ 23,193. Imray (Meister, Lucius und Brüning). Manufacture of blue and violet to black dyestuffs by oxidation on the fibre. Oct. 27.

„ 23,198. Johnson (Badische Anilin und Soda Fabrik). Manufacture of rhodamine colouring matters and intermediate products. Oct. 27.

[C.S.] 24,930 (1903). Johnson (Badische Anilin und Soda Fabrik). Manufacture of sulphur colouring matters and intermediate products. Nov. 2.

„ 26,182 (1903). Imray (Meister, Lucius und Brüning). Manufacture of dyestuffs derived from anthracene. Nov. 2.

„ 712 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Oct. 26.

„ 1389 (1904). Newton (Bayer and Co.). *See under* XIII. A.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 22,295. Walker. Bleaching cloth. Oct. 17.

„ 23,193. Imray (Meister, Lucius und Brüning). *See under* IV.

„ 23,306. Mellor. Method of and means for cleaning or clearing silk and like yarns or threads. Oct. 29.

[C.S.] 24,637 (1903). Howorth (Soc. Franç. de la Viscose). Dressing of yarns and like material. Oct. 26.

„ 26,591 (1903). Watson and Hoyle. Manufacture of woven fabrics and production thereon of figured or variegated effects. Oct. 26.

„ 1867 (1904). Johnson (Badische Anilin und Soda Fabrik). Discharge of halogenated indigo colouring matters. Nov. 2.

„ 15,395 (1904). Venter. Process for bleaching textile materials. Nov. 2.

VI.—COLOURING WOOD, PAPER, LEATHER, ETC.

[A.] 22,547. Lake (Chem.-Techn.-Fabrik, Dr. A. R. W. Brand und Co.). *See under* IX.

„ 23,292. Lake (Chem.-Techn.-Fabrik, Dr. A. R. W. Brand und Co.). *See under* IX.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 22,323. Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable hydrosulphites. Oct. 17.

„ 22,348. Szek. Means for the formation and utilisation of ozone. Oct. 17.

„ 22,540. Johnson (Badische Anilin und Soda Fabrik). Production of technically pure cyanogen compounds. Oct. 19.

„ 22,940. Reaney. Manufacture of hydrated lime from quicklime.* Oct. 25.

[A.] 23,036. Spence, and Peter Spence and Sons, Ltd. Manufacture of aluminous compounds. Oct. 26.

„ 23,379. Zimpell. *See under* III.

[C.S.] 23,550 (1903). Hemingway. Kilns applicable for use in the manufacture of oxide of iron. Nov. 2.

„ 2655 (1904). Keogh and Broughton. Methods of making aluminium compounds and bye products. Oct. 26.

„ 12,358 (1904). Soc. l'Air Liquide (Soc. Anon. pour l'Étude et l'Exploitation des Procédés G. Claude) and Lévy. Method of separating air and gaseous mixtures into their elements, and apparatus therefor. Nov. 2.

„ 19,924 (1904). Cie. des Prod. Chimiques d'Alais et de la Carmarque. Manufacture of alumina. Oct. 26.

„ 20,797 (1904). Fink-Huguenot. Preparation of metallic oxides by the direct combustion of metals, and apparatus therefor. Nov. 2.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 22,655. Imray (Pressed Prism Plate Glass Co.). Manufacture of glass sheets or slabs.* Oct. 20.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 22,366. Herdman. Apparatus for the production of slag wool. Oct. 17.

„ 22,423. Fairweather (Nettleton). *See under* XIII. A.

„ 22,547. Lake (Chem.-Techn.-Fabrik Dr. Alb. R. W. Brand und Co.). Process for colouring natural stone.* Oct. 19.

„ 22,678. Ebers. Method of producing a building material having the properties of trass and similar products. Oct. 20.

„ 22,940. Reaney. *See under* VII.

„ 22,990. Lake (Rütgerswerke Act.-Ges.). Preservation of wood.* Oct. 25.

„ 23,292. Lake (Chem.-Techn.-Fabrik Dr. Alb. R. W. Brand und Co.). The colouring of stone. Oct. 28.

„ 23,364. Van der Vijgh. Manufacture of artificial stone. Oct. 29.

[C.S.] 23,213 (1903). Bond. Apparatus and process for utilising gas lime or other calcium compounds and clinker, slag, or other siliceous or aluminous material for the manufacture of cement or moulded articles. Oct. 20.

„ 25,374 (1903). Michell and Michell. Manufacture of material suitable for use as a non-conducting covering for steam-pipes, boilers, &c. Oct. 26.

„ 20,018 (1904). Ridley, Tate, and Williamson. Slag or scoriæ bricks or blocks. Oct. 26.

X.—METALLURGY.

[A.] 22,346. Huntington. Alloying metals. Oct. 17.

„ 22,422. Auchinachie. Process of obtaining metallic vanadium from its ores or other vanadium compounds. Oct. 18.

„ 22,438. Carson and Ogle. Treatment of zinc and other ores. Oct. 18.

„ 22,633. Woolford. Oxidising and sublimation furnaces. Oct. 20.

„ 22,659. Morgan Crucible Co., Ltd., and Spiers. *See under* XI.

„ 22,688. Zobrab. Manufacture of steel, and the smelting or reduction of iron or other ores and metals. Oct. 21.

„ 22,814. Richardson. Processes for smelting and refining metals, and apparatus therefor. Oct. 22.

[A.] 23,111. Wynne. Machines for the concentration of ores or other substances of different specific gravities. Oct. 27.

„ 23,153. Crowley and Blackman. Furnace or crucible for the reduction or refining of metals. Oct. 27.

„ 23,255. Lett, and Metalia, Ltd. Extraction of copper from its ores. Oct. 28.

„ 23,256. Lett, and Metalia, Ltd. Vats used in the extraction of metals from their ores. Oct. 28.

„ 23,331. De Dion and Bouton. Manufacture of case-hardened articles of chrome-nickel steel. [Fr. Appl., April 23, 1904.]* Oct. 29.

„ 23,380. Soc. Electrométall. Française. *See under* XI.

[C.S.] 20,419 (1903). Sulman and Kirkpatrick - Picard. Separation of minerals from ores and gangue. Nov. 2.

„ 23,299 (1903). Fitzmaurice. Treating molten or semi-molten metal. Nov. 2.

„ 23,457 (1903). Alexander and Shiels. Annealing of metals, and apparatus therefor. Nov. 2.

„ 25,950 (1903). Cockburn. Manufacture of steel. Oct. 26.

„ 18,746 (1904). Goodsell. Method of and apparatus for treating sheet iron and steel. Oct. 26.

„ 19,140 (1904). Swyny and Plucknett. Ore separators and classifiers. Nov. 2.

„ 20,797 (1904). Fink-Huguenot. *See under* VII.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 22,659. Morgan Crucible Co., Ltd., and Spiers. Composition or compound for brushes of dynamo electric machines, for bearings, and other articles. Oct. 20.

„ 22,743. British Thomson-Houston Co., Ltd. (General Electric Co.). Apparatus for the electrical treatment of gases. Oct. 21.

„ 23,204. British Thomson-Houston Co., Ltd. (General Electric Co.). Electric heating apparatus. Oct. 27.

„ 23,380. La Soc. Electro-Métallurgique Française. Process for smelting nickel ores in an electric furnace, and an improved crucible therefor. [Fr. Appl., Oct. 30, 1903.]* Oct. 29.

[C.S.] 22,090 (1903). Cornaro. Manufacture of electrodes and resistances. Oct. 26.

„ 15,952 (1904). Berg. Electrode for electrical accumulators. Nov. 2.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 23,187. Markel. Process of and apparatus for producing bars of soap. Oct. 27.

„ 23,308. Berry. Semi-solid lubricants, and process for manufacturing same. Oct. 29.

[C.S.] 25,868 (1903). Iveson and Wilson. Cooling melted fats or fatty substances, or the like. Nov. 2.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

[A.] 22,423. Fairweather (Nettleton). Composition of matter for fireproof paint or coating.* Oct. 18.

„ 22,732. Kollinger. Manufacture of paint. [Ger. Appl., Oct. 21, 1903.]* Oct. 21.

[C.S.] 23,550 (1903). Hemingway. *See under* VII.

„ 1389 (1904). Newton (Bayer and Co.). Manufacture of new colour lakes. Nov. 2.

(*B.*)—RESINS, VARNISHES.

[A.] 23,173. Staeding. Manufacture of linoleum.* Oct. 27.

[C.S.] 16,800 (1904). Bucklin. Lac derivatives. Nov. 2.

(*C.*)—INDIA-RUBBER.

[A.] 23,168. Frost. Vulcanising apparatus. Oct. 27.

[C.S.] 17,579 (1904). Tiehsen. Manufacture of an improved substitute for india-rubber. Nov. 2.

XIV.—TANNING; LEATHER, GLUE, SIZE, ETC.

[A.] 22,395. De Marneffe. Process of and apparatus for tanning leather. Oct. 18.

,, 23,952. Wetter (Thüringer Gelatinefabrik E. Jetter und Krause). Gelatine or gelatinous foodstuffs. Oct. 25.

,, 23,016. Dougherty. Machines for mechanically seasoning, oiling, or otherwise treating skins.* Oct. 25.

XV.—MANURES, ETC.

[A.] 23,045. Bollé (Conrad Schmidt and Co.). Process of and apparatus for manufacturing artificial manure from offal and the like. Oct. 26.

[C.S.] 3170 (1904). Laer. Fertiliser, and process of making same. Oct. 26.

XVI.—SUGAR, STARCH, GUM, ETC.

[C.S.] 27,186 (1903). Gray, Osborn, Stocks, and White. Manufacture of gum tragasol from locust kernels. Nov. 2.

XVII.—BREWING, WINES, SPIRITS, ETC.

[A.] 22,704. Hornof. Malt kilns.* Oct. 21.

,, 23,277. Schrottky. Manufacture of material for use in the production of fermented liquors. Oct. 28.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—FOODS.

[A.] 22,358. Provoyeur. Manufacture of chocolate.* Oct. 17.

,, 22,476. Glas. Production of desiccated milk and milk preparations. [German Appl., Nov. 12, 1903.]* Oct. 18.

,, 22,512. Williamson. Meat extracts or preparations. Oct. 19.

,, 22,513. Williamson. Cocoa, chocolate, and preparations of same. Oct. 19.

,, 22,639. Hatmaker. Cacao, sugar, and milk compounds in dry, flaky form. Oct. 20.

,, 22,927. Preisz. Method of sterilising foodstuffs and the like. [German Appl., Oct. 28, 1903.]* Oct. 25.

,, 22,952. Wetter (Thüringer Gelatinefabrik E. Jetter und Krause). *See under* XIV.

,, 23,100. Dollner. Production of desiccated milk and milk preparations. [Ger. Appl., Nov. 12, 1903.]* Oct. 26.

,, 23,177. Müller. Food preparation.* Oct. 27.

[C.S.] 5946 (1904). Butler. Manufacture of milk in powder form, applicable also to the treatment of other solutions containing fatty matter. Nov. 2.

,, 20,291 (1904). Kennedy. Treatment of milk. Oct. 26.

(*B.*)—SANITATION; WATER PURIFICATION.

[A.] 22,724. McLean and Paterson. Treatment of sewage. Oct. 21.

,, 23,045. Bollé (Schmidt and Co.). *See under* XV.

[C.S.] 24,651 (1903). Byrne, Scott, and Wheatley. Compound for preventing incrustation in steam boilers. Nov. 2.

,, 28,379 (1903). Taylor. Means or apparatus for distributing sewage or sewage effluent upon filter beds. Nov. 2.

XIX.—PAPER, PASTEBOARD, ETC.

[A.] 22,381. Parkin and Williams. Process for rendering celluloid or nitric cellulose compounds non-inflammable. Oct. 18.

,, 22,385. Castiglione. Treatment of pulp. Oct. 18.

[C.S.] 28,212 (1903). Parkin, Williams, and Casson. Process for rendering celluloid non-inflammable. Nov. 2.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 22,806. Imray (Meister, Lucius und Brüning). Manufacture of dialkylmalonic acid derivatives and dialkylmalonyl ureas. Oct. 22.

[C.S.] 25,481 (1903). Ashworth. Production of saccharin. Oct. 26.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 23,988. Soc. Anon. Plaques et Papiers Photographiques A. Lumière et ses fils. Process of colour photography. [Fr. Appl., Dec. 17, 1903.]* Oct. 25.

,, 23,064. Lucas. Photographic negative. Oct. 26.

,, 23,098. Gärtner. Process of and means for the production of relief photographs or the like. Oct. 26.

[C.S.] 19,940 (1904). Smith. Photographic plates and films. Oct. 26.

XXII.—EXPLOSIVES, MATCHES, ETC.

[A.] 22,390. Bennett and Castiglione. Explosives for machine guns and other purposes. Oct. 18.

,, 23,051. Tyler. Matches. Oct. 26.

,, 23,269. Dickson. Manufacture of blasting cartridges. Oct. 28.

,, 23,366. King's Nerton Metal Co., Ltd., Bayliss and Brownsdon. Additions to the materials employed in the manufacture of percussion caps, detonators, igniters, &c., for the ignition or detonation of explosives. Oct. 29.

[C.S.] 26,978 (1903). Talbot. Explosive compounds and the manufacture thereof. Oct. 26.

,, 4699 (1904). Haddan (Führer). Manufacture of explosives of the nitrate of ammonia group. Oct. 26.

,, 7490 (1904). Rusher and Baudinet. Explosives. Nov. 2.

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C. F. Chandler, D.Sc., M.D., Ph.D., LL.D.	1899—1900.
Sir Jos. W. Swan, K.C.B., D.Sc., M.A., F.R.S.	1900—1901.
Ivan Levinstein	1901—1903.
Sir W. Ramsay, K.C.B., D.Sc., LL.D., F.R.S.	1903—1904.

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SESSION 1904—1905.

Monday, Dec. 5, 1904:—
E. Divers, M.D., D.Sc., F.R.S. "Raschig's Theory of the Lead Chamber Process."
E. Divers, M.D., D.Sc., F.R.S. "Theory of the Action of Metals on Nitric Acid."
Mr. Llewellyn J. Davies. "A Rapid and Accurate Method for the Estimation of Phosphorus in Iron Ores."
Mr. C. S. Stanford Webster, F.I.C. "Fluorescope for comparing Substances under the Influence of Radium Rays."
Monday, Jan. 9, 1905.—Mr. Walter F. Reid, F.I.C. "Some Chemical Aspects of the St. Louis Exhibition."

Manchester Section.

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Vice-Chairman: F. Scudder.
Committee:
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R. Clayton.
W. H. Coleman.
G. J. Fowler.
J. Grossmann.
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K. Markel.
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H. Porter.
W. Thomson.
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SESSION 1904—1905.

Friday, Dec. 2, 1904.—Mr. W. F. Lowe, A.R.S.M., F.I.C. "Note on the Accuracy of the Dry Assay of Galena in an Iron Crucible."

Newcastle Section.

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Official Notices.

ST. LOUIS EXHIBITION, 1904. ADDITIONAL LIST OF AWARDS TO BRITISH EXHIBITORS.

The Royal Commission has furnished an additional list of awards to British exhibitors at the St. Louis Exhibition, from which are taken the following :—

Department of Liberal Arts.

Group 23.—*Chemical and Pharmaceutical Arts.—Gold Medal :* Wellcome Chemical Research Laboratories ; Read Holliday and Sons ; Jeyes' Sanitary Compounds Company (Limited). *Silver Medal :* Dr. G. Barger (collaborator to the Wellcome Physiological Research Laboratories) ; Dr. Frederick B. Power (collaborator to the Wellcome Chemical Research Laboratories).

Department of Agriculture.

Group 80.—*Fertilisers.—Grand Prize :* The United Alkali Company (Limited).

Group 87.—*Farinaceous Products and their Derivatives.—Gold Medal :* Allen and Hanburys (Limited).

Group 94.—*Fermented Beverages.—Silver Medal :* E. Dyer and Co.

Department of Mines and Metallurgy.

Group 116.—*Ores and Minerals.—Gold Medal :* The British South Africa Company (Rhodesia). *Silver Medal :* J. C. Burrow (collaborator to the Home Office).

Group 118.—*Metallurgy.—Grand Prize :* The Monk Bridge Iron and Steel Company (Limited) ; The Farnley Iron Company (Limited).

The total number of awards secured by Great Britain now stands thus :—Grand prizes, 142 ; gold medals, 250 ; silver medals, 170 ; bronze medals, 134. Total, 696.

THE JOURNAL.

From the beginning of next year the Society's Journal will be printed and published by Messrs. Vacher and Sons, Great Smith Street, Westminster, S.W., to whom all communications regarding subscribers' copies and advertisements should be sent.

SUBSCRIPTIONS FOR 1905.

Foreign and Colonial Members are reminded that the subscription of 25*s*. for 1905, payable on January 1st next, should be sent in good time to the Hon. Treasurer (Mr. Samuel Hall), in order to ensure continuity in the receipt of he Society's Journal. Any changes of address to appear o the new List of Members now in course of preparation should reach the General Secretary not later than January 5th, 1905.

List of Members Elected

23rd NOVEMBER 1904.

Aston, Francis William, Tennal House, Harborne, near Birmingham, Chemist.
Bryant, Arthur P., 661, Winthrop Avenue, Chicago, Ill., U.S.A., Chemist.
Calvert, Harry Thornton, West Riding of Yorkshire Rivers Board, Wakefield, Chemist.
Clark, Dr. Homer, c/o The Vacuum Varnish and Chemical Co., 6, Seaview Avenue, East Norwalk, Conn., U.S.A., Chemical Manufacturer.
Cowee, Harvey D., 161, River Street, Troy, N.Y., U.S.A., Chemist.
Dempwolf, Chas., jun., 713, S. George Street, York, Pa., U.S.A., Chemical Manufacturer.
alk, Milton J., 16, East 81st Street, New York City, U.S.A., Teacher of Chemistry.
letcher, William E., Foreite Powder Co., Landing, N.J., U.S.A., Chemist.
oust, Thomas B., c/o Bon Air C. & I. Co, Allen's Creek, Tenn., U.S.A., Chemist.
Frasch, George B., 543, Morris Avenue, Elizabeth, N.J., U.S.A., Chemist.
Goodier, Herbert, 16, Hall Royd, Shipley, Bradford, Yorks., Textile Engineer.
Heurich, Christian, 1307, New Hampshire Avenue, N.W., Washington, D.C., U.S.A., Brewer.
Lane, C. Cyril P., c/o The Avon India-Rubber Co., Melksham, Wilts., Chemist.
Law, Herbert, 72, Belvedere Road, Liscard, Cheshire, Analytical Chemist.
Lesley, R. W., Pennsylvania Building, Philadephia, Pa., U.S.A., Cement Manufacturer.
Mabee, Fred Carleton, McMaster University, Toronto, Ontario, Canada, Assistant in Chemistry.
Marckworth, O. S., Ohio Testing Laboratory, 19 and 25, Board of Trade, Columbus, Ohio, U.S.A., Analytical Chemist.
Miller, William Exley, c/o The Arizona Copper Co., Ltd., 29, St. Andrew Square, Edinburgh, Secretary.
Mukerjee, Dr. S. C., Imperial Pharmacy, Umballa Cantonment, Punjab, India, Pharmacist.
Pickett, Chas. E., 26, East 23rd Street, Bayonne, N.J., U.S.A., Superintendent, Borax Refinery.
Rapelje, Walter S., 957, Liberty Avenue, Brooklyn, N.Y. U.S.A., Chemist.
Remington, Prof. Joseph P., 1832, Pine Street, Philadelphia, Pa., U.S.A., Author, U.S Pharmacopœia.
Richardson, Wm. S., 201, High Street, Lincoln, Chemical Manure Manufacturer.
Robinson, Prof. Franklin C., Bowdoin College, Brunswick, Maine, U.S.A., Professor of Chemistry.
Rosenblatt, A.H., c/o Toch Brothers, 52—62, 9th Street, Long Island City, N.Y., U.S.A., Superintendent and Chemist.
Schniewind, Heinrich, jun., Susquehanna Silk Mills, 62, Greene Street, New York City, U.S.A., Vice-President and Treasurer.
Schultz, Carl R., 440, First Avenue, New York City, U.S.A., Mineral Water Manufacturer.
Setzler, Dr. Horace B., c/o Lake Carriers Oil Co., Coraopolis, Pa., U.S.A., Superintendent.
Skowrioski, S., Republic Rubber Co., Youngstown, Ohio, U.S.A., Chemist.
Smallman, J. E., c/o Canada Chemical Manufacturing Co., Ltd., London, Ont., Canada.
Speiden, C. C., Summit, N.J., U.S.A., Chemical Merchant.
Toyne, Francis D., c/o Messrs. Henry Ashwell and Co., New Basford, near Nottingham, Chemist.
Trubek, M., Wood Ridge, Bergen County, N.J., U.S.A., Manufacturing Chemist.
Tunnell, Raymond W., 425, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Manufacturer.
Turnbull, R. H., c/o MacAndrews and Forbes Co., Smyrna, Turkey, Asia Minor, Analytical Chemist.
Young, James, c/o Flax Pulp, Ltd., Weston Point, Runcorn, Cheshire, Chemist.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

Archbold, Dr. Geo., l/o Ontario ; c/o Omo Manufacturing Co., Research Laboratory, Middletown, Conn., U.S.A.
Bousfield, E. G. P., l/o York ; Ozonised Oxygen Co., Ltd., 20, Mount Street, Manchester.
Boyd, Wm., l/o Johannesburg ; P.O. Box 143, Germiston, Transvaal.
Brown, Wm., l/o Great Clowes Street ; Terrace House, The Cliff, Higher Broughton, Manchester.
Chemical Trade Journal, l/o Manchester ; Dane's Inn House, 265, Strand, London, W.C.

Craven, Jas., l/o Manchester; c/o Columbia Creosoting Co., Shirley, Ind., U.S.A.

Dodd, A. J., l/o Riverview; Heathfield House, Belvedere, Kent, Works Manager.

Holmes, F. G., l/o Liverpool; Northcroft, Tewit Well Road, Harrogate, Yorks.

Jones, Wm. App, l/o New York; c/o Boston Artificial Leather Co., Stamford, Conn., U.S.A.

Jonker-Czn., H., l/o Wörth; Hotel Europaischer Hof, Hagenau, Elsass, Germany.

Kibble, W. Oakes, l/o Denver; Journals to General Delivery, St. Louis, Mo., U.S.A.

Koebig, Dr. J., l/o East Third Street; 127, West First Street, Los Angeles, Cal., U.S.A.

Le Maistre, Fred. J., l/o Montreal; Henry S. Spackman Engineering Co., 1619, Filbert Street, Philadelphia, Pa., U.S.A.

Lindsay, Robt., l/o Alexandria; Geldenhuis Deep G.M. Co., Cleveland, Johannesburg, Transvaal.

Millar, J. H., l/o Greytown; Box 440, Durban, Natal.

More, A., l/o Government Laboratory; 19, Ryecroft Street, Fulham, S.W.

Moses, Herbert B.; Journals to c/o Berkely Hotel, Buffalo, N.Y., U.S.A.

Quinan, Wm. R.: Journals to the General Manager, De Beers Explosive Works, Dynamite Factory, Cape Colony, South Africa.

Ratcliffe, Chas. F., l/o Leeds; c/o Brotherton and Co., Ltd., Provan Chemical Works, Millerston, Glasgow.

Ripley, Philip F., l/o Providence; 48, Central Street, Andover, Mass., U.S.A.

Schlichtung, E., l/o Hicks Street; 38, Cranberry Street, Brooklyn, N.Y., U.S.A.

Seligman, Dr. R.; Journals to 17, Kensington Palace Gardens, London, W.

Shields, Dr. John, l/o Willesden Green; Minas de Rio Tinto, Prov. de Huelva, Spain.

Taylor, Jno., l/o Great Crosby; c/o Brotherton and Co., Ltd., Tar Works, Litherland, Liverpool.

Thatcher, E. J., l/o Knowle; The Manor House, Chew Magna, near Bristol.

Tyler, Charles R., l/o West 57th Street; c/o Dr. Francis Wyatt, 402, West 23rd Street, New York City, U.S.A.

Warden, Jno. B., l/o Deadwood; Sevier Mine, Kimberley, Utah, U.S.A.

Wense, Dr. W., l/o Griesheim; c/o Herrn H. Schultz, Graalstrasse, Lüneberg, Germany.

Wilkins, A. D., l/o Elizabeth; Bellevue P.O. Station, Allegheny, Pa., U.S.A.

Wilson, A. Poole, l/o Nova Terrace; 81, Botanic Road, Glasnevin, Dublin.

CHANGE OF ADDRESS REQUIRED.

Jones, G. Poole, l/o Park Hotel, Williamsport, Pa., U.S.A.

MEMBERS OMITTED FROM LIST.

1902. Forster, Ferdinand E. P., c/o Messrs. Bass and Co., 19, Guild Street, Burton-on-Trent, Chemist.

1900. Richardson, Wm. Derrick, 4306, Forestville Avenue, Chicago, Ill., U.S.A., Chemist (Swift and Co.).

1893. Welch, J. Cuthbert, Montreal and Boston Cons. Mining and Smelting Co., Boundary Falls, B.C., Canada, Chemist and Metallurgist.

CORRECTION.

Sir Michael B. Nairn, Bart., is the father of Mr. Michael Nairn, member of this Society.

Death.

Newton, John, Park Green, Macclesfield.

Annual General Meeting,

NEW YORK, 1904.

PITTSBURG, Thursday, Sept. 15th.

Reception Committee.

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Jas. O. Handy, Secretary.
H. K. Porter, Treasurer.

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Edward E. Armstrong.
Jas. M. Camp.
H. W Craven.
John E. Hurford.
Geo. A. Macbeth.
A. G. McKenna.
Walter H. Stietel.
F. Schniewind.
Emil Swensson.
C. P. Tiers.

Ladies' Committee.

Miss Mary Lynne, Chairman.

Mrs. Chester B. Albree.
Miss May Lynne.
Mrs. J. F. Hurford.
Mrs. W. H. McKenna.
Mrs. H. K. Porter.
Mrs. K. F. Stahl.
Mrs. Emil Swensson.
Mrs. C. P. Tiers.

On arrival at the Pittsburg station the visitors were received by Dr. K. F. Stahl, Mr. Jas. O. Handy, and other members of the Reception and Ladies' Committee, and conveyed to the Hotel Schenley. After dinner the Pittsburg Exposition was visited.

Friday, Sept. 16th.

The ladies visited the Phipps Conservatory, in Schenley Park, and then went for a drive, lunching *en route* at the County Club. In the afternoon they visited the Ward-Mackey Bakery, and in the evening went to the theatre.

The gentlemen in the morning visited the Westinghouse Electric and Manufacturing Co. and the Westinghouse Machine Co., and were conducted through the works by the managers, assisted by a large staff of guides.

The Westinghouse Electric and Manufacturing Co. was organised in 1886; the works were then situated in Pittsburg, and employed 200 men. In 1895, increasing business necessitated removal of the premises to the present site in East Pittsburg, and in 1899 further extension was commenced, and has been continued, until now the works contain a total floor space of about 47 acres, and employ 9000 men, exclusive of the 3000 employed in the various branch works in the United States. The scope of the works may be gauged by the fact that, in the engineering department alone, a staff of 350 mechanical and electrical experts is employed. The offices and works are connected by a local telephone system, which has 400 instruments, and a pneumatic tube system. The erecting shops consist of three aisles, two of which are 1184 ft. long and 70 ft. wide, whilst the third is 1760 ft. long by 70 ft. Among the work turned out by the company may be mentioned the 5500-k.w turbo-generator unit and eight 5000-k.w. alternating current generators supplied for the Manhattan Elevated Railway (New York), and the nine 5000-k.w. alternating current generators supplied for the subway division of the New York Interborough Rapid Transit System. The company is now building transformers of 2750 k.w. capacity, and motors up to 2000 h.p.

The party were then conveyed on special cars to Kennywood Park, on the further side of the Monongahela River, where lunch was served.

After lunch a portion of the party visited the Duquesne Blast Furnaces, Steel Works, and Rolling Mill, while the remainder went to the Homestead Steel Works and Rolling Mill, both belonging to the Carnegie Steel Co.

The Duquesne plant includes four blast furnaces, two 10 gross ton Bessemer converters, and fourteen 50 gross ton basic open-hearth furnaces. The product consists of billets, blooms, slabs, sheet, bars, splice bars, and merchant bars. The annual capacity of this plant is 600,000 tons of Bessemer steel ingots and 480,000 tons of open-hearth steel ingots.

The Homestead plant includes five blast furnaces, fifty 50 gross ton basic open-hearth furnaces, and two 10 gross ton Bessemer steel converters. It produces blooms, billets, slabs, structural shapes, structural work, boiler plates, ship plates, tank plates, universal plates, armour plates, and open-hearth steel castings. The annual capacity of the plant is 425,000 tons of Bessemer steel ingots and 1,550,000 tons of basic open-hearth steel ingots. The blast furnaces are on the other side of the Monongahela River, and the molten metal is conveyed across a bridge to the steel furnaces. This takes three-quarters of an hour, which, seeing that the metal would require some four and a half hours to solidify, leaves an ample margin of time. What strikes the visitor is the economy of labour in handling the great blooms resulting from these operations. Electrically driven machinery rolled ingots of steel weighing more than 10 tons into 40 ft. of steel plate, 5 ins. thick, with the utmost ease. A pyramidal framework, 30 or 40 ft. high, moved about at the bidding of one man seated at the apex, seized an ingot with tongs, put it through the rollers, received it in a new spot, put it through again and again, and then took it to a fresh place and repeated the operation. All this was done by electrically transmitted power. Every now and then water was thrown on the surface of the ingots, then a phosphate, and, though the water created no explosion, the addition of the salt did. Economy of handling and perfection of organisation and arrangement were the lessons taught by this day's visits. Every care and consideration seemed also to be given to the comfort and happiness of the workpeople.

The Union Switch and Signal Co., the Westinghouse Air Brake Co., and the McKeesport Tin Plate Co. were also open to members.

In the evening a smoking concert was held in the banquet hall of the Hotel Schenley.

SATURDAY, SEPT. 17TH.

In the morning one party visited the Phœnix Glass Co.'s works at Monaca, the works of the Pressed Steel Car Co., and the Lake Erie Railroad shops. A second visited the Allegheny Plate Glass Co.'s works. A third visited the Ward-Mackey Co.'s bakery and the food products factory of the H. J. Heinz Co. The ladies joined in this visit, and were each presented with souvenirs by the H. J. Heinz Co. All were impressed with the extreme cleanliness of the factory. A fourth party visited a coal mine, and a fifth went to the Atlantic Refining Co.'s oil works, and thence to the Nernst Lamp Co.'s factory. Another coal mine, the Harbison-Walker Refractories Co.'s works, and those of the Armstrong Cork Co. were also thrown open. Messrs. Heeren Bros. and Co., manufacturing jewellers, also specially invited inspection by the ladies. Accounts of these visits will be published as received.

The Nernst Lamp Co.—The Nernst lamp is the only electric incandescent lamp the filament of which glows in the open air. Certain rare earths, notably zirconia and thoria, belong to the class of "secondary conductors," *viz.*, they permit the passage of an electric current only under certain conditions, of which heating is one. It is therefore necessary to induce this condition before the current can pass. This is done by means of heaters consisting of hollow cylinders made of pure kaolin, looking like a piece of the stem of a clay pipe, wound round with platinum wire, protected in its turn with a coating of some silicate, which also acts as a radiator. This heater may again be wound into a spiral, through which the glower or filament is inserted; or a heater may be placed on either side of the glower. When the current is turned on, it first passes through the heater, which in its turn heats the glower until the temperature rises sufficiently to permit a current to pass through that, whereupon, by an ingenious automatic arrangement, the current is cut off the heater and passes solely through the glower. The number of glowers to a lamp varies from one to six. They are usually made in the form of a slender rod, with a little ball at each end, and consist of a mixture of rare earths, such as zirconia, thoria, and yttria, with admixtures, in varying proportions, of other earths to graduate the colour of the light. The principal sources of these oxides are: allanite, cyrtolite, fergusonite, gadolinite, nivenite, rowlandite, thero-gummite, yttrialite, and zircon. At Pittsburg one or more of these minerals are fused with soda in an iron cauldron heated by a blast of natural gas. Small incandescent beads appearing on the top of the fusion have been ascribed to the liberation of sodium in the reaction, but may only be bubbles of hydrogen gas sufficiently impregnated with soda to give the flame—though, on the other hand, the Castner process has demonstrated the ability of iron to reduce soda under favourable conditions. The product of the fusion consists of rare-earth oxides, mixed with some silicate of soda, which, after purification and separation, form the basis of the glower.* In order to make contact, the little balls at each end of the glower are made white hot in the electric arc by a workman, whose face is protected by a screen, and who only sees a darkened reflection of what he is doing in a mirror. At the right moment he embeds a platinum bead in the white-hot ball, and they fuse together in such wise that any tendency to shrink on the part of the glower material only makes the contact closer, and thus maintains intimate union. A lead wire is then fused on to the embedded platinum beads. This device is called the Hanks terminal. The glower is a secondary conductor, but is also an electrolyte. The presence of oxygen seems to be at least desirable. No electrolytic action is apparent when an alternating current passes, but with direct current a black deposit at the negative end of the glower spreads gradually towards the positive terminal, and the candle power and efficiency fall off. Great improvements are being made in direct-current glowers. A "ballast" or steadying resistance is required with each glower, and this consists of fine iron wire fused to platinum terminals and enclosed in a glass bulb filled with hydrogen.

Enough has been said to show the complicated nature of the manufacture when put into practice, and, seeing that nearly every detail is made on the premises, it was not to be wondered at that the visit soon passed the limits of the ordinary Saturday morning's work. The staff and employees, however, willingly remained working for the Society's benefit for half an hour longer.

All the visitors assembled at 1.30 at the Union Club on the 19th floor of the Frick Building. They were then entertained at luncheon by the Reception Committee. After lunch the party went up the Monongahela River by steamer as far as McKeesport.

An "Abschiedstrunk" terminated a most enjoyable visit to this interesting city, to which the hearty welcome given by the local members, their ladies, and friends contributed much. The thanks of the members are also due to the Engineers' Society of Western Pennsylvania and the local members of the American Chemical Society. At 10 p.m. the special train left for St. Louis.

ST. LOUIS, SUNDAY, SEPT. 18TH.

RECEPTION COMMITTEE.

F. W. Frerichs, Chairman.

Chas. E. Caspari.
August H. Hunicke.
Edw. H. Keiser.
Sherman Leavitt.
H. M. Whelpley.

Honorary Committee.

Edw. Mallinckrodt, Chairman.

R. S. Brookings.
W. S. Chaplin.
Chas. P. Nagel.

With a ladies' committee consisting of Mrs. F. W. Frerichs, Mrs. H. M. Whelpley, Miss Roever, and many others.

On arrival at St. Louis the visitors were received by representatives of the local committee, the St. Louis Chemical Society, and Mr. Walter F. Reid, late Chairman of the London Section and one of the jurors. The bulk of the members remained on the train, which was placed in a siding in the exhibition grounds.

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* This is made by expressing from a die a dough of rare earths mixed with a suitable binding material, cutting the porcelain-like string thus made into lengths, drying, roasting, and finally attaching lead wire.

Monday, Sept. 19th.

Members devoted their time to studying the Exposition, which covers so vast an area, 250 acres, that four days were far too few to do more than form a general idea of it. In the afternoon, many assembled in the Festival Hall to witness the opening of the Science Congress and to hear Prof. Simon Newcomb's opening address. Sir Wm. Ramsay also addressed the meeting in place of the Rt. Hon. James Bryce, M.P., who was unable to be present in time. He expressed the thanks of Great Britain for the courtesies which had been shown to her representatives who had come to attend the Congress.

In the evening the St. Louis Chemical Society gave a banquet at the Southern Hotel to the members of the Society of Chemical Industry and the other foreign chemists who were attending the Congress. Dr. F. W. Frerichs occupied the chair. Among those who were present were Sir William Ramsay, Dr. Theodor Lewald (Imperial German Commissioner), Count Limburg-Stirum, Major-Gen. Waterhouse, Col. Conburgh, Profs. Ostwald, Arrhenius, J. H. Van't Hoff, Erdmann, Oscar Liebreich, C. E. Caspari, J. M. Goad, V. Coblentz, M. T. Bogert, F. W. Clarke, Ernest Rutherford, W. O. Atwater, A. B. Prescott, and S. P. Sadtler; Drs. M. Benjamin, H. M. Whelpley, Otto Zwingenberger, R. Messel, J. Lewkowitsch, R. Möhlau, J. T. Conroy, W. Hermsdorf, J. Holmes Joy, L. Rostosky, and H. W. Wiley; Messrs. Gustave Cramer, Edw. Mallinckrodt, George Merck, C. F. G. Meyer, Theo. F. Meyer, Thos. Tyrer, Eustace Carey, Walter F. Reid, and many others. Chancellor Chaplin, of the Washington University, St. Louis, was the toastmaster, and speeches were made by Sir Wm. Ramsay, Profs. Arrhenius, Van't Hoff, and Atwater, Dr. Wiley, and Mr. Tyrer.

Tuesday, Sept. 20th.

A visit was paid to the German Chemical Exhibit, and the ladies were entertained at luncheon by the ladies' committee at the Imperial German House. Dr. Chapzki gave a demonstration of Carl Zeiss' ultra-microscopic apparatus.

Wednesday, Sept. 21st.

Sir Wm. Ramsay read a paper on the present problems of Inorganic Chemistry before the Science Congress. Prof. Moissan also addressed the meeting. In the afternoon Prof. W. A. Noyes addressed the Congress on Organic Chemistry.

Mr. J. E. Petavel gave a lecture on liquid and solid hydrogen, with experiments. In the afternoon and evening there were receptions at the French Building and at the Imperial German House respectively.

Thursday, Sept. 22nd.

Thursday was again devoted entirely to the Exhibition. In the evening the Society left for Chicago. By an unfortunate change in the arrangements of the International Congress, the date of the Technical Chemistry sectional meeting was altered at the last moment to Friday 23rd. Those who wish to obtain further particulars of the St. Louis Exhibition will find them in a paper to be read by Mr. Walter F. Reid before the Society of Arts on Dec. 7th next. Mr. Reid will also discuss the chemical and pharmaceutical aspects of the Exhibition before the London Section of this Society on Jan. 9th, 1905. The list of awards to British exhibitors in the chemical and allied sections has been published on page 1014 of the Nov. 15th number of the Journal, and on page 1059 of this issue. For those who desire more general information the September numbers of the "Cosmopolitan Magazine," New York, and "The World to-day," Chicago, both devote their space entirely to the Exhibition.

CHICAGO, Friday, Sept. 23rd.

Local Committees.

Executive.

T. B. Wagner, Chairman.
W. A. Converse, Secretary.
John A. Lynch, Treasurer.

C. E. Calm.
John A. Wesener.
John H. Long.
Jacob Baur.
J. P. Grabfield.

Entertainment and Programme.

C. E. Calm. Chairman.
Julius Hieglitz.
C. H. Propach.

Hotel and Transportation.

Jacob Baur.

Invitation and Press.

John A. Wesener.

Ladies' Committee.

Mrs. Theodore Brentano, Chairman.
Mrs. C. E. Calm.
Mrs. T. B. Wagner.
Mrs. John H. Long.
Mrs. J. A. Wesener.
Mrs. C. M. Eddy.
Mrs. W. A. Converse.
Mrs. H. E. Harrison.
Mrs. C. Propach.
Mrs. Alexander Finn.

The above were assisted by a large reception committee and many others, who gave willing help in entertaining the visitors.

The members assembled at headquarters, the Auditorium Annex, at 10.30, and proceeded to visit the "Board of Trade" or Corn Exchange, on which between three and four times the equivalent of the United States wheat crop was bought and sold in 1903. The First National Bank and the Illinois Trust and Savings Bank were also visited. A little before 1 p.m. the visitors proceeded to the Stockyards. These establishments cover an area of about 500 acres, and here are handled daily 75,000 cattle, 300,000 hogs, 125,000 sheep, and 6,000 horses. The Chicago Junction Railway handles the transportation with 300 miles of track, while 45,000 men are employed within the yards. Chicago deals with three-fourths of all the fat cattle marketed in the country, and packs and ships three-fourths of the meat products exported by the United States. On arrival at the yards, luncheon was provided by the courtesy of Messrs. Swift and Co. After lunch, the slaughtering houses were inspected, then the manufacture of oleomargarine at the factory of Messrs. Nelson, Morris, and Co., and the canning of foods at that of Messrs. Libby, McNeill, and Libby; while the laboratories of Messrs. Armour and Co., who make glandular preparations for therapeutic purposes, were also open for inspection. Soap, glycerin, glue, gelatin, bone, hoofs, ammonia, isinglass, curled hair, neatsfoot oil, and fertilisers are turned out in large quantities by these firms. Souvenirs of the visits were presented to each of the visitors. In the evening there was a reception in the banquet hall of the Auditorium Hotel.

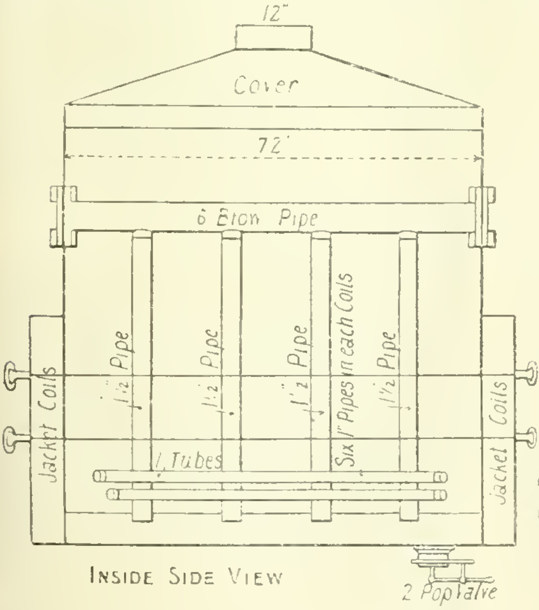
In the daytime the ladies visited Marshall, Field, and Co.'s Retail Store and the Art Institute, joining afterwards in the evening reception.

Saturday, Sept. 24th.

The members divided into several parties. Some visited the Standard Oil Co.'s works at Whiting, Ind., where the plant for the desulphurisation of the oil aroused much interest, some the Matthiessen-Hegler Zinc Works at La Salle, Ill., some the Elgin Watch Co.'s works, and some the Drainage Canal by which the sewage of Chicago is passed over the watershed into the basin of the Mississippi, whereby the death rate of the city has been materially lowered. Visits were also organised to the works of the Liquid Carbonic Co., the Illinois Steel Co.'s Cement Works both at Chicago, and the Milk Products Co., at Carey, Ill., a branch of the Union Condensed Milk Co. of New York, where oxygenated milk is prepared according to the following process, for the description of which the Society is indebted to Mr. F. L. Kneeland, a director of the company.

The Evaporation of Milk.—By an invention of Dr. J. H. Campbell, of New York, milk is now evaporated to any desired density at a temperature not above 145 F.; the accompanying diagram shows the apparatus employed. A rectangular tank is surrounded by a jacket-coil system one-half its height, and contains inside two sets of heating coils. By means of a pump, hot water is rapidly circulated through the outer and inner coils into a receiving tank, which is heated by exhaust steam, the same water being pumped through the coils again and again. A 6-in. pipe extends across the inside of the tank, near the top, and connects with perpendicular 1½-in. pipes extending below the interior coils within 3 ins. of the bottom of the tank. By this means, a root blower drives a large volume of sterilised air into the fluid contained in the tank. If the temperature of the water in the circulating coils is 185° F., the temperature of the milk in the evaporator will be 140° F., owing to the passage of the air through it. This air, saturated with vapour, is drawn off by means of a fan placed in the opening at the top. As the air blast passes through the milk, it carries off the vaporisable impurities and destroys the bacteria in the milk. The process requires from a few minutes to two hours, according to the evaporation desired. The low temperature of the milk causes no coagulation of the casein and lactalbumin, and by adding the amount of water taken from the milk, the resultant product is normal milk, thoroughly sterilised and chemically and physically unchanged. The solid impurities are removed by a separator beforehand, and the separated cream is added to the blown skim milk only towards the close of the blowing, otherwise there would be a risk of churning.

The party which visited the Milk Products Co. travelled by special train, and then proceeded to Lake Geneva, in Wisconsin, where they were met by Prof. Barnard, and conveyed in Mr. Martin Ryerson's yacht "Hathor" to inspect the Yerkes Observatory. The dome of the observatory can be revolved at will, and the floor can be raised or lowered by hydraulic pressure. All these mechanical adjuncts are absolutely necessary; even then observations are made under considerable difficulties, especially in winter, when no artificial heat is admissible. In the library were shown magnificent photographs of star clusters and nebulæ, all taken direct by the professors and their assistants. The refracting telescope weighs 20 tons, and is 63 ft. long; it is so perfectly balanced that a touch on a wheel suffices to move it wherever desired. The opening is 40 ins. in diameter, and the lens is composed of flint and crown glass. The telescope is said to have the best definition in the world. With its aid Prof. Barnard discovered the ninth satellite of Saturn, a star of the seventeenth magnitude, and established its connection with the solar system.



INSIDE SIDE VIEW

Prof. Frost described the spectrographic work, and Dr. Schlesinger explained the arrangements for direct photography. The party then returned to the yacht and sailed the full length of the lake, at the end of which they rejoined the train for Chicago.

On Saturday evening a concert was given in the Auditorium Theatre by Sousa's Band. The whole of the boxes were reserved by the Committee for the Society, the theatre was decorated with intertwined flags, and a special programme was performed in honour of the visitors.

SUNDAY, SEPT. 25TH.

In the afternoon the visitors drove through Washington and Jackson Parks, past the site of the Chicago Exhibition and the Field Museum, to Chicago University. There Prof. Nef showed the Chemical Laboratory, and Prof. Michaelson gave a spectroscopic demonstration in the Physics Laboratory. Tea was served at the Reynolds Club, after which the party drove back to Chicago, and left for Detroit at 10 o'clock.

(*To be continued.*)

London Section.

Meeting held at Burlington House, on Monday, November 7th, 1904.

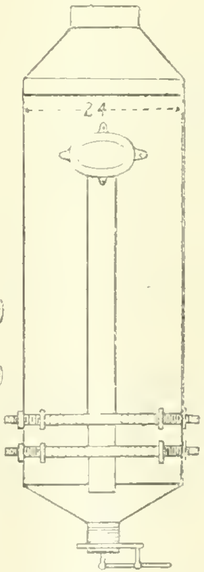
MR. A. GORDON SALAMON IN THE CHAIR.

The CHAIRMAN, after warmly thanking the members for electing him to the office of Chairman, announced that Mr. R. J. Friswell had been elected Vice-Chairman of the Section.

THE TREND OF INVENTION IN CHEMICAL INDUSTRY.

BY J. FLETCHER MOULTON, K.C., F.R.S., M.P.

When your Committee paid me the compliment of asking me to address this formidable scientific assembly, I felt the difficulty of the task even more keenly than I appreciated the honour. I knew too well the men who would form the audience before whom I should have to speak. Throughout my professional life I have been continually brought into contact with the leaders of our scientific industries, and have learnt to appreciate the knowledge and skill they bring to their work. The position that I occupy tonight belongs naturally to them. They can speak to you weighty words of guidance as to your daily difficulties, and by the narration of their triumphs lead and stimulate you to equal successes. But one like myself, who stands outside your sphere of work, has neither the experience to guide nor the knowledge to teach. He is fortunate if only he can understand and sympathise with your labours.



INSIDE END VIEW.

And if this were primarily an assembly of chemists, these considerations would probably have led me to decline the honour. But you represent chemical industry, and not chemistry simply. Theoretical chemistry has long been the land of the chemical specialist alone, and it is idle for any other to affect to be a citizen of it or to attempt to form an independent judgment of its progress. But it is otherwise with chemical industry. Pray do not think that I regard its sphere of effort as less worthy or less difficult than that of theoretical chemistry. But it is different. The chemist seeks after knowledge; chemical industry applies it. The sole test for the one is "truth," for the other "result." That which your profession has under its charge is a part of the practical work of life, and though its leaders and workers must be skilled chemists, and derive their guidance and inspiration from the discoveries of theoretical chemistry, to which many of them have contributed so largely, they take their rank to-night by the practical success of their work, and not by its theoretic merit. The triumphs of chemical industry are economic, however much they may depend on scientific knowledge and research; and thus they are justly open to the contemplation and reverent criticism of all who study the world's work and the world's progress.

This distinction becomes clearer when we look to the forces which are at work to cause progress in these two great branches of human effort. While the one derives its development from the insatiable thirst for knowledge which, in thoughtful minds, is the splendid result of knowledge itself, the other has a far ruder but not less efficient stimulus in the unceasing, though friendly, competition that goes on in the markets of the world. It is here made to feel that its work is practical, and that, like every other branch of industry, its task is to satisfy actual needs of mankind; and its triumph can but consist in doing this well and easily. Hence, progress means that a lessened amount of human labour and sacrifice is required to satisfy such a need; and inasmuch as, broadly speaking, that amount is measured by cost, we may say that the advance to which chemical industry is continually spurred by the pressure of competition is the reduction of the cost of production—in other words, increased cheapness.

Do not think that I am taking a low view of your profession when I speak of cheapness being its aim and the test of its success. I have no sympathy with those who think scorn of cheapness. To me it speaks of a lighter burden in production and a wider possibility of enjoyment—if I may use such a term in connection with the usually uninviting products of chemical manufacture. But while I feel how great is the advantage to mankind of this competition, I appreciate none the less fully how stern and unsleeping a master you have and how you must often groan under his sway. I know that evolution through the struggle for cheapness is not peculiar to your industry, but in no branch is the pressure so keen or the problem to which it gives rise so difficult. In none is the interworking of action and reaction so immediate or so complex. In olden days the chemical manufacturer made the one product he sought and was content. All that which was left was waste. But the pressure of competition soon drove him to seek some contribution to his working costs from that which he had previously thrown away, and the utilisation of by-products began. This has grown to such a pitch that there is scarcely a single important chemical industry that could afford to trust to a single product. Groups of products thus take the place of single products, and the production of a member of a group is linked by quantitative relations to that of the other members, and is no longer regulated independently by the laws of supply and demand. Now turn to the selling side. The needs of mankind measure the demand for your products. Many of these needs are imperative but limited. The demand does not grow with the supply. If too little is produced the price will go up to its highest limit, *viz.*, the equivalent of its value in use. If too much is produced the price will fall, and if by reason of its being a by-product, that production cannot be checked there is no limit to such fall. A change of process may glut the market in some article which has become a by-product, and may send it to a nominal price. The manufacturer has to steer his way among all these difficulties, and, verily, his task is no light one.

I do not know whether his hopes or his fears trouble him most. The selling price is ruled—in the absence of disturbing causes—by the ordinary cost of production. Hence, the pioneer who introduces and works a cheaper method, reaps the difference of cost of production as his reward so long as his method remains exceptional. But the exceptional of to-day becomes the ordinary of to-morrow and brings about a corresponding readjustment of prices, so that the old methods must be abandoned if manufacture is to bring any profit at all, and fresh progress must be made by those who seek exceptional returns. It is this which makes the work of the chemical manufacturer so arduous. Chemistry is too rich in possibilities. The stimulus to advance is keen and the opportunities for it numerous, and when a genuine advance is made all must follow—if not to get the pioneer's reward, at least, to escape the laggard's punishment.

To-night I have to deal with the advance made in this restless field of human effort under this unceasing stimulus. As you will suppose, I find no lack of material.

To give order to my remarks, let me analyse for a moment the forms in which advance may be made in the domain of chemical industry. Like every other department of industry its province is to satisfy practically the wants of mankind, and the aim of those who direct it is to do this as cheaply and in as efficient a way as possible. Hence advance may consist in its extending the scope of its manufactures by taking in new products to satisfy new wants, or more effectually to satisfy old ones. But chemical industry must seek somewhere the necessary materials for its manufactures, because chemistry does not create matter, it only rearranges it, and therefore advance may consist in the choice of new sources from which those materials are derived. These are no doubt two important types of advance, but at the present moment the main line of advance of chemical industry is not to be sought in the list of its products or the sources from which its materials are derived, but in the improved method by which it works. It is in these three divisions I shall consider the subject, *viz.*, the trend of invention in—(1) the products, (2) the sources of material, and (3) the processes of chemical industry.

So far as new products are concerned, the present moment is specially characterised by the initiation of a crowd of small manufactures. No epoch-making change is manifesting itself. This is natural. Some 30 years ago two gigantic chemical industries took their rise, *viz.*, that of modern explosives and that of coal-tar dyes, and the world has ever since been working out in detail the almost revolutionary changes they brought about. I do not suggest that their fertility in new products is checked. New explosives are still being introduced, mainly such as are designed to meet the special difficulties of particular uses, such as the flameless explosives for coal mines, or the almost detonating explosives which can yet stand safely the shock of being fired in shells. New dyes are constantly being invented, and the names of fear which they bear become more terrible each year. But the triumphs of these great industries in the past have been so magnificent that no developments of to-day can overshadow or displace them, and the description of their growth in recent years, however sound and vigorous it may have been, would consist of a detailed list of products wholly beyond the scope, and foreign to the nature of this address.

One victory, however, of the coal-tar dye industry cannot be passed over, and that is the commercial manufacture of synthetic indigo, which has taken such proportions, that it threatens to supplant the natural product, and produce far-reaching economic consequences in our Indian Empire. It is the greatest industrial triumph of synthetic chemistry, and one hardly sees where it will find another like conquest to make. Its history illustrates well how independent, and yet how inter-dependent are the domains of chemistry and chemical industry. It is properly classed as an invention of to-day, although the synthesis of indigo has been possible to chemists for some years past, for it did not pass into the domain of chemical industry until a long series of improvements in the processes for its production, made under the stimulus of industrial development, enabled it to compete in cost with the natural dye.

In my opinion, however, there are two departments in chemical industry, which are of great interest at this moment from the inventive development they manifest in their products. The first is that of pharmaceutical products. A field of research and its practical application is here opening out, the importance of which it is difficult to estimate, but which may be very great. I say this, because one can see, though perhaps as yet only dimly, and with little clearness of outline, the rise of great principles such as those which gave birth to the great chemical industries of which I have just spoken. Physiologists are beginning to associate specific effects on the human organism with specific chemical groups. These groups appear in countless combinations in organic chemistry, and their effect may be masked or hindered by the setting in which they are placed. This may arise in many ways. It may be that their effect is produced in the body by their being set free to form new combinations, so that too great stability in the original substance will paralyse them. It may be that their effect is produced by the selective absorption which is so characteristic of the organs and tissues of the human body, and in such cases the overlading of the molecule may render them inert. Again, it may be that the setting of the group, the combination of atoms with which it is associated to form the molecule may itself be capable of producing conflicting or otherwise deleterious effects. In all such cases the group may be present without producing the characteristic result. But the belief is growing that the tendency of the group to produce its specific effect is real and inherent, and that with a right choice of its setting it will produce it without these extraneous effects. It may well be that we are still in the infancy of pure therapeutics. Few drugs are known which, side by side with the effects they are intended to produce, do not bring with them other consequences, unsought for and often undesirable. So far as these take their rise in the organism as a physiological consequence of the original effect they must be accepted. But physiologists are raising the question whether it is certain that they are of physiological and not of pharmaceutical origin. It may well be that many of the forms in which the effective groups have up till now been administered, have influenced and distorted the normal action of the group itself, and a line of genuine research and invention is being pressed forward, seeking practical solutions of the problem of the best way to use these operative groups. Taking at hazard a concrete example, let me instance the salicylic group which is so potent, but the effects of which on the heart are held in many cases to prohibit the use of it in its ordinary forms. It is claimed now that if, instead of administering it in the shape of salicylic acid, or its salts, you take it in an acetyle setting as salicylic-acetyle, those ill effects are not produced. I am not concerned with the question whether this has or has not yet been demonstrated, but, assuming it to be so, it gives a clear instance of the nature and object of the research to which I am referring. It has already given rise to the discovery and manufacture of a large number of new pharmaceutical products, many of which have been looked for and found by applying the principles I have outlined. Unfortunately it is difficult to prophesy how many of these new manufactures will live. Some have won for themselves a permanent position, but in a department where experiment is so difficult, progress cannot be at once rapid and certain, and, indeed, the chief difficulty in forming a correct opinion on the subject is that in the case of pharmaceutical products, invention too often does not cease with their manufacture, but extends itself to the results of their administration.

The other department of chemical industry to which I wish to refer in this connection is that of foodstuffs. In my opinion the present moment is characterised by a very serious attempt, in a variety of ways, to stop the vast waste of nutritious matter that is going on all around us. There are two forms of this waste. On the one hand, with the exception of cereals, foodstuffs are essentially perishable articles, the preservation of which by existing methods s often more costly than their production, and they are wasted because they cannot be used where and when they are produced. On the other hand, there are many subtances treated as waste which would be capable of giving nutrition if they were in a form suitable for assimilation. I would cite milk as an example of the first of these lasses, and yeast as an example of the second. Now it s a very worthy aim of chemical industry to stop this waste. It may be an excellent advertisement for an xtract of beef company to represent an ox as squeezed into a small earthenware pot, but to the industrial chemist he very existence of such a caricature emphasises the wful waste that is accepted as necessary in order to preserve even any portion of the food. How great would be he consequences of an advance in this department can be measured by the economic value of the system of cold storage at the present time. It would stagger those who have not made a study of the subject to figure out the monetary importance of this system in its present applications, although they are still crude and imperfect in many respects, and need, and will, I think, undergo, great improvement.

The past history of this branch of chemical industry has not shown many successes of which we need be proud. Chemical preservatives are loved but little, and enjoy a social status not much above that of the criminal classes. The difficulties of the problems that present themselves are immense, but personally I think we are at a moment of real advance. For instance, I believe that milk will soon cease to be a perishable article so far as its substantial use for human food is concerned. I should like to see a substantial part of the ability, which is devoted to the practical solution of difficult chemical questions in our existing industries, applied to the preservation of foodstuffs. With one or two exceptions the men who have best succeeded in this department have done so rather by their practical skill and good sense than by their technical knowledge, but I can myself see a change coming, and I hope that I am not wrong in considering it as one of the directions in which invention is about to be most vigorous. It is the great boast of the leaders of our chemical industries that waste has been banished from their factories, and I trust that they will not long be content to see going on around them this enormous waste of that which is necessarily in most universal demand.

These new manufactures, though important in themselves and still more important in their aggregate, are, after all, in point of scale, only the fringe of chemical industry. The main chemical wants of mankind are almost as stereotyped and unchanging as its staple foodstuffs. The overwhelming importance of the alkali industry or of that of sulphuric acid will not materially alter, whatever be the developments in our industrial products. Hence it is that the list of the great chemical industries is so rarely added to. It is rare to find a new want which gives rise at once to a great manufacture. The only approach to this state of things, at the present time, is the cyanide manufacture, which has grown so suddenly to the proportions of a great industry that it almost merits a place in the list of new products. Before 1895 the annual production of cyanides in the world was below 500 tons. Now it amounts to about 8,000 tons. This is entirely due to the MacArthur-Forrest system of gold extraction, to which the world owes the recovery of some 9,000,000 of ounces of gold from its ores, and it is a worthy example of the obligations of chemical industry towards inventors. The demand has been met by the invention and practical introduction of new and ingenious processes of manufacture which have wholly superseded the old methods, and though I do not propose to refer further to them in this connection, they illustrate the abundant resources of chemical industry to deal with newly arising demands.

I turn now to the sources from which chemical industry derives its materials. Here development depends on purely industrial considerations. For the purposes of inorganic chemistry the possible sources from which each element can be obtained have long been known, and organic chemistry has full reason to be satisfied with the inexhaustible mine furnished by our gas industry. But although there is little addition to our knowledge of possible sources, there may come from time to time a shifting of the industrial source from which some element is practically obtained. Take your minds back to the momentous change, extending through the length and breadth of chemical industry, which took place when pyrites were substituted for brimstone as the industrial source of sulphuric acid. The reduction in the cost of producing that king of reagents was not due solely to the fact that fresh sulphur-bearing deposits of enormous extent were made available, but also to the fact that thereby the production of sulphuric acid became linked with, and formed a step in, metallurgical operations themselves of great industrial importance, so that the development of the two industries thereafter went hand in hand, and each shared in the prosperity of the other. Are we on the eve of any such change as this? Not in respect of any element.

strictly so called. But it may be so in respect of something that merits to be considered an element from an industrial point of view. I refer to combined nitrogen.

We all know that nitrogen is the element which is present with us in the greatest and the most useless abundance. It forms five-sixths of the atmosphere, and yet this huge store of nitrogen is substantially useless for practical industry on account of the difficulty of inducing it to combine. But so soon as it is combined it is one of the most tractable of elements. It can be made to pass from its most fiercely acid form of nitric acid to its most alkaline form of ammonia, and through countless intermediate combinations without any attempt to escape from the bondage into which it was so reluctant to enter. It is like the wild horse of the fairy tale that had but to have the magic bridle thrown over him to become the most manageable of steeds. Therefore it is that for industrial purposes we must consider the sources of combined nitrogen rather than those of nitrogen itself, and in this sense combined nitrogen is industrially an element of the widest possible usefulness. In the form of ammonia it is one of those substances to the use of which no limit can be assigned, because it approximates to the position of a food stuff by reason of its manurial value, so that it is hardly possible to think of any abundance so great that it would exceed the demand, provided the price of production be low enough.

It is in connection with combined nitrogen that there is the promise of such a change of source. Important as is the use of pyrites ores it is small in economic importance compared with the generation of power. Engineers have never forgotten the prophecy of the late Sir Frederick Bramwell, that the steam engine would in fifty years be found only in museums, and even though that prediction be somewhat poetic in its phraseology, it is based on the prose fact that the use of the internal combustion engine is developing with a rapidity which promises soon to make it the main source of motive power. To realise the presence of ammonia as an available by-product in the manufacture of gas for such engines, and to work out a practical process which will substantially extract the whole of that which is present in the waste products of combustion in such a manufacture, is to open out a source of combined nitrogen on the most gigantic scale, growing with the growth of all our industries, and specially adapting itself to that tendency to concentrate the generation of power which has followed the development of electricity as a distributing agent. This has been the work of Dr. Ludwig Mond. It is too early to speak of its results, but if the practical and commercial success of the Mond process can be fully established, so that it normally forms part of our power plants, we may expect a change of great and wide-reaching character throughout many branches of chemical industry, similar to, but even more important than, that which followed the substitution of pyrites for brimstone in the sulphuric acid manufacture.

Side by side with this bold endeavour to collect ammonia as a by-product of the production of motor gas, humble, but still, I think, successful efforts are being made to solve the problem which has been attempted so often of getting it from the nitrogenous contents of peat. These attempts are complementary to the work of Dr. Mond and the gas companies. So far as I can see, it is probable that we owe all the combined nitrogen of the world to the patient but humble work of bacteria through the long prehistoric ages, and our business is to recover it from the remains they have left. This combined nitrogen is mainly stored up in coal and peat, small as may be the actual percentage present in these substances, and the choice of these poor but extensive sources of ammonia illustrates the present tendency of invention. The most paying gold mines are those which have an abundance of low grade ore. So is it here. The improvements in plant and the advance in the skill with which it is used have led to a preference for sources which are large in scale over those that are small, even though rich and easily worked. To take infinite trouble to secure success on a large scale is the characteristic of modern developments in industrial chemistry.

But, as I have already said, the main advance in chemical industry is in the processes used. Indeed, the fertility of invention in this respect is so great that it is bewildering to anyone who is striving to classify it or to detect its dominant tendencies. This is especially the case in organic chemistry, where, side by side with the ceaseless stream of new substances, there is poured forth an equally ceaseless and even more abundant stream of new processes for making known ones. Complex molecules are arrived at from different starting points by different routes through different intermediate products. Now one part of the structure is built up first, and now another. Is it possible to detect any definite trend or direction in all this invention?

We must not lose sight of the fact that we are dealing with industrial chemistry, and that, therefore, the invention that concerns us has been developed under the stimulus of competition with a view to obtain economy of production. No doubt there are cases where this is obtained by devising or modifying a process so as to utilise some by-product or cheap raw material. But apart from such cases I think there is a tendency, or perhaps I ought rather to call it an aim, which is so general, that it may fairly be regarded as characteristic of the advance of to-day, taken as a whole. It relates to the question of yield. Both in the modifications of existing processes, and in the choice of new processes, the aim is to increase yield by more perfectly producing the conditions that make for it. It is based on a belief that imperfect returns are due in large measure to our own fault, and that with greater knowledge, and more skilful use of it, the partial successes which now content us could be made complete. Let me try to make my meaning clear.

Consider for a moment a chemical operation which yields various products, one of which is the one sought. Assume that the yield is found to vary. The aim of the chemist is to induce the necessary elements of the combination to be unanimous in arranging themselves so as to form that product, and in avoiding the alternative arrangements which are open to them, so as to give what is known as the theoretical yield. Now in most cases, if not in all, it would be dangerous to dogmatise as to what are the actual chemical changes which go on in producing what are to us the results of the combination. Many steps may intervene in the shape of momentary intermediate combinations, which form the paths to the ultimate products. But it is clear from the variations in the yield that those paths must be so nearly equivalent as alternatives, that very slight variations in the surrounding circumstances will decide in the case of the individual molecules whether they will take the one path or the other. On the break up of the original groupings "moments of molecular indecision" (if I may use such a phrase), evidently occur during which the presence of an otherwise insignificant influencing cause may decide the behaviour of the molecules, and thus determine the ultimate result of the combination.

Let me illustrate my meaning by an example. I will take the manufacture of the toluol sulpho-chloride from which saccharin is ordinarily produced. It was well known that sulpho-acids and sulpho-chlorides could be formed directly from toluol by the action of chlorhydrin, but only a portion of the toluol was thus turned into sulpho-chlorides, and of these only a portion consisted of the ortho-sulpho-chloride —which was the body sought, the para-sulpho-chloride, an isomer of no industrial value, being present in substantial quantities. By using an excess of chlorhydrin, it was found that a total conversion of the toluol into sulpho-chlorides could be obtained, but this helped little inasmuch as the early results showed the chief product to be the useless isomer. But Monnet found that if while using this excess of chlorhydrin you kept the temperature below certain limits you could cause the useful body to be produced in preponderating quantity. This discovery caused the commercial yield of the useful product to rise from 25 to 60 per cent., and diminished the cost of the manufactured article by nearly one-half.

Here we have a striking example of the existence of alternative paths. The two resulting products are isomers, *i.e.*, identical in chemical composition though not in chemical structure. They differ only in the orientation of the entering sulphochloride group, and on that depends whether the result is useful or useless. We know little or nothing of the forces that determine into what position the group shall go, but the conditions that decide for the one or the other must resemble one another so closely that they are both present in the same mixture, under the same external circumstances. The yield is composite, yet there is no ground for supposing that under identical circumstances there would be any variation in the behaviour of the different sets of combining molecules. The variation in the yield must therefore come from slight but decisive variations in the momentary local conditions. It is this which constitutes the difficulty of the problem, *viz.*, that such slight variations of the circumstances that attend the combination of individual sets of molecules can produce such grave practical consequences.

I will take the example one step farther. It has since been discovered that these limits of temperature may be considerably relaxed, if instead of technical chlorhydrin, you use such as has been raised to a high state of purity. Thus between the old and the new limits of temperature we find that the place taken by the entering sulphochloride group is changed from the useful to the useless, from the ortho to the para position by the presence of small traces of impurities, chiefly, I believe, sulphuric anhydride. Now, suppose for a moment that it had been the para body that had been of industrial value, we should here have a case in which the addition of a small amount of sulphuric anhydride—a body having apparently no connection with or relation to the reaction—largely increased the industrial result by influencing, in the right direction, the choice of which of the two alternative paths the combining molecules should take.

The example I have chosen recommended itself to me solely because it happened to come under my notice in my own professional work. Far better instances will occur to the skilled chemists before me. The case is now classical in which the yield of a difficult reaction in the synthesis of indigo was suddenly and unexpectedly increased, and this desirable result was traced to the fact that the mercury thermometer used in the operation had broken and thereby introduced a minute quantity of sulphate of mercury into the combining mass. Such a history makes one almost believe in the truth of the story one was told in childhood about certain pieces of imperial Nankin china preserved in the Summer Palace. The story ran that they owed their surpassing beauty to the addition—trifling from a purely chemical standpoint—of the master workman to the contents of the furnace in which they were being burnt. Cases such as those to which I have referred are not rare. Again and again I have had inventions before me of this type. Even the nomenclature of chemistry recognises them, and the term of "catalytic action" is applied freely wherever it is found that the presence of a foreign body influences reactions in which it apparently takes no part. But catalytic action is only one special case of the results of comparatively small influences at critical moments of molecular earrangement. Any variation in the surrounding circumtances may determine a choice which may be permanent nd irrevocable.

I have said that the fact that slight variations in the urrounding circumstances may have such grave conseuences constitutes the difficulty of the problem. But it lso constitutes its hopefulness. It is clear that the condiions of success are close at hand. We only need the skill o secure them. There is everything to make us believe hat we are here pursuing no dream, but are striving for the racticable. If we compare the knowledge and hopes of o-day with those of, say, five centuries ago, we must feel hat we can do things utterly undreamt of then, but that much at which they hopefully laboured is not only untained, but is known to be unattainable. Science adds aily to the list of the practicable, but side by side there rows a still longer list of the things that she pronounces mpossible. To the fancy of that age nothing seemed beyond ope. All achievements seemed worth attempting. But we ave become wiser and sadder. We have become aware of he walls of our prison house by knocking up against them, ometimes very roughly. The hopes that had supported enturies of search after perpetual motion were scattered for ver by the discovery of the first law of thermo-dynamics. he hope and aim of all mediæval chemistry, namely, the ansmutation of metals, is made more and more clearly impossible by all the discoveries that have taught us so much of the probable identity of their substance. In every branch of practical science we know that sharply marked boundaries exist over which we cannot step, and within which all our work must lie. To disregard these would be to show the worker to be mad. I know that besides those definite laws which have already been formulated, there are others which experience has indicated, but has not accurately ascertained, which it would be unwise to disregard if one would not labour in vain. But in the endeavour by uniformity of conditions to better the practical results attained, there is nothing which should lead us to expect failure, and though, in some instances, it may be found that laws at present unknown to us stand in the way of complete success, the cases in which this is probable are not so numerous as to discourage the prudent worker.

This is to my eye the main trend of invention in chemical industry—rendering certain and complete in their action processes formerly unmanageable or unprofitable by reason of the uncertainty of the reactions that actually and locally took place. Oftentimes this uncertainty grew during the process; the processes worked well at first, but gradually became worse. Others would work in the laboratory, but broke down when tried on a large scale. In others the working loss of some costly reagent was too large. I designedly class this under the same head. For working loss is only negative yield. It signifies that the recovery process is failing to give its full results, and the causes at work and the considerations to which they give rise are the same whether the product sought be a reagent to be recovered, or the direct object of a manufacturing process. The most important and most solid advance that is being made in chemical industry consists in turning these failures into successes by securing certainty and uniformity in the conditions present at each point of the reacting mass throughout the operation.

The realisation of the necessity of uniformity of conditions, in order to obtain full yield, manifests itself not only in the efforts that are being made to improve existing processes, but also in the choice of new ones. That process is a good one which permits the necessary conditions for right choice to be secured at every point and every moment. Here come in the two most common causes of industrial shortcomings. The result of a reaction is the sum total of the results at each point of the mass. Whenever, therefore, there is the possibility of a wrong choice that is irrevocable, the conditions must at no point be such as would lead to it. However narrow the margin between that which would lead the molecules to a right, and that which would lead them to a wrong choice, it must not be overstepped at any point. Average conditions do not determine the result, for it is the sum of local actions each depending on its own local conditions. And, further, this must be maintained throughout the operation. The changes which the operation itself works must not so alter the local conditions that they transgress these limits. Those processes, therefore, are to be chosen where there is a large margin of safety between the conditions which bring failure and those which bring success, where the local conditions are capable of due control, and where the changes due to the reaction itself are either non-injurious or can be kept in check.

Let me take, as an example, the new developments in the manufacture of sulphuric anhydride—new as far as public knowledge is concerned, for there has never been any published account of the process which the well-known English chemists, Messrs. Squire and Messel, have worked for many years at Silvertown. The reaction by which the sulphuric anhydride is formed is an old one—sulphuric acid and atmospheric oxygen passed over platinum black at a fairly high temperature combine to form the anhydride. But though the reaction had long been known to chemists, and had often been proposed as an industrial process, it had failed to win a place in practical manufacture. The results were uncertain, and after a comparatively short run the combination usually ceased to take place. It is now known that one cause of this failure was the difficulty in preserving uniform the local conditions in the contact mass. The action of platinum black depends on its intimate structure being unclogged, and above all on its being untainted with arsenic. Minute traces of dust or solid impurity or of arsenic, even in gaseous form, are fatal to it. But there was another cause of failure of even greater interest. The difficulty of alternate paths here presents itself in a curious form. The reaction is itself reversible. At temperatures well within the limits between which combination can take place, the sulphuric anhydride, though successfully formed, resolves itself back into its components, oxygen and sulphurous acid, and this reverse action becomes more and more energetic the higher the temperature, and the greater the percentage of sulphuric anhydride present. Now the combination itself liberates considerable heat, so that this is a case in which the two products of the reaction—heat and sulphuric anhydride—by accumulating, tend to increase the energy of the reverse reaction. Success thus leads the way to failure. Years of work were worthily spent by Dr. Kneitsch in the complete solution of this great industrial problem. The pyrites fumes cooled, and purified to an almost ideal freedom from solid impurities or arsenic, are made to pass round and then through the tubes that contain the contact agent They thus become raised to the necessary temperature by drawing off the heat given out by the reaction. The combination is made complete by having a long range of the contact mass, and the sulphuric anhydride that is produced is kept from accumulating by the stream of gas being passed at a proper velocity through sulphuric acid of that particular strength which has the property of instantaneously absorbing the anhydride. The result is a process which will work continuously for months and years in place of the previous unsuccessful attempts, and the difference is due to the fact that the necessary uniformity of conditions is secured. Even the difficulty introduced by the reversibility of the reaction is turned to account. The reaction is fiercest near the entering end, and there it is difficult to prevent undue heating. But thanks to the reversibility of the process, the mischief thus done is subsequently undone in the passage through the long and less intensely heated column of contact mass that follows. Thus the limits of safety at any point are widened, and the efficiency of the process is no longer imperilled by local irregularities of temperature. I want no better example of the tendency of the invention of to-day to develop processes in which certainty and fullness of yield are obtained by securing uniformity of conditions throughout the operation.

In considering chemical combination from this point of view, *viz.*, how to direct aright the choice of each molecule, one is at once reminded of the force that is so characteristically a director of molecules—electricity. Is there any evidence of progress in the application of chemistry to chemical industry? A few years ago men's minds were full of expectation in this respect. The greatest of all the chemical industries—the alkali industry—seemed at the mercy of the new method, and people spoke confidently of the abandonment of the older processes, and of obtaining all our soda by electrolysis. These bright anticipations have been only imperfectly realized. Certain forms of the process have, after long and expensive apprenticeship, established themselves commercially, and in any discussion as to the future of the alkali industry, electrolytic production must be taken into account as a factor. But the supremacy of the older methods, as measured by their comparative production, is as yet unchallenged, and personally it seems to me that of late the Le Blanc and Solvay processes have gained rather than lost ground through the increased demand for their by-products. Opinions will differ as to the reason why the success of electrolysis in the alkali industry has been so limited. I attribute it in great measure to the difficulty of preserving uniformity of conditions throughout the operations, and I am strengthened in this view by the fact that the two forms of the process which have met with the greatest practical success with us are those in which the conditions are not altered during the process, but remain unchanged, the products formed being wholly removed. But if the advance is not rapid in this department of industry, I see evidence of steady progress in the use of electrolysis at high temperatures, especially in electro-metallurgy. I am not forgetting the disappointments that have attended many promising processes of electrolysis of fused salts. But these were mainly due to technical difficulties arising out of the new and unfamiliar conditions. Equally great difficulties have been surmounted in processes of older standing, and these will in like manner be ultimately conquered.

The most disappointing branch of this department of chemical industry is the slow advance of the industrial applications of electricity in connection with organic chemistry. It is, of course, easy to see why metallurgy and alkali-making were its first applications. In them it has only to separate an element—a metal—from the electrolyte, and for that it is specially adapted. But the results of electrolysis on a solution containing elaborate coal-tar products can hardly be foreseen. The rude violence which can safely tear an element from its inorganic combinations, may make sad havoc when applied to these complex structures. It may be counted on to produce strong oxidising or reducing action, but nothing but experiment can decide what the ultimate result will be. I have long expected great developments in this direction, but I hear of few of industrial importance. I suspect that one cause is that to which I have already referred—the difficulty of maintaining uniformity in the contents of the cell. The products of the process remain in the elecrolyte, and continually alter its composition. If the yield is to be a full one, these contents must be profoundly different at the end of the operation from what they were at the beginning, and secondary decompositions are likely to arise. I have still great hopes, but whether from the cause I have assigned or not, electrolysis has not up to the present time taken its expected place in industries dealing with organic bodies.

There is, however, another gift of electricity to chemical industry, the value of which is daily becoming more highly appreciated and around which inventions cluster thickly—I mean the electric furnace. It has been rightly said that electricity enabled man for the first time to concentrate, in the form of heat at any point, and in any quantity, energy generated elsewhere. It abolished, therefore, the limitations of temperature which necessarily attend combustion. The bodies exposed to its action could be isolated from the disturbing influences of chemical action, and, indeed, in the form introduced by Moissan, and in that in which the heat is radiated from incandescent carbon rods, the bodies are shielded even from electrolytic action. Already it is the basis of important industries, such as those of sodium, phosphorus, carbide of calcium and carborundum. It specially lends itself to combinations which are endothermic. The heat can be used economically owing to its being concentrated on the bodies operated on, and to its being subject to accurate control. The one great drawback is that you derive your heat from motive power, which usually is itself an expensive product of combustion, but this makes it suitable for use in connection with the water powers that are now being utilised in all parts of the world.

I have now laid before you what, to my eyes, is the trend of invention in chemical industry, whether in its aims, the sources of its materials, or its processes. You will, perhaps, ask yourselves why I use the term invention, and where I draw the line which marks off invention from that judicious use of means and apparatus which fairly belongs as of right to everyone. I am not anxious to treat the advances in your great industry as the subject of legal subtleties, but I feel that I ought to express my personal opinion, that as practical result is the test of success, so it ought to be the main factor in determining the existence of that novelty which our laws hold to merit protection. The step between the discovery and the utilisation of a reaction is the most useful and often the most difficult step in the initiation of a successful manufacture, and should be, and I think generally is, recognised as having a correspondingly high claim to be regarded as invention. Speaking for myself, let me assure this assembly of practical chemists that my own appreciation of your efforts, your difficulties and your successes, is in entire sympathy with the views of those workers who, feeling how great is the work before them, have but one standard by which to measure the value of a new process, *viz.*, by how much does it enable them better to do that work.

Discussion.

Dr. Ludwig Mond said it had rarely been his good fortune to listen to a paper so full of suggestion. He agreed with everything of importance which Mr. Moulton had brought forward, and more particularly with the remark at the end of the paper in which the author referred to the value of the work done by the man who worked out a discovery into a practicable manufacturing industry. There might not be many there that evening who were present at the first meeting of the Society when he brought forward some views on the Patent Laws in general, but those who were, might remember that he dwelt at some length on this very question, and made some suggestions for an improvement in the law.

Prof. Capper said it was impossible to criticise a paper like this off-hand, and, as an engineer, he felt great diffidence, for he was aware that in the development of chemical industry, probably more than in any other branch of industrial development, the chemist and the engineer were both concerned, and the difficulty was to keep the two apart and prevent the one swallowing up the other. The engineer suggested to the chemist that he wished to find out more completely the efficiency of his engineering plant—that he wanted to be able to analyse more precisely the gaseous products of his gas-engine, and the chemist gave him information which obliged him to entirely reform the whole of his gas engineering. He had to scrap all his plant, and to start afresh; and he found that the lines on which he had been developing before were in some respects radically wrong. But, on the other hand, the engineer sometimes had his revenge. Dr. Ludwig Mond had suggested a method by which an internal-combustion engine might, and probably would, in a short time altogether replace the steam engine as a prime mover. Immediately Dr. Mond had shown that, the engineer at once became a producer of ammonia, and therefore, to a certain extent, cut out the work of the industrial chemist. In a case of that sort, the question was how far was it wise in an engineer to develop his knowledge of industrial chemistry, and how far was it wise for an industrial chemist to become an engineer. Probably the best method was to try to live in harmony one with the other, and to take the suggestions of the industrial chemist to help to develop the engineering undertaking. A case recently came under his notice in which an engineer asked a chemist to give him a metal which would have a very minute coefficient of expansion, for producing standards, and the result was the chemist supplied him with a metal which opened out great possibilities, and would probably entirely reorganise engineering industry in working to minute fractions such as they had never had before. Electricity had been referred to, and it seemed to him that one of the great reasons why the use of electricity in chemical industry had been confined to the comparatively small field it had at present was that the engineer had not been able to give the chemist what he demanded, *viz.*, electricity at a very low cost. Now that the demand was rising, there seemed a hope of getting to the position, by the help of the industrial chemist, in which they would be able to supply electricity at a fraction of 1*d.* per unit, instead of the multiples of 1*d.* which were the rule at present; and probably the efforts of the industrial chemists using electricity would enable them to reduce the cost still farther.

Prof. J. M. Thomson congratulated the Society and the Chairman on having induced the author, occupying an entirely different sphere, to put his ideas before the members of the Society, in an aspect, perhaps, somewhat different from that in which they were sometimes inclined to regard them.

The Chairman informed the meeting that Sir William Ramsay had written to express his regret at being unable to be present that evening.

Mr. David Howard said it was many years since first he had to do with industrial chemistry, and he could emphasise the truth of the conclusions arrived at by the author and the reasons given for them. It was on those lines they ought to look for progress. The distinction between the purely theoretical and the practical was one which they had constantly to bear in mind. There was a wide distinction between a theoretical result, which was often of profound interest, where 5 per cent. of the theoretical yield was most satisfactory, and the process which had to be worked out on the large scale, when 95 per cent. was a poor result. They had had the great privilege of hearing one who, not content with the glorious certainties of the higher mathematics and the glorious uncertainties of the law, had brought to bear on their industries a clear preception of their needs of which many of those who are at work upon them were only dimly conscious. The one thing they had to warn one another against was that narrowing up of their studies into the minute point which was before them—that microscopic point of view which was so tempting and so prominent. It was by that wide grasp—bringing to bear on a new subject the ability and experience of studies widely different—that great progress was made, and they would have great chemists just in proportion as they were not chemists and nothing more.

Dr. Divers expressed his admiration of the paper, and full agreement with the views of its author.

Mr. Walter F. Reid said this was a paper which certainly should be in the hands of every industrial chemist and every inventor, whether chemist or not. It contained many pieces of advice, the result of long practical experience, which could not but be useful to any inventor, and he might say he had learned much from it. Recently he had met with some hundreds of inventors at St. Louis, many of whom were too sanguine, and he could only have wished that some months previous to the opening of that Exhibition they could have had a copy of this paper, for he thought it would have saved the juries much trouble. But at the same time there was one word to be said about the sanguine inventor, especially in the United States. Where they in England made scientific experiments on a very small scale, there they made them by the ton. In experimenting on a large scale, enough product could be obtained to send out many samples, thus the material would become known, and other people could try it. For instance, the increase in the consumption of carborundum was enormous. Until two or three years ago it was regarded simply as an interesting chemical. Last year 2,500 tons were manufactured, and the consumption was increasing so rapidly that it might very likely be doubled this year. That showed the advantage of doing things on a rather large scale. Not everybody could afford it, but it was to be encouraged. Some of them had seen the gigantic factories which were being erected at Niagara for making use of the water power. Hitherto caustic soda had not been produced there on the industrial scale, but he was informed of a close approach to the economic production of caustic soda on Niagara Falls.

The question of new industries was one which might entirely upset not only the politics of a nation, but the whole economy of nations. Thus, in the war in the East they saw an enormous loss of life, and it was found that those who were defending their lives could not even locate the batteries by which they were attacked. When he was first connected with explosives, the difficulty was to hide a battery, now there was no difficulty at all. Again, with regard to the use of explosives, there were possibilities undreamed of when these things were first used. A curious case happened in St. Louis. A complaint was made by the owners of some incubating apparatus, that the chickens were spoiled by the detonations from two shows there. The whole atmosphere reverberated with explosions at times, and when these chickens came out of the eggs, some remarkable monstrosities resulted, showing a certain amount of distortion of the chick which was attributed to the explosions. Here was a new modification brought about in the processes of nature by a chemical reaction. In the same exhibition were shown some modern anæsthetics which were of a striking nature. He was assured in one case by an eminent French professor and other authorities that a patient could be anæsthetised sufficiently for an abdominal operation by using six drops of a 1 per cent. solution of the anæsthetic. The manufacture of such preparations frequently produced serious effects on the workmen employed.

Cold storage had completely revolutionised the food of mankind. They now got products from distant places to an extent that formerly was never dreamed of. In the United States cold storage was reduced to an art. He had had to judge apples of last year which were placed side by side with this year's apples, and it required a greater expert than himself to tell the difference. The chemist and the engineer had worked together to effect this; neither the chemist nor the engineer alone could do it, but both together they had done it, and it was one of the greatest advantages of our Society that it brought the two together.

Whilst in America he obtained some interesting information about sulphur. There was a large production now in Louisiana by a process of melting the sulphur in the earth. There were large deposits of sulphur there, but they had never been worked because of the difficulty and expense of sinking shafts and mining. Now water was heated to above 300° C., and passed into the earth, the sulphur being melted and pumped into tanks, where it solidified. This was a new process, which would doubtless have considerable influence on the production of sulphur.

It was open to some doubt whether all the combined nitrogen existing on the earth was due to bacterial action; some of it was at least due to electrical action. He thought probably a large proportion of nitrate of soda owed its origin to electrical discharges in the atmosphere.

The author had very rightly referred to the extreme importance of infinitesimal quantities in chemical reactions, and one of the most valuable portions of the paper was that in which he showed how extremely minute a quantity of a substance might altogether alter an expected reaction. Mr. Watson Smith had shown them not very long ago how, in testing aluminium, the test tube itself played the part of a reagent; that small quantities of material were dissolved from the test tube and affected the reaction so much that previous experiments on metallic aluminium with different solutions were rendered practically valueless.

With regard to the reactions taking place at different temperatures, they stood in face of an enormous revolution in chemical industry. The production of liquid air gave them opportunities of using low temperatures in chemical reactions in a way they had never been able to do before. It might interest those present to know that the largest quantity of liquid hydrogen ever produced in one day was turned out, one day last September, by the Low Temperature Research Apparatus at St. Louis, which had been sent out and erected by the Royal Commission.

Dr. **Squire** said there were one or two points which he should like to allude to, the first being his experience with sulphuric anhydride, which showed how investigators might go utterly astray for a long time. In his original patent for the manufacture of sulphuric anhydride by catalytics he simply utilised a process of Deville's for making oxygen. In that process concentrated sulphuric acid was poured upon very hot platinum foil, which resolved it into sulphurous acid, oxygen and steam; the sulphurous acid was removed by milk of lime or a solution of an alkali, while the oxygen went on its way. When sulphuric anhydride was the product sought, the sulphurous acid was, of course, not removed, but both gases were very thoroughly dried. The other half of the process was really known before, namely that sulphurous acid and oxygen could be combined by means of spongy platinum. It was platinum black at the commencement, but it very soon became spongy platinum. Winckler suggested precisely the same process which he (Dr. Squire) had already patented, only Winckler published his process a few months later. Dr. Messel and himself worked on this process for a long time, and generally on the wrong lines, as was so often the case first. It was thought that neutral or indifferent gases interfered very much with the reaction. Both Winckler and Scheurer-Kestner said so, but as a matter of fact this was not the case. The temperature was kept up to about 450° C. by means of a fire under the vessel containing the spongy platinum. Some hundreds of tons of sulphuric anhydride had been make at that temperature, but it was afterwards discovered that this temperature was far too high and really the heat ought to have been got rid of instead of maintained. The decomposition of sulphuric acid turned out to present a great many difficulties, and was far too expensive. Practically no apparatus lasted for any time. Iron retorts were rapidly destroyed and clay retorts leaked. The fact was the conditions were not at all the same as they were in gas works. In gas works the retorts became lined with graphite, which kept them tight, and if no graphite was produced these clay retorts leaked very badly, and in this case of course no graphite was produced. The next step was to produce a cheap sulphurous acid and mix it with the requisite quantity of air. This process he carried out in the first place at Scheurer-Kestner's works in Alsace. It was accomplished by compressing to four atmospheres the gases from burnt sulphur and treating the gases with water, while in a state of compression. Nitrogen passed away and a strong aqueous solution of sulphurous acid was obtained. This solution was afterwards boiled to evolve the sulphurous acid. The compression of these gases on a large scale presented many difficulties, for it was found that nothing but indiarubber and lead, neither of which had any mechanical strength, should come in contact with the gases, but the mechanical difficulty once overcome, this modified process worked very well. But it was ultimately abandoned, for it was found that the presence of indifferent gases did not as a matter of fact interfere with the process when a much lower temperature was used for the catalytics, and eventually the process became a workable one when applied directly to the gases evolved by burning pyrites without any compression at all. Mr. Moulton, in alluding to cold storage, said that yeast was among the substances which could be kept for a long time at a low temperatute, but cold storage, although it suspended the activity of the bacteria which brought about the decomposition of the yeast, was not a complete success. The best temperature for keeping yeast was about 4° C., it must not go below zero, for freezing completely spoilt it. But if the low temperature were kept perfectly uniform, it did not seem to prevent the growth of the moulds, which grew on the yeast bags almost as well at a low as at a high temperature, and that gave the yeast an unpleasant smell and taste.

Dr. F. B. **Power** said it would be needless to attempt to emphasise the great interest which this paper possessed. He experienced the difficulty of many preceding speakers, that of not being able to deal in an impromptu manner with a paper covering so wide a range and including so much in its scope. Those who had worked in the domain of pharmacological chemistry would recognise the significance and interest attached to the facts brought forward. He was sure this address would stimulate all chemical workers, and afford many ideas which would be useful to them in their investigations.

Mr. **Leon Gaster** said he would like to mention one or two instances in which waste still occurred. One was in the case of blast-furnace gases, which were not as yet sufficiently utilised. They were made use of in Dr. Ludwig Mond's and other ingenious processes for making producer gas for gas engines, but it remained as yet to be proved that the efficiency of the large gas engines came up to expectations, and that they could keep their place against large units of reciprocating steam engines or of steam turbines. The latter had gained favour with central station engineers for greatly contributing to reduce the price of power generation in connection with electric central power stations, whence the current was distributed at a distance for lighting and motive power for industrial purposes. On this occasion he wished to emphasise another waste, and to help to dispel the erroneous idea, which prevailed too much in this country, that the existing water power could not be turned into account. In view of the great improvements made in the modern construction of turbines, governors, and hydraulic plant generally, it might safely be expected that in the future those powers now wasted would be utilised to the advantage of many industries. It must be borne in mind that if, owing to the great fluctuations of the head of water and the amount of available water power, the erection of a reserve steam or gas-power plant were required, so long as the item representing the fuel, which must continually be consumed, was greater than the interest on capital for erecting the water-power plant, there would be more than one reason for utilising the water power, and saving the fuel.

Mr. Oscar Guttman said, if the purport of the paper were summarised, it was that the trend of invention lay in two directions, namely, cheapness, or increase in economy, and increase of yield; but it appeared to him that the author omitted a third direction, which he believed to be the ultimate factor in production, namely, quality. If the cost of production were continually being reduced, a certain limit would be reached when the general expenses amounted to more than the cost of labour, and it was then almost impossible to make any further reduction. If an increase of yield were aimed at, there was also a limit beyond which it was not possible to go. When these two limits were reached there was only one thing left, and that was quality. In many inventions that had come under his notice, the aim was for quality more than for anything else, because the other means had been exhausted. If a manufacturer could get a yield of 98½ per cent. of something at a cost which had beaten every competitor for some time, but was now on a level with everybody else, he turned his attention to producing a product which was free from all possible impurity, and could thereby secure a more ready sale; he might not always patent that method, he might keep it to himself, but he would produce an article which obtained a well-deserved reputation for him, and would secure his market. It appeared to him that the British chemical industry had been kept from decay through having always been able to produce articles of good quality, and insisting on this standard being maintained.

The Chairman asked Mr. Moulton whether any recent progress had been made in the economical conveyance of electricity generated at a distant spot where there was adequate water power. He had seen so much of water-power schemes, where the power was undoubtedly cheap, but where it cost so much to take the raw material there, and so much to bring the manufactured material away, that the cheapness of the water power was useless. He understood that progress had been recently made in connection with this subject, and he thought it would be of much interest if Mr. Moulton would enlighten them upon it. One other point struck him that Mr. Moulton might possibly have included in the scope of his remarks. He had laid such stress upon the fact that aboratory research led to industrial developments in chemistry, that one would like to know his views as to the ndustrial possibilities of present research in connection with stereo-chemistry. He, of course, recognised that at the present moment it was not industrial, but the suggestion was that there might be a possibility of its becoming so, and that it would be well that this possibility should be put before those interested in industries in which it might become a competitor, just as it would have been of enormous advantage to them if the indigo planters of India had taken sufficient notice of Sir Henry Roscoe's discourse years ago at the Royal Institution on the synthesis of indigo from rthonitrophenylpropiolic acid.

Mr. Moulton, in reply, said he had been greatly interested n many of the speeches, and had felt the same difficulty hat they had felt with regard to the paper. It was difficult o take hold of the speeches at the moment so as to keep hem vividly before one's mind. Mr. Reid had tried to correct him on the subject of the combined nitrogen of he world, which he had attributed to the humble but patient work of bacteria, suggesting that it might be due o lightning. He could assure Mr. Reid he had thought of primeval thunderstorms also as a possible source, but his sense of humour had prevented him trying to drive team of bacteria and thunderstorms together. Later on Mr. Guttmann took him to task for not having emphasised he importance of quality. He certainly thought of that, but he viewed it rather as a corollary from what he had aid than as naturally forming part of the paper itself. The whole of that part of the address consisted in emhasising the necessity for absolute control even of the mall forces that influenced local combination, and the onclusion he drew in his mind was that if they were to enter upon a part of progress of that type the first thing hey must insist upon was perfect purity of the reagents. f you were to have uncertainty in your reagents, if you id not know whether they were going to be pure, how in he world could you get certainty in local action. He was delighted to find that so great an authority gave a high place to English productions from that point of view. Might they ever keep it, and then they would have a sure foundation for future progress. The Chairman had attempted to draw him on the subject of conveying electricity to a distance. He was delighted to think the world was getting so wise as to see that it was better to take electricity to their centres of population rather than make centres of population where there was electricity. Raw material and workmen required roads and railways, but a high tension current was well content with three wires, and it was an economic absurdity to attempt to convey cumbrous products, including workmen, that required careful handling, to almost inaccessible places instead of bringing the electricity to the town. Certainly on the other side of the Atlantic they had no doubt about it. They carried electricity of a high potential from 120 to 150 miles, and he thought the time was very near when the great sources of electricity would all be made to supply motive power to centres of industry which were determined by totally different considerations. Then the Chairman had touched on stereo-chemistry and all the wonderful work done with regard to the sugars, which was a marvellous specimen of brilliant chemical research. He had been preaching throughout the paper on the great gulf that existed between theoretical chemistry and industrial. Theoretical chemistry sought the truth, industrial sought the result. Now the Chairman wanted him to treat stereo-chemistry as being part of industrial chemistry. With all due respect to his auditors he must tell them it was their fault that it was not but they must not take him to task because the members had not yet succeeded in making this industrial. Recent researches could not be read, he might say, in any branch of chemistry without seeing the vast possibilities of industrial processes. But to-night they were not dealing with the possible, but with the progress which made them actual. Therefore the synthesis of the sugars was not yet ready for him. Nothing was more charming than that department of chemistry, and nothing that he so much longed to see made industrial, and he trusted there were many present who would distinguish themselves by the conquest over industrial chemistry of that great triumph of theoretical chemistry.

Nottingham Section.

Meeting held on Wednesday, October 26th, 1904.

MR. J. T. WOOD IN THE CHAIR.

NOTE ON COLLIN.

BY J. T. WOOD AND S. R. TROTMAN.

The paper on "A New Method for the Analysis of Tannin and Tanning Materials, and the Identification of Admixtures in Tanning Extracts and Liquors," by Dr. J. Gordon Parker and E. F. Munro Payne, read before this Society on June 6th, 1904, is a very valuable contribution to the history of tannin analysis (see this J., 1904, 648–651). The authors treat the tannin solution with lime water, allow to stand for four hours, filter off the precipitate and titrate the lime remaining in the filtrate, using phenolphthalein as indicator. The figure obtained represents what they call the *total absorption*. They then remove the tannin by means of a neutral solution of "collin" (for preparation see J., 1904, 649). The lime absorption of the detannised solution is now taken. This they call the *acid absorption*, the difference between the two figures being the true tannin.

In the present note we do not wish to criticise the process proposed, but to examine the author's statement that collin is a pure form of collagen (*loc. cit.*, p. 649), but deprived almost entirely of its calcium base. This statement appears to us of importance, inasmuch as, if it can be shown to be correct, it will have an important bearing on the constitution of gelatin. We do not propose to examine the question whether lime forms an essential part of the gelatin molecule (we have not previously heard this maintained), but to show that collin consists of a mixture of hydrolysed gelatin and gelatoses in varying proportions depending on the temperature and length of time the solution is heated, and further to show that this variation in the constitution of the solution has an influence on the precipitation of tannin.

To simplify matters it may be well to state that we adopt Allen's definition for gelatin (Comm. Org. Anal., IV., p. 461), *viz.*:—a proteïd resulting from the hydrolysis of collagen or ossein by boiling with water or dilute acids. The properties of gelatin are given by Allen (*loc. cit.*)

We prepared a 5 per cent. solution of Coignet's Gold Label gelatin, and estimated the nitrogen in 50 c.c. by Kjeldahl's method; 0·343 grm. nitrogen was found, which multiplied by the usual factor 5·42 gives 74 per cent. of gelatin. We then saturated the solution with zinc sulphate which precipitates the whole of the gelatin, and again estimated the nitrogen in the precipitate: 50 cc. of the 5 per cent. solution gave 0·333 grm. nitrogen or 72·22 per cent. of gelatin. The difference between the two results indicated the amount of nitrogenous matter *not* gelatin in the sample.

From the above gelatin a solution of "collin" was prepared exactly as prescribed by Parker and Payne, containing 5 per cent. pure gelatin calculated from the above experiment. The solution was saturated with zinc sulphate to precipitate unchanged gelatin. The resulting precipitate contained only 0·1625 grm. of nitrogen in 50 c.c., indicating 35 per cent. of the original gelatin. The clear filtrate from the zinc sulphate was treated with bromine to precipitate the peptones, shown to be present in the filtrate by the biuret reaction, and nitrogen in the precipitate determined by Kjeldahl's method. The nitrogen found was 0·203 grm. or a total of 0·4655 grm. nitrogen, which corresponds very well with the total nitrogen previously found. We then examined, in the same way, a collin solution which had been heated on the water-bath for 40 minutes instead of 20 minutes as prescribed, the nitrogen precipitated by zinc sulphate amounted to 0·068 grm. in 50 c.c. whilst the bromine precipitate gave 0·371 grm. nitrogen. There was a further 0·020 grm. nitrogen in the filtrate from the bromine precipitate, indicating the presence of 3 per cent. lower compounds of nitrogen.

The results are shown in the following table:—

Nitrogen in 50 c.c. original solution of gelatin—
0·469 grm.

—	A.	B.
	Grm.	Grm.
Nitrogen precipitated by zinc sulphate (gelatin and gelatoses).	0·1625	0·0868
Nitrogen as peptones (bromine precipitate).	0·3030	0·3710
Nitrogen as lower compounds..............	Nil	0·0200

A.—Collin prepared as prescribed by Parker and Payne.
B.—Do. do. heated for 20 minutes longer.

The appearance of lower nitrogen products indicates that the solution is undergoing decomposition, and as these products do not precipitate tannin, it appears to us that a serious source of error may here be introduced into the process. The composition of a gelatin solution heated with caustic soda is so sensitive to change of temperature or time of heating that we have found it practically impossible to prepare solutions of the same composition.

A still more important fact, in view of the purpose for which the collin is to be applied, is that the combining proportions of the unchanged gelatin with gallotannic acid differ considerably from the combining proportions of peptones with gallotannic acid. We hope to give some figures relating to this in a future note. The conditions sought for in a body used to separate tannin from other matters seem to be:—(1) The body should precipitate tannin only and combine with it in definite proportions. Collin appears to precipitate gallotannic acid only, but not in constant proportions. (2) It should be easily procured in a state of purity. It appears to us that these conditions might be fulfilled by selecting a proteid of simple and known constitution, such as the protamines described by Kossel (Rev. Gen. d. Sciences, 1889, p. 380), and which form the nucleus of the proteid molecule.

In conclusion, if collin were a pure collagen or gelatin, it should give constant reactions with different reagents and be of constant composition. We have shown that it does neither of these things. Collin cannot therefore be purified gelatin or collagen.

Discussion.

Dr. Parker said he was afraid the authors had taken the paper published by Mr. Payne and himself a little too literally. They claimed that collin acted in the same manner as a pure form of collogen. Collin was first of all made in 1898 by Mr. Payne, who was then working up pharmaceutical preparations, and he used it for dissolving morphia for the purposes of injecting into blood. He (Dr. Parker) had tested various solutions of collin, and only in one sample was he enabled to get a precipitate of gelatin by means of zinc sulphate, when they had prepared in the manner prescribed by heating for 20 minutes at 90° C., using the correct amount of soda. He and Mr. Payne were pleased that their paper had raised such an amount of criticism, and hoped that much good might arise from it. Accepting the authors' statement, he found from his figures that 35 per cent. of his solution was unaltered gelatin. Even then that would not have altered the process in regard to the estimation of tannin, because in the process Mr. Payne and himself devised in the estimation of tannic acid they used such an excess of collin that even if 35 per cent. of gelatin were present there would still be sufficient collin to precipitate the tannic acid. The taking of a skin and not a bone gelatin was one of the essential features of the process. He further thought that the results obtained by the author were in some measure due to the use of Coignet's gelatin, which was a bone product, and hence contained a considerable quantity of chondrin.

Mr. Trotman considered that more exact directions for the preparation were required. If as Dr. Parker said the nature of the original gelatin influenced the result, then he should have specified a particular form to be used. Secondly, if, as the authors had shown, the preparation of collin solution by the method given did not ensure the hydrolysis of all the gelatin, the importance of the method of analysis was largely discounted, owing to the fact that the collin solution would no longer differentiate between gallic and tannic acid.

Prof. Kipping said he disagreed with Dr. Parker in regarding collin as a definite substance. What he (Dr. Parker) called collin was doubtless a mixture of a great number of substances which were derived from the breaking down of the gelatin. As the object of the analysis was to obtain a substance which would precipitate tannic but not gallic acid, would it be possible to merely take a pure gelatin and boil it until there resulted a solution which gave no precipitate with the latter acid; such a solution might serve as a standard "collin."

The Chairman said, from the experiments which had been carried out, he was of opinion that the action was not quantitative, because the gelatoses appeared to precipitate varying quantities of tannin. He considered it was impossible to make a solution of constant composition by following out the directions given. With regard to their not having used the right gelatin, Parker and Payne specify "a good commercial gelatin," they (the authors) used the *best* they could obtain.

Dr. Parker said it was his custom to test the solution of collin, and if it precipitated gallic acid he rejected it, and made a fresh solution.

THE DIFFERENTIATION OF THE DIFFERENT FORMS OF NITROGEN IN GLUE.

BY S. R. TROTMAN AND J. E. HACKFORD.

Chemists who have had experience in the analysis of glue are well aware of the difficulties attending the operation and connected with the interpretation of the results of the analysis. In our experience there is no class of bodies so difficult to report upon in a satisfactory way, nor in which the ordinary chemical constituents have hitherto given so ittle ground for forming an opinion. In the following paper we hope to indicate a method of analysis which will o a certain extent remove these difficulties. That much ime and trouble has been devoted to the subject is evident from the following brief summary of the methods used by various chemists for the determination of the gelatinous constituents of glue, on the one hand, and its physical haracteristics on the other.

It is of course admitted by all that an analysis must nclude determination of water and ash. So far as these go there is little room for divergence, and we propose o confine ourselves to the nitrogenous constituents only. The following methods are the most important of those roposed for their determination :—

(1) Determination of total nitrogen by Kjeldahl's method nd calculation to gelatin.

(2) Determination of total nitrogen by soda lime (Noffat, Wagners Jahresb., 1867, 672).

(3) Precipitation by tannin and either measuring nitrogen n the precipitate or titrating excess of tannin in filtrate A. Muller, Zeits. angew. Chem., 1902, **15**, 482).

(4) Precipitation by chlorine and determination of itrogen in the precipitate.

To all these methods one fatal objection may be urged, *iz.*: that in every case peptones and other non-gelatinous itrogenous bodies are thrown down or coestimated while he composition of the tannates of gelatin are too uncertain to make the method (3) reliable.

(5) Determination of non-gelatinous constituents by recipitation with alcohol, filtering, and weighing. This is ifficult and somewhat uncertain.

(6) Precipitation of gelatin by tannin and determination f unprecipitated matters in filtrates to which of course the bjection mentioned above applies.

The physical tests for glues are numerous and are affected y so many conditions as to make them unreliable or at ny rate incomparable. Some largely exaggerate differnces, while others do not draw any sufficiently distinct line etween good and bad samples :—

(1) Water absorption figure (Shattermann, Dingler's olyt. J., 1845, **96**, 115).

(2) Consistency and bearing weight of jelly (Lipowitz, eue Chem.-techn. Unters., Berlin, 1861, 37—42).

(3) Determination of melting point (Kissling, this J., 901, 510).

(4) Determination of viscosity (Engler, this J., 1890, 4).

After a long experience of these tests we have discarded l except a consistency test communicated to Mr. Trotman Mr. H. S. Garry, which we find to give reliable comparave results, and which agrees well with those obtained by e method of estimation of nitrogenous constituents which e now employ.

In this method the glues are compared with a standard ue or gelatin, of which it is necessary to keep a stock.

A 10 per cent. solution of the standard, and various rength solutions of the glue under examination are made, d allowed to stand overnight. The consistency is tested the morning by pressing the jelly with the finger tips, in der to ascertain which strength solution of the glue rresponds to that of the standard.

n the subjoined table it will be seen that the consistency of me of the examples is 150, 120, &c., which indicates that se samples are respectively 50 and 20 per cent. better an the particular glue which we take as our standard.

Although the above method may appear crude, the ults obtained are very consistent, and, in our opinion. e error never exceeds 10 per cent. As a rough test for nufacturers, naturally a simple physical test has its vantages, although those which are usually applied are y intelligible to the person who makes them, and while ing comparative figures, are of no absolute value. reover, the physical test is no real check on manufacture, a chemical analysis should be.

—	Consistency by Experiment.	Consistency by Calculation.	Total N × 5·33 by Kjeldahl = Gelatin.	N precipitated by $ZnSO_4$ × 5·33 = Albumoses.	Peptones by Difference.
No. 1, best gelatin.	150	150	74·03	72·22	1·81
No. 2 = No. 1 boiled two hours.	..	143	74·03	71·36	2·67
No. 3	135	131	71·64	69·54	2·10
No. 4	120	124	74·62	68·05	6·57
No. 5	110	112·5	74·30	67·0	7·3
No. 6	90	87	71·04	64·18	7·86
No. 7, a bad over-boiled glue.	40	37	73·02	57·99	15·03

The weak point of all the above methods of analysis is, that they totally fail to differentiate between gelatin proper and hydrolised gelatin and peptones, or lower nitrogenous bodies which may be produced by a faulty method of manufacture. Since these peptones, &c. not only have no glue-like properties themselves but actually prevent glue from properly setting, it is obvious that their determination should be an important factor in the analytical opinion of a glue, and that if this operation be also accompanied by a determination of the gelatin proper, we have in our hands at the same time both the positive and negative sides of the problem to be solved. If, further, a total nitrogen determination be made, we have also a measure of what the glue might or should have been, and the nearer the gelatin figure approaches to the total nitrogen the better the glue.

Briefly, the method we have used is :—

(1) The determination of nitrogen by Kjeldahl's method.

(2) The determination of albumoses by determining the nitrogen in the precipitate thrown down by zinc sulphate (Factor = 5·33).

(3) The estimation of lower nitrogenous bodies either by (*a*) precipitation by bromine, or (*b*) by taking the difference between the figure for albumoses and that for total gelatin as estimated above.

Method.—One grm. of finely powdered glue, or its approximate equivalent of size, is dissolved in a quantity of water not exceeding 20 c.c. While still hot, zinc sulphate crystals are added in excess to saturate the solution. It is then well stirred by a rod or mechanical stirrer, filtered through a funnel containing a plug of glass wool forced into the stem, and washed with saturated zinc sulphate solution. The glass wool and precipitate are subjected to analysis by Kjeldahl's method, the nitrogen found multiplied by 5·33, giving the albumoses present.

Alternative Method.—The solution is made of the same strength as before. Zinc sulphate crystals are used in considerable excess, so that the solution becomes semisolid. It is then stirred with a rod—keeping the solution hot—whereupon the albumoses cling to the rod and to the sides of the vessel, leaving the solution practically clear. Should the precipitated albumose be seen to still float after stirring, the addition of more zinc sulphate will cause it to coagulate and stick to the rod. The remaining liquid is decanted off, the precipitate washed with saturated zinc sulphate solution. The precipitate is dissolved in about 10 c.c. of concentrated sulphuric acid, and the nitrogen determined by Kjeldahl's method. The latter method of estimation is identical with that in which the albumoses are filtered, and is much quicker in operation. The filtrate from the albumoses may be rejected, but if the determination of peptones and of bodies lower than peptones should be required (*e.g.*, creatinine, creatine, asparagine, &c.), the peptones may be estimated in it by Allen's method, and the lower nitrogenous bodies by the estimation of nitrogen in the filtrate from the bromine precipitate. These lower nitrogenous bodies only occur in cases in which the glue has undergone considerable decomposition by hydrolysis, caused by excessive boiling, or by the glue having an excessive acid or alkaline reaction when boiled. The value of a glue depends upon the percentage of albumoses present, and moreover, anything which tends to deduct from the percentage present deteriorates the quality of the glue. In a perfect glue the amounts of albumoses and of gelatin present, as determined by Kjeldahl's method should be identical. Other nitrogenous bodies should be absent, since they have no adhesive properties; whether the amount of these lower nitrogenous bodies acts only as diluents, or whether they are actively deleterious, is not yet quite clear, and we are still experimenting in this direction. It is by no means necessary to estimate the peptones by Allen's bromine method, and then the simpler bodies, since the "peptone" figure obtained by difference is equal to the sum of the above two figures, and this difference figure is a measure of the loss of gelatin by the manufacturer, and thus the care that has been used in manufacture can be criticised.

In the case of No. 2, a pure gelatin (No. 1) was boiled for two or three hours under a reflex condenser. It will be seen from the tables that while the total figure for the Kjeldahl has not diminished, yet the albumoses have done so, illustrating its deterioration in quality. Also in the case of No. 7, an over-boiled glue, while the total nitrogen figure is 73·02 per cent., showing the quality the material might have attained, yet the figure for albumoses is only 57·99, showing that only this percentage of the glue by weight, and not 73·02, is available for adhesive purposes. It will also be seen in this sample that a considerable quantity of the peptones have been converted into simpler nitrogenous bodies, thus indicating that the glue has been considerably over-boiled.

Since the consistency test is made a means of testing the quality of the glue it follows that there should be some analogy between the qualities as given by the albumen figure and that given by the consistency. That such is the case is shown by the figures given in the table, and which are comparable with a set of figures in which the consistency has been estimated from the albumoses by taking a mean difference of 1.4 per cent. in the albumoses to correspond with a difference of 10 in the consistency figure.

Discussion.

Prof. Kipping said that there seemed to be a certain analogy between the changes which glue and gelatin underwent on boiling with water and those brought about in the treatment of an equally complex substance—starch, with acids or with diastase. In both cases the hydrolysis probably results in the production of a great number of products and not merely one or two. The authors had distinguished the two sources of nitrogen, namely, albumoses and peptones, but there was little doubt that under the head of albumoses they were dealing with a great number of compounds, likewise with the peptones. The suggestion for the analysis of glue was obviously a very good one, and the only other point which he might raise was whether the authors of the paper had thought of using the polarimeter, which was so useful in observing the progress of decomposition in the case of starch. So far as protoses were concerned, the Chairman had remarked that no pure specimens had been obtained, but the recent researches of Fischer, in Germany, had already advanced to such a stage that a complex compound related to the protosis could be obtained in a state of purity.

Mr. H. S. Garry said that, on account of the difference of consistency as shown by the statistics, it was evident that a first-class quality of gelatin had been employed. It was possible from the consistencies given to tell exactly where the glues came from, and that in the lowest consistency glue there was a conglomeration of sinews and blood boiled up together. The total amount of nitrogen was due to the source from which the matter was derived.

Dr. Parker said there was no doubt that in the various gelatin factories there was an enormous amount of ignorance as to the nature of gelatin, because it was not definitely known how many gelatins there were. A good many of the tests which chemists employed were worth nothing, but if the method which the authors of the paper suggested would precipitate all the albumoses it would prove to be a very valuable thing.

Mr. Watson said the quality of the resultant gelatin depended upon the percentage of nitrogen of the bodies employed in manufacture.

Mr. Trotman said they did try the polarimeter but the deflexions were not great enough to give satisfactory results. He disagreed with Mr. Garry that the analysis necessarily pourtrayed the origin of the materials used in the manufacture. It seemed to him a curious thing that they always got about 74 per cent. of gelatin by the Kjeldahl method, which went to show that the total amount of nitrogen did not depend upon the origin of the nitrogenous materials used. Whatever they made gelatin from, if they made it properly they could get a good glue. They could make a good bone gelatin and they could make a good skin gelatin. The value of their process was that it showed the manufacturer what amount of gelatin he had got and what amount he ought to get. That was a distinctive advantage.

They did not claim any originality in regard to this, but thought that the examination of glue upon the lines they had suggested was an advance in many of the methods now in use and could give the manufacturer valuable information

NEW METHOD FOR THE ANALYSIS OF TANNI AND TANNING MATERIALS, &c.

BY DR. J. GORDON PARKER AND E. E. MUNRO PAYNE.

(This J., June 30th, 1904, 648—651.)

Discussion on the Total Lime Absorption Figure.

Mr. S. R. Trotman said that in experimenting with thi process he had found that in a few cases the total lim absorption, if taken immediately after shaking, was distinctly greater than at any subsequent period. The difference was sufficiently great to alter the final results to th extent of 5 per cent. As the point seemed somewhat interesting and might require further investigation by thos interested in the process he took advantage of Dr. Gordo Parker's presence to call his attention to it.

Dr. J. Gordon Parker said, in reply, that under certain conditions, especially noted in sumacs, the lime solutio formed at first a precipitate by basic gallate with gallic acid which subsequently dissolved, thus accounting for the fina reading being lower than the first. This point was somewha intimately connected with another he had noted in connection with sumacs, viz., that in some cases practically th whole of the total lime absorption was due to gallotann acid, while in others it was largely due to gallic acid, onl two or three per cent. being gallotannic. This was an important point for tanners, since the gallic acid did no produce true leather. If used merely for bleaching effect these sumacs, containing much gallic acid, might answe very well, but would undoubtedly produce poor leather.

𝔜𝔬𝔯𝔨𝔰𝔥𝔦𝔯𝔢 𝔖𝔢𝔠𝔱𝔦𝔬𝔫.

Meeting held at Queen's Hotel, Leeds, on Monday, October 31st, 1904.

CHAIRMAN'S ADDRESS.

THE UNIVERSITY AND TECHNOLOGY.

BY H. R. PROCTER.

The present year is memorable in the history of scienc in Yorkshire as having witnessed the birth of its fir university. Independence has been forced upon it without i desire, but the necessity having arisen, difficulties have bee met with the accustomed energy of the Yorkshireman, an by private and public liberality funds are being found t make the university one worthy of the county. It therefore an appropriate time to consider in what way the funds can best be administered to promote the well-bein of those, both richer and poorer, who have made conside able sacrifices to provide them; and what objects shoul form the particular aim of a Yorkshire university.

While we cannot hope to compete socially with Oxford and Cambridge, we may reasonably look forward to the time when our university will become a centre of thought and culture for many to whom the older universities are inaccessible, and we hope that it may do much to spread that interest in arts and literature without which no high civilisation is possible, and which is the access to so many of the pleasures of educated life. Much weight must also be laid on the important work which has hitherto been done by the Yorkshire College, and which will be continued and extended by the university, in training teachers for our schools; and it is difficult to estimate the gain to our young people of all classes from being brought under the influence of properly educated teachers, whose mental horizon is not limited to the primary school and the "pupil-teachers' centre."

These services, however, important as they are, are not those which appeal most directly to us as a scientific and technical association; and what I wish more especially to consider, is the direct influence which the university may exert on technology and on trade, and the lines on which, in these respects, it can render the greatest help to the community.

We shall hardly dispute the necessity of a sound foundation of general science for all technology, nor question the wisdom of building up the most perfect teaching departments which we can achieve in order to give it; but what may not be quite so obvious is the need that these departments should not merely teach the elements of their respective sciences, but should be capable of carrying their instruction up to the highest and most recent developments of knowledge. I do not say that the old-fashioned common-places of elementary chemistry are played out, for we all know of industries in which the law of combining proportions would be high science, and of mistakes which the merest schoolboy knowledge should have prevented; but new industries arise out of new knowledge, and it is impossible to say how soon the most abstruse investigation may become the source of important practical progress. How many chemists of the older school are able to discuss the wandering of the ions and their electric potentials, which are subjects of earnest thought to those engaged in the chemistry of such processes as electrolytic soda and bleach nanufacture, or the electrolytic separation of metals; yet we have seen how soon such processes may completely revolutionise an old-established chemical industry. How nany of us have studied, as they ought to be studied, the henomena of catalysis as they affect the sulphuric acid "contact" process, or have fully mastered the intricacies of the "phase-rule" which is shown to have governed the natural separation of the various salts in a salt deposit, and which equally may be applied to the separation by crystallisation of salt-solutions in a chemical works? It is needless to multiply instances; but we want to place in he hands of our young men those weapons which were unknown in our student days, and which we handle, if at ll, with something of the stiffness of middle age. Such eaching needs the resources of a university, and can only be effectively given by the co-operation of the ablest men n the various related sciences working in well-provided aboratories. It is not merely the professors who take heir part in such a training, but of perhaps equal value is he influence of one student upon another, and only those who, like myself, have acquired most of their knowledge y laborious private study, often in loneliness and unsympathetic surroundings, can fully appreciate how our ay would have been smoothed, and how much higher it ight have led, if we had had the advantages which a niversity would have put at our disposal.

In England we have not yet succeeded in enlisting fficiently the highest scientific ability in the cause of dustry. Our greatest masters of pure science rank with ose of any country: but though we can point to many rilliant exceptions, I do not think that the average of ur technical chemists can compare in training, or perhaps en in ability, with their German competitors. As an my depends for success on its officers, so also does an dustry; and if our chemists are inferior, we are bound be driven ultimately from the field, though for a time e may hold the positions which we have won. If my assertion is admitted, and I do not think it will be disputed by anyone to whom both countries are familiar, it is of the utmost importance that we should search for the cause, for I cannot for a moment admit that it lies in any natural inferiority of the English race. Rather, I should be inclined to say, and I have had rather unusual opportunities of observing students of many nationalities, that the Englishman would be well capable of holding his own, if he started with anything like an equal training. Unfortunately this is not usually the case. It is exceptional to find the student fresh from school possessed of a good working knowledge of arithmetic and elementary algebra outside the regular school examples; and this is even more the case with youths from public and upper middle class schools, than with those from the excellent higher grade and modern schools of our cities. A reading knowledge of modern languages is generally conspicuous by its absence, while the foreign student can avail himself of the literature of at least one or two other languages beside his own. This is certainly due to no incapacity in the Englishman, but rather to the conviction on the part of the schoolmaster that a language is mostly important as an exercise in philology and grammar. A mere reading knowledge of any one of the latin or teutonic languages can be attained by most people in a few months of well-directed work, and forms an excellent basis for the more complete study which is needed to write and speak it correctly.

A still more serious difficulty, however, than the want of preliminary training is the lack of inducement to first-rate men to adopt technical chemistry as a profession. It is not to be expected that an able man will encounter the expense and loss of time involved in a four or five years' training such as is common with German chemists, unless he can feel some reasonable certainty of a comfortable livelihood as its ultimate result. If he is possessed of energy and business capacity he will probably find more remunerative ways of spending his time, while the scientific enthusiast finds quite as hopeful a pecuniary result in pure chemistry, and recoils from the narrow routine into which many technical chemists are forced. This condition of things is largely due to the scientific ignorance of manufacturers and business men, to many of whom (I fear I might say to most), a chemist is merely a man who can wash bottles and make an analysis. Now there are plenty of men who can do this, at least when the analysis is not out of their routine, who can be got for from 30s. to 50s. a week, and are very possibly not worth more. A prospect of this sort will not pay for five years' education after school years, or be much inducement to the man who can afford it; and the manufacturer will not see why he should pay more than appears to him to be the market price of the article he wants. Clever as he may be in judging his wares, he does not see that he is getting a chemical labourer instead of a chemist. The labourer has his uses, and is abundant in German laboratories, but he is not there called a chemist, but a "laborant." The only way out of this difficulty seems to me to lie in the better education of the manufacturer. It is in most cases useless for him to suppose, even if he has had an adequate chemical training, that burdened as he is with the business control of a large affair, he can himself devote the time and continuous study necessary to keep his manufacture abreast of the latest scientific thought, and introduce all possible improvements, though, in many cases, if he had adequate aid to develop his practical suggestions, he might do much. But even a far less knowledge than this would enable him to realise the directions in which a first-rate chemist might assist him, and to judge the capabilities of the men at his disposal. Having found the man that he needs, it is a short-sighted policy, commoner I fear in England than in America, to continue to pay him less than his real value. The profits that might be made in many industries by a first-rate chemist under first-rate business management are so large that liberal payment can well be afforded, and if this were given, the fear that your chemist, having learned your technical secrets, might carry them to some better market, would be much less likely to be justified. In this direction, of course, personal reliability is as important as scientific attainments.

Another mistake, which is not confined to English manufacturers, is, having got your ideal chemist, with the rare power of originating and carrying out new ideas, not to give him adequate assistance, but to keep him at routine work, which could be done equally well by the chemical labourer. No man can do more than a limited amount of work, or develop new ideas without time for thought, and I have in my mind a case, not this time in England, where a firm is losing hundreds if not thousands in this way, to save a few pounds a week.

So far I have spoken mainly of purely scientific training, but there are few manufactures in which a chemist trained only in the chemical laboratory can make himself of much use till he has gained experience in the works, and this is true in industries of a purely chemical character, though not to the same extent as in those like my own special branch, in which chemical and mechanical operations are of equal importance. It is not possible that any university or college training can entirely do away with this necessity, but if the gap cannot be entirely avoided, it is worthy of consideration how far it can be bridged or narrowed. This is one of the aims of technological as distinguished from purely scientific teaching. Another aim is to present to the student in a scientific and systematic way the special chemical problems of an industry, and to make clear the underlying reasons for operations, which at the works are often carried on in a purely empirical way, and with little clear understanding of the relation between cause and effect. In order to do this with effect, certain knowledge of the practical methods of the trade is obviously needful. In order to carry out experiments, machines and special apparatus are often necessary, and in the partially mechanical trades a degree of manual skill is required to imitate sufficiently for experimental purposes the processes of the factory. All this must obviously be provided if the university is to undertake technical teaching of more than a purely theoretical kind; and this being so, the question naturally arises as to how far this practical side of the work is to be carried; and the answer will to a considerable extent depend on the circumstances of the trade. The idea which has found favour with the authorities of technical schools has usually been to imitate as far as possible the conditions of the factory in order to give what is called "practical experience." I do not say that this is in every case a mistaken course, but I think very special circumstances are required to render it a wise one, and that these very circumstances usually place it outside the scope of university work. The ordinary evening school technology may in most cases be dismissed as almost a pure waste of public money as regards improvement of trade—a sowing of seeds in untilled and often infertile soil. To improve an industry something more than evening class knowledge is required, and however admirable a little knowledge may be, the working man is rarely in a position to put it in practice. Of course in this estimate I do not include such work as that of the Bradford Technical College, or our own evening classes, which appeal to the class of foremen and works managers, who both need and can use the special information given them. There are also cases in which the actual teaching of a trade in evening schools seems to be justified by public needs. A good instance of this is shoe manufacture. In old times the village shoemaker bought his leather of the village tanner and the village currier, and did the work with his own hands from start to finish. Now a man may spend his entire working life in cutting soles with an eccentric press, or lasting uppers with a lasting machine. However intelligent such a man may be, the factory affords him no scope to learn his trade as a whole, and when a foreman or a works manager is required, it is impossible to find one who has a practical knowledge of the whole manufacture. In this case the trade school comes in to complete the training of the clever workman, and to enable him to realise the relation of his own part of the work to the whole.

A somewhat similar need may be felt in the higher walks of technical education in trades like leather manufacture, where the apprenticeship system has almost completely broken down, and the only way for a young man of moderate means to gain access to leather works is to make himself of sufficient immediate practical value to obtain a post. Apart, however, from these exceptional cases, it is my deliberate opinion that it is no part of the work of a university to teach the manual dexterities of a trade beyond the point which is necessary for successful study and experiment. In fact I think the English manufacturer is apt to waste too much of his son's time on such attainments. For an employer or even a manager it is necessary to know how every part of the work should be rightly done, but he can hardly hope to rival his workmen in manual skill, while it is questionable wisdom to court the possibility of failure. He must know much of which his workmen are ignorant, but need not compete with them in their own department. It is impossible, too, for the University really to give the experience of a factory without transforming itself into one, and as soon as work is on a sufficient scale to give experience, the commercial element must needs come in, and the possibilities of instruction are much lessened. No better teaching in many directions can be given to a student than by the deliberate production of failures in order to ascertain their causes, but this is only possible when the work is on so small a scale that profit and loss can be disregarded. At the same time one may strongly condemn that academic attitude which regards money considerations as of no moment. The cost and practicability of a process should never be lost sight of from the time that any question of practical application arises, though in the study of principles they have no importance.

I have already implied that the University has no place for the slight and superficial technology which is often called "elementary;" but the real scientific elements of the subject it must teach in order to lay a sound foundation, while in my opinion, whatever technology it does touch, it should aim at carrying to the very highest standard which can be attained. To do this, the departments must be staffed with the very best men in their respective branches, and as such men will always have careers open to them outside the academic world, liberal inducements must be offered to secure them, either in direct stipend, or the possibilities of profitable outside work. Again, the maintenance of such departments is necessarily costly, the number of students is at present generally limited, and the space and material required is much larger per student than in the ordinary science course. How then are these expenses to be met? Fees in England are already very high as compared to those in Germany, and many of the young men to whom it is most desirable in the public interest to give a complete education in technology already find the expenses difficult to meet. If fees were raised to such a standard as to pay the present actual cost, the number of students would be so much reduced as again to heavily increase the cost per head, while the numbers educated would be uselessly curtailed. Such education cannot be self-supporting, and we have only the alternatives of letting it drop, or of supporting it by public funds or private liberality. Whatever might otherwise be the economically correct course, we are left little practical choice, since Germany has set the pace and we cannot afford to drop out of the race. Having started we must do it thoroughly, for the prize is only to the winner.

The difficulty, however, is only half overcome when we have found the teaching, we have still to attract the right sort of students in sufficient numbers, and these are not found exclusively or even mainly among the wealthier classes. Originality of mind and the power of continued application to a difficult problem are rare gifts, and still more rare when combined in the same individual, yet they are absolutely necessary for the advanced technical chemist. Men who have them are worth educating even at the public cost, but it is questionable whether we succeed in getting them under our present system of scholarships; the powers which make for success in a school examination often count for very little in after life, and in fact originality rather tends to failure. I think it is worth consideration whether some of the money now spent in scholarships would not be better devoted to a general lowering of fees, so as to make the struggle a more open one, and trust to the "survival of the fittest." But if we are to continue the scholarship system, I should like to see it less dependent on mere examination results than on the opinion of the teacher. It would be no difficult matter for the intelligent schoolmaster to pick out a limited number of his most promising pupils for a year's preliminary university training from those who had passed the test of the school-leaving or matriculation examination. These would come specially under the notice of the University Professors, who would again select or recommend those who should continue for a complete course. No favouritism would be possible, as the Professors would not act individually, but as a board of selection, and would judge not only by the regular examinations but by their personal observation of the work done in classes and laboratories. It would rarely happen that men so chosen would turn out practical failures, though other than purely scientific qualities might be taken into reckoning.

There is, however, another inducement which is needed in addition to scholarships, and which is even more efficient—I mean the reasonable prospect of a remunerative post in the future. It is not necessary, as Sir W. Ramsay remarked in his interesting presidential address, that all the prizes should be large if there are some good ones, and a reasonable chance for the rest. Employers might remember that in offering posts to young men they are not merely in many cases doing a very profitable thing for themselves, but are performing a public service in assisting the great work of education which is to train the captains, if not the generals, of the army of British industry.

So far I have spoken of the University merely as a teaching organisation, but there is another function which I regard as of, at least, equal importance, and which has been carried on in the past under the greatest difficulties—I refer to research, not merely in pure science, but in technology. As regards the application of practical processes already worked out in the laboratory, the manufacturer may be trusted to take care, but there are all sorts of broader issues, which at the moment show no prospect of profit, but which are the foundations of future advance. Unless these are investigated by scientific men, who work not merely for instant reward, and who are independent of the immediate financial result, they will not be investigated at all, and there is nowhere where the work can be done so well or so cheaply as in a university, where both the men and the appliances must be provided for teaching. Even from the teaching point of view there is nothing more calculated to develop the growing mind in the direction of practical and productive work than to see investigation and discovery going on around it, and there is no other way in which a teacher can become a living exponent of advancing science.

If, however, research is to be recognised as an important part of the duty of a university, it must be provided for and encouraged.

Discovery is a thing which cannot be commanded, but must be long and patiently sought, sometimes without result, and always with much planning how the problem is to be attacked, and meditation as to the meaning of the results actually attained. It is often necessary to spend hours apparently doing nothing, but inwardly thinking strenuously. Though this is obvious enough to the discoverer, it is often quite incomprehensible to others. I remember an inventor in the somewhat humbler walks of knowledge complaining to me that when he sat over the fire at nights thinking over his schemes, his wife could not conceive what he was doing and blamed his laziness. I fear that too often the world in general, and specially the employer, adopts the attitude of the wife; and your discoverer is often a sensitive man who dislikes being even tacitly blamed, and turns for safety to the old routine in which immediately tangible results can be shown. It is difficult to put a limit on what might be accomplished in industry by the employer who had sufficient knowledge and tact to sympathise with the intelligent young chemist, to discuss with him the possibilities of advance, and to point out the difficulties which his practical experience told him to expect.

In a university, this want of sympathy and comprehension is not so likely to occur, but on the other hand the want of quiet and uninterrupted time for work is a great bar to success. It is but rarely that odd half hours or even odd hours can be successfully utilised; apparatus takes time to set up, and experiments must often be carried through at one sitting, but above all, time is needed for unbroken thought, only those who have tried can know how a chance visitor or a ring on the telephone can break up a laborious and intricate chain of thought, and how long it takes to get ideas in train again. It is not merely professors but the younger staff whose opportunity for research should be amply provided and carefully guarded, and to the latter it is especially important, since published research is the only means by which they can recommend themselves for the higher posts, the hope of which induces them to work at the low salaries at present paid. For advanced students also simple experimental work on practical problems is the best possible training. For this purpose the University has decided to admit postgraduate students at very much reduced fees, and it is much to be wished that a certain number either of scholarships, and, what would probably be better, of junior posts as research assistants to professors could be created to enable promising students to complete their training in research. Such posts should of course be of a temporary character, say, for one year only, and should be awarded, not by examination, but in recognition of practical work already done.

Discussion.

Prof. A. **Smithells** fully agreed with Prof. Procter's ideas and had never heard a more succinct account of the subject. Many factors had to be considered. Employers said the workmen's attitude often prevented successful application of science to industry. The state of affairs had much improved in the last 20 years, but was still unsatisfactory. He could not see that the professors were to blame. Material was available, but employers expected immediate returns and it was difficult to convince them that time and capital must be spent before results could be obtained. They were often reluctant to let their chemists get practical experience by having the run of the works. In ordinary business valuable services were proportionally well paid, and a good chemist would not be tempted to take his knowledge and experience elsewhere if it were made to his interest to remain.

Mr. F. W. **Richardson** asked what a young man's aim and object was in taking up chemistry. If compelled to become a secondary chemist the outlook was poor. Manufacturers kept chemists testing samples only and expected immediate increases in income, instead of providing time and money for them to improve processes. Chemists often became managers or commercial travellers on account of the low salaries paid. He thought it was important to employ men of originality, and, as examinations were most imperfect tests, some other system was wanted to secure the man of most promising practical ability.

Mr. **George Ward** took exception to the depreciation of technical schools, which he thought were likely to produce in workmen-students more sympathy with, and inclination to try, new and improved processes. He thought a system of bursaries to enable promising workmen to go to universities from technical schools might be useful.

Mr. E. **Breffit**, speaking from an employer's point of view, said that college students although requiring at least three years to learn sufficient to be of value, expected high salaries at once. It had occurred to him that arrangements might be made for scholarship holders to study specified manufactures. He offered to let a college student study glass manufacture at his company's works. The worst manufacturer spoilt the trade of the best, by selling below cost price. In England practically no attention had been paid to the cost of glass manufacture. In Germany and the United States the relative cost of production in all countries had been investigated. He believed that if English industry could not prosper by the application of scientific methods it could not in any other way.

Mr. **Barber** thought examinations did not encourage originality or advance technical knowledge. Unsuccessful candidates often did better work afterwards in research and technology. Manufacturers were now more ready to give their sons technical training. The talent was present in both working and middle classes if only means were devised for getting the original men rather than those who were merely successful in examinations.

Mr. Procter, in reply, said that even if workmen had useful ideas, it was not often that they were in a position to introduce them in practice, and their want of general scientific education rendered it very difficult for them to benefit by advanced technological instruction. It was often difficult to obtain manufacturers' consent for students to see their works, and he thanked Mr. Breffit for his offer.

Obituary.

WILLIAM CHATTAWAY, F.C.S., F.I.C.

Member of the Society of Chemical Industry,
Chief Chemist and Manager for the Society of Apothecaries of London, &c.

William Chattaway was born in 1861, and commenced his professional career in 1877 with Mr. Joseph Young, chemist, Leicester, who with his pharmaceutical profession also united an extensive analytical practice. It was under such auspices that Mr. Chattaway's practical knowledge was gained. Leaving Leicester he proceeded to Paris, where he made the acquaintance of Chevreul. This acquaintance ripened into close friendship, the aged chemist and the younger one keeping in touch with each other until the death of the former. After passing his minor and major examinations, in 1883 and 1885 respectively, William Chattaway went to Sheffield as senior assistant to the late Mr. A. H. Allen, with whom he was associated for seven years, latterly as a partner in a branch laboratory which Mr. Allen had opened in London. Mr. Chattaway rendered Mr. Allen considerable assistance in the compilation of portions of his Commercial Organic Analysis. When the late Mr. R. H. Davies was taken ill, Mr. Chattaway was temporarily appointed as chief chemist and manager of the Apothecaries' Hall, and was confirmed in the appointment when Mr. Davies died in 1893. Mr. Chattaway was also public analyst for the boroughs of Hammersmith and Colchester. He was, moreover, recently commissioned by the Pharmacopœia Committee of the General Medical Council to prepare a digest of published researches and criticisms bearing upon the matter of the latest edition of the British Pharmacopœia. Mr. Chattaway was greatly interested in photography, and had done some good work on colour photography. He died on Oct. 7th, at the age of 43.

Journal and Patent Literature.

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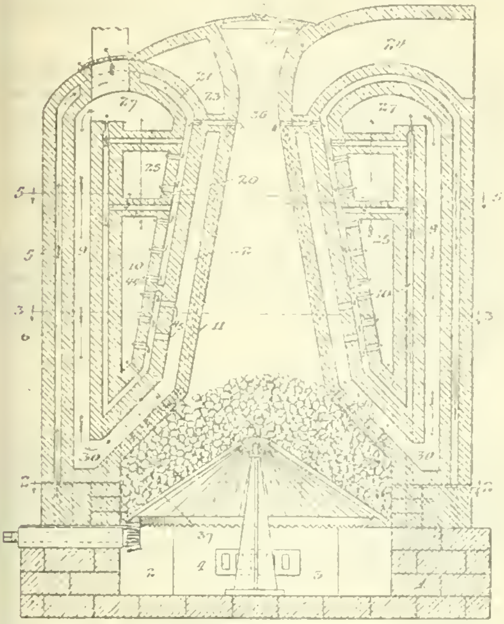
I.—PLANT, APPARATUS, AND MACHINERY.

English Patents.

Furnaces; Impts. in ——. F. J. Doyle, Chicago. Eng. Pat. 22,057, Oct. 13, 1903.

The furnace consists of an outer cylindrical shell 5, supported on a suitable base 1. The dome-shaped grate 37 is supported above the ash-pit 2 by the pillar 38, and can be rotated by the mechanism 42, 40, and 39. The ash-pit 2 has a door 3 provided with an adjustable damper 4 for controlling the supply of the "initial air." Openings in the shell, not shown in the figure, are left at intervals around the grate for stoking. The fuel chamber is formed by the inner sloping wall 11, which, after contracting to the throat at 36, widens again to allow the fuel to be easily charged through the opening at the top, which is closed by the cover 43. The products of combustion pass from the lower part of the fire-box to the primary combustion chamber 25, and thence through the space 27 to the downtake passage 9, through the openings 30, and the uptake passage 22 to the final mixing chamber 23, and away by the passage 24. The air for combustion enters by the passage 6, and flows through the heating passages 21, 20, and 10, one portion going by the openings 44 to the primary combustion chamber 25, and another portion by the perforations 45 to the uptake 22, the direction of the air and gases being indicated by the arrows. Another form of the furnace, applicable to firing a boiler, has an annular fuel chamber,



vith suitable charging hoppers. The gases and heated air, ifter circulating in a somewhat similar manner, finally pass hrough a central vertical chamber to the boiler flues.

—W. H. C.

Pasty or Fluid Substances; Apparatus for Drying ——. A. Huillard, Paris. Eng. Pat. 24,931, Nov. 16, 1903.

An endless band of metal netting is caused to dip in a rough containing the substance to be dried; it thus carries orward a certain quantity of the substance in its meshes, and is passed into a chamber divided by a series of baffle-plates into a number of compartments. The metal band ravels over and under a series of upper guide rolls and a eries of lower driving rolls, arranged alternately, and is hus conducted in a zigzag path through all the compartments, whilst a current of heated air is passed in an opposite lirection. When the metal band emerges from the drying hamber, the dried material is removed by a number of otary brushes. A tension arrangement is provided which eleases the tension on the cloth intermittently by the action f a cam.—J. F. B.

Mixing, Emulsifying, and Homogenising Liquids; Apparatus for ——. G. A. Bonnet, Paris. Eng. Pat. 14,621, June 29, 1904. Under Internat. Conv., July 1, 1903.

See Addition, of June 21, 1904, to Fr. Pat. 333,501 of 1903, ollowing these. —T. F. B.

United States Patents.

Drying Apparatus. F. Meyer, Chicago. U.S. Pat. 771,994, Oct 11, 1904.

A rotary drum, having two annular rows of shelves and a entral tube extending throughout its length, is mounted in heating chamber. The fire gases pass first along the utside of the drum, and return through the same to the utlet. Means are provided for feeding the material to be lried, and for drawing the gases through the drum.

—W. H. C.

Drying Apparatus. H. Hencke, Berlin. U.S. Pat. 773,390. Oct. 25, 1904.

A continuous band passes over and between a series of otating hollow cylinders, which have perforated surfaces, nd are provided with means for sucking air and liquid from their interior. The largest of the cylinders is partly surrounded by a perforated casing, the space between the surface of the cylinder and the casing decreasing in the direction of the rotation of the former, and an outer tank surrounds cylinder and casing. Means are provided for removing the dried material from the band, and for washing the latter.—W. H. C.

Distilling and Evaporating Apparatus. W. H. Gesner, Assignor to the Caribbean Manufacturing Co., New York. U.S. Pat. 773,139, Oct. 25, 1904.

A screw conveyor has a portion of its convolutions solid, and a portion hollow and perforated, with means for supplying heat to the latter. The whole is situated in a perforated tubular case, which is surrounded by a larger, outer, non-perforated casing. The space between the two cases is connected to a condenser, and a current from the apparatus to the condenser is induced by a fan.

—W. H. C.

Centrifugal Machine. T. S. Patterson, New York, Assignor to the Oil and Waste Saving Machine Co., Rochester, N.Y. U.S. Pat. 773,220, Oct. 25, 1904.

The rotating drum of the machine is provided with perforations on its side wall, and is mounted vertically in a steam casing, having a suitable steam inlet and outlet, and a trapped cover. The drum is rotated by means of a turbine placed directly beneath it and in the casing. A pipe is arranged to deliver steam against the vanes of the turbine.

—W. H. C.

Centrifugal Machine [Separator]. A. J. Ericsson, Assignor to Aktiebolaget Separator, Stockholm. U.S. Pat. 773,489, Oct. 25, 1904.

See Fr. Pat. 342,115 of 1904; this J., 1904, 895.—T. F. B.

Furnace. E. Lane, Kansas City, Mo. U.S. Pat. 773,328, Oct. 25, 1904.

The furnace has front and rear combustion chambers, which increase in cross-sectional area from front to rear, and which are separated by a wall, and connected by an opening in the wall and by a flue. A boiler having a flue of increasing cross-sectional area from front to rear, is interposed between the rear combustion chamber and the stack.

—W. H. C.

Filter-Press. J. W. Neill, Salt Lake City, Utah. U.S. Pat. 772,472, Oct. 18, 1904.

The press consists of a vertical cylinder, the bottom of which is formed by the filtering medium, supported by a suitable plate. A reciprocating plunger works in the cylinder and forces the liquid through the filtering medium. Means are provided for actuating the plunger, for feeding the liquid to be filtered, and for controlling the feed.

—W. H. C.

Filtering Apparatus. H. R. Cassel, Colorado Springs, Colo. U.S. Pat. 773,473, Oct. 25, 1904.

A tank is combined with enclosed filtering cells having a suction-pump connected thereto. The apparatus has a removable bottom, with means for raising and lowering the same. Means are provided for withdrawing the "pulp" from the bottom of the apparatus and distributing it at the top.—W. H. C.

French Patents.

Retort Furnaces; Inclined ——. E. Derval. Second Addition, dated June 4, 1904, to Fr. Pat. 321,154, May 3, 1902.

See Eng. Pat. 21,964 of 1903; this J., 1904, 859.—T. F. B.

Liquids; Process for Desiccating [Evaporating] ——. W. D. Neel. Fr. Pat. 344,072, June 15, 1904.

See Eng. Pat. 13,186 of 1904; this J., 1904, 814.—T. F. B.

Heating Fluids of all kinds; Utilising the Heat of [Chemical] Reactions for ——. A. Lang. Second Addition, dated June 17, 1904, to Fr. Pat. 331,997 of May 12, 1903.

In order to set fire to the mixture which, on combustion, is to give out heat, there is embedded in it a conical cup containing a layer of aluminium mixed with some peroxide, and this is covered by a layer of a mixture of magnesium and potassium chlorate. The layer of magnesium is hermetically covered by a plate of celluloid; and this may be ignited by means of a match. (See also this J., 1904 537.)—L. F. G.

Heat liberated by the Crystallisation of Saturated Solutions; Utilising ——. L. J. J. B. Chèneau. Fr. Pat. 344,513, July 1, 1904.

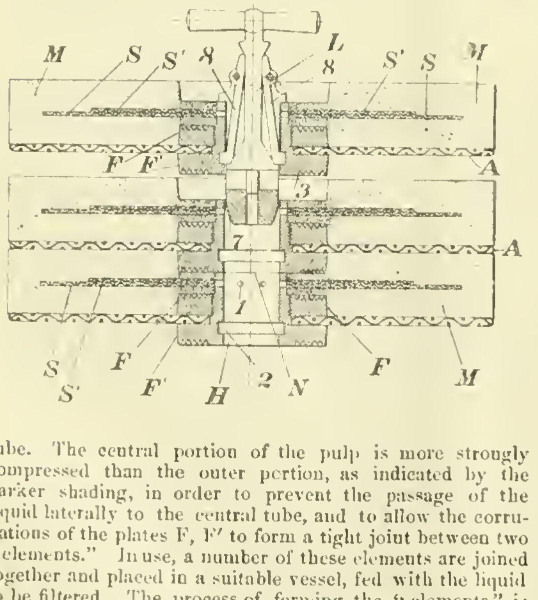
Crystallised strontium hydroxide is dissolved in boiling water to saturation, and the solution is run into suitable vessels, as into the warmers for railway carriages, for supplying heat continuously as long as crystallisation proceeds. The product when cold is stated to be, not a solid, but a pasty mass, putting no strain upon the containing vessel.—E. S.

Filtering Liquids; Apparatus for ——. A. J. Hosier, A. Whatley, and W. Kelly. Fr. Pat. 344,089, June 17, 1904.

The liquid filters through a fine copper or brass sieve contained in a drum suitably rotated, and the residue accumulating on the sieve is swept out by a rotating brush, driven by a belt and pulleys from the shaft rotating the drum, and falls into an outer casing, from which it is removed.—L. F. G.

Filter Element, and Method of Construction. K. Kiefer. Fr. Pat. 344,251, June 24, 1904.

Each "element" of the filter is formed of a metal tube H, having a flange F′ and a collar F, between which a disc of coarse wire gauze A is held, and which serves to separate the "elements" from one another, and to allow the liquid which is to be filtered, to reach the filtering medium. The latter, which consists of two layers of compressed paper pulp M, between which layers of fine wire gauze S, S′, of less diameter than the layer of pulp, are placed. The mesh of this gauze is of sufficient fineness to prevent the fibres of the pulp passing through, but allows the filtered liquid to flow through and away by the openings 1, to the central tube. The central portion of the pulp is more strongly compressed than the outer portion, as indicated by the darker shading, in order to prevent the passage of the liquid laterally to the central tube, and to allow the corrugations of the plates F, F′ to form a tight joint between two "elements." In use, a number of these elements are joined together and placed in a suitable vessel, fed with the liquid to be filtered. The process of forming the "elements" is as follows: A suitable quantity of paper pulp is put into a circular vessel, having a central vertical core, and filter bottom which can be forced upwards. The fine gauze discs are next placed on the surface of the pulp, and then another portion of the latter. The vessel having been closed by a lid, the bottom is forced upwards and the pulp compressed. After releasing the pressure, lowering the central core, and removing the cover, the coarse gauze disc and the central tube are inserted, and the complete "element" removed by a special instrument and placed in the filter.—W. H. C.



Filters; Impts. in ——. Mme. H. Breyer, *née* Mitterbacher, and A. Jurnitschek de Wehrstedt. Fr. Pat. 344,351, June 27, 1904.

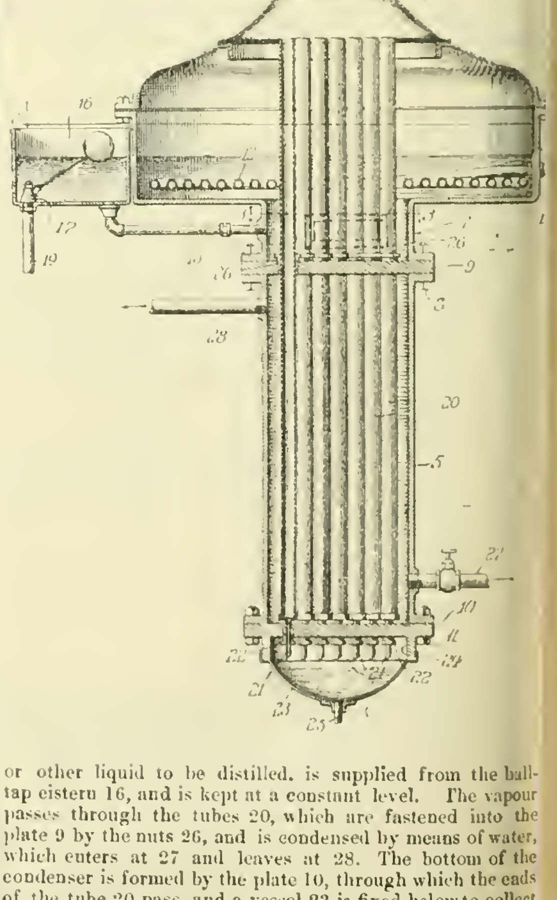
The filtering medium is composed of well-burnt bricks or tiles, reduced to a sufficiently fine condition that the particles adhere to the filter cloth, which is supported on a vertical perforated plate.—W. H. C.

Emulsifying and Mixing Liquids; Apparatus for ——. G. A. Bonnet. First Addition, dated June 21, 1904, to Fr. Pat. 333,501, July 1, 1903.

The liquids to be mixed are forced under pressure into a vertical cylinder, in which slides a piston on which a certain pressure is exerted by a spring. The liquids are then forced through a series of fine holes into a central exit channel, and thus mixed.—L. F. G.

Distillation; Apparatus for ——. I. H. Jewell. Fr. Pat. 344,363, June 28, 1904.

A boiler or still 6 having a cylindrical extension 7, is bolted to a flanged cylinder 5, which forms the condenser. The plate 9, interposed between the flanges, serves to separate the still from the condenser. The still, which may be heated by a steam coil 12, 13, as shown, or by a ring of gas burners placed below, has a dome-shaped cover, part of which, 100, is easily removable. The water, or other liquid to be distilled, is supplied from the ball-tap cistern 16, and is kept at a constant level. The vapour passes through the tubes 20, which are fastened into the plate 9 by the nuts 26, and is condensed by means of water, which enters at 27 and leaves at 28. The bottom of the condenser is formed by the plate 10, through which the ends of the tube 20 pass, and a vessel 23 is fixed below to collect the distillate.—W. H. C.



II.—FUEL, GAS, AND LIGHT.

Benzene in Illuminating Gas; Determination of ——. O. Pfeiffer. XXIII., page 1116.

Soap and Candles; Manufacture of ——. J. Lewkowitsch. XII., page 1100.

English Patents.

Fuels; Method and Apparatus for Determining the Heating Value of Gaseous and Liquid ——. H. Junkers. Eng. Pat. 18,437, Aug. 26, 1904. XXIII., page 1116.

Gas Producers. J. G. Nash, Adelaide, Australia. Eng. Pat. 17,712, Aug. 15, 1904.

A feeding device, comprising a cylinder and reciprocating plunger, is arranged upon the side of the producer for charging bituminous fuel into the incandescent zone of the fuel within the producer. At suitable intervals a quantity of the coal may be allowed to rest in the cylinder until it has become coked by the heat from the interior of the producer, whereupon the coke is withdrawn through a side shoot. At the top of the producer is provided an arrangement for feeding coke or the like, and at the bottom is a water-sealed fire-grate and an inlet for the air blast. The valves controlling the air blast and a blow-off pipe for surplus gas are connected to a gas-holder, so that the production and storage of gas cease when the gas-holder is full. The apparatus is provided at various points with pokers, working through ball-and-socket bearings, for loosening fuel, clearing flues, &c.—H. B.

Gas Retorts [Continuous Carbonisation]. J. Verdier and P. Teulon, Marseilles. Eng. Pat. 18,364, Aug. 24, 1994. Under Internat. Conv., Sept. 2, 1903.

A vertical retort is provided at the top with a feeding device, and at the bottom with a discharging device, each of these consisting of a rotatable plug provided with a cavity. The feeder and discharger are rotated continuously by means of suitable gearing, whilst a conveyor serves to bring fresh coal to the charging hopper and to remove the coke as discharged.—H. B.

Gas-testing Apparatus. A. H. Lymn. Eng. Pat. 23,771, Nov. 3, 1903. XXIII., page 1113.

Cement or Moulded Articles; Apparatus and Process for Utilising Gas Lime or other Calcium Compounds and Clinker, Slag, or other Silicious or Aluminous Material for the Manufacture of ——. J. Bond. Eng. Pat. 23,213, Oct. 27, 1903. IX., page 1091.

Incandescence Bodies for Electric Glow Lamps; Manufacture of ——. C. D. Abel, London. From Siemens und Halske A.-G., Berlin. Eng. Pat. 20,277, Sept. 20, 1904.

Incandescence filaments are made of molybdenum, thorium, tungsten, zirconium, or an alloy of any of these metals with each other, or with other metals fusible with difficulty, the metal or alloy being completely free from all non-metallic substances. The metal is used in the form of drawn wires, preferably drawn from metal which has been fused previously, as, for instance, by passing an electric current through it in a vacuum or in an indifferent atmosphere.—H. B.

United States Patents.

Carbon Analysis; Method of ——. G. O. Seward, Assignor to Eimer and Amend. U.S. Pat. 773,529, Oct. 25, 1904. XXIII., page 1115.

Gas; Apparatus for Manufacturing ——. R. Dempster, Marietta, Ohio. U.S. Pat. 772,224, Oct. 11, 1904.

The apparatus consists of a retort formed of a number of superposed chambers connected together and heated externally. Inside the chambers, perforated tubes, surrounded with a finely-divided packing material, extend from one end to the other. Air-supply pipes lead into one end, and air- and oil-supply pipes into the other end of each of the chambers, the volumes of gas being intermingled by passing through the packing material. See also U.S. Pats. 692,771, 703,901, and 743,468; this J., 1902, 600, 1128; 1903, 1287. —W. C. H.

Gas Producers. J. A. Herrick, Philadelphia, Pa. U.S. Pat. 773,143, Oct. 25, 1904.

The producer is provided with a grated lid, in the openings of which, bricks are seated which extend beyond the inner face of the grating, and their surfaces are exposed to tarry products distilled from fuel in the producer.—W. C. H.

French Patents.

Gas-Retort Furnaces. E. Derval. Fr. Pat. 339,015, Sept. 5, 1903.

The furnace is constructed so as to have a gas-producer and a recuperator situated entirely beneath the retort bench, and separated from one another by the flue which leads to the chimney.—H. B.

Gas-Producer. G. zur Linden. Fr. Pat. 344,069, June 15, 1904.

To prevent the adhesion of clinker to the interior walls of the producer, the walls are kept cool by means of currents of steam. For example, the whole of the lining of the chamber may be provided with perforations and horizontal and vertical slits, through which steam is introduced; or the lining may have the form of a succession of annular, sloping projections, beneath which, when the producer is filled with fuel, there are left open annular spaces into which steam is introduced.—H. B.

Gas or Vapour and Air, or a Mixture of Gas and Air, for Combustion; Method and Apparatus for Obtaining ——. The Scott-Snell, Phillips Syndicate, Ltd. Fr. Pat. 344,020, June 16, 1904.

The apparatus comprises a water-sealed bell, a motor which, acting through a mechanism similar to that used in phonographs, alternately raises and lowers the bell, and a hollow valve (either a slide valve or a rotating valve), which is caused to move synchronously with it, and is brought successively into communication with an air-inlet, a gas-inlet, and an outlet to the main for the mixed gas. During the ascent of the bell, the valve-opening remains in communication first with the air-inlet, and then with the gas-inlet, so that definite proportions of air and gas are aspirated into the bell; whilst during the descent of the latter, the valve opening communicates with the main, into which the combustible mixture is expelled under pressure. An automatic check is provided between the motor and the intermediate driving mechanism, such that the motor does not begin to operate until the latter requires to be wound up again. By enclosing the whole bell within a casing communicating with a modified form of valve, the apparatus may be rendered double-acting, the bell, whilst rising, acting as a compressor upon the gaseous mixture which it has drawn into the casing during its descent, and simultaneously drawing air and gas into its interior, as in the arrangement first described above.—H. B.

Gas-Producers. G. Gautier. Fr. Pat. 344,102, June 17, 1904.

The producer, which is adapted for use with bituminous coal, has an annular boiler surrounding the foot of the combustion chamber, and part of the steam generated is led, along with air, up beneath the rotating conical fire-grate for the production of gas as usual. Another portion of the steam generated, is led through a coil immersed in cold water, and the saturated water-vapour thus obtained is introduced, at various heights, into the interior of the producer, so as to mix with the gas as it is formed. It is said that the water particles bring about a condensation of the heavier tarry matters within the producer itself, where they are burned. The gas is passed through a vertical, tubular washer, where it encounters showers of water, and after further washing it enters a gas-holder, which, when it is quite full of gas, automatically shuts off the supplies of steam and air to the producer.—H. B.

Air Gas; Process of Manufacturing —— in the Cold by means of Liquid Hydrocarbons, Alcohol, &c. E. Gersabeck. Fr. Pat. 344,205, June 22, 1904.

The air is passed through a fixed or rotary carburetter having partitions which cause the air to pursue a tortuous course, the compartments being provided with porous material, the lower portion of which dips into the carburetting liquid.—H. B.

Producer for Weak Gas. N. A. Mongeotte. Fr. Pat. 344,243, June 23, 1904.

A casing, provided with a refractory lining, which constitutes the combustion chamber of the producer, is suspended within two concentric casings, which thus form two concentric annular spaces, at the top of which there is a steam generator surrounding the fuel hopper. The hot gases produced, are led down the outer annular space, so that the entire apparatus is bathed in them, and loss of heat is reduced to a minimum. Two intertwined helical pipes fixed within the outer annular space conduct the air required for combustion, from the outer air to the steam generator, the air thus becoming highly heated. The mixture of steam and air is led down the inner annular space to the foot of the combustion chamber, whence it ascends through the fuel. The elimination of dust from the gas is favoured by the gas having to pursue a helical course between the coiled pipes in the outer jacket, and additional devices for the removal of dust are provided at the base of the apparatus near the outlet.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM AND MINERAL WAXES.

Lignite Tar; Bases in ——. H. Ihlder. Z. angew. Chem., 1904, **17**, 1670—1671.

The author has previously isolated from the bases of lignite tar the three picolines and the $\alpha\alpha'$-, $\alpha\beta'$-, and $\alpha\gamma$-dimethylpyridines. He has sought to isolate, though without success, the $\alpha\beta$- and the $\beta\beta'$-isomerides, the latter of which Ahrens and Gorkow found in coal tar (this J., 1904, 654): but from the fraction of b. pt. 160°—165° C., by fractional precipitation with mercuric chloride, he has obtained, besides the $\alpha\gamma$-isomeride, compounds which he has identified as those of $\beta\gamma$-dimethylpyridine. From the fraction of b. pt. 220°—230° C. he has further obtained a precipitate with mercuric chloride. The small quantity of base regenerated from this did not allow of the determination of its b. pt., but the behaviour of its oxidation product leaves little doubt of its being $\alpha\beta\gamma\beta'$-tetramethylpyridine.—J. T. D.

Petroleum and its Distillation Products; Action of Formalin on —— [Formolit]. A. Nastjukow. J. russ. phys.-chem. Ges., 1904, **36**, 881—898. Chem. Centr., 1904, **2**, 1042—1043.

If sulphuric acid (1 vol.) and formalin ($1\frac{1}{2}$ vols.) be added to refined petroleum (1 vol.), a vigorous reaction ensues, and a solid product separates, which the author names "*formolit.*" It is a yellowish-brown amorphous substance (probably a mixture), infusible, and insoluble in the ordinary solvents. The yield of "formolit" from the distillates of a specimen of petroleum increases with the boiling point of the fraction. The yield of "formolit" from different kinds of petroleum varies; for example, petroleum from Ssurachan and Tiflis yields less than 5 per cent.; that from Tscheleken, Ljakan (Ferghana), Bioagady (near Baku), and part of that from Balachany yield 17—18 per cent.; that from Grosny and Balachany yields 23—24 per cent.; and petroleum from Bibi-Eibat and Kuban yields 37—38 per cent. of "formolit." Experiments with a large number of different hydrocarbons showed that only cyclic, unsaturated hydrocarbons react with formalin. When "formolit" is subjected to destructive distillation, saturated hydrocarbons are mainly obtained; only 6·16 per cent. of the distillate is capable of again reacting with formalin. From the yield of "formolit" the amount of unsaturated cyclic hydrocarbons in a specimen of petroleum can be determined. If the yield of "formolit" be less than 50 per cent., the proportions of sulphuric acid and formalin given above will answer the purpose, but if the yield be 50 per cent. or more, the proportions of petroleum, sulphuric acid, and formalin should be 1 vol. : 2 vols. : 1 vol. The weight of "formolit" multiplied by 0·8 gives the amount of unsaturated cyclic hydrocarbons.—A. S.

English Patents.

Hydrocarbon Derivatives; Process for the Production of Water-Soluble or easily Emulsifiable ——. W. P. Thompson, London. From Ges. z. Verwerthung der Boleg'schen Wasserlöslichen Mineralöle und Kohlenwasserstoffe G. m. b. H., Berlin. Eng. Pat. 22,091, Oct. 13, 1903.

See Fr. Pat. 338,738 of 1903; this J., 1904, 655.—T. F. B.

Vaseline; Process for Production of Water-Soluble or Emulsifiable ——. W. P. Thompson, London. From Ges. z. Verwerthung der Boleg'schen Wasserlöslichen Mineralöle und Kohlenwasserstoffe G. m. b. H., Berlin. Eng. Pat. 22,092, Oct. 13, 1903.

See Fr. Pat. 338,640 of 1903; this J., 1904, 655.—T. F. B.

United States Patent.

Pine Oils from Wood; Process of Manufacturing ——. F. S. Clark and E. A. Harris, Assignors to Georgia Pine Turpentine Co., New York. U.S. Pat. 771,859, Oct. 11, 1904.

The tar and heavy oils are removed by condensation from the vapours arising from the distillation of wood, and steam is introduced into the residual vapours, which are then treated with a caustic alkali (*e.g.*, lime) to remove acetic acid and creosote, the temperature being maintained during this treatment above the boiling point of the lighter oils. The purified vapours are subjected to fractional condensation, to separate the "bad-smelling oils" from the pine oils. —T. F. B.

French Patents.

Pitch; Apparatus for Running-off and Cooling ——. Cie. Paris. d'Eclairage et de Chauffage par le Gaz. Fr. Pat. 344,485, June 30, 1904.

The molten pitch falls from a number of small openings in a tank into a similar number of small troughs situated side by side on the circumference of a wheel, which is rotated in a plane perpendicular to the line in which the orifices in the tank are disposed. This wheel is fixed near the top of a large tank filled with water to such a height that only the small troughs at the top of the wheel at any time are out of the water. Small jets of water are projected on to the pitch as it flows into the troughs, thus causing a sudden cooling. The troughs are normally bottomless, but temporary bottoms are provided for those at the top of the wheel, in the form of plates, which are pressed by springs against the under-side of the troughs. The pieces of pitch in the troughs thoroughly cooled by passing through the water, fall out of the troughs when they reach the lowest position of the wheel, and are received on an endless conveyor, which rotates in the tank, passed thence on to a convenient number of other rotating conveyers, and finally deposited in the buckets of an elevator, which removes them from the tank. A device for forcing the pieces of pitch out of the small troughs when necessary is described, and forms the subject of one of the claims.—T. F. B.

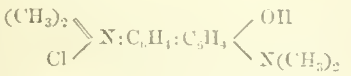
Petroleum; Process for Refining ——. A. J. Durupt. Fr. Pat. 344,129, June 18, 1904.

Petroleum, freed from sulphur compounds, is mixed with stated proportions of such mineral oil as "vaporine," &c., denatured alcohol, and middle oils of coal tar, previously freed from naphthalene and anthracene. The mixture is distilled, the first portion of the distillate being suitable for motor purposes, whilst the remainder is said to consist of a very pure petroleum. The residue, when mixed with rosin or pitch, is stated to be suitable for caulking purposes. —T. F. B

IV.—COLOURING MATTERS AND DYESTUFFS.

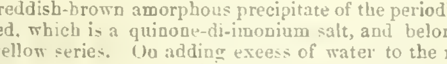
Quinonoid Derivatives of Benzidine. R. Willstätter and L. Kalb. Ber., 1904, **37**, 3761—3775.

Benzidine and its alkyl derivatives give rise, on gentle oxidation, to coloured compounds which form two series of coloured salts, a green series and a yellow one. If tetramethyl benzidine, which is prepared by the oxidation of dimethylaniline, be oxidised with ferric chloride in presence of hydrochloric acid, dark green needles separate out which appear to have the formula $C_{16}H_{21}ON_2Cl + 2H_2O$, but cannot be accurately analysed, as they decompose very rapidly and smell strongly of formaldehyde. The dry substance forms a black-violet powder, and dissolves in water or acetic acid with a deep green colour; mineral acids change the colour to orange yellow. The green salt appears to be half a quinoneimonium salt and half an amino-quinol, and to have the formula—



$$\begin{matrix}(CH_3)_2\\Cl\end{matrix}\!\!>N:C_6H_4:C_6H_4<\!\!\begin{matrix}OH\\N(CH_3)_2\end{matrix}$$

On reduction this gives tetramethyl benzidine. If chlorine be led in excess into a cooled solution of tetramethylbenzidine in alcohol and sulphuric acid, an acid sulphate of the oxidation product crystallises out in red prisms. Analysis agrees fairly with the formula $(C_{16}H_{20}N_2)SO_4.H_2SO_4 + 2H_2O$, but this sulphate is still less stable than the green chloride, and also smells of formaldehyde. It dissolves in water with an orange-yellow colour. The yellow salts appear to be quinone-di-imonium salts, and the sulphate to have the following formula: $HO_4S(CH_3)_2:N:C_6H_4:C_6H_4:N:(CH_3)_2.SO_4H + 2H_2O$. The green chloride dissolves in dilute hydrochloric acid with formation of the yellow chloride, which may be precipitated with platinum chloride as a double salt of the composition $C_{16}H_{20}N_2Cl_6Pt + 2H_2O$. If potassium iodide be added to a solution of the green chloride in 10 per cent. hydrochloric acid, a reddish-brown amorphous precipitate of the periodide is formed, which is a quinone-di-imonium salt, and belongs to the yellow series. On adding excess of water to the red periodide suspended in water, it changes at a certain dilution, into a black body with green reflection; this belongs to the green series, and an atom of iodine has been replaced by a hydroxyl group—



$$I(CH_3)_2:N:C_6H_4:C_6H_4:N:(CH_3)_2.I.I_2 + H_2O =$$
$$HI + \begin{matrix}OH\\(CH_3)_2N\end{matrix}\!\!>C_6H_4:C_6H_4:N<\!\!\begin{matrix}(CH_3)_2\\I.I_2\end{matrix}$$

Sulphur dioxide reduces the green chloride and forms a mixture of a mono-sulphonic acid of tetramethylbenzidine, m. pt. 261°·5 C. and of tetramethylbenzidine. The symmetrical N, N′-dimethylbenzidine is prepared as follows:—Benzidine is dissolved in water and treated first with toluene sulphochloride and then with caustic soda; the ditoluene sulphamide, $(.C_6H_4.NH.SO_2.C_7H_7)_2$, is then methylated with dimethyl sulphate, and the compound formed, $(.C_6H_4.N(CH_3).SO_2.C_7H_7)_2$, is heated with sulphuric acid to liberate the free N, N′-dimethylbenzidine, $CH_3.HN.C_6H_4.C_6H_4.NH.CH_3$, which crystallises from ligroin in snow-white feathery crystals, melting at 74°—76° C. On oxidation, dimethylbenzidine shows very similar colour reactions to the tetramethyl compound. Ferric chloride forms a green quinonoid chloride. Platinum chloride precipitates a double salt in golden-brown prisms, from a solution of the green chloride in 20 per cent. hydrochloric acid. This has the formula $C_{14}H_{16}N_2Cl_6Pt + H_2O$, and is a quinone-di-imonium salt of the yellow series.—A. B. S.

Acetone-dioxalic Ester (Desmotropy and Dyeing Properties). R. Willstätter and R. Pummerer. Ber., 1904, **37**, 3733—3740.

Acetone-dioxalic ester, which is obtained by the action of sodium ethylate on a mixture of acetone and oxalic ester, consists of a mixture of two desmotropic forms. One of these, which forms the chief product of the reaction, is nearly colourless, and forms prisms melting at 104° C. This body has no dyeing properties, and appears to be the mono-enolic form, and to have one of the following formulæ:—$COOR.CO.CH:C.(OH).CH_2.CO.COOR$ or $COOR.CO.CH_2.CO.CH:C(OH).COOR$. The second form can be obtained from the first by treating it with caustic soda solution, and liberating the free ester with hydrochloric acid. It is apparently the di-enolic form with the following formula: $ROOC.C.(OH):CH.CO.CH:C.(OH).COOR$. It forms lemon-yellow needles, m. pt. 98° C. The alcoholic solution dyes wool a deep yellow fast to spirit; acid prevents the dyeing. On chrome-mordanted wool it gives a brownish-yellow shade at once, but on long boiling, the ester is decomposed and the saponification products fixed on the wool. Alkalis convert the mono- into the di-enolic form, whilst acids have a "ketonising action" and reverse the process. It is interesting to note that this is the first nitrogen-free dyestuff of the fatty series.

—A. B. S.

Triphenylmethyl. X. M. Gomberg and L. H. Cone. Ber., 1904, **37**, 3538—3547. (See this J., 1904, 711.)

It has been shown previously that triphenylmethyl is oxidised by the air to triphenylmethyl peroxide. Determinations of the amount of oxygen absorbed showed that the reaction proceeds quantitatively according to the equation—

$$2(C_6H_5)_3C + O_2 = (C_6H_5)_3C.O.O.C(C_6H_5)_3.$$

Determinations of the amount of the peroxide produced by weighing the oxidation product after purifying it by washing with ether, in which the peroxide is insoluble, gave results corresponding to a yield of 80 per cent. The low yield appears to be due to the decomposition of the peroxide formed, an oily substance soluble in ether being produced. By the action of sulphuric acid, triphenylmethyl peroxide is decomposed at the ordinary temperature, according to the equation—

$$(C_6H_5)_3C.O.O.C(C_6H_5)_3 + H_2O = 2(C_6H_5)_3C.OH + O,$$

a yield of 80 per cent. of the theoretical amount of triphenylcarbinol being obtained. The oxygen produced is not evolved in measurable quantities, but acts, in the nascent state, on a portion of the carbinol. Triphenylmethyl peroxide dissolves in sulphuric acid to a deep red solution, in the same way as triphenylcarbinol, the colour being probably due to formation of triphenylmethyl sulphate. The latter compound was prepared by acting with silver sulphate on triphenylchloromethane dissolved in liquefied sulphur dioxide. It is a dark red substance, and forms solutions of an intense red colour. By treating triphenylmethyl peroxide with halogens under varying conditions, triphenylbromomethane pentabromide, triphenylmethyl bromide, triphenylbromomethane penta-iodide, and triphenylmethyl chloride were prepared. By the action of phosphorus pentachloride on triphenylmethyl peroxide above 100° C., the primary reaction products appear to be benzophenone chloride and triphenylmethyl chloride, but the latter decomposes further with formation of diphenylenephenylmethane. A solution of triphenylmethyl in benzene is rapidly decolorised when exposed to direct sunlight, the weight of the product after the exposure amounting to 105 parts for each 100 parts of triphenylmethyl; 65 per cent. of the final product consists of triphenylmethane. In carbon tetrachloride solution the decomposition proceeds more rapidly, but no triphenylmethane is produced. In neither case could hexaphenylethane be detected in the product after exposure to light.—A. S.

Rosaniline; The Triboluminescent Parent-Hydrocarbon of ——. A. Bistrzycki and J. Gyr. Ber., 1904, **37**, 3696—3699.

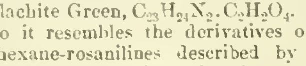
Specimens of diphenyl-*m*-tolylmethane obtained by the authors (this J., 1904, 542) and by Hemilian synthetically, and of the root hydrocarbon of rosaniline, prepared by E. and O. Fischer, are found to be identical as regards melting point, behaviour towards sulphuric acid, and crystalline structure; also they all exhibit a feeble blue triboluminescence; that shown by Fischers' hydrocarbon is much feebler than in the other specimens, but this property appears to depend largely upon the size and form of the crystals. Hence there appears to be no doubt as to the identity of the three specimens. Neither diphenyl-*o*-tolylmethane, nor diphenyl-*p*-tolylmethane, nor diphenyl-*m*-tolylcarbinol exhibit this triboluminescence. On gentle oxidation, diphenyl-*m*-tolylmethane is converted into the carbinol, whilst more energetic oxidation results in the formation of triphenylcarbinol-*m*-carboxylic acid.—T. F. B.

Tetrahydroxycyclohexane-Rosanilines. J. Schmidlin. Comptes rend., 1904, **139**, 676.

LAMBRECHT and Weil have recently described a colourless oxalate of Malachite Green, to which they ascribed the formula $C_{23}H_{26}ON_2.2C_2H_2O_4.3H_2O$. This salt loses 4 mols. of water when heated at 70° C., forming the coloured oxalate of Malachite Green, $C_{23}H_{24}N_2.C_2H_2O_4$. In its other properties also it resembles the derivatives of the tetrahydroxycyclohexane-rosanilines described by the author (this J., 1904, 979), who considers that the 3 mols. of water shown in Lambrecht and Weil's formula do not represent water of crystallisation, but enter into the constitution of the compound, which may be represented by the formula $[C_2H_2O_4.(CH_3)_2N.C_6H_4](C_6H_5)CH[C_6H_6(OH)_4.N(CH_3)_2.C_2H_2O_4]$. It is probable, however, that one of the hydroxyl groups is united to the methane carbon, as the colourless oxalate is obtained by the direct action of oxalic acid on Malachite Green carbinol. This fact is considered by the author to be a proof of the intermediate formation of hexahydrobenzene derivatives in the transformation of the benzenoid carbinol compounds into the coloured quinonoid rosaniline salts.—A. S.

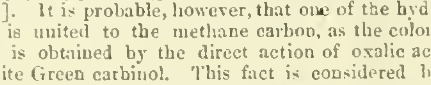
Methinammonium Dyestuffs. H. Rupe and G. L. M. Schwarz. Z. Farben- u. Textil-Ind., 1904, **3**, 397—402.

IF acetylated-β-naphthylamine be melted with phosphorus pentasulphide a thioacetnaphthalide is formed, which, on oxidation with potassium ferricyanide, gives β-naphthothiazole. The latter condenses with benzaldehyde and its derivatives when heated together with zinc chloride in an atmosphere of carbon dioxide. Benzaldehyde gives cinnamenylnaphthothiazole—



$$C_{10}H_6\langle S, N \rangle C.CH:CH.C_6H_5$$

o-Aminocinnamenyl-β-naphthothiazole is obtained by reducing *o*-nitrocinnamenyl-β-naphthothiazol. The hydrochloride of this base dyes tannined cotton in yellow shades, which are, however, not fast. Its formula may be written in the quinonoid form thus—



$$C_{10}H_6\langle S, N \rangle C.CH_2.CH(1):C_6H_4:NH_2Cl(2)$$

The corresponding meta compound has no dyeing properties, and cannot be represented by a quinonoid formula. The para compound dyes better than the ortho. The corresponding compounds of α-naphthothiazole show similar dyeing properties. The amino derivatives of both cinnamenylnaphthothiazoles are dyestuffs when the NH_2 group is in the ortho or para position to the $-CH=CH-$ group. The meta derivatives have no dyeing properties. A quinonoid formula can be written for the former, but not for the latter.—A. B. S.

Aromatic Esters; Electrolytic Reduction of ——. C. Mettler. XI. A., page 1096.

English Patents.

Sulphurised [Sulphide] Dyestuffs; Manufacture of New ——. E. E. Naef and I. Levinstein (Levinstein, Ltd.), Manchester. Eng. Pat. 26,700, Dec. 7, 1903.

PARANITROSOPHENOL, *p*-nitroso-*o*-cresol, or homologous or analogous compounds are condensed with aminosulphonic acids of the benzene or naphthalene series which have the *p*-position to the amino group unoccupied. The resulting solution is precipitated by means of sodium carbonate, and the precipitate either converted directly into a sulphide dyestuff by treatment with sodium polysulphides, or reduced to leuco-indophenol (*e.g.*, with sodium sulphide), and then converted into the dyestuff, which is separated from the melt by treatment with mineral acid or with air. Dyestuffs obtained as above dye unmordanted cotton greenish-blue shades, fast to acids and light.—T. F. B.

Anthracene Series; Manufacture of Colouring Matters of the —— [Anthracene Dyestuffs]. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 712, Jan. 11, 1904.

SEE U.S. Pat. 767,259 of 1904; this J., 1904, 1025.—T. F. B.

United States Patents.

Indoxylic Compounds; Process of Making ——. W. Behaghel and G. C. Schumann, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 772,775, Oct. 18, 1904.

"INDOXYLIC compounds" are obtained by melting with alkali hydroxide hydroxyethylamino derivatives of aromatic hydrocarbons (*e.g.*, hydroxyethylaniline) in presence of a dehydrating agent.—T. F. B.

Trioxyanthraquinone Dye [Anthracene Dyestuff]. L. Wolman, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 772,857, Oct. 18, 1904.

SEE Fr. Pat. 342,195 of 1904; this J., 1904, 898.—T. F. B.

Sulphur Dye [Sulphide Dyestuff]; Yellow ——, and Process of Making same. A. Schmidt and O. Rhodius, Assignors to Farbwerke vorm. Meister, Lucius und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 773,346, Oct. 25, 1904.

SEE Eng. Pat. 21,945 of 1903; this J., 1904, 819.—T. F. B.

French Patents.

Yellow Monoazo Dyestuff; Manufacture of —— from o-Amino-p-sulphobenzoic Acid and Phenylmethylpyrazolone. Cie. Parisienne de Couleurs d'Aniline. First Addition, dated July 23, 1903, to Fr. Pat. 338,531 of March 30, 1903.

ACCORDING to the original patent (this J., 1904, 657, and 1903, 862) a yellow dyestuff suitable for the preparation of lakes is obtained by diazotising *o*-aminobenzoic-*p*-sulphonic acid and combining the diazo compound with phenylmethylpyrazolone. According to the present addition the *o*-aminobenzoic-*p*-sulphonic acid is replaced by either o-toluidinesulphonic acid ($CH_3 : NH_2 : SO_3H = 1.2.4$) or its isomer ($CH_3 : NH_2 : SO_3H = 1.2.5$). The diazo compounds are combined with phenylmethylpyrazolone in alkaline solution. The dyestuffs form yellow powders soluble with difficulty in cold, but easily in hot water. The lakes obtained from them are redder in shade than those from the compound described in the original patent. They are said to be very fast to light.—E. F.

p-Acetylalkylamino-o-aminophenol-o-sulphonic Acid, and Monoazo Mordant Dyetuffs [Azo Dyestuffs] Derived therefrom; Preparation of ——. L. Cassella and Co. Fr. Pat. 338,980, Aug. 12, 1903.

ACETYLALKYL-*p*-PHENYLENEDIAMINE is diazotised and boiled, thus forming *p*-acetylalkyluminophenol. On sulphonation at 50°—60° C. with 100 per cent. sulphuric acid, this forms 1-phenol-4-acetylalkylamino-2-sulphonic acid, which is nitrated at 10°—15° C. by addition of nitrosulphuric acid to the sulphonation mixture, forming 6-nitro-1-phenol-4-acetylalkylamino-2-sulphonic acid. This is reduced to 6-amino-1-phenol-4-acetylalkylamino-2-sulphonic acid by means of sodium sulphide. This acid is converted by nitrous acid into a readily soluble yellow diazo compound which combines with amines and phenols, for instance, with resorcinol, β-naphthol, 1.5- and 2.3-dihydroxynaphthalene 1.4-naphtholsulphonic acid, 1-naphthol-3.6-disulphonic acid, β-naphthol-β-sulphonic acid, 2.7-naphtholsulphonic acid, β-naphtholdisulphonic acid R, 1.8-dihydroxynaphthalene-4-sulphonic acid, 1.8-dihydroxynaphthalene-3.6-disulphonic acid, *m*-phenylenediamine, *m*-toluylenediamine, 1.5-aminonaphthol, 2.8-aminonaphthol-6-sulphonic acid, 1.8.4-, 1.8.5-, 1.6.3-, and 1.7.3-aminonaphtholsulphonic acids, 2.3-aminonaphthol-6-sulphonic acid, 1.8-aminonaphthol-3.6-disulphonic acid, and 1.8-aminonaphthol-2.4-disulphonic acid, to form monoazo mordant dyestuffs, said to give bright, even shades of great fastness. The diazotised acetylethyl acid combines with β-naphthol to form a dyestuff which dyes wool in reddish-brown shades, turning to violet-black on after-treatment with bichromate. With 1.8-dihydroxynaphthalene-3.6-disulphonic acid it forms a dyestuff which gives violet shades on wool, turning to bright blue on after-treatment with bichromate.—E. F.

Tetrazophenol Sulphonic Acid, and an Azo Dyestuff Derived therefrom; Process for making a ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 339,004, Aug. 27, 1903.

See Eng. Pat. 18,283 of 1903; this J., 1904, 818.—T. F. B.

Orthohydroxyazo Dyestuffs Susceptible to Chroming on the Fibre; Production of ——. Badische Anilin und Soda Fabrik. Second Addition, dated April 27, 1904, to Fr. Pat. 338,819, Dec. 17, 1903.

Instead of using chlorine or hypochlorites for replacing the *o*-sulphonic group of 1.2- or 2.1-diazonaphthalenesulphonic acids, or the sulpho- or chloro-derivatives of these, by a hydroxyl group, other oxidising agents may be employed, for example, hydrogen peroxide, alkali peroxides or persulphates, &c. (See this J., 1904, 820 and 1026.) —T. F. B.

Dyestuff containing Sulphur [Sulphide Dyestuff]; Process for Producing a Deep Blue ——. K. Oehler. Fr. Pat. 344,274, June 13, 1904.

See Eng. Pat. 12,270 of 1904; this J., 1904, 863.—T. F. B.

Lakes; Production of —— [from Azo Dyestuffs]. Farbenfabr. vorm. F. Bayer et Cie. Fr. Pat. 344,395, June 28, 1904.

Orange to bluish-red lakes are obtained by precipitating on a suitable substratum, in the usual way, the azo dyestuffs produced by combining the diazo derivative of aniline-*o*-sulphonic acid or its homologues or derivatives with naphtholsulphonic acids. Yellowish-red lakes are produced by combining the diazo derivatives of aniline-*o*-sulphonic acid or of 1.2.4-anilinedisulphonic acid with 1.4-naphtholsulphonic acid. Orange lakes are obtained from aniline-*o* sulphonic acid and 1.5-naphtholsulphonic acid or 2.6.8-naphtholdisulphonic acid. Red lakes result from combining the diazo derivative of monoacetyl-*p*-phenylene diaminemonosulphonic acid ($NH_2:CH_3.CO.NH:SO_3H$ = 1.4.6) with 2.8-naphtholsulphonic acid, or of *p*-toluidine-*m*-sulphonic (1.4.6) with 1.4-naphtholsulphonic acid, whilst a bluish-red lake is obtained from the above-mentioned acetyl-*p*-phenylenediaminesulphonic acid and 1.3.8-naphtholdisulphonic acid.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Silk and Wool as Dyestuff Components. H. Pauly and A. Binz. Z. Farben- u. Textil-Chem., 1904, **3**, 373—374.

Among the products into which albumin can be resolved, two compounds, namely, tyrosine, $HO.C_6H_4.CH_2.CH(NH_2).COOH$, and histidine, probably of the formula $(C_3N_2H_3)CH_2.CH(NH_2).COOH$, are found, which are capable of combining with diazonium compounds. With diazobenzenesulphonic acid the first of these gives, in a solution rendered alkaline with sodium carbonate, a deep red, the second a bluish red coloration. In acid solutions both yield yellowish-orange colorations. The compounds thus formed, dye wool from acid baths, but the baths are not exhausted. The compound derived from tyrosine dyes wool in the same shade as this fibre is dyed by the diazo compound itself. No other albumin decomposition product as yet examined gives similar compounds. The above and similar dyestuff compounds may be obtained with tyrosine and histidine while these are in the combined state, in the form of albuminoids. Moreover, those albuminoids which on hydrolysis are resolved into tyrosine and histidine yield them, but, on the other hand, those, *e.g.*, salmin, scombrin, and clupein, which, when so decomposed do not furnish tyrosine or histidine, do not give them. On hair, finger-nails, wool (keratin) and raw silk (fibroin and sericin), which, when decomposed, yield tyrosine but no histidine, the colorations produced by diazo compounds are hence, it would seem, formed through the intermediary of the tyrosine which these products contain. The colorations formed upon wool, in which 3—4·58 per cent. of tyrosine is present, are less intense than those produced upon silk, from which up to 10 per cent. of the base has been obtained. Those produced upon wool are, however, slightly deeper, when the fibre, before treatment with the diazo compounds, is boiled with 4 per cent. of its weight of sulphuric acid, diluted with water, as in the application of azo dyestuffs to it. Raw silk is coloured more highly than boiled-off silk. This may be due to the fact that more tyrosine is present in sericin than in fibroin, or it may be that the latter substance, in the process of boiling-off, loses some of the tyrosine present in it. When wool and silk are jointly oxidised (by bromine) with dimethyl-*p*-phenylenediamine, in a bath containing sodium acetate and acetic acid, the fibres are dyed grey, while the solution is coloured crimson. These colorations are not produced when the fibres and the diamine compound are oxidised separately. When a solution of tyrosine is used instead of the fibres, a compound of the same color as that of the dyed fibres is formed and precipitated. Similar colorations are obtained with 1.4-aminonaphthol. The colorations thus obtained resemble those produced upon hair and feathers by the oxidation upon them (by the air) of *p*-diamines and *p*-aminophenols (see Eng. Pat. 2525 of 1889; this J., 1890, 174), compounds of the same class being no doubt produced in each case.—E. B.

Dyeing; Theory of ——. R. Willstätter. Ber., 1904, **37**, 3758—3760.

The author has investigated the action of racemic compounds on wool with a view of obtaining evidence as to whether the dyeing of animal fibres depends on chemical or physical changes. Assuming the dyeing to be occasioned by chemical reactions, *i.e.*, by the formation of salts, it follows that the fibre, being optically active, would split up the racemic dyestuff. The author's experiments do not, however, support this contention. Decomposition does not occur; in each case racemic material was found in the bath and on the fibre. Owing to the want of suitable material the experiments were not performed with racemic dyestuffs, but with alkaloids, it having been proved that substances such as atropine, homatropine, and tropacocaïne behave like basic dyestuffs towards animal fibres. From solutions of their salts the alkaloids are taken up as such by fibres, and in this respect they resemble the tannin dyestuffs. Excess of acid was found to retard the progress of absorption, whilst with an insufficient quantity of acid a larger proportion of alkaloid was taken up. Neither the alkaloid absorbed by the fibre nor that left in the bath had undergone any change in optical character.—D. B.

Acid Indigo Discharge Bath [Calico Printing]; Omission of Oxalic Acid from the ——. Schaposchnikoff and Kadygrob. Z. Farben- u. Textil-Chem., 1904, **3**, 374—377.

Schaposchnikoff and Michirew have already pointed out the possibility of dispensing, with considerable economy, with the use of oxalic acid in the acid bath employed in discharging indigo-dyed tissues printed with alkali chromates, and of using for this dilute sulphuric acid alone, the necessary oxalic acid being added to the potassium chromate printing mixture in the form of potassium oxalate. Prud'homme (this J., 1903, 359) has also made some experiments with the same object (see also this J., 1904, 932). In the present series of experiments a cotton tissue dyed on the large scale a dark shade of indigo was used. The proportion of chromic acid required to discharge the indigo upon this was determined by dipping strips of it in solutions containing various proportions of potassium bichromate, squeezing, and immersing for 15 seconds, at a temperature of 65° C., in a bath containing 120 grms. of concentrated sulphuric acid and 60 grms. of crystallised oxalic acid per litre. The minimum proportion required was thus found to be that contained in a solution of 30 grms. of potassium bichromate (equivalent to 39·6 grms. of potassium chromate) per litre.

The Proportions of Chromic and Oxalic Acids which are most Effective in Discharging Indigo.—Strips of the dyed tissue were saturated with solutions containing various proportions of potassium chromate and oxalate, squeezed, and steeped for 15 seconds, at a temperature of 65° C., in a bath containing 120 grms. of concentrated sulphuric acid per litre. Complete discharges of the indigo were produced with the following mixtures:—(i) 1 mol. proportion (39·6 grms. per litre) of potassium chromate and 3½ mol. proportions (1 mol. prop. = 37·6 grms. per litre) of potassium oxalate; (ii) 1½ and 3; (iii) 2 and 2½; (iv) 2½ and 2; and (v) 3 mol. prop. of the first and 1½ mol. prop. of the second salt, the best results being, however, obtained with mixtures (ii) and (iii).

Influence of Temperature.—At a temperature of 65° C. 60 grms. of concentrated sulphuric acid per litre were required to produce a discharge. At 80° C. this proportion could be reduced to 50 grms., and at 100° C. to 30 grms. per litre, without detriment to the result.

Duration of the Action.—The action is complete in 15—20 seconds.

Influence of Thickening Agents upon the Reaction.—A portion of a solution containing per litre 112·8 grms. of potassium oxalate and 59·4 grms. of potassium chromate was thickened with British gum at the rate of 400 grms. per litre. It was then applied to the tissue by machine-padding, the tissue being dried and immersed in sulphuric acid. The effect of the gum on the reaction was found to be slight, the admixture of the proportion mentioned reducing the discharging action to the extent of about 5 per cent.

Printing Mixtures Recommended.—Proportions considered suitable for printing, for discharging with dilute sulphuric acid, are, for a white discharge upon dark indigo dyed tissues, 103 grms. of potassium oxalate and 87 grms. of potassium chromate, dissolved together in 250 grms. of hot water and thickened with 560 grms. of British gum (1 : 1); and for a yellow discharge, 500 grms. of lead chromate (75 per cent. paste), 210 grms. of blood-albumin solution (2:3), 170 grms. of gum-tragacanth paste (6:100), and 40 grms. of water, to which, after stirring well together, 60 grms. of potassium chromate and 50 grms. of potassium oxalate, both salts in a state of fine powder, are added.

—E. B.

Monobromo-Indigo in Dyeing and Printing. A. Sansone. Rev. Gén. Mat. Col., 1904, **8**, 321—323.

The shades obtained with monobromo-indigo are more beautiful and redder than those obtained with artificial indigo; they are also faster to rubbing and bleaching agents, but not so fast to light in pale shades. The ordinary sulphate of iron and lime or zinc and lime vat do not give good results with the monobromo-indigo. Hydrosulphite gives good results. The following is an example of the method of preparing the vat. Mix 500 grms. of monobromo-indigo with 1000 grms. of zinc powder and a little water, so as to make a paste, then add 2 litres of sodium bisulphite solution (30° B.), and 500 grms. of caustic soda in small pieces, allow to stand for one hour with occasional stirring, and then make up to 100 litres with water.

—A. B. S.

Silk Printed with a Fatty Reserve; Dyeing ——. J. Haas. Oesterr. Wollen- u. Leinen-Ind., 1904, **24**, 1135. Chem.-Zeit., 1904, **28**, Rep. 313—314.

The method of dyeing silk which has been printed with a fatty reserve gives small white effects on coloured grounds. The reserve is prepared by heating together for one hour 3 kilos. of colophony, 250 grms. of wax, 200 grms. of spermaceti, 200 grms. of paraffin, and 200 grms. of talc, and then, after cooling somewhat, adding 1½ litres of turpentine. The "mastic" so obtained can be made thicker or thinner by reducing or increasing the amount of turpentine. During the printing the "mastic" is gently warmed, and the fabric is strewn with "Terre de Sommière," a white chalky earth. The reserve dries in the course of 2—3 days. The material is then passed through cold water acidulated with hydrochloric acid to remove the chalky earth, and is finally dyed in a cold bath acidulated with hydrochloric acid. Basic dyestuffs are used, except for black, which is produced by passing the material once or twice during 1—2 hours through an "iron bath of 5° strength," well washing, and dyeing for 1—2 hours in a cold bath of logwood together with some fustic. For Navy blue, a mixture of Malachite Green and Diamond Fuchsin is used, and for reds, mixtures of Safranine, Rhodamine 6 G, Grenadine, Auramine, and Phosphine. After dyeing, the material is washed, wrung out, dried, and the reserve removed by treatment with petroleum benzine for 20—30 minutes in a suitable apparatus.—A. S.

Fabrics for Binding; Finishing of ——. O. Picquet. Rev. Gén. Mat. Col., 1904, **8**, 328—340.

Colouring.—Calico for coloured bindings is either dyed (common colours) or printed (extra colours). It is very important for the colours to be fast to rubbing and also to light. They must also be fast to glue. For the dyed colours the material is usually mordanted with tannin, and fixed with tartar emetic or an iron salt, according as a light or dark shade is needed; it is then dyed with a suitable basic dyestuff. After dyeing, the material is frequently brought to the required shade by means of a coloured finish. In some cases the cotton is dyed with acid dyestuffs from a concentrated salt bath. For printed colours, alumina lakes are usually employed, thickened with starch. The mineral colours, such as Prussian Blue, Chrome Yellow, Ultramarine, &c., are also used, as well as Aniline Black. The pieces are passed through the printing rollers (which are engraved with fine lines or dots) from four to six times, being moistened between each passage.

Finishing.—If the material is sufficiently coloured it is finished with a white finish containing 36 kilos. of white starch, 1½ kilos. of gelatin, and 3 kilos. of tallow or lard per 200 litres. The dyed cloth is usually finished with a coloured finish, which contains, besides the starch flour and gelatin, the requisite dyestuffs, together with a tannin material if basic dyestuffs be used, or alum if acid dyestuffs be employed. The finish is applied to the cloth on one side, two or more times, as necessary, and is always used hot. The pieces are then thoroughly moistened and left rolled up over night in readiness for the next process.

Calendering.—The moistened pieces are then passed between heated steel friction rollers, which smooth the surface and do away with any irregularities in the material.

Embossing.—The pieces which are required to have a raised pattern are then passed, still in a slightly moist state, between two rollers, one of which is made of copper or steel and is engraved with the required design, whilst the other is made of paper or compressed cotton.—A. B. S.

English Patents.

Alkaline Chlorides and Oxychlorides; Preserving the Strength and Keeping Powers of Solutions of —— employed for Bleaching, Disinfecting, Separation of Metals, and other such like purposes. G. J. Atkins, and Oxychlorides, Ltd. Eng. Pat. 25,972, Nov. 27, 1903. VII., page 1088.

Yarns and Fabrics; Dyeing of ——. A. R. Donisthorpe, G. White, and G. E. Ellis, Leicester. Eng. Pat. 25,400, Nov. 21, 1903.

The yarn is dyed in the hank, parts of the hank being in turn immersed in dye-baths of different colours, so that the dyed yarn has definite lengths dyed with different colours. On weaving, the various colours show up in the cloth as if the latter had been woven with different-coloured yarns.

—A. B. S.

Multi-coloured Dyeing of Yarns, &c. A. R. Donisthorpe and G. White, Leicester. Eng. Pat. 25,611, Nov. 24, 1903.

The wool rovings are reeled into hanks, and the latter are then dyed in several colours by immersing only part of the hanks into each colour, so as to get various colours on the same hank. The parti-coloured rovings are then spun, either alone or with other rovings, so that the yarn obtained shows mixed effects.—A. B. S.

Dyeing Hanks of Yarn. L. Destrée and A. Wiescher, Haren-lez-Vilvorde, Belgium. Eng. Pat. 17,240, Aug. 6, 1904.

Several hanks of yarn are spread out side by side, in the form of skeins, upon two sticks, placed parallel to each other, and provided with devices to prevent lateral slipping. The sticks are then fastened by means of hooks or clips, externally to the skeins, each to a stick belonging to another pair of sticks, upon which hanks are similarly spread, this being repeated with the sticks at the ends, until the chain produced is long enough for conveyance by means of rollers through a dye-bath. The hanks are then dyed in the same manner as tissues.—E. B.

Printing of Textile Fabrics; Machine for ——. Sir W. Mather, Manchester. Eng. Pat. 21,595, Oct. 7, 1903.

In a printing machine with several rollers, some of which are only needed to print at intervals, as in the cross borders of scarves, automatically adjustable cams are arranged so as to hold either set of rollers out of printing contact during the whole or a fractional part of the revolution of the main printing bowl.—A. B. S.

Dressing of Yarns and like Material. F. W. Howorth, London. From Soc. Franç. de la Viscose, Paris. Eng. Pat. 24,637, Nov. 12, 1903.

See Fr. Pat. 335,598 of 1903; this J., 1904, 251.—T. F. B.

Coating Fabrics; Machine for ——. The Velvril Co., Ltd., London, and J. S. R. Howkins, Thornton Heath. Eng. Pat. 27,202, Dec. 11, 1903.

The cloth passes over a roller, and the desired waterproofing or other material is spread over it by means of a small roller which is in contact with the cloth, and is driven at a different speed from the large roller. The smaller roller is pressed in contact with the cloth by means of adjustable weights or springs, and the distance between the faces of the two rollers can be regulated according to the amount of material it is required to impregnate the cloth with.

—A. B. S.

Finishing Piece Goods. P. Krais, Ilkley, and The Bradford Dyers' Association, Ltd., Bradford. Eng. Pat. 17,242, Aug. 6, 1904.

To preserve the Schreiner finish, which is produced upon tissues by passing them between rollers engraved with fine parallel lines, tissues are treated, *e.g.* sprayed, with a 5 per cent. solution of nitrocellulose in amyl acetate, and are then passed over hot cylinders, these operations being repeated. The lustre produced in the finishing process on the tissues thus treated resists, it is stated, the influences of steam and moisture.—E. B.

United States Patents.

Viscose; Apparatus for Treating [Fixing Skeins of] ——. L. Naudin, Assignor to Soc. Franç. de la Viscose, Paris. U.S. Pat. 773,412, Oct. 25, 1904.

See Fr. Pat. 340,812 of 1904; this J., 1904, 821.—T. F. B.

Dyeing under Pressure; Apparatus for ——. L. Détré, Reims, France. U.S. Pat. 773,378, Oct. 25, 1904.

See Fr. Pat. 329,896 of 1903; this J., 1903, 1044.—T. F. B.

French Patents.

Copper Solutions; Alkaline —— which can Produce Concentrated Solutions of Cellulose easily made into Threads, and which improve the Appearance and Texture of Cotton Threads and Fabrics. M. Prud'homme. Fr. Pat. 344,138, June 18, 1904.

Ammoniacal copper solutions to which alkali hydroxide has been added, are found to possess considerable solvent power for cellulose, giving solutions very suitable for pressing into threads. Cotton, when treated in such a solution, swells up, and assumes the appearance of parchment. After washing in dilute acid and drying, the fabric is found not to have shrunk, whilst the appearance and texture of the cotton are said to be improved by such treatment.

—T. F. B.

Textile Fabrics; Method for rendering —— Waterproof. F. Sauerland. Fr. Pat. 343,977, June 14, 1904.

The fabric, after being mordanted in the usual manner and coated with some water-resisting substance, is treated for a short time with a weak boiling solution of rosin soap. The following method also gives good results:—Mordant the goods for one hour with a liquor of 3° B. strength containing 100 parts of alum, 160 parts of calcium carbonate, 100 parts of sulphate of alumina (free from iron), 15 parts of oxide of zinc, and 150 parts of acetate of lead. Now coat each side of the material with a layer composed of 60 parts of paraffin, 20 parts of Japan wax, 17½ parts of stearine, and 2½ parts of a 10 per cent. solution of Para rubber. The right side is further treated with a solution of some sticky substance, such as Para rubber. This treatment is advantageously performed in a specially designed machine, consisting of a series of rollers, between which the fabric passes, whence it is conducted through heated troughs containing the solutions.—F. D. T.

VII.—ACIDS, ALKALIS, AND SALTS.

Electrolysis of Potassium Chloride and Sodium Chloride; Differences in ——. F. Winteler. Electrochem. Ind., 1904, 2, 391—392.

Common salt is generally much less pure than commercial potassium chloride is, and the impurities cause trouble in the diaphragm process of alkali production. The fact that the temperature coefficients of the solubility of sodium and potassium chloride are so different further gives rise to a difference in the methods for obtaining caustic soda or caustic potash by evaporation; with the caustic soda evaporation to 50° B. removes all the sodium chloride except 1 per cent., whereas with the potassium salts several per cent. of chloride remain dissolved at the high temperature. In the production of chlorates, the low solubility of the potassium chlorate is undoubtedly an advantage, especially where chromates are added to the electrolyte to increase the efficiency of the process. The potassium chlorate crystallises out, and is thus separated from the chloride, whereas to obtain sodium chlorate it is first necessary to crystallise out the greater part of the sodium chloride.—R. S. H.

Litharge and Sodium Nitrite; Manufacture of ——. M. Liebig. Z. angew. Chem., 1904, 17, 1673—1674.

The sodium nitrate in the melting-pot is kept at the melting point of lead. The lead is cast in thin plates, and added to the melted nitrate till in slight excess. After all the lead has been added, the temperature is kept up for about 20 minutes, till the yellow mass turns brown. The litharge produced is tested for metallic lead, the nitrite for its content of pure nitrite. Litharge for accumulators must be free from metallic lead, and must not contain more than 0·006 per cent. of chlorine. Hence the extraction of the nitrite (when the litharge is prepared by the action of metallic lead on nitre) must be done with distilled water.

—J. T. D.

Magnesium Peroxide ; So-called ——. O. Ruff and E. Geisel. Ber., 1904, **37**, 3683—3688.

By adding 20 grms. of 30 per cent. hydrogen peroxide to a solution of 10 grms. of crystallised magnesium sulphate in 200 c.c. of water, and treating the liquid with 500 c.c. of 2N-alkali, a slimy precipitate was obtained, which in the moist condition yielded 1 atom of peroxide oxygen for each mol. of magnesium oxide. On drying the precipitate, oxygen was lost, the partially dry compound having the composition $MgO.MgO_2.aq$. This product gradually lost more oxygen, until a compound of practically constant composition was left, containing 0·39 atom of peroxide oxygen per mol. of magnesium oxide, corresponding to the formula, $MgO_2.3MgO.aq$. In presence of water, the product rapidly lost oxygen, the peroxide in part dissolving and in part being decomposed according to the equations: $Mg(OH)_4 = Mg(OH)_2 + H_2O_2$; and $Mg(OH)_4 + H_2O_2 = Mg(OH)_2 + 2H_2O + O_2$.—A. S.

Salts in other than Aqueous Solutions ; Reactions of ——. A. Naumann. Ber., 1904, **37**, 3600—3605.

The following substances are soluble in dehydrated ethyl acetate: stannic chloride, cupric chloride, mercuric chloride, bromide and iodide, potassio-mercuric iodide, platinic chloride, cadmium chloride, iodide and nitrate, iodine, uranium bromide and iodide, potassio-cadmium iodide, antimony trichloride, oxalic acid, sulphur, potassium permanganate, lithium chloride, nitrate, fluoride, and bromide, palladious chloride, ferric chloride, zinc chloride, uranium nitrate and chloride, cobalt chloride and nitrate, magnesium chloride, potassium iodide. The following are insoluble: Cuprous chloride, silver nitrate, sulphate, chloride, and carbonate, lithium carbonate, sulphate, borate, metaborate, hydroxide, silicate and silico-fluoride, ferrous chloride and sulphate, zinc sulphate, arsenic trioxide, lead acetate, cadmium oxide, carbonate, bromide and sulphate, calcium chloride, sulphide, sulphite, oxide, carbonate, and hydroxide, potassium chromate, bichromate, bromide, chloride, cyanide, ferrocyanide, ferricyanide, chlorate, bromate, nitrate, sulphate, nitrite, sulphide, pyroantimonate, acid tartrate, oxalate, carbonate, arsenite, arsenate, hydroxide and thiocyanate, sodium chloride, acid sulphite, carbonate, hydroxide, and arsenite, borax, ammonium chloride, sulphate, carbonate, and oxalate, barium chloride, nitrate, carbonate and sulphate, strontium carbonate, magnesium oxide, carbonate and sulphate, cobalt sulphate, potassium cobaltinitrite, nickel sulphate, manganese sulphate, uranium sulphate, uranium acetate, mercuric chloride.

Mercuric Chloride.—A solution saturated at 18° C. contains 1 grm. of salt in 3·5 grms. of solvent, and has a sp. gr. of 1·11. It is completely precipitated by an ethyl acetate solution of stannous chloride, the mercury being converted into calomel. Dry hydrogen sulphide gas passed through the solution gives a yellow precipitate of $HgCl_2.2HgS$. Ammonia gas precipitates the whole of the mercury as $HgCl_2.2NH_3$. Cadmium iodide reacts with it, and forms a precipitate of cadmium chloride.

Cupric Chloride.—1 grm. of salt dissolves in 249 grms. of solvent sp. gr. of solution, 0·9055. Ammonia gas gives a bluish-green precipitate of $CuCl_2.6NH_3$. Hydrogen sulphide precipitates the copper completely as CuS. Hydrochloric acid gas precipitates $CuCl_2.2HCl$. Stannous chloride precipitates cuprous chloride. Cadmium iodide precipitates cuprous iodide, free iodine remaining in solution.—J. T. D.

Sulphuric Acid in Commercial Acetic Acid ; Determination of Free ——. C. Rossi. XXIII., page 1113.

Nitric Acid ; Electrolytic Determination of —— *with a Rotating Anode.* L. H. Ingham. XXIII., page 1114.

Nitrogen [*Nitric Acid*] *from the Air ; Electrical Extraction of* ——. J. S. Edstrom. XI. A., page 1096.

Boric Acid ; Detection of ——. L. Robin. XXIII., page 1113.

Lime ; Determination of —— *in presence of Phosphoric Acid.* K. K. Järvinen. XXIII., page 1114.

Bauxite ; Analysis of ——. Taurel. XXIII., page 1114.

Lead Compounds ; Raw Materials for the Preparation of ——. M. Liebig. XIII. A., page 1102.

English Patents.

Sulphuric Acid ; Manufacture of [*Chamber Process*] ——. H. H. Lake, London. From the Firm of Società Anonima Ing., L. Vogel per la Fabbricazione di Concimi Chimici, Milan, Italy. Eng. Pat. 6846, March 21, 1904.

A pair of iron cylinders is set in the dust-collecting chamber of a pyrites kiln, to be heated by the effluent gases, such cylinders communicating with a series of Gay-Lussac towers. One of the cylinders is charged with sulphuric acid, to which, from time to time, as the acid is heated, portions of sodium nitrate are added. When the charge in one cylinder is exhausted, the second cylinder is similarly charged. The nitrous acid contained in the Gay-Lussac towers, strengthened by the nitric compounds obtained as described, is conducted back to the Glover tower, where it encounters the gases from the pyrites kiln, whereupon the circulation takes place through the lead chambers, and thence, through the Gay-Lussac towers, to the stack.—E. S.

Alkaline Chlorides [*Alkali Chlorides*] *and Oxychlorides ; Preserving the Strength and Keeping Powers of Solutions of* ——, *employed for Bleaching, Disinfecting, Separation of Metals, and other such-like Purposes.* G. J. Atkins, Tottenham, and Oxychlorides, Ltd., London. Eng. Pat. 25,972, Nov. 27, 1903.

It is claimed that the strength and keeping powers of solutions of alkali chlorides and oxychlorides employed for bleaching, disinfecting, separation of metals from their ores, and other purposes, are preserved by the addition of an alkaline salt, such as carbonate or hydroxide of sodium or potassium, calcium oxide, or borax.—E. S.

Ammonia Stills ; Construction of ——. G. E. Davis, Knutsford, Cheshire. Eng. Pat. 26,996, Dec. 9, 1903.

In ammonia stills constructed with serrated caps (see Eng. Pat. 16,349 of 1888 ; this J., 1889, 884), in which fixed ammonia is set free by lime, such caps are, according to the present invention, fixed to the plates forming the tops of the chambers in which they rest, so that the serrations hang free in the liquid, admitting a small rake to be inserted underneath the caps for withdrawal of the deposit. Several methods for fixing such serrated caps are described and illustrated.—E. S.

Aluminium Compounds and By-products ; Methods of Making ——. L. R. Keogh and B. Broughton, Hamilton, Canada. Eng. Pat. 2655, Feb. 3, 1904.

See U.S. Pat. 744,765 of 1903 ; this J., 1903, 1317.—T. F. B.

Alumina ; Manufacture of ——. Cie. des Prod. Chim. D'Alais et de la Camargue, Salindres, France. Eng. Pat. 19,924, Sept. 15, 1904. Under Internat. Conv., Sept. 19, 1903.

Sodium aluminate solution is heated under pressure of, say, 6 kilos. per sq. cm., in a closed vessel for some hours, with agitation, whereby a precipitate containing most of the silica present is stated to be formed. The pressure required may be obtained by passing into the containing vessel high-pressure steam, in such manner as to cause agitation, a small orifice being provided for escape of a little of the steam. Alumina, suitable for application in the manufacture of aluminium, may be prepared from the filtered aluminate solution thus obtained.—E. S.

United States Patents.

Lime ; Machine for Hydrating ——. J. Reaney, jun., Sherwood, Md. U.S. Pat. 773,029, Oct 25, 1904.

Within a rotating inclined cylinder is secured centrally a perforated screen, tapering towards the discharge end, and having an imperforate extension at the charging end, at which the lime to be hydrated is received from a shoot. Water is conducted from an elevated tank by a pipe which discharges automatically within the screen, when the gate to the shoot is opened. A perforated pipe connected to a boiler traverses the length of the screen centrally to maintain a discharge of steam within it. Between the outer cylinder and the inner perforated screen is an intermediate imperforate screen, tapering to a lesser degree than the perforated one. There is a number of discharge openings, one registering with the shorter outer cylinder or jacket: and the other arranged to receive the overflow of the longer inner screen.—E. S.

Quicklime; Process of Converting —— into Powdered Hydrated Lime. J. Reaney, jun., Sherwood, Md. U.S. Pat. 773,030, Oct. 25, 1904.

A WEIGHED portion of quicklime is subjected, in an apparatus such as that described in the preceding abstract, to tumbling with simultaneous wetting with a predetermined quantity of water, and to slow sifting, the hydrated fine particles being then rapidly moved to a point of discharge, whilst the non-hydrated particles remain for further hydration by the action of steam.—E. S.

Alkali Salts; Making and Separating —— from Insoluble Combinations. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 772,206, Oct. 11, 1904.

SOLUBLE alkali salts are obtained from their insoluble combinations by subjecting the latter to the action of water and of a "gas" (such as carbon dioxide), under varying pressure, above and below that of the atmosphere. Lithium carbonate is obtained from insoluble lithium compounds by exposing them to the action of water and carbon dioxide, under pressure. A continuous process of making soluble alkali carbonates from insoluble combinations, consists in mixing the latter with water, withdrawing air by subjecting the mixture to reduced pressure, then admitting carbon dioxide under increased pressure, and diminishing and increasing the pressure at intervals. The soluble salt separated is then withdrawn, and the process is continued after renewing the materials.—E. S.

Refractory Silicates; Method of Decomposing ——. W. T. Gibbs, Buckingham, Canada. U.S. Pat. 772,612, Oct. 18, 1904.

THE method consists in treating the silicate with a decomposing solution containing a catalytic agent and a reagent hat will combine with the base or bases and leave the catalytic agent free for further action. The decomposing olution contains a small proportion of hydrofluosilicic acid and a large proportion of sulphuric acid.—W. C. H.

Refractory Silicates; Process of Decomposing ——. W. T. Gibbs, Buckingham, Canada. U.S. Pat. 772,657, Oct. 18, 1904.

THE silicates are reduced to a finely-divided condition and reated with an amount of hydrofluosilicic acid, which is in xcess of that required to combine with the bases of the ilicates; the silico-fluorides of the bases are subsequently reated to recover the hydrofluosilicic acid.—W. C. H.

Salt; Process of Making Pure ——. O. Sachse, Assignor to the firm of Triplex, Ges. f. Soole-Verdampfung im Vacuum M.B.H., Lüneburg, Germany. U.S. Pat. 773,343, Oct. 25, 1904.

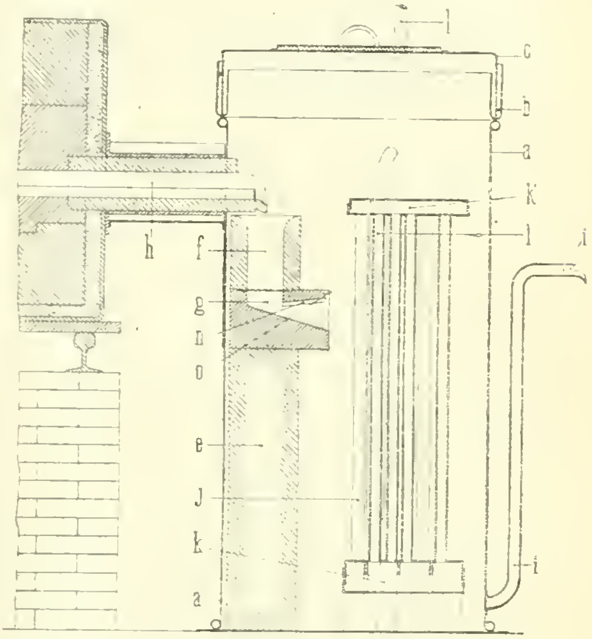
BRINE containing salts of calcium and magnesium is treated with sodium carbonate, slightly in excess of the proportion ecessary to precipitate the calcium as carbonate. The iquid, cleared from the precipitate, is concentrated in a acuum to separate the salt; and the mother-liquor, rich n magnesium sulphate, is added to another portion of untreated brine.—E. S.

Electrically Treating Gases [Air]; Process of ——. K. Birkeland. U.S. Pat. 772,862, Oct. 18, 1904. XI. A., page 1097.

French Patents.

Sulphuric Acid: Apparatus for the Concentration of —— in contact with Heated Gases. J. L. Kessler. First Addition, dated June 20, 1904, to Fr. Pat. 283,752 of Dec. 6, 1898. (See Eng. Pat. 25,169 of Dec. 10, 1898; this J., 1900, 246.)

THIS apparatus is intended to effect the rapid cooling of the concentrated acid down to the point at which it does not materially attack lead, while simultaneously heating chamber acid, or acid for concentration, admitted into a series of vertical lead pipes set in the cooler. Referring to the drawing, the hot concentrated acid is admitted in contact with heated gases (or otherwise, if desired, under the present addition) into the lead cylinder *a*, through the channel *h*, into the short cylindrical stone receptacle *f*, whence it flows until the cylinder is charged nearly up to the level of the piece *f*, the height being determined mainly by the passage of the cooled acid from the exit tube *i*. The dilute acid enters the tubular lead system through the jacketed pipe *l*, and has passage, after being heated by the surrounding hot concentrated acid, to the concentrator through an exit pipe not shown. The stream of concentrated acid entering *f*, when the apparatus is charged, is deflected upwards through grooves formed in the outlet *n*, *o*, and, owing to its less specific gravity than the cooler liquid of the mass, rises to the surface, carrying with it other layers of the acid, where it is cooled. Compare Eng. Pat. 21,376 of 1900; this J., 1901, 807.—E. S.



Sulphuric Acid; Apparatus for Concentrating ——. J. L. Kessler. First Addition, dated June 20, 1904, to Fr. Pat. 305,781 of Nov. 28, 1900. (See Eng. Pat. 21,376 of Nov. 26, 1900; this J., 1901, 807.)

THE arrangements, &c. claimed in the addition to Fr. Pat. 283,752 (see preceding abstract) are claimed also in the present addition.—E. S.

Carbonic Acid; Manufacture of ——. E. A. and J. G. Behrens. Fr. Pat. 343,903, June 11, 1904.

THE products of the combustion of water-gas or of generator-gas are compressed, and passed, still under pressure, into a solution of potassium carbonate, maintained at the temperature of decomposition of hydrogen-potassium carbonate. The unabsorbed nitrogen is allowed to escape, and the hot carbonated solution is conducted away, and as soon as it ceases to be under more than atmospheric pressure, the carbon dioxide absorbed is set free, and is collected for liquefaction.—E. S.

Alumina and Alkalis: Extraction of —— from Alkaline Silicates of Alumina, such as Leucite. G. Levi. Fr. Pat. 344,296, June 25, 1904.

Leucite, or other similar mineral, is treated with a strong solution of an alkali or alkaline earth hydroxide in an autoclave at a pressure exceeding six atmospheres (preferably at about 16 atmospheres) with agitation. Alumina, iron oxide, &c., remain undissolved, and are separated by filtration, whilst from the solution, containing an alkali or alkaline earth silicate, the alkali is recovered by known means. The aluminous residue is mixed with a concentrated alkaline solution to a pasty mass, to which lime is added, and the mass is heated. An alkali aluminate is dissolved out of the product, from which alumina is obtained, as, for instance, by injection of carbon dioxide. —E. S.

Alumina: Preparation of —— by an Electro-metallurgical Process. Soc. Anon. Electro-Metallurgique, Procédés P. Girod. Fr. Pat. 344,549, July 4, 1904. XI. B., page 1098.

Sulphates: Reduction of Alkaline-Earth and Alkali —— to Sulphides, and of Metallic Oxides to Metals. C. Castiglioni and L. Calastretti. Fr. Pat. 343,926, June 13, 1904. Under Internat. Conv., June 26, 1903.

The substance to be reduced is contained in a receptacle heated externally, and is subjected to the action of a reducing vapour or gas obtained by the dry distillation of organic matter, by the decomposition of steam by charcoal heated to incandescence, or by the action of water on alkaline-earth carbides.—A. S.

Nickel Ores: Treatment of ——, and Apparatus therefor. G. H. Gin. Fr. Pat. 344,203, June 22, 1904.

Nickel oxide, or an ore of the oxide, is subjected to the action of sulphuric acid of about 53° B., at a temperature of about 155° C., involving a pressure of 4 kilos. to the sq. cm. The apparatus consists of a pair of lead-lined autoclaves heated by a single furnace, and operated alternately. The solution obtained is cooled by a current of cold air, and by addition of a cold saturated solution of nickel sulphate containing basic nickel sulphate in suspension. The filtered liquid is crystallised.—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

English Patent.

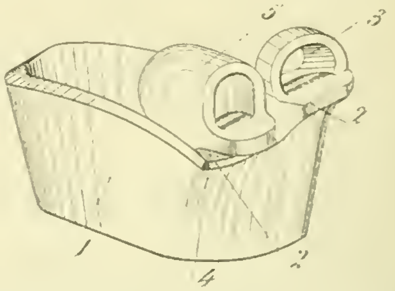
Vitreous Cement [for Porcelain, &c.]; Manufacture of ——. P. Steenbock, Deutsch-Wilmersdorf, Germany. Eng. Pat. 15,176, July 7, 1904.

A solution of basic beryllium nitrate is precipitated with sodium silicate, and the precipitate washed, dried, and slightly calcined. This product is finely ground and may be used by itself or mixed with glass or pure clay. The cement is made by triturating the powder or mixed powders with a solution of orthophosphoric acid almost saturated with aluminium phosphate, with the addition of a little zinc phosphate. See also Eng. Pat. 15,181, July 7, 1904; J., 1904, 901.—W. C. H.

French Patents.

Crucible for Glass for Continuous Working. F. Lang. Fr. Pat. 343,309, May 19, 1904.

The crucible shown allows of constant working, the glass in it being kept at a constant level, and withdrawn by a ladle without cooling the molten mass. It consists essentially of the crucible proper (1), which is placed in the furnace opposite one of the openings. The crucible is provided with a mouth (3) in the shape of an arch, through which the cold materials are fed, and with a vessel (5) cemented on to the wall of the crucible. The front of this vessel is also in the shape of an arch and serves for the introduction of the ladle; the other end of the vessel reaches nearly to the bottom of the crucible, tapering off to an open pipe, through which the molten glass enters from below as fast as it is removed from above by the ladle. In case of damage this vessel can be replaced without interrupting the fusion. For making crystal glass the crucible may be provided with a dome-shaped cover, so as to prevent the flame from coming in contact with the glass. —A. G. L.



Quartz Glass; Manufacture of ——. J. Bredel. Fr. Pat. 344,169, June 21, 1904.

The quartz is fused and run by means of a heated channel into a heated mould, preferably placed below the furnace. Both channel and mould are previously evacuated, to prevent the quartz from being chilled during its flow. —A. G. L.

Quartz Glass; Manufacture of Objects of ——. J. Bredel. Fr. Pat. 344,170, June 21, 1904.

The material is first repeatedly subjected to a cooling process, and is then fused. While still fluid it is treated with a jet of cold air or vapour which transforms it into silica wool; this is then moulded into the required shape and afterwards fused.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Cement; Specifications for ——, submitted to the American Society for Testing Materials. Engin. News, 1904, **51**, 619—620. Science Abstracts, 1904, 7, B, 860—861.

The Cement Committee of the American Society for Testing Materials recommend that the acceptance or rejection of samples of cement be based upon the following requirements, the tests being made in accordance with the methods proposed by the Committee on Uniform Tests of Cement of the American Society of Civil Engineers:—

Natural Cement.—*Definition:* The finely-pulverised product obtained by the calcination of an argillaceous limestone at a temperature only sufficient to expel the carbon dioxide. *Specific Gravity:* The material dried at 100° C. should have a specific gravity not less than 2·8. *Fineness:* Residue on a No. 100 sieve, not more than 10 per cent.; and on a No. 200 sieve, not more than 30 per cent. *Time of Setting:* Initial set in not less than 10 mins., and hard set in not less than 30 mins. nor more than 3 hours.

Portland Cement.—*Definition:* The finely-pulverised product obtained by the calcination to incipient fusion of an intimate mixture of argillaceous and calcareous materials in proper proportions, and to which no addition greater than 3 per cent. has been made subsequent to calcination. *Specific Gravity:* The material dried at 100° C. should have a specific gravity not less than 3·1. *Fineness:* Residue on a No. 100 sieve, not more than 8 per cent.; and on a No. 200 sieve, not more than 25 per cent. *Time of Setting:* Initial set in not less than 30 mins., hard set in not less than 1 hour nor more than 10 hours. *Tensile Strength:* Briquettes, 1 in. square in section should give the following results, and should suffer no retrogression in strength within the periods specified:—

	Strength after:		
—	24 Hours in Moist Air.	7 Days, 1 in Air and 6 in Water.	28 Days, 1 in Moist Air and 27 in Water.
	Lb.	Lb.	Lb.
Natural cement, neat.............	50—100	100—120	200—300
Portland cement, neat............	150—200	450—550	550—650
1 of natural cement and 3 of sand .	..	25—75	75—150
1 of Portland cement and 3 of sand	..	150—200	200—300

Constancy of Volume.—Pats of neat cement about 3 ins. diameter, ½ in. thick at the centre, and tapering to a thin edge, shall be kept in moist air for 24 hours. (*a*) A pat is then kept in air at the ordinary temperature and examined at intervals during at least 28 days. (*b*) Another pat is kept in water maintained at 70° F., and examined at intervals during at least 28 days. (*c*) (For Portland cement only.) A third pat is exposed in an atmosphere of steam above boiling water, in a loosely-closed vessel for 5 hours. In all three tests the pats should remain firm and hard, and show no signs of distortion, "checking," cracking, or disintegration.

Content of Sulphuric Acid and Magnesia.—The cement shall not contain more than 1·75 per cent. of sulphuric anhydride, nor more than 1 per cent. of magnesia.—A. S.

Cement; Notes on the Boiling Test for ——. F. H. Lewis. Eng. Record, 1904, **50**, 33—34. Science Abstracts, 1904, **7**, B, 865.

The author finds that the higher the silica and iron oxide, and within certain limits, the higher the sulphuric acid and lime, the better the results given by a cement when subjected to the boiling test. Magnesia appears to have no influence, but alumina should only be present in small quantity. He suggests as a cement suitable for passing the boiling test, one having the composition: lime, 66; silica, 25; iron oxide, 7; sulphuric anhydride, 2 per cent.—A. S.

English Patents.

Wood; Method for Preserving ——. C. F. Reichel, Grüna, Germany. Eng. Pat. 21,578, Oct. 7, 1903.

See Fr. Pat. 335,781 of 1903; this J., 1904, 254.—T. F. B.

Paving Blocks from Towns' Refuse. W. Weaver, London. Eng. Pat. 22,042, Oct. 3, 1903.

The clinker formed in "destructors" from towns' refuse is crushed, and about 80 parts are mixed with 15 parts of asphalt, and 5 parts of fine lime-stone or other dust, and consolidated into paving blocks under pressure.—W. C. H.

Cement or Moulded Articles; Apparatus and Process for utilising Gas Lime, or other Calcium Compounds and Clinker, Slag, or other Silicious or Aluminous Material for the Manufacture of ——. J. Bond, Leeds. Eng. Pat. 23,213, Oct. 27, 1903.

The materials named in the title, after being mixed and ground, are fed into the top of an upright kiln or tower having a number of horizontal inverted U-shaped flues, open at the ends and bottom, and fixed alternately in sets throughout the whole height of the kiln. Spaces are left between the flues to allow the material to fall around and on their outer surface. The U-shaped flues are connected with vertical flues so as to allow the hot gases from a furnace to travel through the sets in a zigzag course. The material that has passed through the kiln is mixed, ground with clinker, and moulded, and the bricks or slabs are subjected to the action of steam and carbon dioxide under pressure. —E. S.

United States Patents.

Carborundum Article; Self-bonded ——. F. J. Tone, Niagara Falls, N.Y. U.S. Pat. 772,262, Oct. 11, 1904.

A refractory coherent article, or a refractory coherent facing for less refractory articles, is composed of superficially-oxidised particles of amorphous or crystalline carborundum, which are bound together by the oxidation and subsequent cohesion of the particles.—W. C. H.

Lime or Cement Kiln. W. S. Speed, Louisville, Ky. U.S. Pat. 772,184, Oct. 11, 1904.

The kiln is vertical, and has a discharge opening at the bottom. Below this opening is a grid-like feeder with projections on its upper surface, that is worked backwards and forwards continuously by means of a shaft and crank arm. The forward movement of the feeder carries forward the lime deposited on it from the discharge opening of the kiln, and the backward movement causes this lime to fall off the front of the feeder, means being provided to prevent lime falling off the back end.—W. C. H.

Lithographic Stones; Substitute for ——, *and Method of Making same.* G. Bower, St. Neots, and T. W. Gauntlett, London. U.S. Pat. 773,368, Oct. 25, 1904.

See Eng. Pat. 6155 of 1903; this J., 1904, 325.—T. F. B.

French Patents.

Wood; Treatment of —— *by the Injection of Antiseptic Substances by passing it through Vaporisation and Absorption Baths in various Receptacles.* Conti-Vecchi. Fr. Pat. 344,201, June 22, 1904.

The wood to be treated is placed in one of a number of vessels connected with each other and is given a preliminary heating by means of the steam disengaged in the next vessel. Hot water from this vessel is then run into the first, the water being maintained at the boiling-point by circulating it through a suitable heater. The hot water is then run into the next vessel of the series, and its place taken by a cold antiseptic liquid, which is kept cool by circulating it through a cooler. This operation may take place under ordinary or increased pressure. The entry of the cold liquid into the wood is exceedingly rapid as the pores of the latter have been opened and filled with steam in the preceding operation, the steam condensing on contact with the cold liquid. If it is desired to treat the wood with two distinct preservatives, *e.g.*, creosote and a saline solution, one may be run into the bath after the other, or the two liquids may be emulsified and applied together. In the last case a suitable agitator must be placed in the vessel to maintain the emulsion. The cold liquid is then run into the next vessel and the wood removed, after which the same cycle of operations is repeated.—A. G. L.

Fire-Bricks and other Clay Objects; Continuous Furnace for Burning ——. D. F. Henry, jun. Fr. Pat. 344,332, June 27, 1904.

The interior of the furnace is divided by a number of vertical partitions, reaching alternately to the top and to the bottom of the furnace, into vertical compartments. The hot gases are consequently forced to pass through these compartments in a zigzag course, and in so doing meet and impart their heat to the objects to be burnt, which are placed on hollow supports cooled by a current of water. These supports are moved by an endless chain arrangement, situated outside the furnace, in a direction opposite to that in which the gases move, so that the raw bricks, &c., enter the furnace at one end and emerge fully burnt at the other. In the side walls of each compartment are left vertical slits to enable the supports for the bricks to be fastened to the endless chain. The supports themselves come back to the starting point through a channel formed in the bed of the furnace.—A. G. L.

Fire-Bricks and other Clay Products; Apparatus for Turning [during Drying] ——. D. F. Henry, jun. Fr. Pat. 341,333, June 27, 1904.

The moulded bricks are delivered on to a table, of the form of a paddle-wheel, which revolves horizontally in an inter-

mittent fashion, and which also carries certain boards capable of a lateral movement, which support the bricks during one stage of the operation. The whole mechanism is worked by an endless chain arrangement, which alternately works the turning table and the laterally-moving boards.
—A. G. L.

X.—METALLURGY.

Charcoal [*for Blast Furnaces*]; *Varieties of —— in the Ural.* E. Juon. Stahl u. Eisen, 1904, **24**, 1230—1238.

All the pig-iron produced in the Ural district is smelted with charcoal, which is manufactured in furnaces or by the old heap process, according to the relative facilities for transporting the felled timber. No attempt is made in either case to recover any of the by-products, there being no demand except for small quantities of tar for lubricating purposes. The three chief kinds of charcoal are birch, fir and pine; and it was to determine the relative value of these for smelting purposes that the author's experiments were made. The ultimate analysis of numerous samples of furnace-made charcoal gave the following mean results:—

——	Carbon.	Hydrogen.	Oxygen (together with Nitrogen).	Ash.	Calorific Power.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Cals.
Birch	75·04	3·49	19·83	0·90	6,380
Pine	75·38	4·13	17·17	1·24	6,500
Fir	73·41	3·45	20·63	1·26	6,210

The sp. gr. was determined in three different ways; first, that of the powdered charcoal; secondly, that of small cubes coated with molten paraffin; and thirdly, in bulk, *i.e*, by the basketful (1·8 cb. m.) The mean results were:—

——	Powdered.	Cubes.	Bulk.
Birch	1·46	0·40	0·190
Pine	1·40	0·27	0·148
Fir	1·38	0·215	0·131

The smaller difference in the bulk tests was due to the more brittle character of the fir charcoal, and the consequently larger amount going to the basketful. The relative porosity of the three kinds was 72·3 per cent., 80·6 per cent., and 84·7 per cent. in the order given, a result corresponding with figures published by Gubanof for Ural charcoals. The crushing strength of cubes, of 3·5 cm. side, was tested parallel and tranversely to the fibres, the birch charcoal having a mean strength of 204·0 kilos. per sq. cm. in the one case and 24·8 kilos. in the other, whilst for pine charcoal the figures were 81·1 and 11·3 kilos., and for fir charcoal 52·3 and 8·1 kilos. respectively. By correlating these various results to the lowest grade, *i.e.*, fir charcoal, as unity, the relative constants for the other two kinds work out as follows:—

——	Birch.	Pine.
Carbon content	1·02	1·03
Calorific power	1·02	1·05
Sp. gr. of the powder	1·06	1·01
„ „ cubes	1·88	1·25
„ „ bulk	1·45	1·13
Strength (diagonal)	3·45	1·48

so that bulk for bulk, birch charcoal is worth $1\frac{3}{4}$, and pine charcoal $1\frac{1}{4}$ times as much as fir charcoal. These figures coincide with the smelting values of the three charcoals, the relative amounts of iron produced per unit of charcoal being 1·8, 1·2, 1·0.

Similar results were obtained in the case of heap-made charcoals, but the mean carbon content of the latter is 11·80 per cent., and the calorific value 12·01 per cent. higher than with the furnace-made article. Taking heap-made birch charcoal as unity, the value of the furnace-made charcoal is 0·81; the two kinds of pine charcoal are worth respectively 0·68 and 0·57, and the two kinds of fir charcoal 0·54 and 0·41 respectively.

The differences between heap-made and furnace-made charcoal are due to the different temperatures employed in their production, the maxima being respectively 700° C. and 350° C. The higher temperature gives an increased carbon content, which is the chief factor in determining the calorific value for blast-furnace purposes, since the hydrogen in the charcoal does not reach the combustion zone, but goes to enrich the blast-furnace gas.

Another point of investigation was the causes of deterioration in blast-furnace charcoal. These are three in number: underburning, overburning, and bad storage. The first occurs when the temperature is kept so low (284° C.) that the percentage of carbon does not exceed 70, the charcoal being then brown in colour and of high sp. gr. Over-burnt charcoal on the other hand is of normal composition and calorific power, but brittle and rotten, with an increased power of occluding gases and moisture. Damp or prolonged storage unfavourably influences the quality by facilitating the absorption of moisture, which renders the charcoal brittle.

Finally, with regard to the problem whether a charcoal with high or low carbon content is the more economical for blast-furnace work, it is pointed out that if the charring has to be performed in the furnace the latter is uneconomically deprived of energy; but when the furnace gas is to be utilised as motive power, the carbon content of the charcoal should not exceed 85 per cent.—C. S.

Blast-Furnace Smelting; Finely-Divided Ores as a Source of Trouble in ——. A. Weiskopf. Stahl u. Eisen, 1904, **24**, 1225—1230.

In smelting finely-divided iron ore in the blast-furnace, the output is liable to diminution owing to obstructions caused by the agglomeration of fine carbon, and to irregular reduction of the fine and coarse material. At the same time the charge of coke has to be increased, and the furnace works irregularly owing to the "scaffolding" of the charge. The increased blast pressure entailed by these obstructions carries away a larger proportion of dust, thus increasing the strain on the blowing engines and the labour of cleaning out the dust collectors, &c. The fine carbon settles in crevices of, and corrodes, the brickwork, and largely increases the expense of repair. The furnace gas is of inferior quality, containing an excess of carbon dioxide and dust. These evils may be prevented by using coarse ore or briquetting the fine ore, the latter a somewhat expensive process. Of the various ore-briquetting processes introduced, the author considers that only two are suitable for practical application: the Dellwik-Fleischer process and the scoria process. In the former, the ore is maintained at its sintering temperature by means of water-gas, so that the particles cohere; whilst in a modification by Elbers the agglomeration is facilitated by the addition of 3—5 per cent. of powdered slag as a flux, the total cost being about 3*s.* 6*d.* per ton. In the scoria process the ore is treated with granulated blast-furnace slag, disintegrated by steam, the mixture being then exposed to steam at a pressure of 8 atmospheres for 10 hours. The briquettes are strong, highly porous, and of homogeneous composition. Whilst the addition of slag increases the amount of residue, the hydrating action of the steam probably results in the formation of colloidal calcium hydrosilicate or of a metasilicate, distributed uniformly throughout the mass; and the water of condensation dissolves out injurious metallic salts, alkalis, sulphates, &c.—C. S.

Open-Hearth Steel: Influence of Carbon, Phosphorus, Manganese, and Sulphur on the Tensile Strength of ——. H. H. Campbell. Iron and Steel Inst., Oct. 1904.

The author concludes from the results of a large number of experiments that the tensile strength of an open-hearth steel may be expressed by a formula, showing the effects of each of the important constituent elements. The effects of different amounts of the elements were found to be as follows :—

Carbon.—In acid steel, each 0·01 per cent. of carbon, as determined by combustion, causes an increase in the strength of 1000 lb. per sq. in. In the colorimetric determination, all the carbon present is not determined, and the strengthening effect consequently works out as 1140 lb. for each 0·01 per cent. of carbon.

In basic steel, the strengthening effect is 770 lb. per sq. in. for each 0·01 per cent. of carbon determined by combustion and 820 lb. for 0·01 per cent. determined colorimetrically.

Phosphorus.—Each 0·01 per cent. of phosphorus causes an increase of 1000 lb. per sq. in. in the tensile strength of open-hearth steel.

Manganese.—The strengthening effect of manganese on steel is greater as the content of carbon increases. When the amount of the manganese is small, the effect produced is complicated, probably by the presence of iron oxide, so that a decrease in manganese in very low-carbon steels is accompanied by an increase in strength. In acid steel, each increase of 0·01 per cent. in manganese above 0·4 per cent. raises the strength an amount varying from 80 lb. in an alloy containing 0·1 per cent. of carbon to 400 lb. in steel containing 0·4 per cent. of carbon. In basic steel each increase of 0·01 per cent. above 0·3 per cent. raises the strength an amount varying from 130 lb. in an alloy containing 0·1 per cent. of carbon to 250 lb. in steel containing 0·4 per cent. of carbon.

Sulphur.—The effect of sulphur on the strength of open-hearth steel is very small. The following formulæ are given for the strength of open-hearth steels :—

(1) For acid steel, with carbon determined by combustion : $40{,}000 + 1000\,C + 1000\,P + x\,\mathrm{Mn} + R =$ ultimate strength.

(2) For acid steel, with carbon determined colorimetrically : $39{,}800 + 1140\,C + 1000\,P + x\,\mathrm{Mn} + R =$ ultimate strength.

(3) For basic steel, with carbon determined by combustion : $41{,}500 + 770\,C + 1000\,P + y\,\mathrm{Mn} + R =$ ultimate strength.

(4) For basic steel, with carbon determined colorimetrically : $42{,}000 + 820\,C + 1000\,P + y\,\mathrm{Mn} + R =$ ultimate strength.

C, P, and Mn represent 0·01 per cent. of carbon, phosphorus, and manganese respectively : R is a number varying according to the heat treatment to which the steel is subjected ; the strength is given in lb. per sq. in. Tables are given showing the variation of x and y with the carbon content of the steel.—A. S.

Banket Ore [Gold] ; Finer Crushing of —— *[on the Witwatersrand].* W. A. Caldecott. Inst. of Mining and Metall., Oct. 20, 1904.

The crushed ore as it leaves the amalgamating plates is composed of : (*a*) silicious grains, mainly barren ; (*b*) granular auriferous pyrites ; (*c*) quartz grains with adherent pyrites ; and (*d*) very finely divided quartz, clay, and a little auriferous pyrites and free gold, constituting the slime. The results of experiments are quoted showing that higher extractions are obtained if the portion of the pulp comprised under (*b*) and (*c*) be subjected to fine crushing before being treated with cyanide. In practice it would probably be most satisfactory to pass the "spitzlutte" concentrate continuously through a re-grinder, then over amalgamating plates, returning it thence to the mill pulp launder delivering to the tailings wheel, so that any insufficiently reduced particles might gravitate back again from the "spitzlutte" for further grinding. The author estimates that with this secondary fine crushing the present 90 per cent. recovery of the gold contents of 10 dwt. banket ore would be raised to 95 per cent. at an increased expense of less than half the additional 5 per cent. of gold recovered. It should also be possible to successfully treat the large "residue dumps" on the Rand by means of a system embracing washing out the soluble gold contents, together with concentration of the coarser and pyritic portion, followed by fine grinding of this product to render its encased gold contents susceptible to subsequent treatment.—A. S.

Lead-Tin Alloys ; Action of Dilute Acids on ——. O. Sackur. Arb. Kais. Ges. A., **22**, 205—234. Chem. Centr., 1904, **2**, 1106. (See this J., 1904, 255, 791.)

Pure lead is acted upon by dilute acids only in presence of oxygen. The rate of solution is nearly independent of the strength and concentration of the acid (acetic, lactic, and hydrochloric acids), but depends upon the concentration of the dissolved oxygen, and the rate at which the acid is stirred. Pure tin is scarcely attacked, even in presence of oxygen, by dilute acetic acid (more dilute than N/10 solution) and lactic acid (more dilute than N/100 solution). With acids of stronger concentration, the solvent action is greater, but not so great as on lead. In the case of lead-tin alloys, the solvent action of dilute acid increases continually with the proportion of lead in the alloy. Dilute acids dissolve almost exclusively lead, with but little tin from the alloys ; more concentrated acids, on the other hand, dissolve more tin than lead. By the action of dilute acids on lead-tin alloys, in the first place, the lead is dissolved, but is subsequently in part precipitated again by the tin, this precipitation being more complete the greater the acidity of the solution.—A. S.

Alloys ; Structure of ——. W. Campbell. J. Amer. Chem. Soc., 1904, **26**, 1290–1315.

Aluminium-Copper Alloys.—Alloys containing from 0 to 54 per cent. of copper form a simple series with a eutectic point at about 32 per cent. of copper. Between 0 and 32 per cent. of copper, grains and dendrites of aluminium occur in an increasing ground-mass ; between 32 and 54 per cent. of copper, crystals of the compound Al_2Cu occur in a decreasing ground mass of the eutectic. In neither case are the dendrites or crystals pure ; they contain about 2 per cent. of copper or of aluminium, as the case may be, in solid solution. From 54 per cent. of copper, the ground-mass of the compound Al_2Cu decreases, whilst a new constituent in the form of dendrites and then irregular masses increases, until at about 78 per cent. of copper, the alloys are homogeneous. The alloys remain homogeneous from 78 per cent. (Al_2Cu_3) to about 83 per cent. of copper ($AlCu_2$). It is not certain whether the new constituent is AlCu, Al_2Cu_3, or $AlCu_2$, since it forms solid solutions ; there may even be two isomorphous compounds present. The alloys containing from above 83 per cent. to about 90 per cent. of copper solidify as solid solutions, which at a lower temperature rearrange themselves, according as the alloy contains more or less than 87 per cent. of copper—the eutectoid point. This change is similar to that which takes place in steel and in the bronzes. The alloys containing from 92 per cent. to 100 per cent. of copper form a series of solid solutions isomorphous with copper and show no rearrangement in the solid state.

Ternary Tin-Antimony Alloys.—An alloy containing 75 per cent. of tin and 25 per cent. of antimony was melted with 10 per cent. of various metals, and the structure of the resulting products examined. It was found that three types of structure are produced :—

(1) When the third metal is lead or bismuth, the alloy is formed of cubes of the compound SbSn in a ground-mass of tin dendrites, surrounded by the eutectic of tin and lead or bismuth.

(2) With silver or copper as the third metal, crystals of a compound of this metal and tin, together with cubes of the compound SbSn, are found set in the eutectic of tin and the compound of tin and the third metal.

(3) When the third metal is aluminium or zinc, this forms a compound with the antimony. The ground-mass consists of : (*a*) crystals of aluminium in its eutectic with tin ; and (*b*) in the case of zinc, crystals of the compound SbSn in a solid solution rich in tin. Cadmium appears to behave like zinc. Arsenic probably belongs to a sub-group of (2) where the compound SbSn and crystals of a compound of tin and the third metal occur in a ground-mass, which is a solid solution of tin.—A. S.

Alloys of Tin and Antimony. W. Reinders. Appendix III. to 6th Report to the Alloys Research Committee. Proc. Inst. Mech. Eng., 1904, **1**, 209—214. Science Abstracts, 1904, **7**, A, 831.

The freezing-point curve of tin-antimony alloys consists of four branches. The first begins with pure tin and ends with an alloy containing 8 per cent of antimony, melting at 243° C. There is no eutectic point. The crystals which separate from alloys corresponding to the first portion of the curve, consist of isomorphous mixtures of tin with varying amounts (up to 11 per cent.) of antimony. The next branch of the curve is considerably steeper, and corresponds to the separation of crystals of a definite compound, Sn_2Sb, which forms small glittering cubes. The third branch of the curve begins with an alloy containing about 20 per cent. and ends with one containing about 50 per cent. of antimony. The crystals corresponding to the lower portions of this branch of the curve are not well defined, but at 50 per cent. of antimony they again have a definite form, being thick plates of the composition Sn_4Sb_3. The crystals corresponding to the final portion of the curve are probably a solid solution of tin in antimony.—A. S.

Vanadium; Extraction of —— from Lead Vanadate, and Production of Some Alloys. H. Herrenschmidt. Comptes rend., 1904, **139**, 635—637.

The lead vanadate (12—14 per cent. of vanadic acid and about 50 per cent. of lead) is melted with sodium carbonate in a reverberatory furnace. Argentiferous lead is reduced and a slag is formed, containing sodium vanadate, aluminate, and silicate, and ferric oxide. The slag is again melted, air blown through to peroxidise all the vanadium, and the mass is then granulated by pouring into boiling water. This water, and the water of three washings, dissolve out practically all the vanadate, with some silicate but no aluminate. To remove the silicate, one portion is evaporated to syrup, sulphuric acid added to precipitate most of the vanadic acid, the mixture agitated with the rest of the impure solution, and the whole passed through a filter-press. The silica is thus precipitated, and the solution contains fairly pure vanadate. To prepare from it vanadic acid, it is evaporated to small bulk, excess of sulphuric acid added, the whole evaporated to dryness, heated till the excess of sulphuric acid is driven off, and the residue well washed with water. To make ferro-vanadium the purified sodium vanadate solution is precipitated by ferrous sulphate and sodium carbonate in such proportions as to yield on reduction 33 per cent. of vanadium. Nickel-vanadium is made by mixing oxide of nickel and vanadic acid in proportions to yield 25 per cent. of vanadium, compressing into cubes with the quantity of reducing substance necessary, and heating in crucibles packed with charcoal.—J. T. D.

Gold; Influence of Sunlight on the Solution of —— in Aqueous Potassium Cyanide. W. A. Caldecott. Chem. Soc. Proc., 1904, **20**, 199.

The fact that the formation of potassium thiocyanate in aqueous solution, under the conditions indicated by the equation $PbS + KCN + O = PbO + KCNS$, is accelerated by bright sunlight was noted some years ago by Bettel and Feldtmann (Proc. Chem. Metall. Soc. S. Africa, 1896, **1**, 267). In a paper published last year (J. Chem. Metall. Soc. S. Africa, 1903, **4**, 51) by E. H. Johnson and the author, the analogy between potassium aurocyanide and potassium thiocyanate with regard to their formation and reduction was discussed.

The following experiments were carried out with the view of ascertaining whether sunlight accelerated the formation of potassium aurocyanide, as well as that of potassium thiocyanate.

A strip of gold foil weighing 832·5 mgrms. and having a total superficial area of 852 sq. mm. was immersed in a 0·5 *per* cent. potassium cyanide solution, contained in clear glass litre bottle at about 19° C. In another similar glass vessel, coated with three layers of black varnish, was placed a corresponding amount of the potassium cyanide solution and a strip of gold foil weighing 900 mgrms., but with a superficial area equal to that of the other strip. The two bottles were then exposed to direct sunlight for about a $5\frac{1}{2}$ hours daily during five days, and the loss of weight of the gold foil strips was noted, the maximum temperatures of the solutions being recorded daily.

The results showed that the rate of solution of the gold in the clear glass bottle was 43 per cent. greater than that in the blackened vessel, although the temperature of the solution was on an average 3·8° C. lower than in the former case.

The lately published researches of Berthelot (this J., 1901, 786) indicate that the absorption of oxygen by aqueous solution of potassium cyanide is accelerated by sunlight. The greater rapidity with which gold dissolves in potassium cyanide solution in bright sunlight may hence be considered as being due to the liberation of more nascent cyanogen, in proportion to the additional oxygen absorbed, with the consequent increased formation of aurous cyanide.

Iron [in Ores]; New Method for the Volumetric Determination of ——. N. Tarugi and S. Silvatici. XXIII., page 1114.

Silicon in Iron and Steel; Determination of ——. J. Thiel. XXIII., page 1114.

Nitrogen in Iron and Steel; Rapid Determination of ——. H. Braune. XXIII., page 1114.

Silver in Zinc: Determination of —— and Silver-Content of Varieties of Commercial Zinc. K. Friedrich. XXIII., page 1114.

English Patents.

Steel; Manufacture of ——. C. E. Cockburn, Swanley, Kent. Eng. Pat. 25,950, Nov. 27, 1903.

Iron ore, with or without scrap iron, is placed in, for example, a cupola furnace having the usual adjuncts, with a quantity of "dried cohesive peat-moss briquettes," which are fired, and at a certain stage of the heating, a mixture of air and water-gas is injected in regulated quantity. It is an essential condition that the reduction of the ore should be effected in an atmosphere containing an excess of carbon monoxide with hydrogen.—E. S.

Sheet Iron and Steel; Method of and Apparatus for Treating ——. H. H. Goodsell, Leechburg, Pa., U.S.A. Eng. Pat. 18,746, Aug. 30, 1904.

Sheets of iron or steel are passed through a longitudinal chamber heated by flues, which also heat a pan containing water, the steam from which enters the chamber. The steam at the entrance to the chamber is at 212° F., and the plates are sufficiently heated before entering to prevent deposition of moisture upon them. As the plates are carried forward by suitable mechanical means, they reach a "blueing" compartment, in which the steam is heated to 900° F. or more. Beyond this compartment the temperature of the steam becomes gradually lower, and the plates are cooled to 212° F. before passing out by being drawn through the water-pan.—E. S.

Blast Furnaces; Impts. in ——. F. A. E. Samuelson, Thirsk, and W. Hawdon, Middlesbrough, Yorks. Eng. Pat. 28,279, Dec. 23, 1903.

The well of the furnace is made long in one direction and narrow in the other; for example, in the form of an ellipse or of a rectangle with or without rounded ends, so that with an increased area of the well the distance of the tuyères from the central line of the well remains so short that, without increasing the power of the blast, the latter is able to penetrate to the interior of the charge. In order that the charge may descend evenly, the boshes and shaft of the furnace are constructed with the same cross-section as the well.—A. S.

Furnaces [Crucible ——]. D. R. Steele, Curtis Bay, Md., U.S.A. Eng. Pat. 17,536, Aug. 11, 1904. Under Internat. Conv., Aug. 11, 1903.

See U.S. Pat. 743,947 of 1903; this J., 1903, 1297.—T. F. B.

Alkaline Chlorides and Oxychlorides; Preserving the Strength and Keeping Powers of Solutions of —— employed for Bleaching, Disinfecting, Separation of Metals, and other such like Purposes. G. J. Atkins and Oxychlorides, Ltd. Eng. Pat. 25,972, Nov. 27, 1903. VII., page 1088.

Metals from their Ores; Extraction of ——. P. J. Ogle and The Rapid Cyanide Treatment, Ltd., London. Eng. Pat. 26,391, Dec. 3, 1903.

See Fr. Pat. 340,238 of 1904; this J., 1904, 792.—T. F. B.

United States Patents.

Blast Furnace. A. Latto and J. C. Callan, Braddock, Pa. U.S. Pat. 772,723, Oct. 18, 1904.

A conduit communicating with the interior of a blast furnace near the top of the latter, is provided at its end with an "explosion door," and is connected to a dust collector having a curved elbow and a portion extending downward leading to a dust receptacle. On the outer bend of the elbow of the dust collector are arranged angularly disposed plates, spaced apart, the spaces between the plates communicating with the open air. There are means for spraying water within the dust collector.—E. S.

Furnace; Roasting and Smelting ——. H. Cockell and W. H. Fish, Columbus, Ohio. U.S. Pat. 772,925, Oct. 25, 1904.

The products of combustion from the smelting furnace pass around an ore-feeding and roasting chamber. The discharge pipe from the ore-roasting chamber into the smelting furnace is connected with air-inlet and fuel-supply pipes.—A. S.

Slimes Washer. L. E. Porter, Camp Rochester, Cal. U.S. Pat. 773,221, Oct. 25, 1904.

A vertical cylindrical tank, open at the top, is provided with a central, vertical, tubular shaft, and with means for rotating the latter. To the bottom of the shaft horizontal distributing arms are fixed, and connections are provided for introducing air or water into the hollow shaft. A "pervious material" is disposed around the inner upper edge of the cylinder, whilst on its outer edge is an annular trough to receive the liquid passing through the pervious material.—W. H. C.

Slimes Washer; Continuous ——. L. E. Porter, Camp, Rochester, Cal. U.S. Pat. 773,222, Oct. 25, 1904.

The apparatus in the preceding abstract is modified by having a conical bottom to the cylinder, with a valve at the apex of the inverted cone. A scraper is attached to the rotating shaft having its edge parallel to the slope of the conical bottom, and a funnel is arranged in the upper portion of the cylinder concentric with the shaft.
—W. H. C.

Alloys; Process of Making ——. R. S. Anderson, Seattle, Wash., Assignor to W. F. Horner, W. C. Meeker, and H. U. Woodin. U.S. Pat. 773,450, Oct. 25, 1904.

Copper and tin are fused together in about the proportions of 93 lb. of copper to 7 lb. of tin, and to the mixture there is added first a quantity of copper sulphate, and then aluminium in about the proportion of 2 lb. of aluminium to 5 oz. of copper sulphate, copper, and tin. The fused mass is poured off and allowed to cool in the form of pigs.—A. S.

French Patents.

[Steel] Plates; Process and Apparatus for Locally Softening Hardened ——, Permitting them to be worked in the Cold. Schneider & Co. Fr. Pat. 338,998, Aug. 24, 1903.

See Eng. Pat. 19,167, 1903; this J., 1903, 1246.—T. F. B.

Nickel Steel; Impts. in ——. A. de Dion and G. Bouton. Fr. Pat. 344,095, June 17, 1904.

It is claimed that by the addition of silicon to nickel steel the breaking stress and elastic limit are considerably increased, especially in the case of the alloys of martensitic structure, without the resistance to percussion being diminished. The proportions claimed are 0·5—2 per cent. of silicon for pearlitic steels and 0·5—3 per cent. for martensitic steels.—A. S.

Gold from Auriferous Minerals; Process for Extracting ——. Worsey-Hoal Gold Extracting Synd., Ltd. Fr. Pat. 344,301, June 25, 1904. Under Internat. Conv., June 29, 1903.

See Eng. Pat. 14,398 of 1903; this J., 1904, 1031.—T. F. B.

Slag; Process for Making Briquettes from Blast-furnace ——. H. Schulte-Steinberg. Addition, dated June 6, 1904, to Fr. Pat. 334,737, Aug. 19, 1903.

See Eng. Pat. 3235 of 1904; this J., 1904, 444.—T. F. B.

Aluminium and its Alloys; Industrial Process for Perfectly Soldering ——. R. Fortun and E. Semprun. Addition, dated June 10, 1904, to Fr. Pat. 330,609, March 26, 1903.

See Eng. Pat. 13,328, 1904; this J., 1904, 986.—T. F. B.

Minerals containing Lead and Zinc; Treatment of ——. C. H. T. Havemann. First addition, dated June 13, 1904, to Fr. Pat. 318,590, Feb. 11, 1902 (this J., 1902, 1457).

In the main patent, the fumes from the melting furnace are subjected to the action of a forced draught, whereby, the sulphides of lead and zinc are almost completely converted into sulphates, which are subsequently separated. According to the present addition, the conversion of the sulphides into sulphates becomes complete if (1) the composition of the furnace-charge be maintained within the limits:—zinc, 18—20; lead, 18—20; and sulphur, 12—13 per cent.; and (2) the draught be so regulated that the mud obtained on condensing the fumes is white. The process is also applicable to the treatment of minerals containing lead, zinc, and copper. A large proportion of the copper is obtained in the form of a matte rich in copper and silver, whilst the remainder is converted into sulphate with the lead and zinc. From the solution of zinc and copper sulphates obtained, the copper is precipitated by iron.—A. S.

Sulphates; Reduction of Alkaline-Earth and Alkali —— to Sulphides, and of Metallic Oxides to Metals. C. Castiglioni and L. Calastretti. Fr. Pat. 343,926, June 13, 1904. VII., page 1090.

Alloy. U. Travaglini and F. Fabiani. Fr. Pat. 344,255, June 21, 1904.

The alloy is constituted of electrolytic copper, 1·90 to 1·95 kilo.; silver, 0·2 to 0·3 kilo.; ferro-manganese, 0·6 to 1·5 kilo.; aluminium, 4·8 to 9·9 kilos.; and red phosphorus, 5 to 15 grms. The density of the alloy is stated to be 8·187, and its fusing point, 700 C.—E. S.

Air; Method and Apparatus for Extracting the Moisture from ——, and for Supplying such [Dried] Air to Cupola Furnaces, Converters, or the like. J. Gayley. Fr. Pat. 344,399, June 28, 1904.

Air is led into a refrigerating chamber in which, by the oscillation of wings and other suitable means, it is so agitated and circulated as to come into contact with a cooling tubular system, until the greater part of its moisture is deposited. The air thus dried is conveyed to a blower, preferably under a feeble initial pressure, and then forced at a higher pressure into the tuyères of the furnace or converter.—E. S.

Copper; Fusing Sulphide Ores of —— with Simultaneous Concentration in the Matte. N. Lébédeff. Fr. Pat. 344,550, July 2, 1904.

Three parts of copper sulphide ore, two parts of limestone or dolomite, and three parts of quartz sand, all in fine powder, are intimately mixed, and the mixture is exposed to an oxidising flame in a reverberatory furnace, with addition of a suitable flux. The rich matte formed on fusion is withdrawn from the liquid layer of scoria.—E. S

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Temperature in Electric Furnaces; Testing the ——. F. A. J. Fitzgerald. Electrochem. Ind., 1904, **2**, 415.

The increase of density of pure amorphous carbon with rise of temperature is suggested as a suitable method of gauging the temperature of electric furnaces. Even after the transformation into graphite, the density increases with elevation of temperature. The examples of the application of the method refer to temperatures of a blowpipe and muffle furnace.—R. S. H.

Electrolysis and Catalysis. W. Ostwald. Electrochem. Ind., 1904, **2**, 393—395.

The author considers in detail the reactions occuring at the electrodes during the passage of a current through an electrolytic cell. He shows that even in the simplest cases these are made up of a number of changes which follow each other step by step, and with very different velocities. Means exist for altering the speed of some of these changes. The positive or negative (retarding) catalytic action either of the electrode material or of some substance added to or present in the electrolyte is considered as effecting this alteration of speed. Examples are given to show how these views may be applied both synthetically for favouring any particular reaction at the electrode, and also analytically for studying what reactions occur in any special case.—R. S. H.

Nitrogen [Nitric Acid] from the Air; Electrical Extraction of ——. J. S. Edstrom. Electrochem. Ind., 1904, **2**, 399—400.

The process of C. Birkeland and S. Eyde, of Christiania, is described (this J., 1904, 193). Their method consists in magnetically deflecting an arc at right angles to the direction of the electrodes, and thus causing it to be carried upwards and downwards, and to be broken. The speed of formation and breaking can be made very rapid, but in practice only some hundred arcs per second are used. The effects vary according to whether the arc and magnetic field are excited with direct or alternating current. If the arc be fed with alternating current, and the electro-magnet with direct current, the phenomena will appear as shown in Fig. 1, the arcs vibrating between opposite sides of the electrodes. This is the arrangement chiefly used by the inventors. The electric furnace employed is shown in vertical section at right angles to the electrodes in Fig. 2. Air passes through the channels A, into the arc chamber B, around and in the neighbourhood of the electrodes, E, and out by the channel C. The gases contain 2 to 3 per cent. of nitric oxide. A 200-kilowatt furnace fed with alternating current of 50 cycles at 5000 volts gave a yield corresponding to 900 kilos. of nitric acid per kilowatt per year. The nitric oxide (NO) is converted into nitrogen peroxide (NO_2) in a reaction tank of thin sheet iron enamelled on its inner surface. The gases pass thence t an exhauster of clay, where they meet drips of dilute nitric acid. The gases now pass through four water towers and one fed with caustic soda solution. In each towe the liquid is passed through several times for the sake o concentration. Finally, a mixture of sodium nitrite an nitrate is obtained, and from this pure sodium nitrite i manufactured, nitrates being prepared from the residua solution.—R. S. H.

Fig. 1.

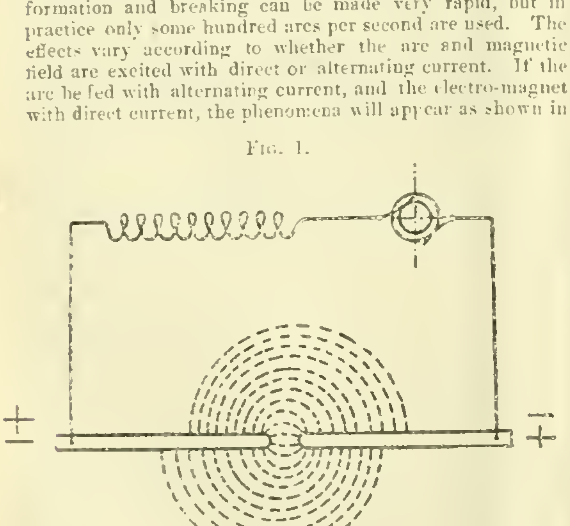
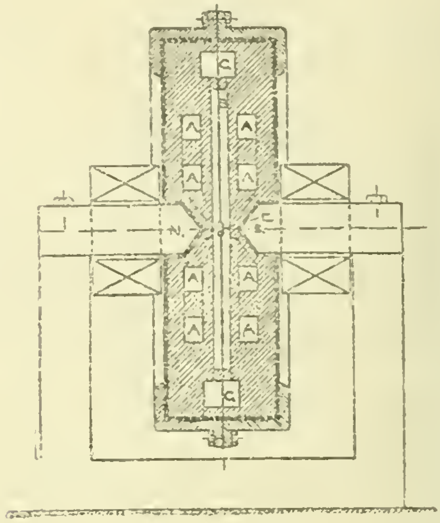


Fig. 2.



Aromatic Esters; Electrolytic Reduction of ——. C. Mettler. Ber., 1904, **37**, 3692—3696.

The methyl and ethyl esters of benzoic acid can be reduced by subjecting them in alcoholic solution, acidifie with sulphuric acid, to the action of an electric current using a lead cathode. Benzyl alcohol and benzyl-methy or benzyl-ethyl ether respectively are produced, accordi to the equations—

$$C_6H_5COO.R + 4H \begin{matrix} \nearrow C_6H_5.CH_2OH + ROH \\ \searrow C_6H_5CH_2OR + H_2O \end{matrix}$$

The halogen derivatives of benzoic acid esters can b reduced in a similar manner, the chief products being th corresponding halogen-benzyl-alkyl ethers, whilst only sma quantities of halogen-benzyl alcohol are formed. B suitable oxidising agents, these halogen-benzyl-alkyl ethe can be easily converted into the corresponding haloge benzaldehydes, many of which are of value in the manufacture of dyestuffs.—A. S.

Rotating Cathodes; Materials and Forms for ——. H. F. Medway. XXIII., page 1113.

Electrolysis of Potassium Chloride and Sodium Chloride Differences in ——. F. Winteler. VII., page 1087.

Defecation [Sugar]; Electrolytic ——. H. Claassen. XVI., page 1105.

Nitric Acid; Electrolytic Determination of —— with Rotating Anode. L. H. Ingham. XXIII., page 1114.

Gold; Determination and Separation of —— in the Electrolytic Way. S. P. Miller. XXIII., page 1115.

Electrolytic Separations possible with a Rotating Anode. D. S. Ashbrook. XXIII., page 1115.

Litharge for Accumulators. M. Liebig. Z. angew. Chem., 1904, **17**, 1674. VII., page 1087.

English Patents.

Batteries; Storage ——. W. Fairweather, London. From Vesta Storage Battery Co., Chicago. Eng. Pat. 8365, April 12, 1904.

A suitable metallic cell, lined with insulating material, is connected to a horizontal cylindrical positive element of copper wire gauze or cloth, and a cylindrical negative element, consisting of a perforated copper tube, is arranged and maintained concentrically within the positive element by means of rubber insulating rings. The negative copper ube is covered first with paper, then with a cylindrical ayer of linen, and finally with a tightly-fitting perforated rubber tube; copper rings or bands surround the positive element, and serve to bind the positive and negative elements together. Insulating discs are inserted within the ends of the positive element, and serve to close the ends of he negative element, the latter being provided internally and concentrically with a copper conductor, embedded in active material which fills the interior of the negative element. A screen of wire gauze of finer mesh than the positive element separates the latter from the sides and bottom of the cell. The active negative material may be oxidised silver and nickel, or silver and cobalt, which is prepared by dissolving the metals simultaneously in nitric acid, precipitating the oxides of the metals with a strong solution of potassium or sodium hydroxide, finally washing several times by decantation, and drying. The alkaline zincate electrolyte is prepared by placing a solution of potassium zincate within the battery, then, by charging the atter, depositing zinc on the positive element. The liquid s poured off, the battery cleansed, filled with a solution of pure potassium hydroxide and the battery discharged. An alternative arrangement is described with vertical elements and with an active sponge metal, containing silver, nickel, and mercury, filling the negative element, which consists of a copper shell perforated with elongated parallel apertures. The active material is prepared by dissolving the metals in nitric acid, then precipitating with potassium hydroxide and finally reducing the precipitate with zinc and hydrochloric acid. An amalgam containing 45 per cent. of silver, 5 per cent. of nickel, and 10 per cent. of mercury is obtained. An alternative form is described with a vertical positive element, consisting of rolls of copper gauze, disposed concentrically, the annular space being filled with ctive material of oxides of copper and cadmium, prepared by a method similar to the preparation of the oxides of ilver and nickel. The copper gauze is coated electroytically with cadmium and mercury, and with a zinc eposit on the coating. A sponge-like silver amalgam is aid to be useful as active material for this type of battery, nd may be prepared by dissolving silver in nitric acid, precipitating with hydrochloric acid, reducing with zinc, and drying the spongy silver. Nine pounds of sponge silver re mixed with 14 pounds of mercury, and the amalgam formed is exposed to the air for three days to bring about xidation, "before it is placed in the negative element of he battery."—B. N.

Electrodes and Resistances; Manufacture of ——. G. Cornaro, Turin, Italy. Eng. Pat. 22,090, Oct, 13, 1904.

See Fr. Pat. 336,817 of 1903; this J., 1904, 377.—T. F. B.

United States Patents.

Mercurial Alkaline Processes; Apparatus for ——. C. W. Roepper, Germantown, Pa., and W. E. Harmon, Mechanics Falls, Me. Assignors to American Electrolytic Co., Delaware. U.S. Pat. 771,833, Oct. 11, 1904.

Apparatus is described suitable for mercurial alkaline processes, and comprises an amalgamating compartment nd a de-amalgamating compartment separated by a main partition, with a groove or passage beneath the partition. The bottoms of both compartments slope downwards and away from the edges of the groove, the edge on the side f the amalgamating compartment being higher than the dge on the side of the de-amalgamating compartment. A return way and sluice-way for the mercury is provided, with a partition between the sluice-way and the amalgamating compartment, and with a groove underneath for the passage of the mercury. A number of such amalgamating and de-amalgamating compartments may be arranged in a gradually descending series, the series being in two rows and sloping in opposite directions. The highest point in each pair of compartments is the edge of the groove under the main partition on the side of the amalgamating compartment. Means are provided for returning the mercury, which occupies the bottom of each compartment, from the lowest level at the extremity of one row to the highest level at the extremity of the other. Inflow and outflow pipes are provided for the solution to be electrolysed; these traverse the entire length of the partitions, and communicate with the amalgamating compartment by a series of spaced apertures above the level of the mercury. Aprons protect the apertures and guide the flow of the electrolyte, so that the latter is evenly distributed across the width of the amalgamating compartment.—B. N.

Electrically Treating Gases [Air]; Process of ——. K. Birkeland, Christiania, Norway. U.S. Pat. 772,862, Oct. 18, 1904.

An electric arc is established and spread into the form of a sheet in a uniform magnetic field, and "transverse to the flux of the same." A current of the gas to be treated, such as air, is passed through the arc in a direction parallel to the surface of the sheet, and the oxide of nitrogen produced is afterwards removed from the remaining gases.—B. N.

French Patents.

Hydro-Electric Pile, which can be chemically Regenerated, and Method and Apparatus for its Operation. H. Jone. Fr. Pat. 339,020, Sept. 7, 1903.

See U.S. Pat. 764,595 of 1904; this J., 1904, 828.—T. F. B.

Carbon Electrodes for Primary Cells: Process for Preparing ——. T. Mann. Fr. Pat. 344,312, June 25, 1904.

In order to prepare an electrode of good conductivity, the carbon is compressed around a piece of gauze or foil, formed of a metal which is a good conductor and is not acted upon by the electrolyte to be employed. The piece of gauze or foil may be provided on one side with projecting filaments, so that more perfect contact with the carbon is obtained.—A. S.

(*B.*)—ELECTRO-METALLURGY.

Iron and Steel; Electro-Metallurgy of ——. P. L. T. Héroult. Electrochem. Ind., 1904, **2**, 408—409.

The different processes which the author has worked out for the electric furnace manufacture of ferro-chromium, crude iron, and fine steel are briefly described. The electric treatment is considered to be particularly suitable for refining ordinary grades of steel, *e.g.*, the molten product of a Siemens-Martin furnace, so as to obtain a fine metal containing less than 0·01 per cent. of sulphur and 0·01 per cent. of phosphorus, and with as low a carbon content as desired. The product obtained is at least equal in quality to the best grades of crucible steel.—R. S. H.

Nickel Steel from Magnetic Sand; Preparation of ——. E. A. Sjöstedt. L'Electricien, 1904, **27**, 270. Chem.-Zeit., 1904, **28**, Rep. 330.

The magnetic sand obtained at Sudbury, Canada, contains 2—3 per cent. of nickel and 1—2 per cent. of copper. After mechanically separating the portion rich in copper, the average composition of the sand is found to be:—Nickel, 3 per cent.; copper, 0·5 per cent.; sulphur, 28 per cent.; iron, 50 per cent.; and phosphorus, 0·01 per cent. This is roasted and then smelted with coke and lime in an electric furnace of the usual type; the product contains about 8 per cent. of nickel, 53 per cent. of iron, and 3 per cent. of sulphur. By this means it is stated that 27 kilos. of nickel steel can be produced in one hour, by employing 108 kilowatts, the cost being computed to be 105·5 marks per ton.—T. F. B.

Electro-plating; Chemistry of ——. W. D. Bancroft. Electrochem. Ind., 1904, **2**, 389—391 and 400—401.

The following conclusions are illustrated by details of special cases occurring in practice. A non-adherent deposit is always due to the precipitation of some salt or metalloid along with the metal; the function of many additions to plating baths being solely that of dissolving these salts or metalloids. Any beneficial action due to the presence of a reducing agent in the bath is probably owing to the removal of the dissolved oxygen. A fine-grained deposit is favoured by high current-density and potential difference, by the use of acid or alkaline solutions, by low temperature, and by the addition of colloidal substances to the bath.—R. S. H.

Electrolytic Deposition of Aluminium from Ethyl Bromide Solutions. H. E. Patten. Electrochem. Ind., 1904, **2**, 413.

A solution of aluminium bromide in ethyl bromide gives a deposit of crystalline aluminium, provided the solution is sufficiently concentrated and the current density exceeds 0·0023 ampère per sq. cm.—R. S. H.

Metal Deposition from Rapidly-Stirred Electrolytes; Theory of ——. R. Amberg. Z. Electrochem., 1904, **10**, 853—855.

Instead of considering the effect of rapid stirring as connected with the virtual volume of the electrolyte, as in a previous communication (this J., 1904, 684), the author applies Nernst's theory of reaction velocity in heterogeneous systems. According to this theory, the velocity of reaction is conditioned only by the rate at which the differences of concentration between the bounding layer, and the two phases are equalised by diffusion.—R. S. H.

Anodic Solution of Metals and their Passive State. O. Sackur. Z. Elektrochem., 1904, **10**, 841—844.

The author considers the anodic solution of all metals to be conditioned by one and the same reaction, *viz.*, the discharge of hydrogen ions. For instance, with a divalent metal $M + 2H^{\cdot} \rightleftarrows M^{\cdot\cdot} + H_2$. If the removal of the hydrogen can be effected by reaction with one of the discharged anions present, the metal will continue to dissolve; this is, for instance, the case with chlorides, bromides, &c.; the velocity of reaction of the discharged oxygen ions from most of the other salts is, however, sometimes very low. The greater the catalytic influence of the particular metal used for electrode upon this reaction, the more easily will that metal dissolve. The author therefore considers that the power which metals possess of assuming the passive condition is inversely proportional to the magnitude of their catalytic effect in the reaction between hydrogen and oxygen.—R. S. H.

English Patents.

Metals such as Lead and Silver; [Electrolytic] Process for Extracting —— *from Ores.* S. Ganelin, Friedenau, and Accumulatoren Fabrik Akt.-Ges., Berlin. Eng. Pat. 1767, Jan. 23, 1904.

See Fr. Pat. 339,849 of 1904; this J., 1904, 718.—T. F. B.

Zinc from Sulphate Solutions; Producing —— *by Electrolysis.* C. D. Abel, London. From Siemens and Halske A.-G., Berlin. Eng. Pat. 16,396, July 25, 1904.

The current density at the anode, either over its entire surface or at separate parts, is from 20 to 50 times greater than that at the cathode. Platinum or platinum alloys may therefore be used as the anode, and electrolytic zinc, hard, smooth, dense, crystalline, and free from sponginess and nodules, is obtained.—B. N.

French Patents.

Electric Induction Furnace; New System of ——. Schneider et Cie. Fr. Pat. 339,010, Sept. 2, 1903, and Addition thereto of Nov. 12, 1903.

See Eng. Pat. 28,805 of 1903; this J., 1904, 549.—T. F. B.

Electrostatic Separation: Process of ——. F. O. Schnelle. Fr. Pat. 344,068, June 14, 1904. Under Internat. Conv., June 15, 1903.

The invention relates to the separation of minerals, the individual constituents of which possess varying degrees of electric permeability. The material is fed uniformly over the surface of a body of suitable shape, the sides of which are inclined, and the lower edge horizontal, and which is connected with one pole of a source of electric current. A field of intense electrostatic force is produced around the edge of the charged body by connecting the receivers placed below, with the earth, or with the other pole of the source of electric current. The particles of material, in falling from the electrically charged body, are projected varying distances according to their electric permeability and are collected in separate receptacles. An oscillating movement may be imparted to the electrically charged body.—A. S.

Titanium; Electrolytic Extraction of —— *from its Oxides.* Elektrochem. Werke G. m. b. H. Fr. Pat. 344,099, June 17, 1904. Under Internat. Conv., June 18, 1903.

The electrolyte used consists of dry halogen salts of the alkaline-earth metals heated to moderate redness. Before or during electrolysis the titanium oxide is introduced into the containing vessel, as near as possible to the cathode. When sufficient current has been passed to reduce the titanium oxide, the electrolysis is discontinued, and, after cooling, the titanium is separated from electrolyte by lixiviating it with water and with dilute hydrochloric acid, the alkaline-earth chlorides being recovered from the solution by evaporation and calcination, and used over again.—A. S.

Nickel or its Alloys; Manufacture of ——. G. H. Gin. Fr. Pat. 344,202, June 22, 1904.

Nickel oxide, or an ore of the oxide, is reduced in an electric furnace in presence of silica and carbon, to obtain either a nickel silicide, or a double silicate of iron and nickel. These are refined in a "four-canal" (Ger. Pat. 148,253), mixed with calculated proportions of nickel oxide or iron oxide, or a mixture of the two, according to whether it is desired to obtain pure nickel or ferro-nickel. Sulphur may be eliminated in the process by addition of a small proportion of manganese silicide.—E. S.

Alumina; Preparation of —— *by an Electro-Metallurgical Process.* Soc. Anon. Électro-Métallurgique, Procédés P. Girod. Fr. Pat. 344,549, July 4, 1904.

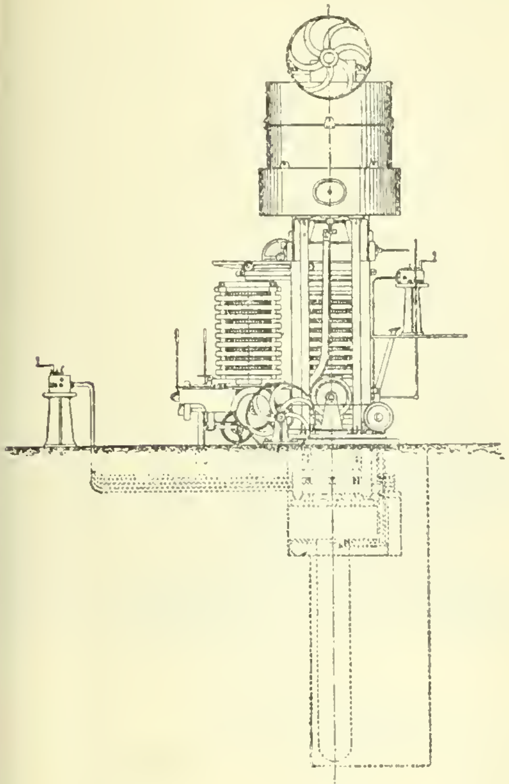
The alumina is obtained as a by-product in the manufacture of ferro-chromium by utilising bauxite as a flux in place of lime. During the process the bauxite becomes thoroughly dehydrated, and any silica and iron oxide it contains are reduced, so that the slag consists of nearly pure alumina. —R. S. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Oils and Fats; Uses and Applications of ——. J. Lewkowitsch. Cantor Lectures. J. Soc. Arts, 1904, **52**, 795—805, 809—815, 819—832.

Raw Materials.—In this country cocoanut oil and palm and palm kernel oils are still the principal vegetable fats extensively used, but on the Continent other fats are largely employed, *e.g.*, Chinese vegetable tallow and shea butter in Marseilles and the North of Europe. Only small quantities of these fats and other fats, such as mowrah-seed oil and mahwah butter, are imported into England. The use of fast steamers in place of sailing vessels has led to a great development of the commercial fish oil industry. As regards animal fats our chief sources of supply are now Australia, New Zealand, and the Argentine. Russia no longer exports tallow, but imports it largely from Australia.

Recovery of Oils by Expression.—In modern installations seeds rich in oil are frequently expressed in a hydraulic press known as a "clodding press," to avoid the exudation of the mass through the cloth in the plates of the ordinary Anglo-American press. This press (see figure) is provided



with a seed kettle at the top, in which are openings corresponding with the chamber in the head of the press or series of presses. The material is introduced into the circular press box, and each successive layer covered with a circular metal plate until the press is full, when pressure applied by the ram forces the box against the block at the head of the press. The press cake is broken up and pressed a second time in the Anglo-American press. In modern improved processes this second expression is also done in a press of the same type as the "clodding press," so that the work becomes practically continuous.

Recovery of Oil by Extraction with Solvents.—The solvents employed on a large scale are still petroleum spirit and carbon bisulphide. The use of carbon tetrachloride in technical processes has been prevented by its high price, and by its physiological effect on the workmen, which resembles that of chloroform.

Purification.—In the author's experience manganese dioxide with hydrochloric acid is the best bleaching agent for tallow, and bichromate with hydrochloric acid for palm oil. Bleaching by ozone or oxygen is only used to a limited extent. The author has found that the colour of oils bleached by certain ozone processes eventually becomes dark again. The old natural process of "demargarination" for cotton-seed oil has become too expensive, owing to the large storage room required, and has been largely replaced by an artificial process of refrigerating the oil and separating the "stearin" by means of filter- or hydraulic presses. This has led to the introduction of various oils (*e.g.*, arachis and Tunisian olive oils) as edible oils, which hitherto were objectionable on account of depositing "stearin."

Lard Substitutes.—Special cooling machinery is largely employed. The melted mixture of fats is cooled by means of a hollow cylinder through which flows chilled brine, and the sheet of fat deposited on the surface is removed at once by means of a pump.

Chocolate Fats.—The most suitable substitutes for cacao butter are prepared from the harder portions of palm-nut and cocoanut oils, which are made to crystallise at a temperature slightly over the normal atmospheric temperature, and the crystalline mass is expressed. To raise the melting points of such fats, animal fats are sometimes added as stiffening agents, but, unless carefully refined, animal fats, such as tallow and tallow stearine, may impart an unpleasant flavour to the chocolate. The author suggests the use of some of the tropical vegetable fats of higher melting point as suitable for this purpose, *e.g.*, margosa oil, mowrah-seed oil, &c. (see this J., 1903, 593).

Burning Oils.—Rape oil is still largely used on the railways in this country, whilst in America lard oil, and in Italy olive oil, are employed for the same purpose. The whiter qualities of whale and seal oil are still in demand for illuminating lighthouses.

Lubricating Oils.—Rape oil is still the favourite lubricant for railways, and it is a curious fact that India should export nearly the whole of the rape-seed crop to this country, and import rape oil for her railways. The high price of castor oil a few years ago gave an impetus to the manufacture of "blown" cotton-seed, maize, seal oils, &c. as substitutes. The author states that the suitability of these oils for lubricating purposes is still open to question, and that their tendency to gum and their low flashing points have been mentioned by many engineers as objections to their use.

Paint Oils.—Attention is called to the suitability of safflower oil and candle nut oil for this purpose. Linseed oil bleached by sunlight still holds the first place as the oil for artists' colours. The author has investigated several of the processes of bleaching linseed oil by means of ozone, and considers that they offer no advantage over the method of bleaching by sunlight.

Boiled Oils.—At the present time most of these are prepared by heating linseed oil with "driers" to a temperature not exceeding 150° C., the process being carried out in a cylindrical vessel provided with a heating coil and stirring arrangement.

Sulphonated Oils.—The price of castor oil is now so low that at the present time it would not pay to use other oils for this purpose.

Hydrolysis of Oils and Fats (see this J., 1903, 67, 1094).—Twitchell's reagent, prepared by the action of sulphuric acid in excess on a solution of oleic acid in aromatic hydrocarbons, gives a better emulsion with fats than either hydrochloric or sulphuric acid, practically complete hydrolysis being effected on heating the fat with 1 to 1½ per cent. of the sulpho-aromatic compound in a current of steam, the initial reaction being promoted by the presence of a small amount of free fatty acids. In the following experiments 100 grms. of the oil or fat were heated with 1 per cent. of the reagent in open flasks :—

—		Oil or Fat.					
		Cotton Seed.	Whale.	Rape.	Lard.	Tallow.	Cocoanut.
Original acid value.		5·67	6·01	2·16	2·6	11·15	18·75
Acid value after	2 hours	8·75	14·99	8·4	11·37	15·03	114·0
	7 „	61·28	48·69	23·24	38·66	25·68	221·1
	9 „	99·8	63·72	30·59	58·73	43·44	232·9
	12 „	129·4	72·42	44·26	82·42	49·39	233·2
	14 „	137·6	80·8	50·57	90·81	50·11	236·2
	16 „	148·7	84·31	53·6	98·49	52·03	236·2
	18 „	150·1	85·82	55·4	107·3	53·1	237·2
	20 „	155·9	89·68	56·58	107·9	53·85	237·9
	22 „	157·9	90·71	56·72	109·0	55·6	238·9
	24 „	161·4	91·67	57·91	110·5	57·11	239·5
	26 „	164·5	91·67	59·58	112·0	59·82	239·8
	28 „	165·2	91·7	60·6	115·2	60·23	239·8
	30 „	166·3	94·69	61·46	118·3	63·95	240·6
	32 „	167·0	97·88	61·61	118·6	66·2	240·9
	34 „	168·4	98·07	61·87	119·1	[illegible]	241·0
	36 „	168·9	98·9	62·3	120·2	[illegible]	241·2

The most thorough emulsion of all is obtained by means of enzymes, and this supports the author's theory that the various agents used to bring about hydrolysis act as accelerators or "catalysts," the actual hydrolysis being effected by water. Moreover, in the case of basic materials, *e.g.*, calcium oxide and caustic alkalis, a similar view can be held. Thus it is possible to effect complete hydrolysis by heating the fat with 1 per cent. of lime (as accelerator) in an autoclave under pressure, whilst in the case of caustic alkalis the more rapid hydrolysis may be attributed to the formation of a water-soluble soap, which assists the emulsification of the fat.—C. A. M.

Soap and Candles; Manufacture of ——. J. Lewkowitsch. Cantor Lectures. J. Soc. Arts, 1904, **52**, 833—842.

Candle Industry.—In the older processes of hydrolysing the fats to obtain the free fatty acids, the reaction is somewhat slow, which the author considers may be due to incomplete admixture of the fat with the water. In the recent method of using seed enzymes in the hydrolysis, there is much more thorough emulsification, and in experiments on a manufacturing scale cotton seed oil has been hydrolysed up to 90 per cent. Tallow is much more refractory in this process. Since, however, enzymic hydrolysis at its best has not been quite complete, the author regards it as useless to the candle-maker. As regards Twitchell's reagent (see preceding abstract) the author has obtained the best results with the sulpho-compound of naphthalene.

Cotton Seed Oil containing Free Fatty Acids, hydrolysed with 1 per cent. of Reagent.

——	Sulpho-aromatic Compound of		
	Naphthalene.	Anthracene.	Phenanthrene.
Original acid value	8·3	8·3	8·3
Acid value after 6½ hours	30·9	15·04	42·3
13 "	194·1	60·5	159·9
19½ "	216·9	112·4	156·4
26 "	210·7	147·2	181·6
32½ "	..	148·2	184·2
39 "	..	189·8	204·2
45½ "	..	202·8	204·2

In working on the large scale it is necessary to use a fat with the addition of a small percentage of free fatty acids, since otherwise the reaction does not start rapidly. This process has been introduced into several works in the United States as specially suitable for low-class material that could not be profitably worked in an autoclave. It has the drawback of yielding somewhat dark-coloured fatty acids, which are unsuitable for soap-making. In the processes in which the hydrolysis is carried out by means of an accelerator in an autoclave, the high pressure is liable to cause bulging eventually. Hence spherica autoclaves (see Fig. 1) have been introduced. Th oleic acid, separated by hot pressure from the soli fatty acids, contains a considerable amount of "stearin," which is deposited by cooling the mixture in tanks, o more rapidly by means of Petit's refrigerating wheel This consists of a hollow wheel through which passe chilled brine. As it revolves it dips into a trough containing the oleic acid, and carries up a thin film, whic rapidly cools, and deposits "stearin" crystals. The crystalline mass is removed by means of a scraper, and fall into a tank, whence it is pumped into a filter-press The separated crystals may then be added to a fres lot of candle material at a suitable stage, whilst the olei acid may be partially converted into solid compounds This conversion of oleic acid takes place to some exten in the acid saponification process, where sulphuric acid i used as the reagent, and the latter process is therefore favourite one for working up poor material containin little glycerin. The loss from the destruction of glyceri is compensated by the increased yield of solid candl material. Thus taking the yield of palmitic and steari acids from tallow to be 45 to 47 per cent. in the autoclave process, the yield of solid material from the same fa by the acid saponification process is about 63 per cent.

Soap Industry.—A machine devised by the autho (this J., 1893, 597) for rapidly cooling soap has prove unsuitable for household soaps, owing to its destroyin their crystalline structure. But the same principle (that o the candle-moulding machine, Eng. Pat. 4581 of 1893 has been embodied in a recent patent by Schnetzer Klumpp's apparatus for the same purpose resembles copying press with closed sides, in which the hot soa can be rapidly cooled and compressed, whilst Schrauth'

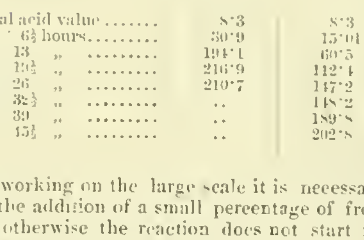


FIG. 1.

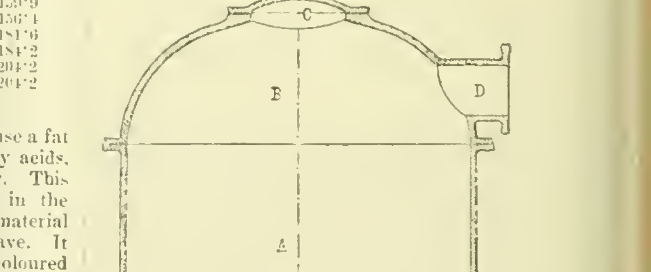


FIG. 2.

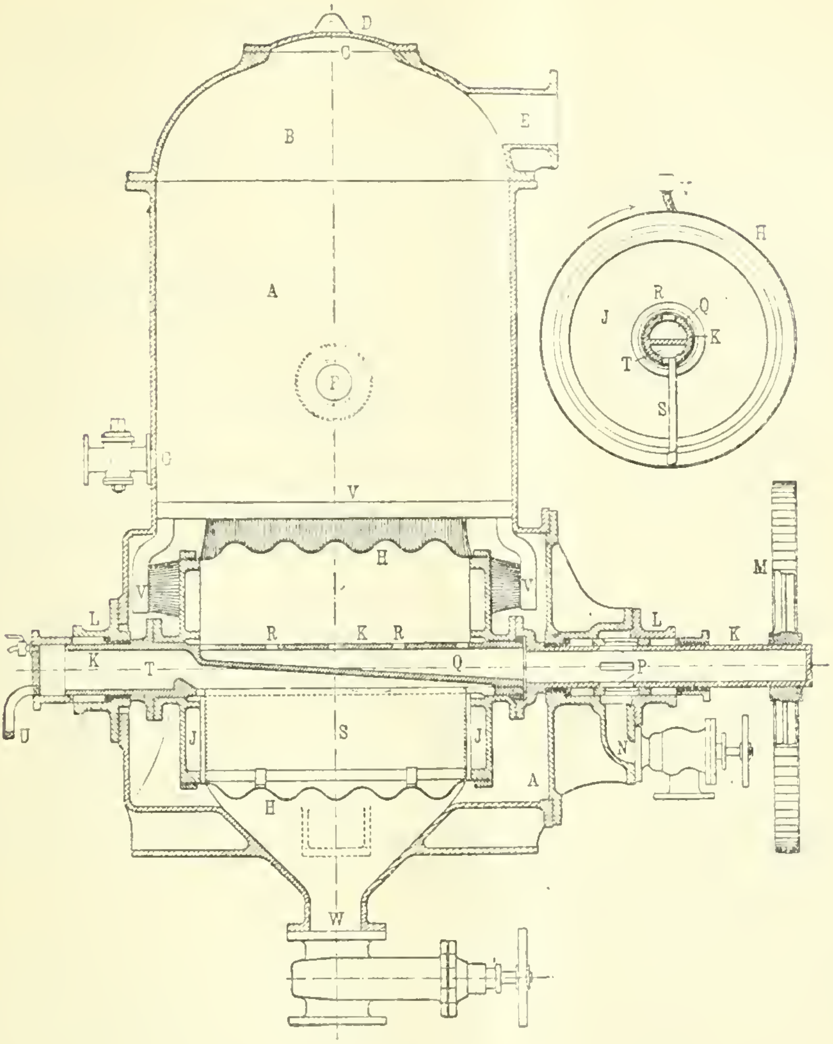


Fig. 3.

atent is based on the principles underlying both the preeding patents. The development of the uses for nitroglycerin as made it profitable to recover glycerin from the soap leys, nd in England, America, and France this is done in the most mportant soap works. Numerous attempts have recently een made to obtain the glycerin from the fats first, and then convert the fatty acids into soap. Autoclave methods ied and found wanting in this country are being revived n the Continent, and, in order to lessen the darkening ffect of the autoclave process on the fatty acids, reduced ressure has been employed, with the result that whilst a etter-looking product has been obtained, there is from 15 20 per cent. of unsaponified fat present, the glycerin which it does not pay to recover subsequently from the oap leys. It is, however, acknowledged, even on the Connent, that first-rate soap cannot be produced by the utoclave process.

Soft Soaps, made from autoclave material, and so conining little glycerin, are dark in colour, unpleasant in ppearance, and will not "hold water." Moreover, the bsence of glycerin from soft soaps is objected to by oollen manufacturers, since the glycerin gives a gloss nd soft feel to their best materials, *e.g.*, cashmeres.

Recovery of Glycerin.—In modern works the old Wetzel an has been replaced by a vacuum-tube evaporator similar those used in sugar works. In the case of glycerin solutions from the acid saponification process, it is necessary to use similar apparatus to that illustrated in the preceding for soap-lye glycerin, since otherwise the calcium sulphate that separates out on concentrating the liquid would form a crust on the tubes and reduce the evaporating effect. In the earlier attempts to recover glycerin from soap lyes the concentration was carried out in fire-heated pans, the sides of which were kept free from deposit by stirring and scraping devices. Then tube evaporators heated by steam were tried, but it was found that the tubes were liable to be completely stopped. The author has therefore patented the apparatus shown in the Figs. 2 and 3, which have proved suitable in practice for the concentration of such leys. It will be seen that the heating surface is kept clean by a mechanical arrangement, so that the salt falling to the bottom can be drawn off into a vessel beneath. This apparatus, is constructed in single effect and double effect, the latter combining a tube evaporator with the apparatus as illustrated by Figs. 2 and 3. The soap leys are concentrated in the vessel, B, until they reach the point at which the salt begins to deposit. They are then transferred to the vessel A, and the boiling continued, the salt being meanwhile removed as it falls out, until eventually the glycerin reaches a concentration of 1·3 sp. gr., when it is withdrawn. A triple effect apparatus is constructed on similar lines.—C. A. M.

Olive Oil; Formation of Free Acid and Production of Rancidity in ——. R. Marcille. Essay at the Oil Culture Congress at Sfax (Tunis). Chem. Centr., 1904, **2**, 1064.

The formation of free acid is due chiefly to the action of lower organisms, especially mould fungi, which secrete a ferment capable of hydrolysing fats and assimilating the glycerin produced. The formation of acid frequently occurs in the olives themselves, when they are badly preserved. The production of rancidity, on the other hand, is caused by the absorption of atmospheric oxygen; the unsaturated fatty acids become saturated and in part are decomposed. The absorption of oxygen is accelerated by heating and still more by exposure to light. The harsh and astringent taste characteristic of rancid olive oil is due to the formation of volatile fatty acids. The author recommends that the freshly-picked olives never be preserved for more than three to four days in heaps: that separation of the oil from the "margines" be effected more expeditiously; and that the oil be preserved in flask-shaped vessels of yellow glass filled up to the neck.—A. S.

Refractometer Scale for use with Fats and Oils; Comparative ——. A. E. Leach and H. C. Lythgoe. XXIII., page 1113.

Cholesterol. A. Windaus and G. Stein. XXIV., page 1117.

Yeast; Some Constituents of ——. O. Hinsberg and E. Roos. XVII., page 1107.

English Patents.

Substances of Fatty Nature that are Hard at Ordinary Temperatures; Method of Rendering —— Plastic. F. Lausen, Aarhus, Denmark. Eng. Pat. 17,866. Aug. 17, 1904.

The material is subjected while in a soft condition to the action of a current of cold air or other inert gas. The gas may be introduced under pressure, and then allowed to expand suddenly, with the result that the heat absorbed by the expansion causes the material to solidify and retain particles of gas distributed throughout the mass.—C. A. M.

Glycerin and Other Products from Distillers' Wash and other Industrial Liquids; Process for Obtaining ——. L. Rivière, Paris. Eng. Pat. 16,836, July 30, 1904.

See Fr. Pat. 338,962 of 1903; this J., 1904, 1035.—T. F. B.

United States Patent.

Hydroxystearic Acid; Process of Making ——. W. M. Burton, Assignor to Standard Oil Co., Chicago. U.S. Pat. 772,129, Oct. 11, 1904.

Oleic acid is diluted with a liquid hydrocarbon of the paraffin series, and is converted into a "saturated oleic acid" by adding a suitable polymerising agent, *e.g.*, sulphuric acid; steam is blown through the mixture, and the aqueous portion is separated. On adding hot petroleum spirit to the oily portion and cooling the solution, hydroxystearic acid crystallises out.—T. F. B.

French Patents.

Oils and Sulphonated Fats; Manufacture of Compounds from ——. J. Stockhausen. Fr. Pat. 344,125. June 18, 1904.

Claim is made for emulsions miscible with water in all proportions prepared by mixing an oil (notably mineral oil) or carbon tetrachloride with the gelatinous soap obtained by saponifying sulphonated castor or other oils. (See Fr. Pat. 253,578.)—C. A. M.

Glycerin; Extraction of —— from Industrial Liquids containing it, and notably from Distillery Residues. E. A. Barbet. Fr. Pat. 344,036, April 16, 1904. XVII. page 1108.

Soap; Machinery for Manufacture of ——. Soc. Talvande Frères and Donault. Fr. Pat. 344,006, June 15, 1904.

The liquid soap runs from an upper tank into a series of vertical rectangular moulds, round which circulates a current of cold water. Above the tank is a funnel in which the pressure of the liquid soap compensates for the contraction caused by the solidification of the material in the moulds. When the soap has set, the upper tank and funnel are removed and the moulds emptied by means of pistons which force the slabs upwards against a system of cutting wires.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

Lead Compounds [White Lead]; Raw Materials for the Preparation of ——. M. Liebig. Z. angew. Chem., 1904, **17**, 1671—1672.

The lead for white-lead preparation must be as pure and soft as possible. A trace of bismuth favours the oxidation of the metal; iron and copper hinder it. The latter metals are estimated colorimetrically by dissolving in nitric acid, precipitating the lead as sulphate, evaporating to small bulk, and adding to one half potassium thiocyanate, to the other ammonia. The colours struck are compared with those of iron and copper solutions of known strengths. The coke used to prepare carbonic acid must be thoroughly burnt and desulphurised, or lead sulphate will be formed, which protects the metal from the action of the acetic acid. For the German (chamber) process 15 per cent. acetic acid, for the French (drum) process 80 per cent. acetic acid is used. Its strength is determined by titration with alkali and phenolphthalein. The sodium nitrate for litharge and nitrite preparation is "refined saltpetre," containing 96—97 per cent. of sodium nitrate. It is usual to determine in samples of it the moisture and the chloride; the latter should not exceed 0·05 per cent. A direct determination of the nitrate by the nitrometer is also sometimes advisable. —J. T. D.

White Lead; Manufacture of ——, by the German (Chamber) Process. M. Liebig. Z. angew. Chem., 1904, **17**, 1672—1673.

Several indications help to control this process. The temperature should be kept at 59°—60° C. A slight excess of acetic acid should always be present, so that the lead acetate draining away should be faintly acid. The percentage of acetic acid in the evaporation pans should be 0·6—0·9. If a test shows more than this, there is too much acid or too little water; if the former, the lead-acetate drainage will be high, both in acidity and in lead content. Lack of water and of carbon dioxide is shown by the formation of stalactites of acetate or basic lead acetate. Too much carbon dioxide is to be avoided, as it converts the lead hydroxide into carbonate, and lessens the covering power of the final product. If the chamber, on inspection after 14 days, does not show a sufficient corrosion, the cause is hard lead, sulphur in the coke, or lack of air. In the first case, a repacking with new lead is the only remedy. In the second, a thorough washing with water may be effective. In the third, additional air must be allowed to enter. With insufficient air, a yellowish or reddish tint in the product, due to the formation of suboxides, is often seen; this disappears on further working of the chamber. In the grinding process, any adhering acetate is precipitated by alkali; the waste waters must be tested to see that neither lead acetate nor excess alkali is contained in them. The white lead should not be dried at a temperature above 70°—80° C., or it is apt to assume a yellow or brownish tint.—J. T. D.

White Lead; Manufacture of —— by the French [Drum] Process. M. Liebig. Z. angew. Chem., 1904, **17**, 1674.

The litharge used must be calcined to oxidise any metallic lead and decompose any peroxide it may contain. To tes when sufficient carbon dioxide has been added to the basic acetate prepared from this litharge, a 1 per cent. mercuric chloride solution is used, and the process judged by the amount of the precipitate formed. In the grinding process metallic lead, lead acetate, and lead sulphate should be tested for.—J. T. D.

Red Lead; Manufacture of ——. M. Liebig. Z. angew. Chem., 1904, **17**, 1674—1675.

The temperature in the furnace should not exceed 300°—350° C., or loss of oxygen is likely to occur. In red lead used as paint only the tint and the fineness are of importance. The latter is judged by suspending 10 grms. in water in a tall narrow cylinder, and noting the times of clearing by settlement through each successive 10 c.c. Impurities of lower specific gravity can also be sometimes detected in this way. Red lead for glassmaking must be free from adulterations, and from iron and copper. To test, the sample is dissolved in nitric acid (sp. gr. 1·24), and oxalic acid added till all peroxide is reduced. Any residue s examined for barium sulphate, ferric oxide, ground brick, &c. The filtrate, after removal of lead, is tested for copper by ammonia, and for iron by thiocyanate. Red lead for matchmaking is valuable in proportion to the peroxide it contains: this may vary from 28 or 30 to 33 per cent. Orange lead is usually made from white lead produced by he French method; it is less dense than ordinary red lead, and has a more vivid colour.—J. T. D.

United States Patent.

Lakes from Sulphur [Sulphide] Dyes; Process of Making ——. R. Gley, Assignor to Act.-Ges. f. Anilinfabrik., Berlin. U.S. Pat. 772,931, Oct. 25, 1904.

See Fr. Pat. 341,246 of 1904; this J., 1904, 873.—T. F. B.

French Patent.

Lakes; Production of —— *[from Azo Dyestuffs]*. Farbenfabr. vorm. F. Bayer et Cie. Fr. Pat. 344,395, June 28, 1904. IV., page 1085.

(*B.*)—RESINS, VARNISHES.

United States Patents.

Pine Oils from Wood; Process of Manufacturing ——. F. S. Clark and E. A. Harris. U.S. Pat. 771,859, Oct. 11, 1904. III., page 1082.

Linoleum; Material for Use as a Substitute for ——. E. V. Clausen, Nörre Nebel and C. A. Heilmann, Skjelskör, Denmark. U.S. Pat. 773,276, Oct. 25, 1904.

See Eng. Pat. 19,233 of 1903; this J., 1903, 1358.—T. F. B.

Floor Coverings and Plastic Wall and Ceiling Facings; Manufacture of ——, G. R. Schmitt, Munich, Germany. U.S. Pat. 773,427, Oct. 25, 1904.

Claim is made for floor-covering material consisting of inoxyn (100 parts), rosin (30 parts), turpentine (30 parts), nd waste-paper pulp containing 20 per cent. of water 150 parts). A plastic mass, obtained by heating these ngredients together, may be worked into slabs, strips, &c., uitable for wall and ceiling facings.—C. A. M.

French Patents.

Gum [and Resins]: Process for Dissolving Hard and Semi-hard ——. H. Terrisse. Fr. Pat. 344,300, June 25, 1904. Under Internat. Conv., June 30, 1903.

See Eng. Pat. 14,554 of 1903; this J., 1904, 552.—T. F. B.

(*C.*)—INDIA-RUBBER, &c.

Gutta-Percha; Occurrence of Cinnamic Acid Esters in Different Kinds of ——. P. van Romburgh. Ber., 1904, **37**, 3440—3443.

From the resin of a specimen of gutta-percha from Dutch New Guinea, the author isolated an amorphous substance, which, when boiled with alcoholic caustic potash, yielded cinnamic acid and an alcohol melting at 177°—178° C. and containing 84·2 per cent. of carbon and 11·85 per cent. of hydrogen. From the resin of gutta-percha from *Palaquium calophyllum*, two substances were isolated, melting at 145° and 228° C. respectively, both of which were found to be esters of cinnamic acid. A compound closely resembling the high-melting product from the gutta-percha of *Palaquium calophyllum* was isolated from a low-grade commercial gutta-percha from Amsterdam; after repeated crystallisation from ethyl acetate, it melted at 237·5° C. (corr. 242° C.). When boiled with alcoholic caustic potash, it yielded cinnamic acid and an alcohol melting at 210° C. The same alcohol was also prepared from the high-melting ester of cinnamic acid isolated from *Palaquium calophyllum*. Tschirch's crystal-alban (this J., 1903, 1250) was found to be identical with the ester of cinnamic acid, melting at 237·5° C., described above. The presence of esters of cinnamic acid was also proved in a number of other kinds of gutta-percha. Gutta-percha from *Payena Leerii* is, however, free from esters of cinnamic acid.—A. S.

Vulcanisation-Coefficients. C. O. Weber. Gummi-Zeit., 1904, 83—84.

The author originally introduced the vulcanisation-coefficient of india-rubber entirely on technical grounds, and agrees with Esch that they should be calculated as the percentage of sulphur to pure india-rubber and not the percentage of sulphur in the vulcanised product. When given in this manner, different coefficients can be compared directly without further calculation. The author cannot confirm Frank's statement that some rubbers contain resins which are converted during vulcanisation into sulphur compounds insoluble in acetone. On the other hand, he has almost invariably found the amount of matter soluble in acetone greater after, than before, vulcanisation.—J. K. B.

India-Rubber; Behaviour of —— *towards Solvents.* G. Fendler. Gummi-Zeit., 1904, **19**, 41—45.

Owing to the very contradictory statements made by different writers, the author undertook the determination of the solubility of some 26 varieties of india-rubber, in ether, light petroleum spirit, benzene, and, in one or two cases, in chloroform and carbon bisulphide. The results, which are given in the table overleaf, show that Weber's statement that rubber is absolutely insoluble in ether, is quite incorrect, ether being, on the contrary, a good solvent, in most cases equal, or nearly equal, to petroleum spirit and benzene. Some kinds of rubber are not entirely soluble in any of the rubber solvents, but contain insoluble rubber-like constituents which swell up but do not dissolve. These insoluble portions vary in their behaviour towards the different rubber solvents, and their presence can only be accounted for by assuming them to be either oxidation-products formed during the coagulation process, or the result of the action of sulphurous acid given off by the burning Urikuri nuts. Further experiments by the author show that petroleum spirit dissolves the least highly oxidised constituents of india-rubber, and probably could be used for a rough separation, as in fat analysis for the separation of oxidised from non-oxidised unsaturated fatty acids. The portions insoluble in petroleum spirit but soluble in benzol contained, in two out of three cases, considerably more oxygen than the portion soluble in petroleum spirit. Closely associated with these partially oxidised constituents of india-rubber is the question whether they are estimated as pure rubber by Harries' "nitrosite" method (this J., 1903, 875), and from the analyses given it appears they are, so long as they retain their rubber-like condition. The author concludes that the valuation of rubber by precipitation from its solution in petroleum spirit and estimation of the resins is the only reliable method, and the nitrosite method is only applicable to the analysis of vulcanised rubber, where the amount of rubber substance originally used is required to be known. Chemical analysis of rubber alone is not sufficient, but should go hand in hand with technical valuation, as the conditions resemble those in the valuation of wine, which cannot be determined by mere analysis.

Brand.	Percentage of Pure India Rubber precipitated by Alcohol from the following solutions of India-Rubber after filtration through Glass Wool.					Insoluble Residue.	Resin.
	Ether.	Petroleum Spirit.	Benzol.	Chloroform.	Carbon Bisulphide.		
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		Per Cent.
Para (crude)	(a) 46·67 (b) 47·20	(a) 33·00 (b) 35·30	63·31	77·41	64·38	Swollen	2·09
Ia. Para (crude)	89·00	94·17	95·11	..	..	..	4·55
Para (washed)	95·56	95·44	95·44	..	..	Swollen	2·67
„ „	97·00	96·00	96·44	..	..	..	3·66
„ sheet	68·09	67·40	89·32	..	..	Swollen	7·10
Negrohead (crude)	75·54	88·95	93·15	..	..	„	2·50
Santos (Mangabeira), Rio-Platten from Brazil (crude).	85·50	93·34	92·00	..	..	..	6·34
Ia. Manicoba (crude)	81·60	80·07	73·20	(a) 81·16 (b) 80·87	82·27	Partially swollen Greater part heterogeneous.	3·60
Manicoba (washed)	95·04	95·25	92·66	..	..	..	5·20
Westind. scraps (crude)	95·83	96·75	95·42	..	..	..	3·30
Mexican scraps (crude)	85·50	89·50	88·22	..	..	..	11·67
Guatemala (sheets) (crude)	80·33	80·25	78·11	..	..	Heterogeneous	17·56
Madagascar (crude)	87·92	92·51	92·50	..	..	..	8·00
Calabar (crude)	64·75	65·25	67·96	..	..	Heterogeneous	29·83
Ordinary red ball rubber, Upper Congo (crude)	90·33	93·07	89·67	..	..	„	4·83
Root rubber, Mozambique (crude)	47·80	46·00	50·78	..	..	„	2·25
Kamerun clusters (crude)	96·00	94·83	93·67	..	..	..	1·60
Red Congo Thimbles (crude)	54·75	57·92	58·11	..	..	Heterogeneous	3·04
Isangi (Africa) (crude)	89·20	89·60	89·75	..	..	Partially heterogeneous. Partially swollen	6·15
Manihot Glaziovii, East Africa (crude)	80·00	81·77	79·20	84·00	..	Swollen	7·06
Manihot Glaziovii Togo (crude)	84·00	85·33	85·39	85·00	..	Greater part swollen.	6·20
Ia. Borneo (crude)	81·75	89·50	87·22	..	..	Heterogeneous	8·60
Borneo (crude)	69·75	70·92	72·23	..	..	„	24·61
Ceylon-Para (crude)	72·90	86·86	96·67	..	..	Swollen	2·09
Bissao (Portuguese Guinea) (crude)	88·17	92·16	90·50	..	..	Heterogeneous	4·80
Ia. Java	94·00	94·34	92·00	..	..	„	5·20

By heterogeneous is meant containing foreign matter, such as sand, dirt, &c.

—J. K. B.

Rubber, particularly Crude Rubber; New Methods for the Analysis of ——. G. Fendler. XXIII., page 1117.

XIV.—TANNING; LEATHER, GLUE, SIZE.

Quebracho Extract: Detection of Adulteration in ——. T. Koerner and P. Düllberg. XXIII., page 1115.

French Patents.

Leather and Skins; Process for Cleaning and Colouring ——. J. Kjeldsen. Fr. Pat. 343,931, June 13, 1904.

The use is claimed of a solution of stearic acid in benzene or other similar hydrocarbon, to which is added a concentrated aqueous solution of an alkali or alkaline carbonate or a solution of alkaline earths or bicarbonates of the same. Or the benzene may be mixed with an excess of ammonia together with a suitable colouring matter and some lanoline. —F. D. T.

Skins and Leather; Process for Treating Partially Prepared ——. H. W. Southworth. Fr. Pat. 344,441, June 29, 1904.

The skins which have been previously cleaned, are plunged into water containing a small quantity of ferrous sulphate. They are then allowed to drain and afterwards immersed in a bath composed of glycerin and a solution of about one part of acetate of alumina to from four to eight parts of water. After they have been partially dried, they are rubbed with a mixture of castor-oil and alcohol and piled on each other until they are completely saturated. Finally a mixture of oil, beeswax, or gum lac, to which a little rubber may be added, is allowed to thoroughly penetrate the material.—F. D. T.

XV.—MANURES, Etc.

Lime; Determination of —— *in presence of Phosphoric Acid.* K. K. Järvinen. XXIII., page 1114.

English Patents.

Fertiliser, and Process for Making the same ——. N. van Laer, Burton-on-Trent. Eng. Pat. 3170, Feb. 9, 1904.

Pressed yeast is mixed with from 2·5 to 10 per cent. of sodium or potassium nitrate and allowed to liquefy and ferment for about 24 hours. Other salts of potassium, sodium, magnesium, phosphorus, or ammonium may be used to cause liquefaction. During fermentation from 5 to 10 per cent. of soot is added and afterwards the pasty mass is treated with about 10 per cent. of mineral superphosphates together with from 15 to 40 per cent. of finely-powdered unslaked lime. The final product is air dried, if necessary, disintegrated and screened.—W. P. S.

Insect-killer adapted for use as a Manure. R. and M. Jenkner and J. Pleyl. Eng. Pat. 19,068, Sept. 3, 1904. XVIII. C., page 1109.

French Patent.

Glycerin; Extraction of —— *from Industrial Liquids containing it, and notably from Distillery Residues.* E. A. Barbet. Fr. Pat. 344,036, April 16, 1904. XVII., page 1108.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar Cane Fibre; Hydrolytic Products of ——. C. A. Browne, jun. XIX., page 1110.

Syrups of Acid Fruit Juices; Inversion of Sucrose in ——. H. Quériault. J. Pharm. Chim., 1904, **20**, 407—408.

The author has observed that sucrose is inverted less quickly in the syrups of acid fruit juices than in a sugar solution containing an equal or even less percentage of added tartaric acid. The following table gives the results obtained by diluting 10 grms. of syrup to 100 c.c., and observing the rotation in a 200-mm. tube.

Syrups.	Acidity as Tartaric Acid.	Differences between the original and the observed deviation.			
		After 1 week.	After 2 weeks.	After 1 month.	After 2 months.
	Per Cent.	° ′	° ′	° ′	° ′
Tartaric acid (Codex).	1·000	0 40	1 20	2 58	5 56
Raspberries......	0·736	0 6	0 18	0 32	1 0
Black currants ..	0·792	0 6	0 12	0 22	0 32
Mulberries.......	0·855	0 4	0 16	0 8	0 12
Cherries	0·576	0 2	0 4	0 8	0 16
Quinces	0·468	0 2	0 2	0 4	0 6
Tartaric acid	0·500	0 18	0 32	1 4	2 34

He suggests that the presence of albuminoid matters in fruit juices may exercise a retarding action on the inversion. —L. J. de W.

Sugar Solutions ; Boiling-Points of ——. H. Claassen. Z. Ver. deutsch. Zuckerind., 1904, 1159—1169.

Two series of determinations were made. In the first solutions of pure sugar, and syrups such as occur in the manufacture of beet sugar, were brought to boiling in a steam-jacketed copper pan of 22 cm. diameter and 25 cm. height by passing in well-dried live steam. The concentration corresponding to each temperature of ebullition was ascertained by taking out samples and estimating the total solids and rotatory power. The second series of experiments was made upon factory syrups only, in the full-scale vacuum-pans of a sugar works. For the tables of figures obtained, the original must be consulted; they go to prove that the increments by which the boiling points of saccharine solutions rise with concentration, are the same in vacuo and under atmospheric pressure.—W. A. C.

Defecation [Sugar] ; Electrolytic ——. H. Claassen. Z. Ver. deutsch. Zuckerind., 1904, 1157—1158.

Against the view of Gurwitsch (this J., 1904, 993), the author maintains that electrolytic methods have no prospect of competing successfully with existing processes of defecation. In the treatment of molasses by the strontia or lime process the products are (1) a bright syrup from which a high yield of sugar is directly obtained, and (2) the whole of the non-sugar originally present, which is worked up into whatever is most profitable, *e.g.*, cyanides at the present time. By Gurwitsch's electrolytic process (this J., *ibid*), on the other hand, only about one-half of the non-sugar is recovered, whilst the purified syrup has only 75 degrees of purity, and leaves about 50 per cent. of the original molasses as an uncrystallisable syrup. The proposed sale of the latter as an edible syrup is deprecated on account of the mercury with which it has come into contact. Finally, the initial cost of an electrolytic plant would certainly not be less than that incurred in the rival process.—W. A. C.

Dextrose : Indicator for Use in the Quantitative Determination of —— *with Fehling's Solution.* C. Griggi. XXIII., page 1117.

United States Patent.

Milk Sugar ; Process of Making ——. S. R. Kennedy, Philadelphia. U.S. Pat. 772,517, Oct. 18, 1904.

Milk is concentrated to a density between 11° and 27° B., the condensed product is subjected to a temperature approaching 32° F. until the sugar crystallises, the sugar crystals are removed in a centrifugal apparatus, and washed with alkaline water at a temperature below 50° F. The salts of the milk may be recovered by evaporation of the washing liquors and recrystallisation.—J. F. B.

French Patents.

[Sugar Extraction] Protection of Beetroots and Sugar Cane from the Action of the Air during Treatment. G. Tauer. Fr. Pat. 338,999, Aug. 24, 1903.

The process of reducing the beetroots or sugar canes to chips, pulp, &c., is conducted in a closed vessel, from which the air is expelled by an inert gas at a suitable temperature (*e.g.*, the gases from the boiler flues). The material is also conveyed to the diffusion vessels, presses, or heaters in a closed apparatus in an atmosphere of inert gas, which precludes the entry of air at any stage.—J. F. B.

Sugar Juice ; Preparatory Treatment of Beetroots or Sugar Cane for the Extraction of ——, *in order to Increase the Yield.* G. Tauer. Fr. Pat. 339,000, Aug. 25, 1903.

The saccharine material (beetroot or cane) is reduced to pulp or ground, and before extraction of juice, is heated by means of waste flue-gases (previously cooled to a temperature preferably not below 90° C.) to between 50° and 100° C. (preferably 85° C.) before the juice is extracted therefrom. The gases which have served for heating the reduced material may be subsequently utilised for protecting the latter from the action of the air during conveyance to the heaters and during the process of reduction.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Barley ; Methods and Apparatus for Testing the Germinative Capacity of ——. H. Wichmann. Allgem. Zeits. f. Bierbrau. und Malzfab. ; through Woch. f. Brau., 1904, **21**, 686—688.

The author has carried out a series of comparative tests on the germinative power of different barleys, determining (*a*) the germinative energy, *i.e.*, the proportion of corns which had germinated after 72 hours ; (*b*) the total germinative capacity. The value of the different methods and apparatus was judged by the magnitude of the results obtained and by the closeness with which the germinative energy approached the total germinative capacity. Only three of the apparatus tested were in any degree satisfactory ; these were : Aubry's germinating box, with a germinating bed consisting of filter-paper on a glass plate, 500 corns per test ; Schönjahn's apparatus, with a germinating bed of sea-sand on a perforated porcelain plate, 100 corns per test ; Schönfeld's germinating funnel, without germinating bed, 1,000 corns per test. Of these, Schönjahn's apparatus is perhaps the most reliable, but it does not quite answer all requirements, on account of the small number of corns tested, and it would be necessary to perform five determinations simultaneously for testing one sample. It may, however, be relied on as a convenient means for controlling results yielded by other apparatus in important cases. Schönfeld's germinating funnel was found to be very simple and generally satisfactory, giving maximum values within 72 hours, but in one case of a freshly harvested barley it gave very deficient results as compared with two other apparatus.—J. F. B.

Barley-Germination Tests : Comments on Wichmann's Article (see preceding abstract). F. Schonfeld. Woch. f. Brau., 1904, **21**, 688—689.

In reply to Wichmann's criticisms, the author points out that with all germinating apparatus small errors in manipulation readily lead to incorrect results ; this is most marked in the case of over-steeping. As the result of hundreds of tests on different barleys, carried out with the glass germinating funnel, the author prescribed a period of five hours' steeping. With sound barleys this period scarcely ever leads to over-steeping, but it may easily do so in the case of freshly-harvested, unmatured barleys, especially with small-corned and rain-damaged samples. The defect of over-steeping, which causes a very large decrease of the germinative capacity, may easily be remedied by curtailing the time of steeping to 3—4 hours, and any operator can detect such errors due to excessive steeping by conducting two parallel tests, one with three hours' and the other with five hours' steep. In this way experience is gained by which the period of steeping may be judged in accordance with the constitution of the barley, so as to give the maximum germinative values. With due discretion in this particular, Schönfeld's germinating funnel will be found to give results in three days, which are almost identical with the total germinative capacity.—J. F. B.

Malt Analysis. H. A. Hunicke. J. Amer. Chem. Soc., 1904, **26**, 1211—1209.

The author has examined the effect of variation in the moisture content of malt on the yield of extract. Some of the results obtained with Wisconsin malt are shown in the following table. The fine meal was obtained by grinding the malt in a coffee-mill, whilst the three coarse grades were obtained by grinding in a Seck mill set at the marks indicated.

Percentage of Moisture.	Percentage of Extract on Dry Material.			
	Fine.	0.	25.	50.
4·45	74·26	73·12	71·23	53·65
6·32	73·91	72·13	69·99	70·02
7·99	74·26	71·66	68·58	48·31
9·69	73·91	70·58	65·47	37·69
11·45	73·71	69·41	60·70	30·76
13·22	74·28	68·66	55·55	25·47

The decrease of yield of extract with increase of the moisture content appears to be due principally to the grains becoming softer and less brittle, whereby the quality of the ground product is affected, and probably also to increased dilution of the charge in the determination of the extract. The influence of stirring on the yield of extract was also examined, and it was found that with coarsely-ground products, the yield is perceptibly decreased when the mash is not stirred at all, and that stirring at intervals of five minutes does not give such high results as stirring every minute. It is essential that the mash be well stirred while the temperature is being raised. The author also discusses the influence on the yield of extract of the lack of uniformity of the samples of malt, the formation of dust during the grinding, and the rate of grinding.—A. S.

Yeast Ferments; Some ——. K. Shiga. Z. physiol. Chem., 1904, **42**, 502—507. Chem. Centr., 1904, **2**, 1327.

The author found that in the course of the auto-digestion of the expressed juice of yeast, the amount of xanthine increases continuously, whilst that of guanine decreases, even if it be added in the free state. No definite rule could be observed with regard to adenine and hypoxanthine, the amounts of these bases increasing and decreasing in an irregular manner during the course of the digestion. The expressed juice of yeast is stated to contain an *arginase*, which produces ornithine from arginine, but does not attack guanidine.—A. S.

Yeasts; Fermentation and Respiration of Different Kinds of —— *in Roll Cultures.* M. Leschtsch. Centr.-Bl. f. Bakter. u. Parasitenk, 1904, **12**, 649—656; **13**, 22—28. Chem. Centr., 1904, **2**, 1350.

By observing the separation of carbon dioxide in roll cultures in different media (beer wort, "plum decoction," and saline solutions containing peptones and sugar), the various races of yeast may be divided into three classes, typical representatives of which are *Sacch. cerevisiæ*, *Sacchar. Pombe*, and *Sacch. membranæfaciens*. With *Sacch. cerevisiæ* in the first two days, nearly equal amounts of carbon dioxide are disengaged, whether the surrounding atmosphere be one of hydrogen or of air. Afterwards, the production of carbon dioxide ceases at an earlier period in hydrogen than in air; if the hydrogen be replaced by air, an increased evolution of carbon dioxide is caused for a short time. *Sacch. Pombe* produces more carbon dioxide in air than in hydrogen. In air, the curve representing the evolution of carbon dioxide rises sharply, and subsequently sinks rapidly. In hydrogen, on the other hand, the rise and fall of the curve are very gradual. Replacement of the hydrogen by air causes an increased production of carbon dioxide for a short time. *Sacch. Pombe* does not propagate so well as *Sacch. cerevisiæ* in an atmosphere free from oxygen. *Sacch. membranæfac.* is a typical aerobe. The amount of carbon dioxide evolved is much less in hydrogen than in air. If the hydrogen be replaced by air, the amount of carbon dioxide produced increases rapidly, but the increase is not maintained.

—A. S.

Yeast; Researches on the Respiration and Respiratory Enzymes of ——. J. Grüss. Z. ges. Brauw., 1904, **27**, 686—692, 699—704, 721—724, 734—739, 752—754, 769—772.

Determination of Glycogen.—The amount of glycogen was calculated from the iodine absorption value of the yeast before and after storage in the moist state for 48 hours at 28°—30° C., during which period the glycogen was used up. The differences between the two iodine values were standardised in terms of glycogen by the acid hydrolysis of the yeast at the two stages in question. Average results indicated that 1 per cent. of iodine is equivalent to 3·2 per cent. of glycogen.

Formation and Disappearance of Glycogen in relation to the Respiratory Quotient.—The yeast plasma is capable of producing and storing up glycogen in equal quantities during the fermentation of either dextrose or fructose under similar conditions. The glycogen is therefore built up, not directly from the sugar, but from the atomic groupings into which the sugar must first be split up by the zymase or other fermentative enzyme. The respiration experiments showed that the store of glycogen is first converted by hydrolysis into dextrose, and that this latter, serving as the respiratory material proper, is then resolved into carbon dioxide and varying quantities of alcohol.

Respiratory Enzymes: Oxydase and Hydrogenase.—When the yeast cells are in a state of vigorous fermentative activity, *i.e.*, when the sugar molecule is being broken up with the greatest intensity, the oxydase reaction ["tetra-base" reaction] is suppressed. This stage corresponds with the formation of glycogen and with a considerable rise in the respiratory energy, *i.e.*, the quantities of oxygen absorbed and carbon dioxide exhaled in unit time. These conditions exist at a maximum after the yeast has been fermenting for some time out of contact with the air. Since the disappearance of the oxydase reaction takes place when the respiratory energy is relatively high, it is probable that the reducing substance which interferes with this reaction attracts the oxygen through the cell wall more strongly than the "tetra-base." It is suggested that the reducing substance in question is nascent hydrogen and that it is produced from the constituent groups of the glucose [hydrolysed glycogen] by the action of a hydrating ["wasser-addierendes"] enzyme, *e.g.*, according to an equation of the type $CH(OH) + H_2O = CO_2 + 4H$. This hydrogen is not liberated, but combines with any reducible substances present, or, in default, with the oxygen fixed by the oxydase, thereby masking the reaction of the latter. In absence of air this nascent hydrogen would tend to form alcohol according to the equation $2CH(OH) + 4H = C_2H_5(OH) + H_2O$. The hypothesis explains the increase of the respiratory energy after fermentation, the occurrence of direct reducing actions such as reduction of sulphur or colouring matters, the absence of the oxydase reaction after fermentation, the fluctuations of the respiratory quotient, the disappearance of the glycogen and the reappearance of the oxydase reaction when the glycogen has been used up or when fermentative activity is inhibited by the addition of sodium chloride. If it be valid, the addition of a reducible body such as sulphur should result in a decreased yield of alcohol, which appears to be the case. The author shows that the enzyme which is the anti-enzyme of the oxydase and which produces nascent hydrogen by hydration is identical with the enzymes described by other authors under the names of "philothion," "catalase," and "hydrogenase." Whether it can be assumed to be identical with Buchner's zymase depends on whether the fermentative action can be proved to take place in two such stages as are illustrated in the above equations or whether it is a direct specific breaking up of the sugar molecule into carbon dioxide and alcohol.—J. F. B.

Yeast; Some Constituents of ——. O. Hinsberg and E. Roos. Z. physiol. Chem., 1904, **42**, 183—192. Chem. Centr., 1904, **2**, 1062—1063. (See this J., 1903, 920, 1012).

In the method previously given by the authors (*loc. cit.*) for the preparation of yeast-fat, the alcoholic extract of the yeast was evaporated, and the residue dissolved in a solution of caustic soda or sodium carbonate and extracted with ether. It is now found that only by using sodium carbonate can a fat rich in lecithin be obtained; when caustic soda is used the fat undergoes considerable decomposition. For medicinal purposes, the yeast-fat containing lecithin is to be preferred, as the lecithin "contains active unsaturated acids."—A. S.

Glycerin; Formation of —— *during Alcoholic Fermentation.* W. Seifert and R. Reisch. Centralbl. Bakt., 1904, **12**. [2], 574. Z. Spiritusind., 1904, **27**, 441.

The authors have studied quantitatively the formation of glycerin during the alcoholic fermentation of grape must. The formation of glycerin is at a maximum in the earlier stages, when the degree of fermentation and of yeast propagation is greatest; towards the end of the fermentation, hardly any glycerin is produced. There is no connection between the formation of glycerin and that of alcohol, but the presence of large quantities of alcohol hinders considerably the formation of glycerin. Glycerin is not a direct fermentation product, but a product of metabolism of the yeast, and the amount of it formed depends upon the vital energy and nature of the yeast. Substances which have the power of increasing the vital energy of the yeast, *e.g.*, sugar, at certain concentrations, cause also an increase in the formation of glycerin.—A. S.

Fusel Oils; Origin of ——. O. Emmerling. Ber., 1904, **37**, 3535—3538.

Many experiments with various races of yeast and several different fermentable carbohydrates showed that, under normal conditions of alcoholic fermentation, only infinitesimal quantities of fusel oil are produced, so long as the fermenting wort remains pure. On the other hand, many bacteria possess the property of forming higher alcohols, especially butyl alcohol, from carbohydrates. Amongst these may be mentioned *Granulobacter butylicum*, *B. orthobutylicus* and the "amylic" ferment of Péreire and Guignard (this J., 1902, 558 and 1090). Bacteria which are especially active in this kind of fermentation occur on the skins of potatoes. The production of fusel oil takes place only under anaërobic conditions. The most suitable carbohydrates appear to be starch and cane-sugar, especially in the unhydrolysed state. For instance, 1,000 grms. of boiled potatoes and 50 grms. of wheat grist, suspended in 3 litres of water with a little chalk, and infected with potato peel, yielded 25 c.c. of insoluble fusel oil; 500 grms. of molasses, containing 48 per cent. of sugar, yielded 19 c.c. of fusel oil under the same conditions. The fermentations were carried out anaërobically for four weeks at 37° C. Hydrogen, carbon dioxide, and butyric acid were obtained as by-products. The same materials saccharified by malt or inverted yielded only 1·8 and 1·5 c.c. of fusel oil respectively. The products consisted of propyl, butyl, and amyl alcohols with only traces of ethyl alcohol. The author found that the addition of nitrogenous materials, such as decomposed yeast, was not favourable to the production of fusel oil.—J. F. B.

Fine Spirits. K. Windisch. Z. Untersuch. Nahrungs u. Genussmittel, 1904, **8**, 465—505.

The author details the examination of samples of cherry brandy, plum brandy, apple brandy, quince brandy, currant brandy, and grape brandy, including the determination of the higher, insoluble fatty acids, formic acid, acetic and butyric acids, and the free and combined hydrocyanic acid; also the determination of fusel oil in various kinds of raw spirit, over 100 samples of "cognac" (mean 0·339 per cent.), 33 samples of rum (0·234 per cent.), 7 of arrack (from 0 to 0·47 per cent.), 36 of cherry brandy (mean 0·457 per cent.), 31 of plum brandy (0·313 per cent.), 12 of grape brandy (0·95 per cent.), and 20 of apple brandy (0·527 per cent.). In addition the paper deals with judging fine spirits on the basis of chemical analysis, and the limitation of the various appellations for these spirits, such as "cognac," "cherry brandy," &c. The author opposes the view that the presence of furfural is an indication of purity and *vice versâ*, nor does he agree with the proposed "coefficient of impurity" as a criterion, since the amount of impurities will depend on the nature of the raw material and the method of distillation. Dealing with the improvement of spirits, he advocates distillation accompanied by slight dephlegmation, this having been found to furnish superior products to the old method of distilling with direct fire heat. Still more can be done by properly controlled fermentation with pure yeasts. It is considered desirable to express analytical results in grms. per 100 c.c., the fusel oil values, obtained by the Roese method, being multiplied by 0·814 for that purpose. The volatile acids and esters, fusel oil and aldehydes, should be referred to 100 c.c. of absolute alcohol to make the results independent of the actual alcohol content of the spirits. Owing to the practice of adding sweet wines to spirits, the volatile acids and total acidity should be determined, the latter by titration with alkali in presence of phenolphthalein (for white spirits) or violet litmus (for coloured); the volatile acids by steam distillation, and titration with phenolphthalein as indicator, the results in both cases being expressed as acetic acid. The esters are determined by boiling for half an hour with excess of alkali under a reflux condenser, and titrating the residual free alkali. In the case of spirits containing extract, sugar or colouring matters, which would falsify the titration by consuming alkali, the esters must be separated by distillation. The results should be expressed in terms of ethyl acetate.—C. S.

Alcohometric Tables for each Integral Percentage by Weight, and for each Degree of the Hydrogen Thermometer from 15° to 22°. E. W. Morley. J. Amer. Chem. Soc., 1904, **26**, 1185—1193.

Tables are given showing the true specific gravity of mixtures of alcohol and water for each integral percentage by weight (from 0 to 100), for each degree of the centigrade hydrogen thermometer from 15° to 22°, according to the results of Mendeléeff. The specific gravity given is the quotient of the weight of the liquid divided by its volume, increased by the correction for displaced air.—A. S.

Yeast Extract in Meat Extract; Detection of ——. M. Wintgen. XXIII., page 1116.

Boric Acid [in Wine, &c.]; Detection of ——. L. Robin. XXIII., page 1113.

English Patents.

Fertilizer [from Yeast] and Process for Making the same. N. van Laer. Eng. Pat. 3170, Feb. 9, 1904. XV., page 1104.

French Patents.

Beer or Malt Extract; Nutritive ——. J. Moberts. Fr. Pat. 343,896. June 11, 1904.

Beer brewed with pure malt is mixed with 0·4 kilo. of crystallised sugar-candy per 100 kilos. of malt, or 2 grms. per litre of beer. The wort is boiled for 60 hours and subjected to a slow fermentation for nine days.—J. F. B.

Phlegms, Wines and Fermented Washes; Continuous, Direct Rectification of ——. A. Baudry. Fr. Pat. 338,992. Aug. 19, 1903. (See also this J., 1904, 725.)

The fermented liquor is fed into a first distilling column which communicates above with a separatory column and below with a second distilling column. The light volatile impurities from the first distilling column rise into the separatory column, where they are concentrated and separated from any alcoholic vapours; the purified alcoholic liquor descends from the first to the second distilling column, the alcoholic vapours from which are passed to a rectifying column. The heavy "tail" products from the

rectifying column descend into a third distilling column where they are freed from alcohol and discharged.
—J. F. B.

Phlegms, Wines and Fermented Washes; Continuous, Direct Rectification of ——. A. Baudry. First Addition, dated Jan. 6, 1904, to Fr. Pat. 338,992, Aug. 19, 1903. (See preceding abstract.)

The improved arrangements provide for the return of some of the impure alcoholic liquors from the lower plates of the rectifying column to the first distilling column in which the phlegms are first distilled.—J. F. B.

Wine; Automatic Conversion of Newly Fermented —— *into Wine suitable for Bottling.* E. Faller. Fr. Pat. 343,999, June 15, 1904.

The wine or other alcoholic beverage is caused to flow from the cask through a worm immersed in a water-bath, in which it is heated to any desired temperature. The precipitated matters are removed by passing the wine from the heating worm through a filter, from which it flows through a worm immersed in cold water, in which it is cooled to a temperature suitable for bottling. It is important that this worm should be so narrow that the whole of its section is filled with the liquid, in order to avoid any loss of alcohol or "bouquet" by volatilisation.—J. F. B.

Glycerin; Extraction of —— *from Industrial Liquids containing it, and notably from Distillery Residues.* E. A. Barbet. Fr. Pat. 344,036, April 16, 1904.

The liquid is concentrated to about 40°—42° B. and treated with powdered lime in the proportion of, say, 1 to 1¼ kilos. to 1 kilo. of the syrup, from which, if necessary, crystals have been previously separated by means of a turbine. The porous mass is then treated with alcohol of as high a strength as possible (95—98 per cent.), and the alcoholic extract evaporated by means of a current of hot air or gas. The residual mass ("vinassate") from the alcoholic extraction forms a good manure. (See this J., 1903, 502; 1904, 1035.)
—C. A. M.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Oils and Fats; Uses and Applications of ——. J. Lewkowitsch. XII., page 1098.

Boric Acid [in Milk]; Detection of ——. L. Robin. XXIII., page 1113.

Watered Milk; Detection of ——. A. E. Leach and H. C. Lythgoe. XXIII., page 1116.

Yeast Extract in Meat Extract; Detection of ——. M. Wintgen. XXIII., page 1116.

English Patent.

Centrifugal Separators (for Cream, &c.). H. Austin, Birmingham. Eng. Pat. 23,091, Oct. 26, 1903.

The plates of the separator are formed with curved upper edges, forming weirs over which the milk to be separated flows, and pockets in which the separated cream collects. A number of short tubes extend from these pockets, inwardly, into vertical slots formed in the central pillars and up which the separated cream flows. In this way the cream does not come into contact with the inflowing stream of milk, which flows up the central aperture of the plates and over the curved edges between the tubes.—W. H. C.

Milk; Treatment [Condensation] of ——. [*Preparation of Milk Sugar*]. S. R. Kennedy, Philadelphia, U.S.A. Eng. Pat. 20,291, Sept. 20, 1904.

See U.S. Pats. 770,909 and 772,517 of 1904; this J., 1904, 996 and page 1105.—T. F. B.

Food and other Substances; Sterilisation of ——. A. Schröder, Berlin. Eng. Pat. 12,113, May 27, 1904.

The process described consists in adding peroxides to the article, such as foods, water, milk, butter, &c., to be preserved, and decomposing the peroxides by means of carbon dioxide (under pressure), carbonates, bicarbonates, or acid phosphates. The peroxides employed are those of calcium, magnesium, or sodium. For decomposing the two former, calcium or magnesium acid phosphates may be used with or without the aid of carbon dioxide. The articles before or after treatment may be subjected to a temperature of 40° to 50° C.—W. P. S.

French Patents.

Foodstuffs; Process for Preserving —— [*with Trioxymethylene*]. A. Foelsing. Fr. Pat. 343,944, June 13, 1904.

See Eng. Pat. 13,689 of 1904; this J., 1904, 878.—T. F. B.

Preservatives for Foodstuffs, Articles of Use, and the like. Deutsche Conservierungs-Ges. für Nahrungs-und Genussmittel. Fr. Pat. 344,101, June 17, 1904.

See Eng. Pat. 18,428, 1903; this J., 1904, 832.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

English Patents.

Paving Blocks from Towns' Refuse. W. Weaver. Eng. Pat. 22,042, Oct. 13, 1903. IX., page 1091.

[*Water*] *Filters: Aeration of* ——, *and Apparatus for use in connection therewith.* F. Candy, London. Eng. Pat. 23,772, Nov. 3, 1903.

In the case of a pressure filter, such as is described in Eng. Pat. 5242, 1898 (this J., 1899, 391), air is forced into the upper part of the filter by means of an air-pump or fan. The suction-pipe of the pump may be either (1) connected to the bottom of the filter, (2) open to the air, (3) connected to an air-sterilising chamber, or (4) to an ozone-producing apparatus. Instead of forcing air through the filter, the pump may be employed as a suction-pump at the bottom of the filter, this alternative process being also applied to open filters. In place of a pump or blower a closed tank may be used provided with means for admitting and withdrawing water therefrom and connected to the filter by a pipe. By the introduction of water to this tank, air is forced into the filter, and, when the tank is emptied, air is drawn through the bed. The object of the process is to remove water mechanically retained by the filter-bed, and it is applied after the filter has been washed or cleansed from suspended matter.—W. P. S.

Sewage or other Liquid; Apparatus for Distributing ——. J. B. Alliott, Nottingham, and W. D. Scott-Moncrieff Staines. Eng. Pat. 24,838, Nov. 14, 1903.

For distributing sewage uniformly and intermittently ove a filter-bed, two vehicles are provided, each comprisin a trough-shaped receptacle mounted on wheels, wit mechanism causing the trough to tilt gradually as i travels to the end point of a pair of inclined rails. Th two vehicles are connected together by chains and trave reciprocally down and up the two inclined tracks. Th sewage supply is situated at the highest point of the track and supplies the vehicles alternately; one vehicle havin been filled, it travels down the track distributing its sewag contents uniformly in its path as the trough tilts over During the upward course the trough is tilted back int an upright position ready to receive a fresh charge.—J. F. B

Sewage; Filtering and Purifying ——. S. Barwis Duffield, Derbyshire. Eng. Pat. 25,480, Nov. 23, 1903.

This is a process for assisting and increasing the natura action of filter-beds. For this purpose air is drawn in a the top of the filter-bed by means of a fan (or othe mechanism) fixed on a pipe coming from the bottom c the bed. From this pipe, branch pipes and subsidiar branch pipes, terminating in perforated earthenware sagger extend to all points of the floor of the filter. The sewage is supplied to the filter by a revolving spreader and leaves by an effluent channel, the effluent reaching the latter through suitably placed trapped pipes. The sides of the filter-bed are composed of air-tight material and the air and effluent pipes may be combined or separate.—W. P. S.

Bacteria Beds and the like; Apparatus for Use with ——. H. L. Doulton and R. J. Pleace, London. Eng. Pat. 26,466, Dec. 3, 1903.

The first part of the invention relates to an apparatus for the automatic delivery of sewage to two or more bacteria beds in succession. A chamber has two or more outlets at its bottom, each outlet communicating with a separate filter-bed. Above these outlets is fixed a revolving plate provided with one opening, the latter, as the plate revolves, passing over the outlets. An automatic siphon is fixed in a second chamber and discharges into the first chamber. As the sewage rises in the second chamber it raises a floating ball, which, in its turn, by means of a ratchet wheel, shafting, and cog-wheels, causes the plate in the first chamber to revolve. The opening in the plate is thus brought over a separate outlet between each discharge of the siphon. The second apparatus claimed consists of a device for the automatic discharge of sewage from a chamber after it has been retained some pre-arranged period. The sewage flows into a chamber containing a siphon in which air is compressed and from which the air must be released before the siphon acts. The top of the pressure-chamber of the siphon is connected by a pipe to a valve in a second chamber. This valve is operated by a floating ball and lever, the ball being raised by allowing part of the sewage to flow into this second chamber through a regulated valve. The ball-valve is so arranged that it opens quickly. A small siphon is provided for emptying the second chamber and discharges into the first siphon.—W. P. S.

United States Patents.

Water; Method of Purifying ——. T. Jones, Acme, Tex. U.S. Pat. 773,395, Oct. 25, 1904.

To remove gypsum and carbonates dissolved in water, the patentee adds milk of lime to the latter, and then to the residual water a solution of orthosilicate of soda of the consistency of syrup.—W. P. S.

Sea or Hard Water; Composition for Purifying ——. A. Gutensohn, Southend, Eng. U.S. Pat. 773,494, Oct. 25, 1904.

The composition consists of rosin, prepared by repeated heating and cooling, dissolved in a solution containing sodium carbonate, sodium hydroxide and sodium silicate, mixed with a solution of zinc hydroxide in sodium hydroxide.—W. P. S.

French Patents.

Sewage and other Refuse; Treatment of ——. J. L. F. Garrigou. First Addition, dated June 16, 1904, to Fr. Pat. 340,740, Feb. 26, 1904. (This J., 1904, 833.)

The modification described consists in heating the refuse, &c., without the addition of chalk or other materials, in order to directly obtain the ammonia contained in the refuse.—W. P. S.

Sewage; Apparatus for [Electrically] Treating ——. W. J. Schweitzer. Fr. Pat., 344,192, June 21, 1904.

See U.S. Pat. 763,026 of 1904; this J., 1904, 758.—T. F. B.

Ammonia from Waste Waters; Process for Extracting ——. R. Schilling and C. Kremer. Fr. Pat. 344,420, July 1, 1904.

See Eng. Pat. 14,966 of 1904; this J., 1904, 947.—T. F. B.

Water; Clarification of ——. L. E. Vial. Fr. Pat. 344,174, June 21, 1904.

The turbid water is allowed to settle in a long tank or basin, having its greatest depth at the middle and being shallow at each end. The sides of the tank slope inwards to form a channel along the bottom. A series of walls or partitions are placed at certain distances apart along the channel. The upper edge of each partition is just below the surface of the water, whilst the lower edge reaches to within a short distance of the bottom of the tank. The entrance to the tank consists of a horizontal slab over which the water flows in a shallow layer.—W. P. S.

(C.)—DISINFECTANTS.

Mould Fungi; Influence of some Salts and Monatomic Alcohols on the Development of ——. K. S. Iwanoff. Centralbl. Bakteriol., 1904, **13**, [2], 139. Chem.-Zeit., 1904, **28**, Rep., 310.

The experiments were carried out with four different nutrient solutions:—Solution G: Wehmer's modification of Henneberg's solution of N/30 *l*-asparagine, N/6-dextrose, N/30-potassium dihydrogen phosphate, and N/100-crystallised magnesium sulphate: Solution N: solution G with the asparagine replaced by ammonium nitrate: Solution S: solution G with the dextrose replaced by saccharose: Solution DG: solution G with the amount of dextrose doubled. The fungi used were *Amylomyces β*, *Aspergillus niger*, *Mucor spinosus*, *Mucor racemosus*, *Oidium lactis*, and *Trichothecium roseum*. The substances of which the action was examined comprised the sulphates of magnesium, zinc, cadmium, manganese, nickel, cobalt and copper, mercuric chloride, methyl, ethyl, propyl, normal and secondary butyl, isopropyl, isobutyl, iso-amyl and allyl alcohols, trimethylcarbinol and amylene hydrate. It was found that in the case of the metals of Mendelejeff's second group, the poisonous action on the fungi increases with the atomic weight: Mg < Zn < Cd < Hg. Of the other metals manganese was the least poisonous in solution N, and then cobalt, nickel, copper, in the order given. The poisonous action of the metallic salts varies according to the nature of the nitrogenous food supplied to the fungi; for example, in solution G, the order is Mn < Cu < Co < Ni. The different action exhibited by the same salt in different nutrient solutions is due partly to chemical reactions, and partly to physiological causes. The nature of the nutrient material containing carbon has also an influence on the action of the salts; this is likewise due partly to chemical and partly to physiological causes. In the cultures of *Mucor spinosus* the metallic salts produce coloured crystalline precipitates. With regard to the action of the alcohols, the poisonous effect increases with the length of the carbon chain in the case of primary, monatomic alcohols. With the butyl alcohols the poisonous action increases in the order, trimethylcarbinol, secondary normal butyl alcohol, primary isobutyl alcohol, primary normal butyl alcohol. Primary propyl alcohol is more poisonous than the corresponding secondary alcohol, primary iso-amyl alcohol more than the corresponding tertiary alcohol, and allyl alcohol more than normal butyl alcohol.—A. S.

English Patents.

Alkaline Chlorides and Oxychlorides; Preserving the Strength and Keeping Powers of Solutions of ——, *employed for Bleaching, Disinfecting, Separation of Metals, and other such like Purposes.* G. J. Atkins and Oxychlorides, Ltd. Eng. Pat. 25,972, Nov. 27, 1903, VII., page 1088.

Insect-Killer adapted for Use as a Manure. R. and M. Jenkner and J. Pleyl, Floridsdorf, Austria. Eng. Pat. 19,068, Sept. 3, 1904.

Potassium cyanide and other cyanogen compounds are found not to affect the growth of plants, whilst they destroy *phylloxeræ* and other parasites and insects. The insecticide-manure to which the present invention relates consists of a mixture of potassium cyanide and quicklime, also ammonium salts, and a decolorising agent, such as magnesium hydrosilicate, or alumina. The cyanogen compounds are used in the form obtained in the purification of coal-gas by the ferric oxide process.—T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

Sugar-cane Fibre ; Hydrolytic Products of ——. C. A. Browne, jun. J. Amer. Chem. Soc., 1904, **26**, 1221—1235.

The author has studied the products obtained by the hydrolysis of sugar-cane fibre with dilute caustic soda solution. 200 grms. of purified fibre obtained by washing finely-cut bagasse successively with water, 2 per cent. hydrochloric acid, and again with water, were digested for eight hours with 3 litres of a 5 per cent. solution of caustic soda. The residual pulp was washed several times with small quantities of cold water and the washings added to the caustic soda solution. The pulp was then further purified by washing with hot water till free from alkali, and finally with strong alcohol. From the caustic soda solution the cane-gum was precipitated by alcohol, and purified by treatment with an alcoholic solution of hydrochloric acid, followed by washing with alcohol and then with ether. On hydrolysis with 4 per cent. hydrochloric acid, the cane-gum yielded *l*-xylose and *l*-arabinose, the latter being isolated in the form of its benzylphenylhydrazone. Xylan and araban make up nearly 80 per cent. of the cane-gum; the presence of galactan could not be detected. From the filtrate from the cane-gum, lignin was precipitated by dilute sulphuric acid after expelling the alcohol. After purification the lignin formed a brown-coloured powder, which, when treated with chlorine, yielded a product apparently identical with the lignone chloride, $C_{19}H_{18}Cl_4O_9$, prepared by Cross and Bevan from jute and other fibres. The acid filtrate from the lignin yielded acetic acid when distilled in a current of steam. The cellulose obtained by digesting the cane fibre with caustic soda amounted, in the dry condition, to only 42 per cent. of the original fibre. This low yield of cellulose, compared with the result obtained by Cross and Bevan's chlorination method, is due to the solvent action of the alkali, especially on the pith. The following figures show the relative resistance of the different tissues of the cane to various chemical treatments:—

——	Pith.	Fibro-vascular Bundles.	Rind.
	Per Cent.	Per Cent.	Per Cent.
Cellulose by chlorination (Cross and Bevan).	49·00	50·00	51·09
Cellulose by treatment with 1·25 per cent. sulphuric acid and 1·25 per cent. caustic soda solution (Weende).	42·86	48·64	54·76

These results have an important bearing upon the utilisation of cane-fibre for paper-making, since a chemical treatment necessary for the proper preparation of the rind would result in a large loss of pith. Drewsen (U.S. Pat. 731,290 of 1903; this J., 1903, 876) has patented a process by means of which this loss is avoided, the pith being separated from the sugar-cane, corn-stalks, &c., before digestion, The pith is not fibrous, and has no felting properties, but paper prepared from it is stated to possess the quality and strength of parchment. The cellulose prepared from the cane-fibre by digestion with caustic soda yielded dextrose on hydrolysis with sulphuric acid.

The yields of the different products, calculated to the fibre free from protein, ash, fat, &c., were:—Cellulose (including oxycellulose), 55; xylan, 20: araban, 4; lignin, 15; and acetic acid, 6 per cent. The sugar-cane fibre resembles very closely in composition the pithy stalks of maize, both being allied to the cereal straws, a distinguishing characteristic of which group is a cellular complex low in cellulose and high in pentosans.—A. S.

Printing Papers ; Production of Dust by ——.
X. Wochenbl. f. Papierfab., 1904, **35**, 3270—3271.

The production of dust on low-grade printing papers, which clogs the type and makes the printing on the high-speed "news" machine almost impossible, is due either to imperfections in manufacture or to inferior raw material. As regards manufacture, the continual fall in the price of "news" makes it imperative that the paper-machines should be run at ever-increasing speed. When a mill thus increases its output it is very seldom provided with more beating engines, nor is the construction of the paper-machine altered by increasing the length of the wire and the number of the drying cylinders. Under these conditions the increased output is only obtained at the expense of the quality of the paper; the short-fibred stuff has to be beaten "free," it does not have time to felt properly, and the paper is dried far too quickly. Paper prepared thus will nearly always make a large quantity of dust on the printing machine. As regards raw material, "news" paper generally contains 20 per cent. of chemical wood-pulp, and 80 per cent. of mechanical wood-pulp, and is loaded with about 20 per cent. of clay. The quality of the clay is of great importance, it should have a fatty feel and should suspend well in water; gypsum and the cheap, "thin" qualities of clay are quite unsuitable as loading materials for printing papers. But the quality of the paper is chiefly dependent on that of its main constituent, the mechanical wood-pulp. A cheap, free-ground quality of wood-pulp, ground with coarsely sharpened stones, cannot be made into good paper whatever the care bestowed on the beating; it will also frequently prove dearer than a wet-ground pulp, higher in price, because it causes more loss and will not retain the clay. The best sort of pulp is prepared by stones which have a fine grain and are delicately sharpened; above all, the wood employed should not be old and dry, but as fresh as possible. The quality of the paper can best be tested by pressing the palm of the hand on the reel as it is being wound up; if the hand become covered with a layer of fine white dust, composed mainly of wood-fibres, the paper will be quite unfit for high-speed printing.
—J. F. B.

United States Patents.

Paper-Making ; Means for Dissolving Size for ——. B. Kniffler, Milwaukee, Wis. U.S. Pat. 771,986, Oct. 11, 1904.

The apparatus consists of a large water-tank, and two small tanks provided with steam coils. The size is placed in one of the small tanks and is heated by the coil, the steam from which is utilised for disintegrating and discharging the size, by means of an injector, into a pipe dipping below the surface of the water in the large tank. During its passage through this pipe, the size is intimately mixed with atomised hot water discharged through a second injector fitted to the second small heating tank.
—J. F. B.

Paper; Process for Making —— Moisture or Grease Proof. J. Kitsee, Philadelphia. U.S. Pat. 772,103, Oct. 11, 1904.

Paper is treated superficially with a mixture of nitric and sulphuric acids, in such a manner as to make the surface soluble whilst leaving the interior unchanged. The treated surface is then subjected to the action of a solvent.
—J. F. B.

Pulp Washer or Condenser. H. G. Turner, Montreal. U.S. Pat. 772,192, Oct. 11, 1904.

The apparatus consists of a vertical, cylindrical tank in which is situated a vertical, cylindrical strainer capable of being rotated. The space between the walls of the tank and the strainer is divided horizontally into a number of superposed, annular compartments, communicating with each other by openings which are disposed in different angular positions, each opening being separated from the next one by means of transverse partitions. The pulp is fed in at the bottom of the tank and is caused to travel upwards through all the compartments: a series of doctors is provided, one in each compartment, and pressed against the screening cylinder by springs, so that when the cylinder rotates, the pulp is agitated and scraped off the screen, whilst being subjected to the action of jets of water.—J. F. B.

French Patents.

Cellulose Xanthate ; Purification of —— for the Preparation of Viscose. Soc., Franç. de la Viscose. Second Addition, dated June 11, 1904, to Fr. Pat. 334,636, Aug. 14, 1903.

In place of using alkali or alkaline-earth sulphite solutions for toughening crude cellulose xanthate, it is found more advantageous to use alkali or alkaline-earth bisulphites, either alone, or in conjunction with aluminium sulphate, alkali chloride, sulphate, &c. (See this J., 1904, 75 and 501.)—T. F. B.

Celluloid Non-inflammable ; Process for Rendering ——. G. E. Woodward. Fr. Pat. 344.048, May 25, 1904.

Celluloid is rendered non-inflammable by incorporating with it, for each kilo. of celluloid, 1·5 kilos. of fish glue, 400 grms. of gum arabic, 100 grms. of gelatin, and 40 grms. of colza oil.—T. F. B.

Celluloid or Nitrocellulose : Rendering Non-inflammable ; Process for ——. W. C. Parkin. Fr. Pat. 344,501, July 1, 1904. Under Internat. Conv., Dec. 23, 1903.

Celluloid or nitrocellulose may be rendered incombustible by incorporating with it aluminium chloride, strontium chloride, magnesium chloride, and calcium chloride. Two parts of celluloid dissolved in 3 parts of acetone are added to a solution of 1 part of one (or a mixture) of the above salts in 2 parts of methyl alcohol. The solvents are distilled off and the celluloid obtained in powder form suitable for working up in the usual manner.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Esterification ; New Method of ——, for Organic Acids. A. Werner and W. Seybold. Ber., 1904, **37**, 3658—3661.

By the action of dimethyl sulphate on aqueous solutions of the alkali salts of organic acids, good yields of the methyl esters of the acids can be obtained. The reaction proceeds according to the equation:—$R.COOX + (CH_3)_2SO_4 = R.COOCH_3 + CH_3.X.SO_4$. 5 grms. of the acid are treated with a slight excess of N/1 alkali, and about 2 molecular proportions of dimethyl sulphate are added. If the mixture be shaken continuously, the reaction is complete in half-an-hour. The excess of dimethyl sulphate is decomposed by heating the product on the water-bath, and after cooling, the ester is separated from the free acid by adding excess of alkali. The methyl esters of acetic, isovaleric, stearic, 2.4.6-tribromobenzoic, 2.4.6-trinitrobenzoic, β-methoxy-α-naphthoic, and β-methoxy-β-naphthoic acids have been prepared by this method. The method is stated to give good yields in cases where the usual method of esterification with the corresponding alcohol fails, *e.g.*, in the preparation of esters of 2.4.6-tribromo-, and 2.4.6-trinitrobenzoic acids. —A. S.

Quinine ; Refining of ——. C. Martinotti and G. Castellini. Boll. Chim. Farm., 1904, **43**, 529—536. Chem. Centr., 1904, **2**, 1154—1155.

After a description of the known methods for the separation of quinine sulphate from the amorphous and resinous substances accompanying it, the authors propose a new process based on the following facts:—(1) The resinous, uncrystallisable substances remain in solution in perfectly neutral and in acid liquids. (2) On adding alkali to liquors poor in quinine, but still contaminated by amorphous substances, the latter are precipitated first, separating as a viscous magma. For the separation of quinine from the mother-liquors, the authors recommend working with the basic quinine hydrochloride, $C_{20}H_{24}N_2O_2.HCl.2H_2O$ converting it into the dihydrochloride, $C_{20}H_{24}N_2O_2.2HCl$.—A. S.

Essential Oils ; Treatment with Sulphuric Acid for the Identification of ——. M. Duyk. XXIII., page 1116.

Patchouli Oil ; Composition of ——. H. v. Soden and W. Rojahn. Ber., 1904, **37**, 3353—3355.

Patchouli oil, freshly prepared from the leaves, was resolved by distillation into four fractions of equal weight, having sp. grs. 0.946, 0.964, 0.984, and 1.002 (at 15° C.), and optical rotations − 44°, − 52°, − 64°, and − 70° respectively. The last two fractions consisted mainly of patchouli alcohol, with small amounts of another liquid sesquiterpene alcohol. The first two fractions, which contained the sesquiterpenes and also the aromatic constituents of the oil, were repeatedly fractionated, distillates of like sp. gr. and rotatory power being mixed together and further fractionated. Finally, four products were obtained, viz., small quantities of the aromatic substances, larger quantities of patchouli alcohol (these two were not examined further), a fraction (A) of sp. gr. 0.93—0.94 and $\alpha_D = - 50°$, and a fraction (B) of sp. gr. 0.93—0.94 containing both, feebly, dextro- and levo-rotatory substances. Fractions A and B were treated with alcoholic potash, washed, and repeatedly fractionated as above. The chief component of fraction A was a new liquid sesquiterpene, colourless, of sp. gr. 0.9335 (at 15° C.), b. pt. 264°—265° (750 m.m.), α_D (20° C.) = − 58° 45′; it absorbs bromine, hydrobromic acid, and hydrochloric acid (the latter forming a liquid hydrochloride) ; it somewhat resembles cedrene (this J., 1897, 555) as regards physical constants, but is not identical with it. Fraction B yielded mainly another sesquiterpene, of sp. gr. 0.930 (15° C.), and b. pt. 273°—274° ; $\alpha_D = + 0° 45′$. It forms with hydrochloric acid a liquid hydrochloride. Cadinene, found by Wallach (Annalen, 1887, 81) in patchouli oil, was not detected in either fraction.—T. F. B.

Birch Leaves ; Essential Oil of ——. Haensel's Report, Oct. 1904. Apoth.-Zeit. 1904, **19**, 854.

The leaves of *Betula alba* yield 0·049 per cent. of an olive-green oil, which solidifies at normal temperatures, from the presence of an unidentified crystalline constituent. The oil is fluid at 35° C., at which temperature its sp. gr. is 0·9074 ; it is optically inactive in 10 per cent. alcoholic solution at 30° C. ; acid value, 99 ; saponification value, 146·7. It is wholly soluble in absolute alcohol only on warming. By filtering the oil from the stearoptene, 57 per cent. of a thickly fluid oil was obtained with an acid reaction : sp. gr. 0·8723 at 20° C. Its acid and saponification values are very close to those of the original oil.—J. O. B.

Raspberries ; Essential Oil of ——. Haensel's Report, Oct. 1904. Apoth.-Zeit., 1904, **19**, 854.

By distilling raspberry press-marc, a small quantity of essential oil was obtained, of a greenish colour and acid reaction, having an intense raspberry aroma, sp. gr. 0·8883 at 15° C. ; $\alpha_D = + 2·8°$; saponification value, 193 ; saponification value after acetylating, 215 ; solubility in 80 per cent. alcohol 1:30.—J. O. B.

Burdock Leaves ; Essential Oil of ——. Haensel's Report, Oct. 1904. Apoth.-Zeit., 1904, **19**, 854.

Air-dried burdock leaves yielded 0·0285 per cent. of a dark brown oil, resembling that obtained from burdock root in taste and odour, entirely fluid at 30° C. ; not entirely soluble in 96 per cent. alcohol. The stearoptene deposited at ordinary temperatures is probably palmitic acid, similar to that isolated from the essential oil of the root. This leaf oil has the sp. gr. 0·9562 at 20° C. ; acid value, 76 ; saponification value, 91·5. On re-distilling, 39 per cent. of brown, faintly acid, rectified oil was obtained, readily soluble in 96 per cent. alcohol, not wholly soluble in 80 per cent. alcohol : sp. gr. 0·9407, at 20° C. ; acid value, 18 ; saponification value, 70 ; $\alpha_D = + 0·28°$ in 20 per cent. alcoholic solution for 25 mm. tube.—J. O. B.

White Peruvian Balsam ; Constituents of ——. H. Thoms and A. Biltz. Allgem. Oester. Apoth. Verein, 1904, 943. Apoth.-Zeit., 1904, **19**, 1732.

White Peruvian balsam contains myroxocerin, free cinnamic acid, a crystalline body, m. p. 270° C., myroxol, cinnamic esters of cinnamyl and propyl alcohols, and probably a hydrocarbon. White Peruvian balsam does not contain benzyl alcohol nor peruviol, which are present in ordinary dark balsam of Peru.—J. O. B.

Bergamot Oil and other Oils of the Citrus Series: Note on ——. H. E. Burgess and Th. H. Page. Chem. Soc. Proc., 1904, **20**, 181–182.

Acetic acid, octylene, pinene, camphene, and limonene have been identified as constituents of a specimen of pure oil of bergamot. The pungency of the first fractions of this oil on distillation is accounted for by the presence of acetic acid, which was also found in smaller quantities in lemon oil, and is probably present in the other oils of this series. The octylene found in lemon oil was identical with that in bergamot oil, for both gave butyric acid on oxidation with potassium permanganate. It is probably a normal constituent of the citrus oils. A second phenylurethane isolated from the terpineol fraction of distilled oil of limes melts at 132° C., is more soluble than that obtained from ordinary terpineol, crystallises in tufts of needles, and gives on hydrolysis an oil with an intense odour of distilled oil of limes.

Formic Acid; New Reaction of ——. E. Comanducci. XXIII., page 1116.

Aromatic Esters; Electrolytic Reduction of ——. C. Mettler. XI.A., page 1096.

Atropine: Contributions to the Knowledge of Alkaloid Reactions.—III. C. Reichard. XXIII., page 1116.

Yeast; Some Constituents of ——. O. Hinsberg and E. Roos. XVII., page 1107.

English Patent.

Saccharin; Production of ——. A. Ashworth, Bury, Lancs. Eng. Pat. 25,481, Nov. 23, 1903.

If, in the oxidation of o-toluenesulphonamide to saccharin, an alkaline earth permanganate be used in place of an alkali permanganate, the yield is found to be much improved. A mixture of 100 lb. of o-toluenesulphonamide, 23 lb. of slaked lime, and 200 gallons of water is heated to 70°–80° C., and 180 lb. of calcium permanganate (98 per cent.) dissolved in 50 gallons of water is added gradually with stirring; the precipitate of manganese compounds is removed by filtration, and the saccharin recovered from the filtrate in the usual way.—T. F. B.

United States Patent.

Ureide of Dialkylacetic Acid and Process of making same. E. Fischer, Berlin, and J. von Mering, Halle a Salle. Assignors to the Firm of E. Merck, Darmstadt, Germany. U.S. Pat. 773,251, Oct. 25, 1904.

See Eng. Pat. 1944 of 1903; this J., 1903, 880.—T. F. B.

French Patent.

Dialkylbarbituric Acids: Process for Preparing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 343,976, June 14, 1904. Under Internat. Conv., Oct. 21, 1903.

See Eng. Pat. 22,967 of 1903; this J., 1904, 76.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic Plates; Action of certain Substances on —— [in the Dark]. J. Blass and P. Czermak. Phot. Ind., 1904, 923. Chem.-Zeit., 1904, **28**, Rep., 332.

The action of a variety of substances on photographic plates in the dark is described. Brown wrapping paper is the most active, followed by other kinds of paper, wood, straw, shellac, leather, silk, and cotton in the order given; glass and metals (other than zinc) and most minerals and inorganic substances had little or no action. Photographic films and films removed from their support were not sensitive to any substances. Thin sheets of metal, glass, quartz, or mica also prevent the action of the substances on glass plates. Sheets of gelatin, through which blue or violet rays can pass, have no influence on the action, but yellow sheets of gelatin completely prevent it. (See also Russell, this J., 1904, 998, and von Aubel, this J., 1904, 560.)—T. F. B.

English Patent.

Photographic Plates and Films. J. H. Smith, Zürich, Switzerland. Eng. Pat. 19,940, Sept. 16, 1904. Under Internat. Conv., Sept. 17, 1903.

Compound plates or films for use in multi-colour photography are produced by superimposing on a support of glass, paper, &c., the requisite number of sensitive films, each one being separated from the adjacent one by a thin layer of collodion or celluloid. After exposure, a temporary support, coated with some adhesive, is pressed on the uppermost film, which can then be transferred to a permanent support; the collodion or celluloid layer is dissolved away, and the film is then treated in the usual way. All the other sensitive films, with the exception of the lowest one, are removed in the same manner, a series of negatives suitable for colour-work being thus obtained by a single exposure.—T. F. B.

United States Patent.

Photograph on Linen, and Process of making same. O. Fulton, Chiswick, and W. M. Gillard, Twickenham, England. U.S. Pat. 773,384, Oct. 25, 1904.

See Eng. Pat. 11,219 of 1903; this J. 1904, 622.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

Nitrocellulose; Decomposition of —— below the Temperature of Ignition. A. Saposchnikow and M. Borissow. J. russ. phys.-chem. Ges., 1904, **36**, 836—841. Chem. Centr., 1904, **2**, 1030.

The authors represent the decomposition at 150° C. (in the course of 20—25 hours) of two specimens of nitrocellulose (mixed with quartz sand) containing 13·25 and 12 per cent. of nitrogen, respectively, by the equations:—

$$(1)\quad C_{24}H_{29·31}(NO_3)_{10·7}O_{9·31} = C_{20·14}H_{8·27}N_4O_{22·55} + 2·58NO + 1·88CO_2 + 1·98CO + 2·06N_2 + 10·52H_2O.$$

$$(2)\quad C_{24}H_{30·72}(NO_3)_{9·28}O_{10·72} = C_{20·82}H_{[illegible]}N_{2·76}O_{19·5} + 1·52NO + 1·42CO_2 + 1·76CO + 2·50N_2 + 12·96H_2O.$$

If the nitrocellulose be not mixed with sand, the decomposition is more complete and proceeds more rapidly. The brown pitch-like residue is readily soluble in acetone. The decomposition at 135° C. proceeds in the same manner qualitatively as at 150° C. The limit of temperature beyond which nitrocellulose is unstable and has a tendency to readily decompose is 137°—138° C.—A. S.

English Patents.

Nitroglycerin; Apparatus for Weighing Substances such as ——. G. E. Arnold. Eng. Pat. 26,575, Dec. 4, 1903. XXIII., page 1113.

Explosive Compounds and the Manufacture thereof. M. S. Talbot, Durban, Natal. Eng. Pat. 26,978, Dec. 9, 1903.

An explosive mixture of the following composition is claimed: Potassium chlorate, 56 parts; camphor, 4 parts; castor oil, 4 parts; burnt umber, 8 parts; manganese dioxide, 4 parts; and potassium bichromate, 12 parts. It is said to evolve very little smoke on explosion.—T. F. B.

Explosives of the Nitrate of Ammonia Group; Process for the Manufacture of ——. R. Haddan, London. From J. Führer, Vienna. Eng. Pat. 4699, Feb. 25, 1904.

See Fr. Pat. 341,633 of 1904; this J., 1904, 882.—T. F. B.

French Patents.

Powders [Artillery, Sporting and Mining]; Manufacture of ——. J. Luciani. Fr. Pat. 339,022, Sep. 8, 1903.

The explosive in the form of sheets is passed through a machine consisting of two cylinders travelling at the same rate of speed. The upper cylinder has a design of any required form engraved on it in relief. The distance between the cylinders is regulated by a screw of fine pitch. By this means cuts or indentations can be made in the sheet to any desired depth, and with a given thickness of sheet the rate of combustion of the powder can be varied as may be required.—G. W. McD.

Nitrated Hydrocarbons [Explosives] and Process for Manufacturing the same. A. Hough. Fr. Pat. 343,907, June 11, 1904. Under Internat. Conv., June 13, 1903.

See U.S. Pat. 751,076 of 1904; this J., 1904, 385.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Rotating Cathodes; Materials and Forms for ——. H. E. Medway. Amer. J. Science, Silliman, 1904, **18**, [4], 180–182. Chem. Centr., 1904, **2**, 1019. (See this J., 1903, 823; 1904, 952.)

For electrolytic determinations the author has recently used as rotating cathodes crucibles of silver and nickel, as also a plate-electrode of platinum. In the electrolysis of copper sulphate solution, accurate results were obtained with a silver crucible as cathode, but a nickel crucible was attacked both during the electrolysis and in the subsequent separation of the deposit. The deposited copper was detached from the silver crucible as far as possible by mechanical means, the last portions being removed by treatment with hot concentrated hydrochloric acid. The plate electrode recommended by Shepherd is not quite so satisfactory; the deposited metal does not adhere very firmly at the edges of the plate, and greater care is therefore necessary in washing it. Aluminium proposed by Hough is not a suitable material for a rotating cathode.—A. S.

Refractometer Scale for Use with Fats and Oils; Comparative ——. A. E. Leach and H. C. Lythgoe. J. Amer. Chem. Soc., 1904, **26**, 1193—1195.

The variation of the butyro-refractometer (Zeiss) readings of oils and fats with the temperature is not regular, and in order to obtain scale readings at temperatures other than that at which the determination has been made, it is necessary to transform the refractometer readings into the corresponding values for $[n]_D$, apply the correction for temperature, and re-transform into scale readings. The authors give a description and illustration of a slide-rule, by means of which readings may be obtained on the scale of the butyro-refractometer at different temperatures, without first transforming them into indices of refraction; readings in indices of refraction may be obtained at different temperatures without calculation; and readings on either refractometer scale may be readily transformed into readings on the other.—A. S.

English Patents.

Gas Testing Apparatus. A. H. Lymn, London. Eng. Pat. 23,771, Nov. 3, 1903.

The method of ascertaining the value of illuminating gas from the length of its flame, when burned under standard conditions, is not easily applied to the testing of non-luminous gases, such as water-gas, owing to the comparative invisibility of the flame. The patentee renders the length of the flame of such gases more apparent by placing in the flame a vertical rod or wire, or a ladder-like arrangement of horizontal wires of some material which readily becomes incandescent, or by inserting some substance, such as a salt of sodium, strontium, or the like, which is capable of rendering the flame readily visible.—H. B.

Weighing Substances such as Nitroglycerin; Apparatus for ——. G. E. Arnold, Faversham, Kent. Eng. Pat. 26,575, Dec. 4, 1903.

To obviate the danger incurred by using ordinary weights in weighing nitroglycerin, an apparatus is described consisting of a pair of scales, one of the pans of which is designed to receive the substance for weighing, having fixed upon it a graduated receptacle, the other scale-pan being in the form of a graduated reservoir for a liquid such as water, and provided with an inlet and outlet. To use the apparatus, sufficient water is run into the liquid vessel until it attains the load corresponding to the weight of the nitroglycerin, &c. required, and the said substance is then introduced into its receptacle until equilibrium of the scale-pans is restored.—G. W. McD.

INORGANIC—QUALITATIVE.

Bismuth; Reactions of ——. C. Reichard. Chem.-Zeit., 1904, **28**, 1024—1026.

If to the solution of a bismuth salt, there be added preferably a fragment of brucine, or a concentrated solution of a brucine salt, a deep red colour is at once struck, which, on heating, becomes more intense. The colour is permanent only when the brucine is present in considerable excess. The same colour is yielded by a basic bismuth salt, provided a trace of hydrochloric acid is added to it before adding the brucine. None of the other metals of the hydrogen sulphide group gives a similar reaction save antimony, and, the coloration in the case of antimony is developed only after heating, and does not appear at all in the cold. The bismuth reaction might possibly be confused with the well-known coloration given by nitric acid with brucine, but the latter fades to yellow on heating.

—J. T. D.

Boric Acid; Detection of [by means of Tincture of Mimosa Flowers]. L. Robin. Annales de Chim. Analyt., 1904, **9**, 336—338.

In a Mixture of Salts.—The solution, rendered faintly alkaline with sodium carbonate, is boiled and filtered. A drop of tincture of mimosa flowers (this J., 1904, 561) is placed in a porcelain capsule, and a few drops of the filtrate are added, followed by sufficient hydrochloric acid to discharge the yellow tint. The mixture is then evaporated to dryness. In the presence of boric acid a yellow residue is obtained, which gives a red colour when treated with a few drops of a 10 per cent. solution of sodium carbonate. If no boric acid be present, the residue is greyish, turning yellow with the alkali carbonate solution. In the presence of mere traces of boric acid, bibulous paper moistened with a little of the tincture of mimosa and dried may be used instead of the tincture itself, as giving a more delicate reaction. In this case the filtrate, after acidifying with hydrochloric acid is evaporated to a small volume in a capsule and a band of the test paper 2 to 3 cm. long and 1·5 cm. wide is immersed in the concentrated liquid; evaporation is then carried to dryness. The dry paper then affords the above colour reactions.

In Wine, Cider, &c.—Ten or 15 c.c. of the liquid are evaporated to dryness, and the residue incinerated. The ash is taken up with 20 drops of water, the solution filtered, rendered very faintly acid with hydrochloric acid and then tested with the test paper as above.

In Milk.—Fifteen or 20 c.c. of milk are coagulated with two drops of acetic acid, the casein is filtered off, the filtrate neutralised with sodium carbonate, using phenolphthalein or mimosa tincture as the indicator, boiled, filtered, and evaporated to dryness. The residue is then incinerated and treated as in the case of wine.—J. O. B.

INORGANIC—QUANTITATIVE.

Sulphuric Acid in Commercial Acetic Acid; Determination of Free ——. C. Rossi. L'Industria chimica, 1904, **6**, 253–254. Chem. Centr., 1904, **2**, 1165—1166.

In certain solvents, *e.g.*, alcohol, formaldehyde, and especially acetone, the degree of ionisation of acetic acid is diminished to such an extent that the acid becomes indifferent to Methyl Orange. The degree of ionisation of strong inorganic acids, on the other hand, is affected only slightly or not at all, by the solvents mentioned. It is possible, therefore, in presence of one of these solvents to determine directly the free sulphuric acid in commercial acetic acid by titration with alkali in presence of Methyl Orange. The amount of the solvent required, varies with the concentration of the acetic acid. The author used 6·5 c.c. of acetone with 10 c.c. of 40 per cent. acetic acid. The method is stated to give accurate results.—A. S.

Nitric Acid; Electrolytic Determination of ——, with a Rotating Anode. L. H. Ingham. J. Amer. Chem. Soc., 1904, **26**, 1251—1255.

The electrolytic determination of nitric acid has been already studied by Vortmann (this J., 1890, 1066) and by Easton (this J., 1903, 1258). The author finds that the time can be materially shortened by using a rotating anode. The following conditions were found to be the most satisfactory:— 25 c.c. of copper sulphate solution (containing 0·2533 grm. of metallic copper), 25 c.c. of "standard" sulphuric acid, 0·5 grm. of potassium nitrate, 4 ampères, 10 volts at the outset, or 17 volts at the end of the reduction, and the anode rotating at a speed of 230 revolutions per minute. The time occupied was 30 minutes. When the electrolysis was complete, the excess of acid in the electrolyte not neutralised by the ammonia produced, was titrated with "standard" ammonia solution, with litmus or Methyl Orange as indicator.—A. S.

Lime: Determination of —— in presence of Phosphoric Acid. K. K. Järvinen. Z. anal. Chem., 1904, **34**, 559—562.

In the precipitation of solutions of calcium phosphate by ammonium oxalate, some lime always remains in solution, and some phosphoric acid always contaminates the oxalate precipitate. This is so whether the solution be simply treated with excess of ammonium oxalate, whether it be neutralised with ammonia after precipitation, or precipitated in acetic acid solution, or in acetic solution followed by neutralisation. Accurate results, however, are obtained in the following way:—To the solution, as free as possible from ammonium salts, ammonia is added till a permanent precipitate appears, and this is redissolved in the least possible quantity of hydrochloric acid. The liquid is heated to boiling, and poured very gradually into a mixture of ammonium oxalate and oxalic acid (say, 10 c.c. of N/1 oxalate and 5 c.c. of 2N-oxalic acid diluted to 50 c.c.). The calcium oxalate separates slowly in small crystals. When precipitation is complete 1 per cent. ammonia solution is very gradually added till the liquid is just alkaline. The precipitate is collected on the filter, washed, and treated as usual.—J. T. D.

Bauxite; Analysis of ——. Taurel. Ann. Chim. anal. appl., 1904, **9**, 323—327. Chem. Centr., 1904, **2**, 1251—1252.

The presence of titanic acid frequently exerts a disturbing influence in the analysis of bauxite. Leclère (this J., 1903, 926) observed that titanic acid is precipitated along with silica from formic acid solution, and the author makes use of this fact in the following method: 2 grms. of the bauxite are fused with 8—10 grms. of a mixture of equal parts of sodium and potassium carbonates, until the melt ceases to effervesce. After cooling, the mass is dissolved in water and 20 c.c. of sulphuric acid of 66° B. and the solution evaporated till white fumes appear, the residue diluted with water and the silica filtered off. To determine the titanium dioxide and ferric oxide together, the filtrate is diluted to 1 litre, and 100 c.c. are run gradually into a mixture of 10 c.c. of ammonia and 50 c.c. of water. The ammoniacal solution is boiled, the precipitate filtered off, washed with boiling water, dissolved in hydrochloric acid, and reprecipitated with ammonia. The liquid is now treated with excess of formic acid, 1 grm. of sodium sulphite added or a current of sulphur dioxide passed through, and the whole boiled gently for one hour, whereby titanium dioxide is precipitated. Ammonium citrate or tartrate (8—10 times, the amount of alumina present) is then added, followed by, excess of ammonia, and the iron is precipitated by ammonium sulphide. The weight of the precipitate after ignition gives the amount of titanium dioxide and ferric oxide. For the separate determination of titanium, the filtrate from the silica is neutralised with ammonia, 10 c.c. of formic acid are added, and the solution is boiled gently whilst a current of sulphur dioxide is passed through for one hour. The titanic acid is filtered off, and the filtrate made up to 1 litre. In 100 c.c., the alumina and iron are precipitated by ammonia, and in another portion of 500 c.c., the iron is precipitated with ammonium sulphide in presence of ammonium citrate.
—A. S.

Iron; New Method for the Volumetric Determination of ——. N. Tarugi and S. Silvatici. Boll. Chim. Farm., 1904, **43**, 637—641. Chem. Centr., 1904, **2**, 1341—1342.

The method depends upon the titration of ferric chloride solution with potassium oxalate solution, in presence of thiocyanate as indicator. The iron salt is dissolved in concentrated hydrochloric acid, converted into the ferric condition by means of nitric acid or potassium chlorate, the excess of acid neutralised, and the filtered solution made up to a definite volume. An aliquot portion of the solution is then treated with a few drops of a N/10-thiocyanate solution and titrated with N/10-potassium oxalate solution (1 c.c. = 0·00186673 grm. of iron) till a characteristic yellowish-green colour is produced. The method is especially suitable for iron ores, as tungsten, silicon, iron and manganese can be determined in one and the same sample.—A. S.

Silicon in Iron and Steel; Determination of ——. J. Thiel. Z. anal. Chem., 1904, **34**, 552—553.

In Drown and Shimer's method of determining silicon, the evaporation with sulphuric acid of the nitric acid solution of the metal absorbs much time; it must be done on the water-bath, or the risk of loss by bumping and spirting is very great. The author mixes a litre of strong sulphuric acid with an equal bulk of water, and after cooling, adds a litre of nitric acid (sp. gr. 1·40) and a litre of solution of ammonium chloride containing 240 grms. of the salt. To the weighed sample (1—2 grms.) in a 400—500 c.c. beaker he adds 50—70 c.c. of this mixture, covers with a watch-glass till solution is complete, and heats on wire gauze over a Bunsen flame. The liquid can be rapidly boiled down till fumes of sulphuric acid escape, without any danger of loss. After cooling, 100 c.c. of water are added and the solution is warmed, filtered, and the residue on the filter washed with hot water, then with warm dilute hydrochloric acid and finally with hot water; the filter is then placed moist in a platinum crucible, and dried and burnt off in the muffle.
—J. T. D.

Nitrogen in Iron and Steel; Rapid Determination of ——. H. Braune. Oesterr. Z. Berg.-Hütt., **52**, 491. Chem. Centr., 1904, **2**, 1167.

The author makes use of the colour reaction of ammonia with Nessler's reagent. 250 c.c. of water and 20 c.c. of a solution of alkali of an equivalent strength to hydrochloric acid of sp. gr. 1·124 are heated to boiling in an Erlenmeyer flask of 1500 c.c. capacity, provided with a rubber stopper, carrying a funnel and a tube connected to a condenser. 1 grm. of the iron or steel is dissolved in 10 c.c. of hydrochloric acid free from nitrogen compounds, and the filtered solution allowed to drop into the boiling alkali solution. The distillate is treated in a graduated tube, 35 mm. diameter, with a solution made by diluting 2 c.c. of the ordinary Nessler reagent to 10 c.c. The coloration produced is matched by one obtained from a known volume of a solution of ammonium chloride containing 0·038147 grm. per litre (1 c.c. = 0·01 mgrm. of nitrogen).—A. S.

Silver in Zinc; Determination of —— and Silver-content of varieties of Commercial Zinc. K. Friedrich. Z. angew. Chem., 1904, **17**, 1636—1644.

The author has examined critically the methods of determining silver in zinc adopted by Karsten (solution in nitric acid and precipitation with hydrochloric acid); Malaguti and Durocher (oxidation, fusion of oxide with litharge and black flux, and cupellation); Kerl (fusion with excess of lead and borax, and cupellation); Pufahl (solution in hydrochloric acid, fusion of residue with potassium cyanide and cupellation). The considerable solubility of silver chloride in various acid and saline solutions makes the first method valueless, and the loss of silver due to the reaction on it of potassium cyanide at high temperatures is an objection to Pufahl's method. Kerl's method is excellent in the case of zincs rich in silver, but for poorer alloys the large quantities which must be dealt with make it impracticable. A combination of Pufahl's and Kerl's methods, however, has proved most satisfactory with all classes of zinc, and the method is employed as follows:—The sample is granulated, and a suitable quantity (100—1000 grms., according to the expected richness) weighed off into a beaker (or beakers, in case of large amounts). A small quantity of hydrochloric acid is added, and when nearly saturated is poured off through a filter, and a second quantity poured on the sample; by this plan solution is greatly hastened. As soon as, or just before solution is complete, the whole residue is rinsed on to the filter and washed free from chlorides. The filter is placed in a crucible, dried and incinerated; to the residue 7.5—15 grms. of assay lead and some borax are added, and the whole heated to fusion. The button of alloy is then cupelled, alongside of a lead-silver button of about the same content, from which the unavoidable loss of silver by volatilisation is determined and allowed for in the usual way. The author has established by experiments on alloys of known composition that: (1) The cupellation method gives accurate results when zinc as well as lead is present in the alloy; (2) If the excess of acid, after dissolving the zinc, be allowed to stand upon the residue, the silver gradually goes into solution: hence the direction to filter off before complete solution of the zinc; (3) In presence of hydrochloric acid or zinc chloride, very considerable quantities of silver chloride may be formed and volatilised during the incineration of the filter; hence the need for thorough washing of the residue. A table is given showing the amount of silver (in grms. per metric ton) in various specimens of commercial zinc.—J. T. D.

Gold; Determination and Separation of —— Electrolytically. S. P. Miller. J. Amer. Chem. Soc., 1904, **26**, 1255–1269.

In Cyanide Solution.—From 150 c.c. of a solution containing 1 grm. of potassium cyanide and 0·1291 grm. of gold, the latter was completely deposited in 2½ hours with a current of 1·8 volts. and $N.D_{100} = 0·02—0·04$ ampère during the first 1½ hours and then increased so as to maintain a voltage of 1·8; temperature, 55°—65° C. Gold was quantitatively separated from iron by working under the following conditions:—125 c.c. of solution containing 0.1286 grm. of gold, 0·13 grm. of iron and 3 grms. of potassium cyanide; current, 2·3—3 volts and $N.D_{100} = 0·13—0·36$ ampère; temperature, 65° C.; time, 2½ hours.

In Phosphate Solution.—Satisfactory conditions for the determination of gold and for its quantitative separation from cadmium, iron, zinc, cobalt, and nickel are shown in the following table:—

——	Gold Present.	Foreign Metal Present.	Disodium Hydrogen Phosphate Solution (Sp. gr. 1·028.)	Phosphoric Acid. (Sp. gr. 1·35).	Dilution.	Time.	Temperature.	Current, $N.D_{100}$.	Volts.
	Grm.	Grm.	c.c.	c.c.	c.c.	Hours.	° C.	Ampère	
Determination of gold	0·1196	..	20	5	125	3	60	0·03	1—2
Separation of gold from cadmium	0·1696	0·1107	20	5	125	4½	65	0·02	1—1·7
" " " iron....	0·1188	0·1100	40	10	150	5	62	0·02—0·08	1—2·7
" " " zinc....	0·1117	0·1150	30	6	150	2	67	0·04	2—2·5
" " " cobalt ..	0·1237	0·1200	30	6	150–200	2	66	0·04	1·1—2
" " " nickel..	0·1256	0·1200	40	6	150	4	68	0·04—0·06	1—2·2

In Sodium Sulphide Solution.—10 c.c. of a solution containing 0·1276 grm. of gold chloride were treated with 50 c.c. of water, 15 c.c. of sodium sulphide solution (sp. gr. 1·19) were added, the liquid was warmed until it became clear, diluted to 150 c.c. and electrolysed at 61 C. with a current of 0·1—0·2 ampère and 2·4—3 volts. A quantitative yield of gold was obtained in 2 hours. Gold was also satisfactorily separated from arsenic, molybdenum and tungsten under similar conditions.—A. S.

Electrolytic Separations possible with a Rotating Anode. D. S. Ashbrook. J. Amer. Chem. Soc., 1904, **26**, 1283—1290.

The author has examined whether Exner's method (this J., 1903, 1150) of using a high current density and strong pressure with a rotating anode gives satisfactory results in the electrolytic separation of metals. It was found that copper could be quantitatively separated from aluminium, chromium, iron, and magnesium in sulphuric acid, nitric acid or phosphoric acid solution, from arsenic in ammoniacal or nitric acid solution, from cadmium and cobalt in nitric acid solution, from manganese and uranium in sulphuric acid or nitric acid solution, and from zinc in sulphuric acid or phosphoric acid solution. Cadmium was separated from aluminium, iron, magnesium, and manganese in sulphuric acid or phosphoric acid solution, from chromium in phosphoric acid solution, and from nickel in sulphuric acid solution. Silver was separated from aluminium, cadmium, chromium, cobalt, iron, lead, magnesium, manganese, nickel, and zinc in nitric acid solution. Mercury was quantitatively separated from aluminium and magnesium.—A. S.

United States Patents.

Carbon Analysis: Method of ——. G. O. Seward, Holcombs Rock, Va., Assignor to Eimer and Amend, New York. U.S. Pat. 773,529, Oct. 25, 1904.

The amount of carbon contained in a substance is determined by mixing it with an oxidising agent, and placing the mixture in a crucible suspended in a cylindrical glass vessel. The stopper of this vessel is pierced by gas-inlet and outlet tubes, by a funnel for the admission of liquid, and by the terminals of an electric generator, the ends of which dip into the mixture in the crucible. The gaseous products of combustion are passed through a carbon dioxide absorption apparatus; sulphuric acid is then added to the residue in the crucible through the funnel, and a current of purified air is passed through the contents of the crucible, driving the remaining products of combustion through the absorption apparatus.—T. F. B.

French Patents.

Hydrogen Contents of Gaseous Mixtures; Process for the Continuous Determination of the ——. Verein. Maschinenfabrik Augsburg und Maschinenbau. - Ges. Nürnberg, A.-G. Fr. Pat. 344,340, June 27, 1904.

See Eng. Pat. 15,706 of 1904; this J., 1904, 951.—T. F. B.

ORGANIC—QUALITATIVE.

Quebracho Extract; Detection of Adulteration in ——. T. Koerner and P. Düllberg. Deutsch. Gerber Zeit., 1904, **47**, 115—126. Chem.-Zeit., 1904, **28**, Rep., 328.

The following method is proposed for the detection of adulteration of quebracho extract, especially by mangrove bark:—

The sample is dissolved in a small quantity of hot water, and alcohol is added to it when cool, until the solution ceases to become turbid. An equal volume of ether is added to precipitate the first fraction of the tannin, and a further quantity to precipitate the remainder. The two fractions are dissolved separately in alcohol, and again precipitated in two fractions by ether. The second of the two fractions in each case is subjected to elementary analysis. A pure quebracho extract should give 62—63 per cent. of carbon, or at any rate not less than 60 per cent.; a smaller percentage indicates adulteration (since mangrove bark gives only 56·15 per cent. of carbon when its alcoholic solution is precipitated with ether). Attempts to detect adulteration by determining the percentage of alkyloxy-groups present gave negative results.—T. F. B.

Watered Milk; Detection of ——. A. E. Leach and H. C. Lythgoe. J. Amer. Chem. Soc., 1904, **26**, 1195—1203.

The authors find that the addition of water to milk perceptibly affects the degree of refraction of the serum. For determining the degree of refraction, the Zeiss immersion refractometer is recommended, but, the Abbé refractometer may also be employed. 100 c.c. of the milk at a temperature of about 20° C. are treated, in a beaker, with 2 c.c. of 25 per cent. acetic acid (sp. gr. 1·0350); the beaker is covered with a watch glass, and heated on the water-bath for 20 minutes at 70° C. It is then placed in ice water for 10 minutes, the solution filtered, and the degree of refraction of the clear filtrate determined immediately. Tables are given of: (1) readings on the immersion refractometer at temperatures of from 15° to 25° C. reduced to the corresponding values at 20° C.; and (2) refractive indices as read on the Abbé refractometer, corresponding to the scale readings on the immersion refractometer. Of the numerous samples of pure milk examined, the immersion refractometer reading of the serum was nearly always above 40° at 20° C., and in no case was it below 39°. The authors propose that milks of which the serum gives a reading on the immersion refractometer below 39° at 20° C. should be declared fraudulently admixed with water.
—A. S.

Yeast Extract; Detection of —— in Meat Extract. M. Wintgen. Archiv der Pharm., 1904, **242**, 537—538.

When albumins are salted out from meat extract by means of zinc sulphate solution, a clear filtrate is obtained; with yeast extract, however, the resulting filtrate is cloudy. 20 c.c. of freshly-prepared 10 per cent. aqueous solution of the extract are acidified with 2 c.c. of 20 per cent. sulphuric acid, and treated with excess of powdered zinc sulphate. After standing one or two days, the solution is filtered, only the first c.c. which runs through being returned to the filter. In the presence of yeast extract, or a mixture of 20 to 30 per cent. of yeast extract with meat extract, the filtrate will be turbid when first filtered.
—J. O. B.

Formic Acid; New Reaction of ——. E. Comanducci. Estr. aus Rend. della R. Accad. delle Scienze, Fisiche e Matematiche di Napoli, 1904. Chem. Centr., 1904, **2**, 1168.

Formic acid gives a characteristic yellow coloration with sodium bisulphite, and this reaction can be used for its detection (as small a quantity as 1 per cent.) in formalin, methyl alcohol, glycerin, and acetic acid. 2·5 c.c. of the liquid to be examined are diluted with an equal volume of water, 15 drops of a concentrated solution of sodium bisulphite (5 grms. in 5 c.c. of distilled water) are added, and the mixture is shaken and warmed. In presence of formic acid a yellowish-red coloration is produced.
—A. S.

Atropine; Contributions to our Knowledge of Alkaloid Reactions. III. C. Reichard. Chem.-Zeit, 1904, **28**, 1048—1050. (See this J., 1904, 458.

(1) When atropine sulphate is warmed with mercurous nitrate, reduction takes place, and a highly characteristic fragrant odour is produced, this odour being also produced when atropine is warmed with concentrated sulphuric acid. (2) If atropine sulphate is warmed with platinic chloride solution and sulphuric acid, metallic platinum separates out and the same fragrant odour is produced. With palladium chloride a similar reaction ensues. (3) A very characteristic reaction is with bismuth chloride. When a solution of this salt is mixed with atropine sulphate there is no change; but if concentrated sulphuric acid is added there is an immediate egg-yellow coloration. This reaction only takes place in the cold. (4) Sodium nitroprusside produces a reddish precipitate as with cocaine. (5) When atropine is ground with cane-sugar and hydrochloric acid, a fine rose-red colour is produced on warming. (6) When atropine sulphate is treated with arsenious or arsenic acid and sulphuric acid, rings of reduced arsenic are slowly formed. (7) If a drop of concentrated antimony trichloride solution be warmed with a trace of atropine sulphate, a bright green liquid is formed, permanent on further heating or evaporating. Stannous chloride does not change the green residue. This reaction can be used to distinguish between atropine and morphine. (8) When a trace of solid atropine sulphate is evaporated with dilute cobalt nitrate solution, a green coloration is produced. The most delicate and characteristic reaction of atropine is the odour produced with sulphuric acid.—F. S.

Essential Oils; Treatment with Sulphuric Acid applied to the Identification of ——. M. Duyk. Les Corps gras ind., 1904, **31**, 70—72. Chem. Centr., 1904, **2**, 1348—1349.

According to the author, the Maumené test used in the examination of vegetable oils may also be applied to the identification of essential oils. 4 c.c. of *Paraffinum liquidum* are well mixed with 1 c.c. of the oil in a glass tube, then 2 c.c. of pure sulphuric acid are introduced at the bottom of the tube by means of a pipette, the tube is closed with a cork carrying a thermometer, the temperature observed, then the contents of the tube are well mixed, and the highest temperature attained is noted. The 4 c.c. of paraffin give a rise of 1° C. with 2 c.c. of sulphuric acid. The following values have been determined by the author:—Cymene, 4°; pinene, 36°; limonene, 26°; carvene, 26°; thymene, 13°; cedrene, 15°; anethol, 22°; thymol, 7°; safrol, 33°; carvacrol, 4.5°; apiol, 32°; eugenol, 27°; sandal-wood oil (*a*) 22.5°—33°, (*b*) 12°—18°; lemon-oil, 25°—26.5°; geraniol, 31.5°; menthol, 9°; linalool, 38°; eucalyptol, 22°; terpineol, 26°; santalol, 33°; cedar-wood oil, 16°—18°; peppermint oil, 13°—26°; eucalyptus oil, 24°; citral, 40°; anisaldehyde, 14°; benzaldehyde, 9°; menthone, 11°; citronellone, 33°; carvol, 30°; lavender oil, 33°—37°; and geranium oil, 24°—25° C.—A. S.

ORGANIC—QUANTITATIVE.

Fuels; Method and Apparatus for Determining the Heating Value of Gaseous and Liquid ——. H. Junkers, Aachen, Germany. Eng. Pat. 18,487, Aug. 26, 1904. Under Internat. Conv., Sept. 1, 1903.

An improvement on the method described in Eng. Pat. 13,083 of 1892, requiring the measurement of only one magnitude. The fuel and cooling agent are supplied to the calorimeter in constant proportions, so that both may be made positively dependent on the time occupied in feeding. The heating value is then obtained directly from the difference of temperature of the cooling agent as it enters and leaves the calorimeter. The pressure of either the fuel or the cooling agent may be utilised for driving the meters through which the supply passes. By employing some form of differential thermometer or by keeping one of the two temperatures constant, the readings may be recorded directly in terms of the calorific value of the fuel.—J. F. B.

Benzene; Determination of —— in Illuminating Gas. O. Pfeiffer. Chem.-Zeit. 1904, **28**, 884—885.

The author in 1899 (J. f. Gasbeleucht, **42**, 697) modified Harbeck and Lunge's method of determining benzene in illuminating gas (conversion into dinitrobenzene by sulphuric-nitric acid) by using for the determination a measured volume instead of a stream of the gas, by which means several advantages are claimed. Whilst, however, the modified method is accurate with pure benzene, Korbuly has found it to give with illuminating gas much higher results than Harbeck and Lunge's method. This has been found to be due to another constituent of the gas, which forms, on treatment with the acid mixture, a bright yellow solid substance which is weighed with the nitrobenzene; this substance can be removed by means of animal charcoal, however, and when this is done the author's method gives results in accord with the methods of Harbeck and Lunge and of O'Neill. The author has introduced a further modification of the method, and now, instead of weighing the dinitrobenzene formed, titrates it by means of stannous chloride. An ordinary stoppered separating funnel of about 500 c.c. capacity (the exact capacity being in the first instance determined) is used. It is inverted, filled with the gas by displacement from above, closed, and the gas adjusted to atmospheric pressure by momentarily easing the stopper or opening the stopcock. Now 2 c.c. of the mixture of equal volumes of strong sulphuric and fuming nitric acids are introduced through the stem and stopcock, spread over the surface of the glass by inclining the funnel, and allowed to act for half an hour. The funnel is then turned right side up, and 30 c.c. of strong solution of sodium hydroxide are introduced. After all acid gases have been absorbed, hydrochloric acid is added till the liquid is faintly acid, and any carbon dioxide formed, is, as far as possible, expelled by shaking; then 50 c.c. of ether are added, the whole is well shaken for five minutes, and the ether decanted into a flask containing 1 grm. of well-dried potassium carbonate and half a grm. of animal charcoal. This treatment is repeated with a second 50 c.c. of ether, and the united ethereal extracts are shaken with the charcoal at intervals during several hours. The ether is then filtered into a 200 c.c. flask, the residue on the filter washed with ether, and the whole of the latter evaporated. To the residue about 10 c.c. of alcohol and exactly 10 c.c. of stannous chloride solution are added, the whole is heated for ten minutes on the water-bath, cooled, the liquid made up to the mark with distilled water, and 20 c.c. (one-tenth of the whole) are titrated with iodine and starch. Into a second 200 c.c. flask, 10 c.c. of alcohol and 10 c.c. of stannous chloride solution are introduced, and this mixture is heated similarly, cooled, made up to the mark, and 20 c.c. withdrawn for titration. The difference between the two titrations represents the amount of stannous chloride oxidised by the dinitrobenzene present.

$$C_6H_4(NO_2)_2 + 6SnCl_2 + 12HCl = C_6H_4(NH_2)_2 + 6SnCl_4 + 4H_2O.$$

The stannous chloride solution is made by dissolving 150 grms. of tin in hydrochloric acid, adding 50 c.c. of the strong acid and diluting to a litre.—J. T. D.

Petroleum and its Distillation Products; Action of Formalin on ——. A. Nastjukow. III., page 1082.

Rubber, particularly Crude Rubber; New Methods for the Analysis of ——. G. Fendler. Ber. deutsch. Pharm. Ges., 1904, 208 and 215. Through Monit. Scient., 1904, **18**, 834—838.

Various samples of rubber were examined by the author's method (this J., 1904, 764), and also by the methods of Harries, and Weber (see this J., 1901, 1123; 1902, 1404; 1903, 1211), and the following conclusions are drawn:—Harries and Weber's methods give results agreeing fairly well as regards percentage of pure caoutchouc, Weber's method being perhaps preferable, on account of its greater simplicity, when slightly modified in small details suggested by the author. With certain kinds of rubber, however, these two methods indicate a much too high percentage of caoutchouc, since certain resins present in rubber give compounds with nitrous acid, soluble in acetone and insoluble in benzene. Harries' and Weber's methods also give too high a value to the insoluble matter in many cases. The author's method appears the best on account of its greater accuracy and simplicity.—T. F. B.

Dextrose; Indicator for use in the Quantitative Determination of —— *with Fehling's Solution.* G. Griggi. Boll. Chim. Farm., 1904, **43**, 565—567. Chem. Centr., 1904, **2**, 1169—1170.

In the determination of dextrose with Fehling's solution, the author recommends as a suitable and sensitive indicator Bach's reagent (this J., 1893, 401, 519), so-called formaldoxime, CH_2NOH, the alkaline solution of which gives a violet coloration with copper salts. For the preparation of the indicator, 5·6 grms. of pure potassium hydroxide dissolved in water and 2·9 grms. of formaldehyde (7·25 c.c. of a 40 per cent. aqueous solution) are added to a solution of 6·95 grms. of hydroxylamine hydrochloride in cold water, and the whole diluted to 100 c.c.—A. S.

Fine Spirits; [*Examination of* ——]. K. Windisch. XVII., page 1107.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Radium in American Carnotite. A. H. Phillips. Eng. and Mining J., 1904, **78**, 673.

The author carried out some experiments with 25 lb. of an ore from Richardson, Utah, containing about 10 per cent. of carnotite. From the radio-activity of the product obtained, he estimates that 1 ton of the ore would yield 1 grm. of chlorides having a radio-active power of 60,000, as compared with that of uranium. A specimen of "radium" prepared in Nov. 1902 is stated to be as active now as when first prepared.—A. S.

Colloidal Solutions; New Method of Preparing ——, *and their behaviour towards Barium Sulphate.* L. Vanino and P. Hartl. Ber. 1904, **37**, 3620—3623.

The mould *Aspergillus oryzae* possesses strong reducing powers, and readily produces colloidal solutions. A solution of 0·01 grm. of gold chloride in 100 c.c. of water, to which has been added a few grains of rice with this mould growing on it, gives in a few days a blue solution of colloidal gold. For rapidly demonstrating the formation of colloidal solutions, Faraday's solution of phosphorus in alcohol is excellent; when added to a solution of gold chloride, it instantaneously produces a red solution, which gradually deepens in colour and becomes more bluish, then remaining permanent. Nearly all these colloid solutions (arsenic trisulphide, antimony trisulphide, cadmium sulphide, copper sulphide, silver sulphide, and metallic silver) when shaken with pure precipitated barium sulphate, become colourless, and deposit their contained substance. The action is purely mechanical (in some cases filtration through kieselguhr, or even prolonged agitation of the solution, produces the same effect), and furnishes another argument in favour of the view that these colloidal solutions are in reality suspensions of solid particles.—J. T. D.

Cholesterol. A. Windaus and G. Stein. Ber., 1904, **37**, 3699—3708.

The authors conclude from the results of their study of the decomposition products (oxidation products, &c.) of cholesterol, $C_{27}H_{44}O$, that it may be regarded as a complex terpene, composed of five reduced rings, of which one contains a double linking, and another a secondary hydroxyl group. It is pointed out that nearly all the resin acids of the conifers will give the characteristic reactions of cholesterol.
—A. S.

New Books.

Technisch-Chemisches Jahrbuch, 1902. Ein Bericht über die Fortschritte auf dem Gebiete der chemischen Technologie. Herausgegeben von Dr. Rudolf Biedermann. 25ter Jahrgang. Friedrich Vieweg und Sohn, Braunschweig. 1904. Price M. 15.

8vo volume, containing 580 pages of subject-matter, a classified Review of New Books on Pure and Applied Science, filling 27 pages, and the alphabetical index of names of authors and subjects, followed by a Register of Patents, classified, and paged with reference to the body of the Jahrbuch. There are 72 illustrations. The matter is classified as follows:—I. Iron. II. Aluminium and Rare Earth Metals. III. Gold and Silver. IV. Copper. V. Zinc. VI. Lead. VII. Nickel, Cobalt, Manganese, and Chromium. VIII. Tin, &c. IX. Sulphur and Sulphuric Acid. X. Alkali Industry. XI. Electro-chemistry. XII. Ammonia and Cyanogen Compounds. XIII. Alkaline Earths, &c. XIV. Gases. XV. Phosphorus, Boron, Silicon, and Carbon. XVI. Glass. XVII. Earthenware. XVIII. Cements and Artificial Stone. XIX. Explosives, &c. XX. Illuminants. XXI. Fuels. XXII. Sugar. XXIII. Starch, Dextrin, and Glucose. XXIV. Fermentation Industries. XXV. Fats, Soaps, and Resins. XXVI. Ethereal Oils and Perfumes. XXVII. Water. XXVIII. Foods. XXIX. Organic Products. XXX. Albumins, &c. XXXI. Dyestuffs. XXXII. Textile Fibres. XXXIII. Paper. XXXIV. Photography. XXXV. Tanning, Glue, &c. XXXVI. Manures, Disinfection, &c. Following each of the foregoing groups, is a Section devoted to Statistics.

Handbook of Chemical Engineering. Illustrated with Working Examples and Numerous Drawings from Actual Installations. By George E. Davis, Chemical Engineer, &c. 2nd Edition. Davis Bros., 32, Blackfriars Street, Manchester. 1904. Price 2*l.* 2*s.*; for all Foreign Countries, 2*l.* 5*s.*

This work is complete in two 8vo volumes, each with an alphabetical index, Vol. I. containing 524 pages of subject-matter and 282 illustrations, and Vol. II. 515 pages of subject-matter and 257 illustrations.

The subject-matter of Vol. I. is classified as follows:—I. Introduction. II. The Technical Laboratory. III. Materials used in the Construction of Plant. IV. Weighing and Measuring. V. Steam Production and Distribution. VI. Power and its Application. VII. Moving Solids, Liquids, and Gases. VIII. Treating and Refining Solids. Vol. II.:—I. Application of Heat and Cold. II. Separating Solubles from Insolubles. III. Absorbing and Compressing Gases. IV. Evaporation and Distillation. V. Crystallisation and Dialysis. VI. Application of Electricity. VII. Construction of Packages. VII. Organisation and Building.

The Chemical Synthesis of Vital Products and the Inter-Relations between Organic Compounds. Vol. I. By Raphael Meldola, F.R.S., &c., Professor of Chemistry in the City and Guilds of London Technical College, Finsbury, London. Edward Arnold, 41 and 43, Maddox Street, Bond Street, London, W. 1904. Price, 21*s.* net.

Large 8vo volume, containing preface, table of contents, list of synthetical products, titles of journals quoted, and subject-matter filling 293 pages, followed by an alphabetical index. In his preface the author points out that, with Wöhler, our own countryman, Henry Hennell, must take equal rank, as being among the first to produce an organic compound independently of the living organism. Hennell was the first to synthesise alcohol from olefiant gas, and this synthesis was effected at practically the same time as that of urea by Wöhler. The work is arranged in the dictionary form, and the matter treated of is classified as follows:—I. Hydrocarbons. II. Alcohols and Terpene Alcohols. III. Ketone Alcohols. IV. Glycols and Polyhydric Alcohols. V. Aromatic Alcohols and Phenols. VI. Aldehydes and Ketones: Fatty Group. VII. Aromatic Aldehydes and Ketones. VIII. Carbohydrates and Glucosides. IX. Sulphur Compounds. X. Cyanogen Compounds. XI. Camphor and Terpene Group. XII. Flavone Group.

A Text-Book of Quantitative Chemical Analysis by Gravimetric, Electrolytic, Volumetric, and Gasometric Methods. With Seventy-two Laboratory Exercises, giving the Analysis of Pure Salts, Alloys, Minerals, and Technical Products. By J. C. Olsen, A.M., Ph.D., Professor of Analytical Chemistry in the Polytechnic Institute of Brooklyn, &c. D. van Nostrand Company, 23, Murray, and 27, Warren Streets, New York. 1904. 4 dols. net.

Large 8vo volume, containing 468 pages of subject-matter, 21 pages of tables, and the alphabetical index. The text is illustrated with 68 engravings.

The matter is classified as follows:—I. The Balance. II. General Operations. III. Determination of Water. IV. Determination of Metals. V. Determination of Acids. VI. Analysis of Alloys. VII. Analysis of Minerals. VIII. Electrolytic Methods. The Ionic Theory; Electrolytic Apparatus and Manipulation. Electrolytic Determination of Metals. IX. Volumetric Analysis. X. Acidimetry. XI. Standard Acids. XXII. Standard Alkalis. XXIII. Oxidation and Reduction Methods. XXIV. Precipitation Methods. XXV. Technical Analysis. A. Iron, Steel, and Coal. B. Water Analysis. C. Analysis of Oils and Fats. D. Gas Analysis. E. Stoichiometry.

The Textile Fibres: their Physical, Microscopical, and Chemical Properties. By J. Merritt Matthews, Ph.D., Head of Chemical and Dyeing Department, Philadelphia Textile School. First Edition. John Wiley and Sons, New York. 1904. Price 15*s.* net. Chapman and Hall, Ltd., London.

8vo volume, containing 271 pages of subject-matter, with 69 illustrations, and an appendix with Bibliography of the Textile Fibres, followed by the alphabetical index. The matter is classified as follows:—I. Classification of the Textile Fibres. II. Wool and Hair Fibres. III. Chemical Nature and Properties of Wool and Hair Fibres. IV. Shoddy and Wool Substitutes. V. Other Hair Fibres. VI. Silk: its Origin and Cultivation. VII. Chemical Nature and Properties of Silk. VIII. The Vegetable Fibres. IX. Cotton. X. Physical Structure and Properties of Cotton. XI. Chemical Properties of Cotton, Cellulose. XII. Mercerised Cotton. XIII. Artificial Silks: Lustra-Cellulose. XIV. Linen. XV. Jute, Ramie, Hemp, and Minor Vegetable Fibres. XVI. Qualitative Analysis of the Textile Fibres. XVII. Quantitative Analysis of the Textile Fibres. Appendix:—I. Microscopic Analysis of Fabrics. II. Machine for Determining the Strength of Fibres.

The Cultivation and Preparation of Para Rubber. By W. H. Johnson, Director of Agriculture, Gold Coast Colony, West Africa, &c. Crosby Lockwood and Son, 7, Stationers' Hall Court, Ludgate Hill, London. 1904. Price 7*s.* 6*d.* net.

8vo volume, containing frontispiece showing a "flowering branch of the Para rubber tree," preface, 96 pages of subject-matter, with five illustrations, and the alphabetical index. The subject matter is classified as follows:—I. Introductory. II. The Para Rubber Tree (*Hevea brasiliensis*) at Home and Abroad. III. Cultivation of the Tree. IV. Insect Pests and Fungoid Diseases. V. Collecting the Rubber. VI. Preparation of Rubber from the Latex. VII. Yield of Para Rubber from Cultivated Trees. VIII. Establishment and Maintenance of a Para Rubber Plantation. IX. Commercial Value of the Oil in Hevea Seeds.

Trade Report.

I.—GENERAL.

NORWAY: PROPOSED REVISION OF CUSTOMS TARIFF OF ——.

Bd. of Trade J., Nov. 10, 1904.

The following statement shows certain proposed changes in the Norwegian customs tariff which are under consideration :—

Article.	Unit.	Present Rate of Duty.	Duty Proposed by the	
			Customs Committee.	Government.
		Kroner	Kroner	Kroner.
Starch and potato meal.......... ...	Kilo.	0·10	0·13	0·10
Calcium carbide ...	*ad val.*	Free	15 per cent.	Free
Celluloid manufactures	Kilo.	1·00	1·20	1·20
"Patent" glass	„	Free	0·06	Free
Glass tiles and floor slabs	„	„	0·06	0·06
Printing paper (except that made from wood pulp)..	..	0·03	0·08	0·03
Sulphuric acid......	100 kilos.	Free	0·50	Free
Gunpowder.........	Kilo.	0·10	0·12	0·10
Smokeless powder ..	„	0·10	0·50	0·10
Dynamite and similar explosives	..	0·10	0·20	0·10
Sugar...............	..	0·20	0·15	0·20

On most manufactures of metal increased duties are proposed both by the Customs Committee and by the Government.

YOKOHAMA IMPORTS OF DRUGS AND CHEMICALS.

Chem. and Druggist, Nov. 1, 1904.

A return of principal articles of import at the port of Yokohama during 1903 and 1902 includes the following drugs, chemicals, &c. :—

Articles.		1903.		1902.	
		Quantity.	Value.	Quantity.	Value.
			£		£
Acetic acid	lb.	..	..	313,850	5,184
Carbolic acid	„	693,652	15,415	585,477	15,933
Alcohol...........	gals.	415,331	27,175	226,260	11,465
Bismuth sub-nitrate	lb.	34,392	8,139	58,779	13,121
Cocaine hydrochloride	..	..	5,877	..	..
Glycerin..........	lb.	284,449	7,596	203,921	5,314
Hops.............	„	96,652	7,529	77,964	5,453
Potassium chlorate	..	..	..	563,265	6,788
Quinine	oz.	..	..	117,318	6,118
Rosin.............	lb.	..	..	2,237,806	5,225
Saltpetre	..	..	..	2,029,836	17,602
Santonin	„	5,445	5,385	..	..
Soda ash	„	6,535,198	16,680	7,123,769	19,633
Soda, bicarbonate of	„	2,739,957	6,599	2,563,979	6,864
Soda, caustic	„	1,856,331	22,717	5,139,653	24,687
All other............		..	49,120	..	140,213
Total		..	272,223	..	283,543

BOSNIA; CHEMICAL INDUSTRY AND TRADE OF ——.

Foreign Office Annual Series, No. 3297.

The ammonia-soda factory at Lukavac near Tuzla gave as usual a high interest on the capital engaged. The production during the past year was about 18,000 tons, of which 17,000 tons were exported to Austria-Hungary and the Balkan States. The petroleum refinery "Danica," in Bosnian Brod, which is a dependency of the above-mentioned ammonia-soda factory, has not hitherto given very satisfactory results; last year it produced about 9000 tons of refined oil, of which 6000 tons were exported to Austria-Hungary and Servia. The crude oil comes from Galicia.

The sugar factory in Usora seems to have done no better in 1903 than heretofore. The culture of the beet, owing to the great care it requires, does not seem to find favour with the native population. About 5000 tons of sugar were produced last year, of which 4000 tons were consumed in the province, and the remainder exported to Dalmatia. The alcohol distillery in Tuzla continues to thrive. Of the 220,000 galls. produced in 1903, 176,000 galls. were sold in the province, and the remaining 44,000 galls. exported. The brewery at Serajevo is also very prosperous; 1,100,000 galls. of beer were brewed in 1903, the greater part of which was consumed in the country, the remainder being exported to Dalmatia and Montenegro.

The chemical works known as the "Elektricitäts-Aktien-Gesellschaft-Jajce" appears to be still suffering from the general over-production of carbide, but since the works have taken to producing chloride of lime and caustic soda they have paid a small dividend. The production in 1903 was 5000 tons of calcium carbide, of which 4500 tons were exported, and 3000 tons of chloride of lime and caustic soda, the whole of which was exported.

The "Holz-Verwerthungs-Gesellschaft" at Teslic in 1903 produced about 9000 tons of methylated spirit and acetate of lime, all of which was exported to Austria-Hungary. Also large quantities of charcoal were burnt, which is all delivered under contract to the iron works at Vares.

The iron mines and works at Vares proved as remunerative in 1903 as heretofore, and paid a dividend for the year of 9 per cent. About 40,000 tons of raw iron were produced, of which 25,000 tons were exported, chiefly to Hungary, and the remainder found a market in the country. 4000 tons of cast iron wares were produced and the greater part exported, and also about 40,000 tons of iron ore were exported to Trieste and Italy. The iron works at Zenica seem to have achieved rather better results in 1903 than hitherto. About 5000 tons of iron and steel from these works were sold in the country, and about 10,000 tons were exported to Austria-Hungary, Servia, Roumania, and the sandjak of Novi-Bazar. The match factory at Travnik, which is only on a small scale, and is content with a modest profit, sells its produce chiefly in the province, and exports a small quantity to the sandjak of Novi-Bazar.

Mining.—The mining industry does not seem to have been very active during the past twelvemonth. There was a falling-off in all minerals except in coal and iron pyrites, although the total result in value was an increase 3733*l.* over 1902. The three mines of Kreka, Zenica and Kakanj-Doboj supplied all the requirements in coal of Bosnia and Herzegovina, but did not export more than 70,000 tons, the state of the market not being favourable. The gross production of all foundries, smelting works and salt works during the year 1903 shows an increase in all products both as regards quantity and value, except copper-work and raw iron, the total increase in value being 22,104*l.* The salt springs at Tuzla yielded 33,244,740 galls. of brine, of which 18,390,080 galls. were supplied to the ammonia-soda factory at Lukavac, and 14,854,660 galls. to the salt works, from which 13,126 tons of fine salt, 5154 tons of coarse salt, and 180 tons of briquettes, or a total of 18,460 tons of table salt, were produced.

In the subjoined table are particulars of imports and exports of chemical interest into and from Bosnia and the Herzegovina during the year 1903.

Articles.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	Met. Tons.	£	Met. Tons.	£
Sugar and molasses	8,053	157,062	333	10,496
Fatty substances ...	1,286	59,965	257	6,590
Oil	1,299	35,746	17	470
Liquors.............	13,253	171,064	3,882	46,174
Minerals............	12,045	22,108	47,[illegible]	29,780
Drugs and perfumery	11	1,849	1	69
Dyestuffs and tans .	13	379	3,183	8,982
Gums and resins....	349	1,338	18	77
Mineral oil, tar, &c. .	20,232	48,498	6,902	48,338
Paper and paper goods............	1,496	34,296	74	1,397

Articles.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	Met. Tons.	£	Met. Tons.	£
Indiarubber goods .	8	2,166	1	63
Leather and leather goods............	916	111,507	106	3,234
Glass and glassware	1,286	19,829	34	29
Stone and stoneware	486	2,434	122	280
Bricks earthenware, and china.........	14,488	21,731	3,720	1,651
Iron and ironmongery	9,739	195,304	41,457	209,221
Base metals and goods............	343	22,176	255	16,373
Salt...................	1,643	4,011	10	43
Chemicals	1,587	13,106	29,836	310,627
Paints, varnishes, &c.	533	15,338	32	695
Candles and soap ...	949	28,484	20	620
Matches and explosives	1,576	78,170	112	4,244

FRANCE TRADE OF —— IN 1903.

Foreign Office Annual Series, No. 3301.

The following returns show the values of certain articles of import and export under the head of "Special commerce" during the years 1902–3 :—

Imports.

Articles.	Value.	
	1902.	1903.
Food products :—	£	£
Wine	4,428,000	7,260,000
Sugar, French colonial.........	792,000	1,241,000
Margarine and other fats	528,000	809,000
Olive oil	704,000	620,000
Brandy and other spirits.......	428,000	332,000
Raw materials :—		
Coal and coke.....................	11,268,000	10,020,000
Oil seeds and nuts	8,808,000	8,888,000
Hides, raw, and peltries	6,464,000	6,796,000
Copper	2,916,000	3,036,000
Minerals of all sorts............	3,042,000	2,848,000
Sodium nitrate	1,876,000	2,160,000
Mineral oils......................	1,784,600	2,296,000
Vegetable oils, other than olive.	1,228,000	972,000
Lead...............................	840,000	772,000
Tin.................................	1,088,000	992,000
Guano and chemical manures .	456,000	572,000
Zinc	760,000	808,000
Iron and steel	418,000	464,000
Sulphur	360,000	460,000
Indigo............................	229,000	112,000
Hops	228,000	264,000
Saffron	172,000	188,000
Manufactures :—		
Skins, prepared..................	1,464,000	1,640,000
Potassium nitrate..............	32,000	32,000

Exports.

Articles.	Value.	
	1902.	1903.
Food products :—	£	£
Wine	9,300,000	8,968,000
Sugar, raw.......................	1,400,000	608,000
Brandy, spirits, and liqueurs...	1,840,000	1,664,000
Sugar, refined...................	1,548,000	1,576,000
Fats of all sorts................	964,000	908,000
Olive oil..........................	180,000	180,000
Raw materials :—		
Hides, raw, and peltries	5,592,000	4,760,000
Chemicals	3,604,000	3,828,000
Copper and copper ore	1,792,000	1,176,000
Pig iron and steel...............	1,820,000	1,948,000
Coal and coke	808,000	780,000
Building materials	1,044,000	1,248,000
Oils, other than olive	1,076,000	1,040,000
Oil cake	800,000	716,000
Oilseeds and nuts..............	216,000	280,000
Indigo............................	84,000	68,000
Saffron	132,000	116,000

Exports—continued.

Articles.	Year.	
	1902.	1903.
Manufactures:	£	£
Skins, prepared.................	4,628,000	4,680,000
Leather manufactures	2,500,000	2,452,000
Pottery and glassware	2,764,000	2,904,000
Dye-wood extracts	540,000	480,000
Perfumery......................	588,000	644,000
Colours..........................	440,000	480,000
Soap, common	536,000	572,000
Candles, stearine, &c.	164,000	168,000

The annexed return shows certain articles of import from the United Kingdom (including Malta and Gibraltar) into France, during the years 1902–3:—

Articles.	Value.	
	1902.	1903.
	£	£
Coal	5,234,000	4,114,000
Chemicals and chemical manures	803,000	854,000
Copper	237,000	225,000
Iron, cast iron, and steel	274,000	305,000
Skins, dressed	697,000	858,000
Indiarubber goods	385,000	423,000
Pottery, glass, and crystal wares .	196,000	222,000
Rubber...........................	479,000	573,000
Coal tar	343,000	374,000
Raw hides and peltries...........	358,000	349,000

The subjoined table gives the value of some exports from France to the United Kingdom (including Malta and Gibraltar) during the years 1902–3:—

Articles.	Value.	
	1902.	1903.
	£	£
Wines............................	2,391,000	2,304,000
Sugar, raw	1,005,000	373,000
Dressed skins	1,862,000	1,839,000
Copper and copper ore...........	555,000	466,000
Brandy, spirits, and liqueurs.....	990,000	765,000
Raw hides and peltries	1,070,000	719,000
Sugar, refined	526,000	387,000
Pottery, glass, and crystal wares .	821,000	770,000
Chemicals	583,000	595,000
Oils, essential....................	179,000	163,000
,, other	196,000	146,000
Caoutchouc and guttapercha.....	325,000	314,000
,, manufactures of	111,000	137,000
Perfumery.......................	142,000	150,000

II.—FUEL, GAS, AND LIGHT.

COKE FROM BY-PRODUCT OVENS.

Eng. and Mining J., Oct. 20, 1904.

The total coke made in the United States in 1903 was 25,262,360 net tons, as compared with 25,401,730 net tons in 1902. Of the 77,188 active ovens in 1903 there were 1,956 by-product ovens which produced 1,882,394 tons, or an average of 962·4 tons per oven. The average output of beehive ovens was 311 tons. The by-product ovens made 7·4 per cent. of the total coke, against 5·5 per cent. in in 1902. The output of the by-product ovens in the current year will show a large increase, chiefly from the new plant of the Lackawanna Steel Company at Buffalo.

NATURAL GAS PRODUCTION OF THE U.S.A.

Bd. of Trade J., Nov. 10, 1904.

A report by the United States Geological Survey upon the production of natural gas in 1903 states that, notwithstanding the decreasing pressure in several of the most important fields, the production in that year was greater than in any previous year, being valued at 35,815,360 dols., as compared with 30,867,863 dols. in 1902. Four States, namely, Pennsylvania, West Virginia, Indiana, and Ohio, produced 94 per cent. of the value of natural gas in 1903, and in the aggregate the United States produced 99 per cent. of the entire world's production.

IV.—COLOURING MATTERS AND DYESTUFFS.

Indigo; East Indian ——.

Chem. Trade J., Nov. 12, 1904.

The first general memorandum of the indigo crop of the season 1904 states that the reports of the area planted are still incomplete, but they indicate that the slight improvement of last year was only a temporary arrest of the decline in cultivation characteristic of recent years. In Bengal, where the estimated area sown this year is 223,100 acres, against 249,700 last year—a decrease of 10 per cent. —the plant has yielded badly, and the output is the lowest on record, about 60 per cent. of a normal crop for Bengal proper, 56 per cent. for North Bihar, and 80 per cent. for the other Bihar districts. For the whole province, it may be estimated at not less than 60 per cent. The total yield will probably not be more than 35,000 factory maunds. In the United Provinces the area in 1902 was 135,800 acres, and increased in 1903 to 140,800; but the reports received this spring indicate a contraction in the present season. The seed germinated well, and up to July a normal output was expected. Since then the prospects have deteriorated, serious damage being done by the heavy and continuous rains in the second half of July and throughout August. The output is now estimated at not more than 75 per cent. of the normal for the province as a whole. In the Punjab, the estimated area in the four principal growing districts is 73,900 acres, the area finally ascertained in 1903 being 74,200 acres. The crop, on the whole, is in good condition. In Madras, the area sown is only half that of the corresponding period of last year, the returns from the Raijatwari villages up to the end of August showing 71,300 acres, equal to about 48 per cent. of that in the preceding year. It is less than the average of five and ten years by 54 and 68 per cent. respectively. The decrease is marked in Kistna, Nellore, Kurnool, and Duddapah, and is attributed to the fall in prices and to want of timely rains. The crop is reported to be generally good, but to require rain in parts.

V.—PREPARING, BLEACHING, Etc., TEXTILES, YARNS, AND FIBRES.

Alizarin Assistant: U.S. Customs Decision.

Nov. 1, 1904.

It was held that a preparation obtained by sulphonating allow and treating with an alkali, processes used to make Turkey Red oil, is dutiable at 30 per cent. *ad valorem* as " other alizarin assistant not specially provided for," under paragraph 32 of the present tariff. This article had been he subject of a decision of the United States Circuit Court, which held that it was dutiable at 20 per cent. *ad valorem* under Section 6, as a "manufactured article unenumerated," on the ground that it was used as a softener. Further evidence taken by the Board led them to the different conlusion above given, as it was shown that Turkey Red oil was used as a finisher and softener for cotton goods.

—R. W. M.

VII.—ACIDS, ALKALIS, Etc.

Magnesite in the United States.

Eng. and Mining J., Nov. 3, 1904.

In a recent report by the United States Geological Survey u the production of magnesite, it is stated that in the United States the entre product of magnesite comes from California. During 1903 the quantity reported was 3744 hort tons crude, valued at 10,595 dols., equivalent to 1361 ons calcined, worth 20,515 dols.

The production of crude magnesite is practically in the ands of one firm at present. The crude product is sent to the manufacturers of carbon dioxide gas for calcination, and the calcined product is used by the paper mills. The demand for both crude and calcined magnesite is limited on the Pacific coast. Owing to a freight rate of 13 dols. to 15 dols. a ton on shipments to eastern points, it is not shipped out of California except to the paper mills in Oregon. The production of California could be quadrupled if the demands of consumption warranted the increase.

The principal producing point in California is in the vicinity of Portersville, Tulare county, though small quantities still come from Chiles valley and Pope valley, Napa county. The most extensive deposit in California is in Placer county, but it is in an almost inaccessible mountain region, where a very costly road would be necessary to get the product out, and the deposit therefore has not been utilised. Near Sanger, Fresno county, is another deposit, which is now being opened. A deposit has been discovered also near Walkers Pass, Kern county, but it has never been developed. There are also unutilised deposits near Morgan Hill, Santa Clara county.

Iron Pyrites, &c.: Opening for —— in Russia.

Foreign Office Annual Series, No. 3253.

H.M. Consul at Warsaw states that there is a large and growing demand for imported iron pyrites in factories in Poland, and indeed throughout the empire, as those found in the Urals, Twer district, and the Caucasus do not nearly suffice. This demand, which is put down at 40,000 tons for Poland alone, is partly covered by a Berlin firm to whom a British firm, who have large mines in Spain and Portugal, have given the monopoly of the sale of their pyrites for Eastern Europe, but it appears that there is plenty of room for others to come in, and other nations are already about it. The Germans are beginning to compete with Westphalian pyrites, and the Hungarian mines at Schmöllnitz have already come in to a considerable extent and, as their present output is pretty nearly covered by the home demand, are specially enlarging their works with a view to obtaining a larger portion of the Russian trade. A British firm in a position to supply iron pyrites would do well to look into the matter.

The colour factory at Skarzysko, which seems to be doing well in spite of the war, complains of the length of time it takes to get red oxide from England, especially in winter, when it takes three months to come. The import of it is, however, small, and chiefly for three factories in the district. Complaint is also made that the Russian Customs refuse to recognise pure iron ore from India as a pure mineral product, and charge duty on it under paragraph 125b of the tariff as if it were a colour like red oxide. At present the iron factories import almost all Greenland cryolite, tin oxide, and calcium fluoride, for enamelling from Berlin, and there seems no reason why British firms should not compete.

IX.—BUILDING MATERIALS, Etc.

Sand-Lime Brick.

Eng. and Mining J., Oct 27, 1904.

According to the United States Geological Survey, there are in America at present about 50 plants, with a total capacity of approximately 1,000,000 bricks a day. The experience of these plants indicates that sand lime brick can usually be manufactured at a cost below that of common clay brick. Sand lime bricks have been in use long enough, both in America and in other countries, to prove that when properly made they have sufficient strength and sufficient water- and weather-resisting qualities to make them a safe building material.

The commercial development of the industry dates back only 15 years in foreign countries, and not more than four years in the United States. In 1896 Germany had only five factories where sand-lime brick was made, but now it has about 200, with an annual output of between 350,000,000 and 400,000,000. Early in 1901 a plant was built in Michigan City, Ind. In 1902 about 20 plants were in existence and 6,000,000 bricks were actually sold. Full data are not obtainable as to the actual output in 1903, but about 26,000,000 bricks have been reported as sold in that year. Many of the factories had just started, and were not manufacturing to their full capacity during the year.

Portland Cement; Amended Definition for ——.

Scient. Amer. Suppl., Oct. 29, 1904.

An amended definition of the term Portland cement has been adopted by the Association of German Portland Cement Manufacturers. It is, in this, defined to be a hydraulic cementing material of specific gravity not less than 3·1 in the calcined state, and containing not less than 1·7 parts by weight of lime to each one part of silica + alumina + iron oxide, the material being prepared by mixing the ingredients intimately, calcining them to not less than clinkering temperature, and then reducing the whole to the fineness of flour.

Lumber; Fireproofed —— : U.S. Customs Decision.

Oct. 25, 1904.

It was decided that lumber which had been treated with solutions of ammonium sulphate and phosphate to render it fireproof was dutiable at 2 dols. per 1000 ft. as "sawed lumber not specially provided for," under paragraph 195. The assessment of duty at 35 per cent. *ad valorem* as a "manufacture of wood" under paragraph 25 was overruled on the ground that the fireproofing treatment had not changed its character sufficiently to remove it from the category of lumber. The Treasury Department, Nov. 1, 1904, has appealed against this decision to the United States Circuit Court, and pending their decision the higher rate of duty will be levied.—R. W. M.

X.—METALLURGY.

British Mineral Output in 1903.

Mines and Quarries: General Report and Statistics for 1903. *Part III., Output. Home Office* [*Cd.* 2283]. *Eyre and Spottiswoode, East Harding Street, E.C. Price* 1s. 6*d.*

Part 9 [Cd. 2283] of the General Report on Mines and Quarries for 1903, issued by the Home Office as a Blue-book, gives the account and value of the minerals produced, in general and in detail. The introductory summary shows that the total value of the minerals raised during the year amounted to 101,808,404*l.*, a decrease of 5,296,480*l.* as compared with 1902. This decrease is to be accounted for by the fall in the average price of coal from 8*s.* 2·84*d.* per ton in 1902 to 7*s.* 7·93*d.* in 1903. The total output of coal was the highest hitherto recorded, *viz.*, 230,334,469 tons, but the value was only 88,227,547*l.*, as against 93,521,407*l.* in 1902, when the output was less by more than 3,000,000 tons. The quantity of coal exported, exclusive of coke and patent fuel and of coal shipped for the use of steamers engaged in foreign trade, was 44,950,057 tons, an increase of nearly 2,000,000 tons on the exports for 1902. Germany, France, and Italy each received over 6,000,000 tons, Sweden over 3,000,000 tons, and Russia, Spain, Denmark, and Egypt each over 2,000,000 tons. Adding the 2,055,414 tons exported in the form of coke and patent fuel, and the 16,799,848 tons shipped for the use of British and foreign steamers engaged in foreign trade, the total quantity of coal which left the country was 63,805,349 tons. The amount of coal remaining for home consumption was 166,529,120 tons, or 3·930 tons per head of the population; 18,302,240 tons were used in the blast furnaces for the manufacture of pig iron, as against 17,649,137 tons in the previous year. The output of iron ore, 13,715,645 tons, shows a further increase of 289,643 tons, but the value, 3,229,937*l.*, is less by 58,164*l.* than in 1902. The ore yielded 4,500,972 tons of iron, or about one-half of the total quantity of pig iron made in the country; 6,314,162 tons of iron ore were imported during the year, 78 per cent. of which came from Spain. Copper, gold, lead, silver, and zinc all show an increase on the figures of 1902 both in the amount and value of the metal obtained, and in the case of tin, although the amount obtained is less, the value is greater. Among non-metallic minerals the increase in the output of natural gas at the Heathfield workings, from 150,000 to nearly 1,000,000 cubic feet, may be noticed.

Gold Production of Canada.

Eng. and Mining J., Nov. 3, 1904.

Official returns show that the gold produced in the Canadian Yukon for the nine months ending with September this year was 8,593,734 dols., that being the amount on which the Government royalty of 2·5 per cent. was paid. Adding two districts from which returns were incomplete, and also some gold which may have escaped royalty, the total for the nine months was about 10,000,000 dols. As the Yukon working season is over, the probability is that the total for 1904 will be somewhat less than the 12,500,000 dols. reported last year.

Iron and Steel Production of the World.

Eng. and Mining J., Oct. 20, 1904.

The figures collected for the *Mineral Industry*, Vol. XII., show that the total production of pig iron in 1903 was 46,733,000 met. tons. Although the United States output was nearly stationary, and several countries, such as Canada and Russia, showed decreases, the total exhibits a gain of 5·5 per cent. over the previous year, and is evidence of the activity of trade and construction all over the world.

The following table gives the quantity of pig iron made in 1902 and 1903, the figures being reduced to met. tons, for purposes of comparison :—

——	1902.	1903.
United States	18,003,448	18,297,400
Germany	8,402,660	10,085,634
Great Britain	8,653,976	8,952,183
Three chief producers	35,060,084	37,335,217
Austria-Hungary	1,335,000	1,355,000
Belgium	1,102,910	1.216,500
Canada	324,670	265,418
France	2,427,427	2,827,668
Italy	24.500	28.250
Russia	2,566,000	2,210,000
Spain	330,747	380,284
Sweden	524,400	489.700
Other countries	615,000	625,000
Total	44,310,738	46,733,037

The increase was largely due to the gain of 20 per cent. by the German blast furnaces, though it was assisted by other European countries, all of which, except Russia, had a prosperous year. The German increases kept up the proportion of the total made by three leading producers, which was 79·9 per cent. of the total in 1903, against 79·1 per cent. in 1902; although the proportion furnished by the United States alone fell from 40·6 per cent. in 1902 to 38·9 per cent. last year.

The proportion of pig iron made into steel, which had been steadily increasing for a considerable period, received a slight check last year. The total steel produced showed a gain of only 2·5 per cent., as against 5·5 per cent. in pig iron. This was due to a decline in American steel production, and to a greater output of foundry iron in Germany and Great Britain.

The total steel production of the world is given in the following table, also in metric tons :—

——	1902.	1903.
United States	15,186,406	14,768,593
Germany	7,780,682	8,801,515
Great Britain	5,102,420	5,114,647
Three chief producers	28,069,508	28,684,755
Austria-Hungary	1,143,900	1,146,000
Belgium	776,875	981,740
Canada	184,950	132,500
France	1,635,300	1,854,620
Italy	119,500	116,000
Russia	1,730,250	1,525,000
Spain	163,564	198,642
Sweden	283,500	310,000
Other countries	412,000	418,000
Total	34,519,347	35,368,257

The United States showed a decrease of 2·8 per cent., while Germany's gain in steel was 13·1 per cent. and that of Great Britain 0·2 per cent. only, against increases of 20 per cent. and 3·4 per cent. respectively, in pig iron. The United States last year made 41·8 per cent. of the total steel, against 44 per cent. in 1902; while the three leading producers reported 81·1 per cent. of the total, as compared with 81·3 per cent. in the preceding year. Germany, which took the second place as an iron producer for the first time in 1903, has long been far ahead of Great Britain in steel. The British iron-masters have kept up the manufacture of wrought or puddled iron to a greater extent than those of any other country.

A marked feature of the iron trade in 1903 was the withdrawal of the United States, to a large extent, from the list of exporting nations. The active condition of trade at home during a large part of the year induced manufacturers to give up their foreign business, and in some cases they found it necessary to import iron and steel. It was largely to this that the increase in German output and trade was due. This year, conditions have been reversed, but the export business has hardly been recovered.

IRON AND STEEL IN GREAT BRITAIN.

Eng. and Mining J., Oct. 20, 1904.

The production of pig iron in Great Britain for the first half of 1904, as reported by the British Iron Trade Association, was less than that of the first half of 1903 by 330,033 tons, or 7·5 per cent. If a further comparison is made with the first half of 1902, a decrease is shown of 47,513 tons, or 1·2 per cent. It is necessary to go back to 1901 to find a lower output.

The production of pig iron for the half-year is shown in he following table, in long tons, in comparison with the first half of last year:—

——	1903.	1904.
Foundry and forge	2,096,313	1,850,463
Bessemer pig	1,716,069	1,606,660
Basic pig	456,371	506,970
Spiegel and ferro	110,245	84,872
Totals	4,378,998	4,048,965

Of the 15 ironmaking districts into which Great Britain s divided for the purposes of these returns, 11 show a lecrease, and the remainder show an increase in 1904 compared with 1903. The most notable declines appear to have aken place in Scotland, in West Cumberland, in Lancashire, n Notts and Leicestershire, in South and West Yorkshire, nd in Cleveland.

The total production of steel ingots for the first half of 904 was as follows, in long tons:—

——	Acid.		Basic.		Total.
	Tons.	Per ct.	Tons.	Per ct.	Tons.
Bessemer	553,071	21·8	312,612	12·3	865,683
Open-hearth	1,326,883	52·3	343,247	13·6	1,670,129
Totals	1,879,953	74·1	655,859	25·9	2,535,812

There were 480 open-hearth furnaces in existence at the lose of the half year. A notable change took place in the leveland district, the two works which formerly made acid teel having adopted the basic process, so that all the steel nade in that district in 1904 was basic steel.

The production of rails from Bessemer steel during the alf year was 523,771 tons, which compares with 483,964 ns in the first half of 1903, and 410,420 tons in 1902. he greatest increase in rails was in the South Wales strict.

The total production of steel ingots in the half-year was s follows, in long tons, comparisons being made with the rst half of 1903.

The total decrease this year was 0·6 per cent. Openarth steel this year was 65·9 per cent. of the total, and Bessemer, or converter, steel was 34·1 per cent., against 64·3 and 35·7 per cent. respectively in 1903. The open-hearth process continues to make steady gains.

——	1903.	1904.
Bessemer	911,670	865,683
Open-hearth	1,639,239	1,670,129
Totals	2,550,909	2,535,812

INDIA; MINERAL PRODUCTION OF ——.

Ch. of Commerce J., Nov., 1904.

The production of salt in India averages about a million tons annually, the total in 1903 being 894,840 tons owing to the much smaller production in Bombay and Madras. More than two-thirds of the Indian production is sea salt. Saltpetre is most largely produced in Bihar, whence the article is sent to Calcutta for export after refinement; the average annual exports thence of refined saltpetre in the last five years amount to 374,629 cwt.

Although the output of coal last year (7,438,386 tons) was progressive the figures show an arrest of the rapid expansion of recent years. India now takes the lead as a coal producer in the British Empire outside Great Britain. The quantity exported last year rose slightly and now amounts to nearly half a million tons. India is yearly approaching a state of being able to supply all her own wants in fuel, the import of foreign coal shrinking gradually; this amounted in 1903–4 to 180,040 tons imported as merchandise, and 26,789 tons as Government stores, or one-fourth of the quantity imported nine years previously. The greatest development has occurred in Raniganj, in which the collieries are from 120 to 140 miles only from Calcutta, but Jherria, some 40 miles further from the port, is being developed and is rapidly overtaking Raniganj as a producer.

The development of the petroleum resources of Burmah and Assam has exceeded the rate of growth in the coal trade. In 1902 the production was nearly 57 million gallons, and in 1903 it rose to nearly 88 million gallons, of which over 85 million gallons were raised in Burmah. Though this is far from meeting the total demand in India, the home production has already affected the imports of foreign oil, which has steadily decreased, during the past three years, from nearly 99 million gallons in 1901–2 to 80½ million gallons in 1903–4. The exports from Burmah of the products of petroleum were:—

Mineral Oil.	1902-3.	1903-4.
Kerosene (gallons)	17,271,151	35,586,378
Other kinds (gallons)	3,454,638	3,235,803
Paraffin wax (cwt.)	51,470	35,969

Besides the steady rise in output from Kolar, where the gold-mining industry has gradually expanded since 1885, and during the past year reached an output of 600,000 oz., work has commenced in the Nizam's dominions, and during the 10 months, Feb.—Dec., 1903, 34,114 oz. of gold were raised. The Burmah output declined from 2179 oz. in 1902 to 1905 oz. in 1903. The ancient native industry of smelting iron has undergone a gradual decline, but it still lingers in parts of Madras and the Central Provinces. Except in Barakar, where the conditions for manufacturing pig-iron are favourable owing to the proximity of ore supplies and good coking coal, no successful attempt has been made to manufacture iron on a large scale in India. Of graphite the output in Travancore was 3,394 tons only, as against 4,575 tons in 1902.

The most remarkable development has taken place in the quarrying of manganese ore. In 1903 the total output reached a record of 171,800 tons, which places India amongst the first two of the countries producing high-grade manganese ore. That produced in the Central Provinces is of very high grade, ranging from 51 to 54 per cent. of the metal, and in consequence of its high quality is able to pay the heavy tax of freight over 500 miles of railway, besides the shipment charges to Europe and America, the whole of the ore being exported to Great Britain, Germany, and the United States. The largest proportion of ore is raised in the Nagpur district, though work has been begun in Bhandara and Balaghat, and prospecting in Chatisgarh district, in the Jhabua State in Central India, and a few other places, besides Vizianagram, where mining still continues. The work hitherto has been little more than quarrying, and no approach to exhaustion can be said to have occurred in the chief deposits, which, however, are being worked for the highest grade of ore only. India still retains the lead amongst the producers of mica, the exports of which in 1903–4 were 21,548 cwt., value Rs. 12,94,453, as against 20,412 cwt., value Rs. 13,13,909 in 1902–3. The centres of production are still in the Nellore district in the south, and a belt of pegmatites near the borders of the Hazaribagh, Gaya, and Monghyr districts in Bengal. Little or no work has been done in the other areas where the mineral is known to occur in plates of marketable size and quality.

Amongst other minerals of value the magnesite deposit of the so-called "Chalk Hills," near Salem, have attracted attention on account of the great purity of the mineral; 3,540 tons were raised in 1902, and 826 tons in 1903. Tin mining continues on a small scale in Southern Burmah and the Karenni. In the Tenasserim division the ore raised in 1903 amounted to 110 tons, valued at Rs. 1,37,295. The quarrying of slate is an important industry along parts of the outer Himalayas, near Rewari in the Punjab, and in the Kharakpur hills of Monghyr district, but accurate statistics are only available for the two or three large companies producing slate.

GOLD AND SILVER PRODUCTION OF THE WORLD IN 1903.

Bd. of Trade J., Nov. 3, 1904.

The following figures are taken from a statement issued by the Director of the Washington (U.S.A.) Mint :—

The production of gold in the world amounted to 325,527,200 dols. in 1903 against 295,889,600 dols. in 1902.

The world's production of silver in 1903 amounted to 170,443,670 fine ounces, valued at 92,039,600 dols., compared with 166,955,639 fine ounces, valued at 88,486,500 dols. in 1902.

GOLD PRODUCTION IN AUSTRALIA.

Eng. and Mining J., Oct. 20, 1904.

Official figures, compiled by the Mines Department of New South Wales, show that, during the eight months of the current year ending with August, there was a slight decrease in the gold production of Australia, as compared with the corresponding period in 1903. The following table shows the production of the different States for the eight months, four of them being official, while the comparatively small production for South Australia and Tasmania is estimated. The figures are in ounces of fine gold :—

——	1903.	1904.	Changes.
West Australia	1,390,660	1,313,865	D. 76,795
Victoria	484,860	502,839	I. 17,979
Queensland	429,963	414,389	D. 15,574
New South Wales	152,337	178,644	I. 26,307
South Australia and Tasmania.	32,000	32,000	..
Totals	2,489,820	2,441,737	D. 48,083

It will be noted that the principal decrease is shown in the reports from Western Australia; and this is due to the fact that the output from the mines at Kalgoorlie is a little below that of the previous year. Notwithstanding this, the production of this State is 55 per cent. of the total output for the present year. In Queensland also there is a slight falling off. This was confined to the Charters Towers and Gympie fields, the Mount Morgan and the minor fields having shown considerable gains. The production reported from Victoria shows a satisfactory growth; this is largely due to satisfactory yields reported this year from the Bendigo goldfield.

COPPER PRODUCTION OF UNITED STATES IN 1903.

Bd. of Trade J., Nov. 10, 1904.

The official figures of the Geological Survey give the production of copper in the United States in 1903 as 311,627 tons (of 2,240 lb.), the figures for the preceding year being 294,423 tons. The output from Montana represented 38·9 per cent. of the whole; that from the Lake Superior District, 27·5 per cent.; and from Arizona, 21·1 per cent.; the three districts combined thus contributed 87·5 per cent. of the total output in 1903.

THERMIT: U.S. CUSTOMS DECISION.

Oct. 26, 1904.

Thermit, a mechanical mixture of four parts of powdered aluminium and one part of powdered oxide of iron, and used to produce high heat for welding purposes, was held to be dutiable at 45 per cent. *ad valorem*, under paragraph 193 of the present tariff, as "an article not specially provided for in this Act, composed wholly or in part of aluminium or other metal."—R. W. M.

XII.—FATS, FATTY OILS, Etc.

OLIVE OIL PRODUCTION IN ITALY.

U.S. Cons. Rep., No. 2100, *Nov.* 5, 1904.

According to the *Moniteur Officiel du Commerce*, Italy produced 86,119,700 gallons of olive oil during the year 1903–4, or 37,248,000 galls. more than in 1902–3; 1,585,200 galls. more than in 1901–2, and 5,811,700 galls. more than the annual average.

Much of this year's olive crop was being abandoned because of its abundance. It hardly paid to pick the fruit in some parts; besides, the drought from July to October had ravaged Italy and seriously affected the quality. The fruit, though abundant, was small and poor, hence of little value for making oil. This is to be regretted, for it was otherwise free from disease and well skinned.

The cultivation of the olive is increasing constantly, though slowly. The area devoted to olives increased from 2,673,666 acres in 1901 to 2,683,550 acres in 1902, and 2,690,963 acres in 1903. The oil yield per acre last year was 32 gallons, or 13·8 gallons more than the yield of 1902–3, 0·3 gallons more than the yield of 1901–2, and 2 galls. more than the average.

XIII. B.—RESINS, VARNISHES, Etc.

GUM GUAIAC: U.S. CUSTOMS DECISION.

Nov. 3, 1904.

It was decided that gum guaiac which had been freed from mechanical impurities by straining, was dutiable at ¾ c. per lb. and 10 per cent. *ad valorem* under paragraph 20 of the present tariff. The claims of the importer for free entry under paragraph 548, as a "crude gum," or under paragraph 617, as a "crude vegetable substance," or at 10 per cent. *ad valorem* under section 6, as an "unmanufactured article unenumerated" were overruled.—R. W. M.

XIII. C.—INDIA-RUBBER, Etc.

RUBBER IMPORTS INTO FRANCE.

Dépêche Col.; through U.S. Cons. Rep., No. 2100, *Nov.* 5, 1904.

The development of the bicycle and automobile industries, the use of rubber in the manufacture of garments, and the extension of electric lighting and the telephone have caused enormous importations of raw rubber into Europe.

Brazil last year exported over 30,000 tons, of which one-fifth was consumed by France. The production of the world is estimated at 50,000 tons, one-eighth of which goes to France. The industrial consumption of raw rubber and gutta-percha in France in 1902 was 6,217 tons, of which 5,000 tons came from the principal foreign producing countries, and the remainder from the French colonies.

Brazil, despite foreign competition (especially from occidental Africa), is the principal furnisher of France, entering more than 2,000 tons annually; England enters some 1,400 tons; India, 500; Peru, 280; Germany, 260; the United States, 245; Belgium, 140; and divers little countries of the Antilles, Central America, and elsewhere, 350.

The English market, which on account of its great importations of Brazilian rubber is the principal intermediary between production and French industry, is of much greater importance than all the other markets. The Belgian and German markets do not furnish France with half as much as do its own colonies.

Within the last few years Bordeaux has become an important rubber market. Considering the length of time it has existed it compares favourably with that of Antwerp. The latter market, at its creation in 1891, imported 210 tons. Since that year the imports, by tons, have been as follows: in 1892, 629; in 1893, 1,671; in 1894, 2,745; in 1895, 5,310; in 1896, 11,158; in 1897, 17.241; in 1898, 20,145; in 1899, 34,028; in 1900, 56,980; in 1901, 58,492; in 1902, 54,089; in 1903, 57,264. Bordeaux imported 510 tons in 1898; 1,755 tons in 1899; 2,395 tons in 1900; 2,353 tons in 1901; 6,784 tons in 1902; and 11,130 tons in 1903.

XVII.—BREWING, WINES, SPIRITS, Etc.

ALCOHOLIC PRODUCTS IN SPAIN; MANUFACTURING AND CONSUMPTION DUTIES ON ——.

Ch. of Commerce J., Nov. 1904.

A Spanish law, dated July 19th, imposes manufacturing and consumption duties on alcoholic products. The consumption duties, which are leviable on both native and imported products, and take the place of the surtax of 37·50 pesetas per hectol. previously levied on such products, are fixed at the following rates:—

		Pesetas.
Neutral spirits and alcohols, anise-seed spirits, with or without sugar, rum, cognac, gin, and other spirituous compositions;* also liqueurs	litre (liquid)	0·50
Denatured alcohol	hectol.	5·00

Drawback of the manufacturing and consumption duties paid on the alcohol contained will be allowed on the exportation of the following products: Wines fortified with alcohol; alcohols, spirits, and liqueurs manufactured in the country; "*mistelas*"†; chemical products, perfumery, varnishes, and medicines prepared with alcohol. A similar drawback will also be allowed at the time of their entering into consumption, on spirits of wine which have been rectified. The Government are authorised to impose additional import duties at varying rates, to countervail the consumption duty on the alcohol used in the manufacture of similar articles of domestic production, on chloroform, ether, pharmaceutical products, and perfumery containing alcohol, and on dari and yeast. The importation of mixtures of alcohol and ether is prohibited.

XXII.—EXPLOSIVES, MATCHES, Etc.

DANGEROUS GOODS AND EXPLOSIVES IN SHIPS; REVISED AND CONSOLIDATED INSTRUCTIONS RELATING TO THE CARRIAGE OF ——.

F. J. S. Hoopwood and W. J. Howell. Bd. of Trade, Sept. 1904.

Explosives.—The regulations are those of the Explosives Act of 1875, licensed explosives being divided into seven classes, viz.:—(1) Gunpowder. (2) Nitrate mixtures. (3) Nitro compounds. (4) Chlorate mixtures. (5) Fulminate. (6) Ammunition. (7) Firework. Gunpowder, &c., must be conveyed in a single or double package of such construction that it will not be broken or become defective whilst being conveyed. The interior of the package must be kept clean and free from grit, and no iron or steel must be used in the construction unless same is effectually covered with tin, zinc, &c. The nature of the explosive and the name and address of the sender must be conspicuously attached by a mark on the outside of the package

Inodorous Felt and India-rubber Solution are classed as "dangerous goods" and are not accepted as general cargo.

The following packing regulations are stipulated for the undermentioned goods:—

Methylated Spirit.—Substantial iron drums properly closed and secured.

French Polish.—Hermetically sealed tins packed in a wooden iron-bound case containing not more than 15 tins.

Carbide of Calcium.—Hermetically sealed tins enclosed in wooden cases or air-tight and damp-proof iron drums.

Sulphuric Acid.—Electrically welded steel drums.

Liquid Ammonia.—Iron vessels tested up to a pressure of 675 lb. per sq. in.

Aqueous Solution of Ammonia (sp. gr. 0·880).—Twelve-gallon drums, capable of withstanding a pressure of 66 lb. per sq. in. with an empty space of 5·33 per cent. in each drum.

Carbon Bisulphide.—Strongly made and perfectly tight two-gallon drums tested to 40 lb. per sq. in. with an empty space of at least 10 per cent., packed in perforated wooden cases with not more than two drums in each case.

Sodium Sulphide and Potassium Sulphide.—Strong air-tight steel drums.

Oiled Materiols.—Perforated cases.

Potassium Chlorate.—Iron drums or strong paper-lined cases.

Amorphous Phosphorus.—Tin cases.

Collodion Cotton.—When not intended to be used by itself as an explosive, it is not regarded as coming within the meaning of the Explosives Act when it is—

(1) In solution in alcohol and ether.
(2) Wet.
(3) Saturated in methylated spirit and contained in air-tight cases.

Marking and Packing of Poisons.—To be marked according to the terms of section 17 of Sales of Poison and Pharmacy Act, 1868.

Sodium Peroxide.—Strong iron or steel drums.

Carbolic Acid.—Thoroughly sound casks.

Liquefied Carbonic Acid.—Cylinders after the pattern recommended by the Committee appointed by the Home Office in 1895 on the manufacture of compressed gas cylinders.

Naphtha.—Gas-tight drums with not less than 5 per cent. clearance packed in sawdust in iron tanks.

Lamp Black.—Printed paper should not be used in packing lamp black.

Sheep Dips and Similar Preparations.—To be marked "Poison" in conspicuous character.

Petroleum Spirit.—Steel barrels or drums.

Carbon Papers.—Air-tight tins within a suitable case.

—G. W. McD.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 23,600. Petavy. Furnaces. [Fr. Appl., Nov. 3, 1903.]* Nov. 1.

„ 23,938. Grossmann. Method and apparatus for the condensation, absorption, and chemical combination of gases in the presence of liquids, or of liquid and solid substances. Nov. 5.

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*Including varnishes prepared with alcohol; pharmaceutical products and perfumery containing alcohol; ether, chloroform, and other products manufactured with alcohol.

† Wines made with sugar, cinnamon, &c.

[A.] 23,942. Allison (Niles-Bement-Pond Co.). Filter press plate.* Nov. 5.
,, 23,983. Ray. Process of and apparatus for continuous distillation.* Nov. 5.
,, 24,033. Kestner. Means for moistening or washing air or other gases.* Nov. 7.
,, 24,038. Crawford. Rotary kilns. Nov. 7.
,, 24,231. Harvey and Wilson. Crucible furnaces. Nov. 9.
,, 24,261. Baker. Means for compressing gases. Nov. 9.
,, 24,363. Green. Separation of volatile compounds by distillation, and apparatus therefor. Nov. 10.
,, 24,446. Meura. Filter-press frames. Nov. 11.
,, 24,511. Oxford, Buxton, and Oxford. Apparatus for drying semi-liquids. Nov. 12.
,, 24,547. Birrell. Furnaces. Nov. 12.
,, 24,587. Thompson (Best). Furnaces.* Nov. 12.
[C.S.] 26,386 (1903). Shaw. Nozzles for discharging liquids. Nov. 16.
,, 27,935 (1903). Van Steenkiste. Drying apparatus. Nov. 16.
,, 28,791 (1903). Houghton, and The United Aklali Co., Ltd. Apparatus for separating liquid from solid matter, and partially drying the solid matter. Nov. 9.
,, 2002 (1904). Hauberg. Centrifugal separators. Nov. 9.
,, 13,489 (1904). Schnelle. *See under* XI.
,, 19,186 (1904). Suzuki. Vacuum evaporating apparatus. Nov. 16.
,, 20,857 (1904). Kostalek. Filters. Nov. 9.

II.—FUEL, GAS, AND LIGHT.

[A.] 23,444. Nairn. Manufacture of incandescent gas mantles.* Oct. 31.
,, 23,787. Griffin and Cox. Production of gas. Nov. 3.
,, 23,984. Brunck. *See under* VII.
,, 24,040. Crawford. Treatment of peat for fuel. Nov. 7.
,, 24,242. Arzt and Baron. Gas for illuminating and heating purposes. Nov. 9.
,, 24,248. Winkler. Incandescent light mantles. Nov. 9.
,, 24,293. Breckon. Method of producing superior coke in connection with gas works and the like.* Nov. 10.
,, 24,308. Redman and Redman. Inclined retorts. Nov. 10.
,, 24,333. Desgraz. Process and apparatus for obtaining producer gas free of tar and of high calorific value.* Nov. 10.
,, 24,336. Carpenter and Davis. Artificial composition fuel. Nov. 10.
,, 24,400. Sutton and Rudd. Incandescent gas mantle. Nov. 11.
,, 24,467. Kirkham, Hullett, and Chandler, Ltd., and Hersey. Apparatus for washing and scrubbing gas. Nov. 11.
[C.S.] 24,995 (1903). Little. Inclined gas retort beds. Nov. 9.
,, 28,342 (1903). Bell and Masters. Furnaces of gas producers. Nov. 9.
,, 28,498 (1903). Bowing. Manufacture of combustible gas. Nov. 9.
,, 544 (1904). Armstrong. Manufacture of producer gas, and apparatus therefor. Nov. 9.
,, 4995 (1904). Schlickeysen. Process for converting raw peat into solid peat fuel. Nov. 16.
,, 16,766 (1904). Colson. Manufacture and purification of illuminating gas. Nov. 9.
,, 21,318 (1904). Neuman. Combined double gas producers and steam generators for producing water gas and producer gas, and generating steam by the heat of such gases. Nov. 16.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 23,680. Rud. Rütgers Chem. Fabr. f. Theerprodukte. Treatment of heavy tar oils for the manufacture of pitch or of a special kind of tar. [Ger. Appl., July 1, 1904.]* Nov. 2.
,, 23,727. Kuess. Process for transforming into soap mineral oils in general and petroleum in particular. [Fr. Appl., Nov. 3, 1903.]* Nov. 2.
,, 24,297. Gittings. Manufacture of volatile oils. Nov. 10.
,, 24,554. Scholvien. Manufacture of benzenes, and hydroxyl derivatives of the same. [Ger. Appl., May 27, 1904.]* Nov. 12.
[C.S.] 26,366 (1903). Lothammer and Trocquenet. Process for saponifying petroleum and other like hydrocarbons. Nov. 9.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 24,045. Newton (Bayer and Co.). Manufacture of new azo dyestuffs. Nov. 7.
[C.S.] 26,379 (1903). Johnson (Kalle and Co.). Manufacture of black sulphur dyes. Nov. 16.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 23,426. Shearer and O'Brien. Process for retting flax or degumming rhea, ramie, or china grass. Oct. 31.
,, 23,493. McNaught. Wool washing machines. Oct. 31.
,, 23,635. Walker (Kestner). Ageing or conditioning yarn and the like. Nov. 2.
,, 23,647. Graham and Cope. Preparation for bleaching cotton and other vegetable fibres. Nov. 2.
,, 23,651. Wray and Wray. Apparatus for spraying and conditioning yarn. Nov. 2.
,, 23,861. Stillie. Dyeing woollen goods. Nov. 4.
,, 23,950. Lye and Lye. Dyeing wool, hair, cotton, and linen fibres in sliver, yarn, or thread, and apparatus employed therein. Nov. 5.
,, 24,207. Robertson. Process of dyeing cotton and linen in mixture, textiles, goods, &c., composed of wool and cotton; wool, cotton, and linen; wool, silk, and cotton; and wool, silk, cotton, and linen. Nov. 9.
,, 24,285. De Keukelaere. Machine for dyeing and otherwise treating textile materials. Nov. 9.
,, 24,329. Mycock. Process of producing figured indigo dyed textile fabrics. Nov. 10.
,, 24,412. Owens. Machine for dyeing or otherwise treating fibrous material in cop or other compact form. Nov. 11.
,, 24,505. De Naeyer. The dyeing or otherwise treating with liquor of textile materials in rolls, spools, cheeses, or the like. [Appl. in Belgium, Nov. 26, 1903.]* Nov. 12.
,, 24,545. Spivey. Apparatus for distributing oil or other liquid upon fibres. Nov. 12.
[C.S.] 24,666 (1903). Tomlinson (Haas and Haas). Apparatus for treating textile piece goods with air or other gas or vapours for dyeing, bleaching, carbonising, or other processes. Nov. 16.
,, 25,891 (1903). Wood, Secombe, and Lang Bridge, Ltd. Cotton printing machines. Nov. 16.
,, 51 (1904). Morton. Manufacture of figured fabrics. Nov. 16.
,, 13,485 (1904). Thompson (Wickels Metallpapierwerke G.m.b.H.). Method of producing a silky appearance on cotton and other fabrics. Nov. 9.
,, 18,330 (1904). Beckmann. Machines for finishing fabrics. Nov. 9.
,, 21,793 (1904). Hofmann. Machines for printing yarns in several colours. Nov. 16.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

[A.] 24,456. Soc. C. et E. Chapal Frères et Cie. Machines for dyeing furs and carotting skins. [Fr. Appl., Nov. 14, 1903.]* Nov. 11.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 23,465. Hunter. Apparatus for use in the manufacture of carbonic acid gas. Oct. 31.

„ 23,473. Gibbs. *See under* IX.

„ 23,515. Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable hydrosulphites. Oct. 31.

„ 23,984. Brunck. Extraction of ammonia from distillation gases. Nov. 5.

„ 24,014. Taylor. Recovery of mineral acids and other products from residual liquors containing iron. Nov. 7.

„ 24,156. Davis and Davis. Treatment of galvanisers' " waste " or " spent " pickle and obtaining useful products therefrom. Nov. 8.

„ 24,198. Howles, McDougall, and McDougall. Utilisation of crude sulphides of arsenic. Nov. 8.

„ 24,328. Gittings. Oxidising and deoxidising agents. Nov. 10.

[C.S.] 26,148 (1903). Jaubert. Preparation of oxygen. Nov. 16.

„ 28,585. (1903). Tixier, Cambier, and Adnet. Manufacture of a barium permanganate. Nov. 9.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 24,199. Frugier. Process and apparatus for disintegrating kaolinic stone and the like, and for separating the constituents thereof. [Fr. Appl., Nov. 9, 1903.]* Nov. 8.

[C.S.] 20,879 (1904). Bredel. Manufacture of quartz glass from quartz, sand, silica, and the like. Nov. 9.

„ 20,880 (1904). Bredel. Manufacture of articles from quartz glass. Nov. 9.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 23,473. Gibbs. Decomposing refractory silicates. [U.S. Appl., Oct. 30, 1903.]* Oct. 31.

„ 23,492. Gacon. Manufacture of artificial emery.* Oct. 31.

„ 23,587. Johnson. Manufacture of cement. Nov. 1.

„ 24,426. Hamblet. Brick kilns and the like. Nov. 11.

„ 24,451. Boult (Hülsberg und Co.). Impregnation of wood and other porous materials. Nov. 11.

„ 24,589. Burnet. Treatment of wood and other porous material for rendering it non-porous and impermeable to the passage of fluids. Nov. 12.

[C.S.] 23,786 (1903). Gare. Solutions for treating wood and other fibrous and porous materials or compounds. Nov. 9.

„ 28,731 (1903). Middleton. Process of manufacturing refractory material. Nov. 9.

„ 28,733 (1903). Thompson. Manufacture of bricks, tiles, slabs, &c. Nov. 9.

„ 4275 (1904). Nelson. Manufacture of slag wool, silicate cotton, or mineral wool. Nov. 9.

„ 15,057 (1904). Muller. Manufacture of a pulverulent product for coating and joining masonry or brickwork of furnaces, ovens, pipes, retorts, and the like. Nov. 16.

X.—METALLURGY.

[A.] 23,436. Angel. Concentration of zinc and other metals from sulphide ores. Oct. 31.

„ 23,508. Weiller and Weiller. Process for extracting copper from its ores. Oct. 31.

„ 23,713. Dupré (Dupré). Process for dissolving gold. Nov. 2.

„ 23,826. Davies and Clark. Metallurgical furnaces. Nov. 3.

„ 23,906. Schwarz. Process for extracting metal from ores, and apparatus for performing same.* Nov. 4.

[A.] 23,909. Barber (Kingsley). Apparatus for and process of treating sulphide and other ores.* Nov. 4.

„ 24,082. Tresidder. Manufacture of steel. Nov. 7.

„ 24,136. Angel. Reduction of sulphide ores and recovery of the metals therefrom. Nov. 8.

„ 24,175. De Dion and Bouton. Manufacture of nickel steel. [Fr. Appl., July 17, 1904.]* Nov. 8.

„ 24,231. Harvey and Wilson. *See under* I.

„ 24,232. Bayliss, Jones, and Bayliss, Ltd., and Milner. Method of melting pig iron in puddling furnaces. Nov. 9.

„ 24,445. Witter. Process of obtaining and utilising tin from tin slags. Nov. 11.

„ 24,563. Rouse and Cohn. Briquetting manganese ores or oxides and mixtures of manganese ores and iron ores. Nov. 12.

„ 24,585. Blenkinsop. Treatment of copper ore.* Nov. 12.

[C.S.] 23,861 (1903). Soc. Anon. La Neo-Métallurgie. Alloy. Nov. 16.

„ 27,172 (1903). Cowper-Coles and Co., Ltd., and Cowper-Coles. Hardening of metals and alloys. Nov. 16.

„ 28,464 (1903). Edwards. Furnaces for calcining or roasting mineral ores and desulphurising the same Nov. 9.

„ 263 (1904). Brand. Extraction of zinc. Nov. 9.

„ 3628 (1904). Brand. Extraction of zinc. Nov. 9.

„ 4706 (1904). Cunnington. Extraction and purification of zinc. Nov. 16.

„ 14,985 (1904). Cie. du Réacteur Métallurgique. Manufacture of steel and treatment of copper, nickel, and like matts. Nov. 16.

„ 20,159 (1904). Gillies. Apparatus for separating and recovering sulphides from their ores. Nov. 9.

„ 20,468 (1904). Duncan. Manufacture of steel. Nov. 9.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 23,622. Möllmann. Galvanic batteries.* Nov. 1.

„ 23,765. Rudenick. Insulating material for electrotechnical purposes. Nov. 3.

„ 23,768. Wilson, and the East Anglian Engineering Co., Ltd. Electro-magnets for extracting magnetic impurities from liquefied materials. Nov. 3.

„ 24,286. Cowper-Coles. Anodes. Nov. 9.

[C.S.] 13,489 (1904). Schnelle. Process of and apparatus for the electrical separation of granular material. Nov. 9.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 23,448. British Oil and Cake Mills, Ltd., and Pearson. Treatment of linseed oil. Oct. 31.

„ 23,727. Kuess. *See under* III.

„ 24,023. Boardman. Manufacture of soap. Nov. 7.

„ 24,100. Garrigues. Processes for the recovery of glycerin from spent soap lye, and apparatus therefor. Nov. 8.

„ 24,375. Hunter. *See under* XVII.

„ 24,440. Holoubek. Manufacture of soap, and apparatus therefor. Nov. 11.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

[A.] 23,915. Scott. Machine for the manufacture of white lead, and for use in similar processes.* Nov. 5.

„ 24,238. Gebr. Heyl und Co., and Wultze. Process for manufacturing white lead. [Ger. Appl., June 11, 1904.]* Nov. 9.

(*C.*)—India-Rubber.

[A.] 24,105. Livesay. Vulcanisers. Nov. 8.

„ 24,330. Gittings. Manufacture of india-rubber. Nov. 10.

XIV.—TANNING; LEATHER, GLUE, SIZE, Etc.

[A.] 23,569. Lauch and Voswinkel. *See under* XX.
,, 23,619. Notelle and Leroux. Method of treating corneous substances. Nov. 1.
24,408. Fell. Treatment or finishing of hides or skins. Nov. 11.
,, 24,456. Soc. C. et E. Chapal Frères et Cie. *See under* VI.

XV.—MANURES, Etc.

[A.] 23,850. Seaman. Scheme to preserve and use bacteria for fertilisers. Nov. 4.
[C.S.] 494 (1904). Myers. Manufacture of a fertiliser or manure. Nov. 16.

XVI.—SUGAR, STARCH, GUM, Etc.

[A.] 24,374. King (Bertels). Process for the separation of alkaline salts contained in sugar-juice and the subsequent extraction of crystallisable sugar. Nov. 10.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 23,597. Rübsam. Processes of preparing beer wort. Nov. 1.
,, 24,368. Hewer. Process for infusing and extracting hops. Nov. 10.
,, 24,375. Hunter. Method of and means for treating or purifying wines, spirits, or the like; applicable also to oils and certain other substances. Nov. 10.
[C.S.] 5774 (1904). Mead. Apparatus for use in fining malt liquors. Nov. 16.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—Foods.

[A.] 23,616. Fulda. Preserving animal food substances. Nov. 1.
,, 24,174. Overbeck. Method of separating arsenic from liquid food materials, whether used as a liquid or treated or combined with other material to produce a more or less solid food. Nov. 8.
,, 24,430. Mitchell. Producing proteid. Nov. 11.
,, 24,527. Mitchell. Process for the production of proteid. Nov. 12.
[C.S.] 6720 (1904). Rayner (Maemecke). Manufacture of milk powder. Nov. 16.

(*B.*)—Sanitation; Water Purification.

[A.] 23,640. Spence, Spence, and Peter Spence and Sons, Ltd. Treatment of sewage and other similar sludges. Nov. 1.
,, 23,641. Spence, Spence, and Peter Spence and Sons, Ltd. Treatment of certain waste waters. Nov. 1.
,, 23,747. Bolton and Mills. Apparatus for the automatic filtration or treatment of sewage or other impure liquid. Nov. 3.
,, 23,924. Spence, Spence, and Peter Spence and Sons, Ltd. Treatment of certain waste waters. Nov. 5.
[C.S.] 20,889 (1904). Kremer and Schilling. Method of and apparatus for the bacterial purification of sewage and the like. Nov. 9.
,, 21,777 (1904). Schou. Water-purifying apparatus. Nov. 16.

(*C.*)—Disinfectants.

[A.] 23,463. Hawliczek. Disinfectant and detergent compounds. Oct. 31.
,, 24,015. The Scottish Peat Industries, Ltd., and Meilke. Disinfecting powders. Nov. 7.
[C.S.] 16,715 (1904). Woollard and Batten. Insect destroyer and disinfectant powder. Nov. 9.
[C.S.] 21,053 (1904). Morgan. Method and process of disinfecting. Nov. 9.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 24,083. Johnson (Badische Anilin und Soda Fabrik). Manufacture of acetylated cellulose. Nov. 7.
[C.S.] 27,738 (1903). Strange, Garle, and Longsdon. Treatment and utilisation of residual matters containing alkaline and organic substances, such as the residual matters resulting from the treatment of esparto grass, straw, wood, and the like, with alkali in the preparation of paper pulp. Nov. 16.
,, 21,101 (1904). Birkbeck (Brooks). Process of making a substitute for cork. Nov. 9.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 23,569. Lauch and Voswinkel. Manufacture of condensation products from tannin like substances and urea by means of formaldehyde.* Nov. 1.
,, 23,578. Knoevenagel. Manufacture of odoriferous compounds or perfumes. [Ger. Appl., Nov. 10, 1903.]* Nov. 1.
,, 23,729. Luttke, Arndt, und Löwengard. Preparation of condensation products from *p*-aminophenol with aldehydes.* Nov. 2.
,, 23,974. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of o-oxybenzene carboxylic acid esters of the phenyl or naphthyl series. Nov. 5.
,, 24,297. Gittings. *See under* III.
,, 24,298. Gittings. Manufacture of menthol and camphor. Nov. 10.
,, 24,494. Dakin. Manufacture of a chemical substance and of allied bodies and intermediate products. Nov. 11.
,, 24,536. Ewan and Young. Manufacture of guanidine salts. Nov. 12.
[C.S.] 24,631 (1903). Fourneau. Preparation of amino alcohols and their derivatives. Nov. 16.
,, 449 (1904). Fehrlin. Production of compounds of pyrocatechuicmonoalkylethers, and especially of guaiacol and guaethol with protein substances. Nov. 9.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 23,766. Höchheimer. Photographic pigment paper. Nov. 3.
,, 23,900. Boguerts. Reproduction of pictures. Nov. 12.
,, 24,235. Crocker. Method of photography. Nov. 9.
,, 24,290. Koppmann. Process for producing coloured photographs. Nov. 9.
,, 24,341. Gittings. The art of photography. Nov. 10.
[C.S.] 808 (1904). Riebensahm and Koppmann. Process for producing coloured photographs. Nov. 16.
,, 20,954 (1904). Schmidt. Arrangement of films and filters for three-colour photography. Nov. 9.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 23,973. Mitchell. Explosives.* Nov. 5.
,, 23,986. Carter and The New Explosives Co., Ltd. Manufacture of compressed gun-cotton. Nov. 5.
,, 24,223. Hargreaves, and Curtis's and Harvey, Ltd. Blasting compounds. Nov. 9.
[C.S.] 21,481 (1903). Bowen. Explosives. Nov. 16.
,, 21,482 (1903). Bowen. Explosives. Nov. 16.
,, 28,710 (1903). Russell. Explosives for blasting or like purposes. Nov. 9.
,, 20,106 (1904). Evangelidi. Explosives. Nov. 9.
,, 21,204 (1904). Soc. de la Poudre Peigne et des Brevets J. Luciani. Manufacture of gunpowder. Nov. 16.

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E. Howard Tripp, Ph.D.	III., VII., XVI.
L. J. de Whalley, B.Sc.	XVI.

Official Notices.

NEW SECTION FOR NEW ENGLAND, U.S.A.

The Council has granted the application of eighty members of the Society residing in the States of Maine, New Hampshire, Vermont, Connecticut, Rhode Island, and Massachusetts, to be allowed to form a section, to be called the New England Section of the Society.

THE JOURNAL.

From the beginning of next year the Society's Journal will be printed and published by Messrs. Vacher and Sons, Great Smith Street, Westminster, S.W., to whom all communications regarding subscribers' copies and advertisements should be sent.

SUBSCRIPTIONS FOR 1905.

Members are reminded that the subscription of 25*s.* for 1905, payable on January 1st next, should be sent in good time to the Hon. Treasurer (Mr. Samuel Hall), in order to ensure continuity in the receipt of the Society's Journal. Any changes of address to appear in the new List of Members now in course of preparation should reach the General Secretary not later than January 15th, 1905.

COMMUNICATIONS.

Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

Adams, M. A., l/o Ashford Road; The Kulm, Bearsted, near Maidstone.

Allen, W. W., l/o Broadway; 25, Broad Street, New York City, U.S.A.

Baty, E. J.; all communications to Nunclose, Prince's Avenue, West Kirby, Liverpool, Works Chemist.

Berolzheimer, D. D., l/o Philadelphia; 1, West 92nd Street, New York City, U.S.A.

Broadhurst, W. H., l/o 294; 290, Lafayette Avenue, Brooklyn, N.Y., U.S.A.

Burgess, W. T., l/o Holland Park; 20, Priory Road, Bedford Park, W.

Campbell, Jas. E., l/o Chandler Street; 22, Shirley Street, Worcester, Mass., U.S.A.

Darling, G. A., l/o Johannesburg; c/o Lisbon Berlyn, Ltd., Frankfort, Pilgrim's Rest, Transvaal.

Duncan, Jas.; Journals to Hotel Bristol, San Remo, Italy.

Dyck, Geo. E., l/o Chicago; c/o Morris and Co., South Street, Joseph, Mo., U.S.A.

Erskine, J. K.; all communications to c/o New Kleinfontein Co., P.O. Benoni, Transvaal.

Fitch, A. J.; Journals to 19, Grange Road, Canonbury, N.

Fotheringham, John; communications to 28, Barnwell Terrace, Govan, Glasgow (temporarily).

Garry, H. Stanley, l/o Clipstone Avenue; 66, Mapperley Road, Nottingham.

Hall, Prof. Robt. W., l/o New York; Denver, Colo., U.S.A

Hall, S. Godfrey; Journals to 19, Aberdeen Park, Highbury, N.

Harris, F. W., l/o Montrose Street: Corporation Chemical Department, 26, John Street, Glasgow.

Hurry, E. H., l/o Westbourne Grove; Goodwyns, Haslemere.

Jewell, W. M.; Journals (temp.) to c/o G. W. Wright, Norfolk, Va., U.S.A.

Jones, Arthur B.; Journals to 452, Russell Avenue, Cleveland, Ohio, U.S.A.

Leese, Jos., jun., l/o Plymouth Grove; 13, Albert Place, Longsight, Manchester.

Luck, A. Courtenay, l/o Stowmarket; Naval Arsenal, Zarate, Argentina.

Meldrum, Dr. Andrew N., l/o Mid Stocket Road; 16, Moor-oaks Road, Aberdeen.

Merry, John B.; Journals to 61, Woodfield Road, King's Heath, near Birmingham (temporarily).

O'Neill, Chas., l/o Buenos Aires; c/o The British Dyewood and Chemical Co., 33, Faulkner Street, Manchester.

Renwick, F. F., l/o Woodford Green; Hylands, Brentwood, Essex.

Royle, C. L.; Journals to 329, Upton Lane, London, E. (temporarily).

Rumbold, Wm. R., l/o Holmwood; 47, Watling Street, London, E.C.

Shorey, Dr. Edmund C., l/o Board of Health; P.O. Box 360, Honolulu, Hawaii.

Stockdale, E., l/o Birstall; c/o E. Dewhurst and Co., Ltd., Printworks, Batley, Yorks.

Voss, Walter A., l/o South Norwood; Eastwood Road, Rayleigh, Essex.

Watkins, Norman; Journals to 1701, Makiki Street, Honolulu, and (subscriptions) Box 767, Honolulu.

Wilkinson, Walter S., l/o Baltimore; P.O. Box 285, Wytheville, Va., U.S.A.

Willard, Chas. T., l/o Schenectady; c/o Singer Manufacturing Co., Elizabethport, N.J., U.S.A.

CHANGES OF ADDRESS REQUIRED.

Brach, Dr. L., l/o 223, Central Avenue, Norwich, Conn., U.S.A.

Weil, Jacob A., l/o Power Gas Corporation, Ltd., 39, Victoria Street, Westminster, S.W.

Weston, Wm., l/o H.M. Dockyard, Portsmouth.

Death.

Drown, Prof. T. M., Lehigh University, South Bethlehem, Pa., U.S.A. Nov. 16.

Annual General Meeting,

NEW YORK, 1904.

DETROIT, MONDAY, SEPT. 26TH.

While in Detroit the members were the guests of Messrs. Parke, Davis, and Co. On arrival they were received by Mr. Parker (of the City department of the firm) and Mr. F. M. Fisk (the London representative), and taken to the Russell House, where breakfast was served. They were then conveyed in trolley-cars to the factory, where they were received by Mr. E. G. Swift, general manager; Mr. J. C. Spratt, business manager; Dr. F. G. Ryan, chief of the manufacturing department, and others of the directors. The factory is situated on the river front, with plenty of space, the research laboratory being in a handsome detached building surrounded by lawns, and the biological stables separated from the works by a road. Across the river is Canada, where, within sight, the firm has another factory. Groups of ten, conducted by one of the heads of departments, were shown round the pill department—cutting, forming the mass, drying, sugar and gelatin coating, manufacture of globules; and the tablet department—compressing, triturating, and coating. Fire drill then took place in the inner courtyard on a preconcerted signal, whereon all workmen left their tasks, and proceeded to allotted posts without confusion or disorder. The visitors then proceeded through the hypodermic tablet and correspondence departments to see the manufacture of glassware (including vaccine points, serum bulbs, and hypodermic tubes), paper boxes, granular effervescent salts, lozenges, and tablet milling and granulating. Next came the drying of digestive ferments, and the binding and mailing of the firm's literature. After the crude drug and pressed herb, milling and printing departments had been inspected, the chemical department was shown, in which the preparation of digestive ferments, extracts, percolates, and soluble elastic capsules is carried on, finishing with the pharmaceutical department and power plants (electricity, compressed air). The stock, finishing, bottle-washing, and shipping departments came next, and then the party assembled on the river front to see the City fireboat throw 5000 galls. of water a minute. In the Scientific Building, of which Drs. McClintock and Houghton are directors, the departments of analysis and experimental medicine were thrown open for inspection. Behind glass partitions trained assistants were seen preparing, finishing, and filtering serums in special aseptic rooms. One of the laboratories in the Department of Experimental Medicine is devoted almost exclusively to the work of testing different antiseptics for germicidal power.

This property can be accurately determined by exposing cultures of the *Bacillus pyocyaneus*, the most resistant of vegetative forms of bacteria, to the action of certain dilutions of the disinfectant to be tested, transferring such cultures from the disinfectant to plain bouillon, in which the result, after a suitable period of incubation, is noted. In this manner a certain standard can also be established to which disinfectants must conform before being placed upon the market.

Physiological Testing of Adrenalin.—In determining the activity of solutions of adrenalin or other suprarenal extracts, the almost immediate characteristic rise in blood pressure peculiar to this drug, when injected intravenously, is taken as the index of its activity. This rise in blood pressure can be made quantitative by measuring the height to which a certain weight of mercury is raised by the action of a definite amount of adrenalin.

Standard and sample to be tested are injected alternately nto the veins of an animal, the dose of the sample being changed if necessary until the rise in blood pressure caused by each is the same. The delicacy of a physiological test s well illustrated by the effect of minute quantities of adrenalin on the blood pressure. An appreciable change n the blood pressure can be induced by a difference of 3 per cent. in the amount used, equal to 0·0000003 grm. of pure adrenalin.

The biological stables, the vaccine-propagating rooms, operating room, guinea-pig loft, and dog and rabbit cages were visited, and, in the horse-operating room, Dr. Dunckley, he firm's veterinary surgeon, injected toxin into one horse, and had another brought in to show the mode of drawing off the blood into sterilised tubes.

The party then returned to the Russell House, where uncheon was provided, at which the Mayor of Detroit (the Hon. Wm. Mayberry) made an eloquent speech. The fternoon was passed in driving in four-in-hand coaches, hrough the boulevards and suburbs of the city to Belle sle, an island park of great beauty. The day's hospitality oncluded with a dinner at the Russell House, at which were present the chief officers of the company and principal members of the staff. Prof. A. B. Prescott and Prof. Campbell, of the University of Michigan, Sir Wm. Ramsay, Prof. Erdmann, Prof. V. Coblentz, Dr. Lewkowitsch, Mr. Thos. Tyrer, and Mr. Eustace Carey spoke on behalf of he guests, and Mr. Switt and Mr. Spratt on behalf of Messrs. arke, Davis, and Co. Dr. Ryan acted as toastmaster.

NIAGARA AND BUFFALO, Tuesday, Sept. 27th.

Buffalo and Niagara Falls Reception Committee

Charles E. Acker, Chairman.

Edw. G. Acheson.
F. M. Becket.
G. F. Brindley.
C. H. Clowes.
Geo. W. Davenport.
S. P. Franchot.
Harry Gardiner.
Chas. M. Goodyear.
Francis V. Green.
A. Monroe Grier.
C. M. Hall.
J. M. Hancock.
A. C. Hastings.
H. M. Hill.
H. A. Irvine.
E. C. Knight.
John D. Larkin.
D. R. Lovejoy.
E. C. Lufkin.
J. H. Miller.
Roswell Park.
H. M. Poole.
E. F. Price.
W. B. Rankine.
A. Schoellkopf.
Lee H. Smith.
T. Guilford Smith.
B. F. Thurston.
E. B. Stevens.
F. J. Tone.
Francis D. Ward.

Assisted by a large Ladies' Committee.

Toronto Reception Committee (Canadian Section).

Alfred Burton.
G. P. Girdwood.
W. R. Lang.
F. J. Smale.
H. Van der Linde.

On arrival at Niagara Falls, each visitor was presented with a copy of "The Niagara Falls Electrical Handbook," published under the auspices of the American Institute of Electrical Engineers for the guidance of visitors from abroad attending the International Electrical Congress at St. Louis. It contained authoritative information concerning Niagara Falls, the numerous power developments on both sides of the river, and the various industries. After breakfast at the International Hotel, the Gorge Railway trolley cars were taken for a trip down the Niagara Gorge, past the Whirlpool Rapids on the American side, to Lewiston, thence across the bridge to the Canadian side, and back along the Gorge to Queen Victoria Park. Here lunch was provided by the Canadian Section in the new refectory.

After luncheon the two great power houses of the Niagara Falls Power Company were visited. These give a total of 100,000 horse power from water taken from the Niagara River, a mile above the falls, on the American side. All this is sold, at from 4*l.* to 5*l.* per horse power, to industries in Niagara, Buffalo, Tonawanda, and Lockport; other schemes are in progress on the Canadian side. Then the International Acheson Graphite Co.'s plant, with the highest temperature electric furnaces in existence, was visited. In the evening another trip was made down the gorge, preceded by a search-light car, which illuminated the rapids in various colours.

Wednesday, Sept. 28th.

The power-house of the Niagara Falls Hydraulic Power and Manufacturing Co.—which works a railway of 360 miles, the tramway running round the gorge, all the trolley lines in the district, all the street lighting, and the chief electrolytic plants—was visited. Some went also to the Natural Food Co.; others visited the islands above the falls, the Cave of the Winds, or viewed the falls from the steamer "Maid of the Mist."

At 11.15 the train left for Buffalo, where the visitors were received enthusiastically and entertained at the Ellicott Club. Then they went on board special fireboats in order to inspect the harbour and the new Lackawanna steel plant, the largest in the world. On their way back they landed for a while on the gigantic breakwater, which protects Buffalo from the storms which occasionally affect Lake Erie, and here saw an exhibition of fire practice. The Larkin Soap Co.'s works were also opened to the members of the Society. On their return they were received at the Buffalo Club, where many of the most prominent ladies and gentlemen in the city assembled to honour the Society.

The Society is particularly indebted to Mr. Chas. E. Acker, Chairman of the Reception Committee; to Mr. E. B. Stevens, President of the Niagara Research Laboratories; Dr. Roswell Park; Mr. Chas. W. Goodyear; Mr. H. M. Poole, President of the Ellicott Club; Mr. Pendennis White, President of the Buffalo Club; Mr. Francis D. Ward, Commissioner of Public Works; and Dr. Lee H. Smith, all of Buffalo, for the hearty reception given to the members.

BOSTON, Thursday, Sept. 29th.

Reception Committee.

Godfrey L. A. Cabot, Chairman.
Henry Howard, Secretary.
W. H. Walker, Treasurer.

F. E. Atteaux.
E. F. Billings.
A. L. Cochrane.
W. J. Webber.
Henry Wood.

Ladies' Committee.

Mrs. Charles Eliot.
Mrs. Edgar F. Billings.
Mrs. Henry Howard.
Mrs. W. H. Walker.
Mrs. W. J. Webber.

On arrival the members and ladies were conveyed to the Hotel Somerset, the headquarters. After breakfast they inspected the laboratories of the Massachusetts Institute of Technology, so long associated with the name of the late Prof. T. M. Drown. The Public Library, with its staircase embellished by the frescoes of Puvis de Chavannes; the reading room, with its frieze illustrating the "Quest of the Holy Grail," by Abbey; and the upper gallery, decorated by Sargent; and the Art Gallery, were also visited.

Thence they proceeded to Harvard University, Cambridge, Mass., where they were welcomed by President Eliot, formerly Professor of Chemistry at the Mass. Inst. of Technology, and Prof. T. W. Richards. After lunch the principal laboratories and buildings were shown. In the museum there is a remarkable collection of reproductions of flowers in glass, given in memory of Dr. C. E. Ware, and made by Messrs. Leopold and Rudolph Blaschka, of Austria. Additions are constantly being made to this collection, which is said to be entirely a labour of love on the part of the makers.

On leaving the University the members started to drive through the parks and environs of Boston to the Country Club, but were overtaken by a storm, and were reluctantly compelled to abandon the excursion.

At a smoking concert at the Hotel Somerset, in the evening, Sir Wm. Ramsay presented, on behalf of the visiting members, addresses and a small memento, in the shape of a gold match-box, to the following gentlemen, on whom had fallen the organisation and conduct of the tour:—Dr. L. Baekeland, Prof. M. T. Bogert, Prof. V. Coblentz, Dr. E. G. Love, Dr. R. W. Moore, Mr. T. J. Parker, Dr. H. Schweitzer, Mr. R. C. Woodcock, and Mr. C. B. Zabriskie. A silver cigarette case was also presented to Mr. H. C. Bates, the agent of the Pennsylvania Railroad, in recognition of his courtesy and attention.

Friday, Sept. 30th.

Parties of members visited the works of the Merrimac Chemical Co. and the Cochrane Chemical Co., both of which manufacture heavy chemicals; the New England Coke and Gas Co., with its 500 coke ovens of the Otto-Hoffman type; the Hamilton Print Works, where also all kinds of cotton goods are manufactured, bleached, and dyed; and the Douglas Shoe Co., which makes 10,000 pairs per day.

The New England Gas and Coke Co.—To Mr. Henry M. Whitney, of Boston, chiefly belongs the credit of the inception of this enterprise. From a very inferior coal, which could be very cheaply mined, it was proposed to obtain a merchantable coke containing little sulphur and a large amount of gas, for which there was an immediate sale in the neighbourhood of Boston. It was then proposed to associate this enterprise with the Massachusetts Pipe Line Co., which possessed rights of way all over the State of Massachusetts. Coke ovens, to the number of 400, were erected, agreements effected with adjoining companies, and the by-products were worked up in the immediate vicinity by subsidiary companies. After a period of considerable stress, the gas interests of Boston and the surrounding districts were brought under one management, and the experiment is now to be tried of conducting and selling coke-gas made from by-product ovens to communities at a considerable distance for fuel and light, and recovering the ammonia, tar, and other by-products.

In the afternoon the members and ladies assembled at the Point Shirley Club, at the seaside, near Boston Harbour, to partake of a clam-bake, cooked by a method which is a survival of an aboriginal custom before cooking utensils were introduced. The bake was served at 5 o'clock. Mr. F. E. Atteaux was toastmaster, and Sir Wm. Ramsay, Dr. Wm. H. Nichols, Prof. H. Walker, Mr. W. Henry Howard, and Mr. Armstrong were among the speakers. The party then broke up, some returning to New York, and others going on to Canada.

On Oct. 4th, Columbia University conferred the degree of D.Sc. on Sir Wm. Ramsay and Dr. Wm. H. Nichols. In the evening Sir Wm. Ramsay was entertained at a banquet by the Brooklyn Institute of Arts and Sciences. Prof. Irving W. Fay presided, and among those who sat at the guest table were Prof. C. F. Chandler, Dr. H. W. Wiley, Dr. F. W. Atkinson (President of the Brooklyn Polytechnic Institute), Prof. John S. McKay, Dr. Wm. H. Nichols, Mr. Fred B. Pratt, and the Rev. Dr. S. Parkes Cadman.

On Oct. 5th, Sir Wm. Ramsay and many members and ladies sailed for England by the s.s. "Baltic."

On Oct. 7th, a meeting of the New York Section of the American Chemical Society was held, preceded by a dinner at the Hotel Savoy, to which the members of the Society were invited. Dr. F. D. Dodge was in the chair, and papers were read by Messrs. Chas. Baskerville and Fritz Zerban on "Inactive Thorium," and by Mr. D. D. Jackson on the "Use of Copper Sulphate as an Algæcide in the Treatment of Water Supplies." Dr. J. Lewkowitsch also delivered an address on the "Recent Advances in the Chemistry of Fats."

Canadian Section.

Meetings held at Toronto, on Oct. 27th and Nov. 24th, 1904.

DR. F. J. SMALE IN THE CHAIR.

A discussion on "Smoke Consumers and Flue Gases" was introduced on Oct. 27th by Dr. W. B. Cohoe and Mr. Jas. Milne, after which the subject was thrown open for general discussion.

On Nov. 24th a discussion took place on "Boiler Waters and Compounds," in which Profs. Ellis and Lang, Drs. Allan and Kenrick, Messrs. Taylor, Van der Linde, Bain, Murray, and Sparrow, and the Chairman took part. The meeting was well attended.

The aim of the Committee has been to make such a selection of subjects as will be of general interest to manufacturers. Among other papers promised are: "Producers and Gas Engines," "Food Preservatives," and "Manufacture of Artificial Silk."

Newcastle Section.

Meeting held in the Chemical Lecture Theatre of the Armstrong College, Thursday, October 20th, 1904.

CHAIRMAN'S ADDRESS.

THE FUSION OF REFRACTORY MATERIALS.

BY J. T. DUNN, D.Sc.

Refractory materials have an important bearing upon many branches of chemical and metallurgical industry; and with the progress of these industries greater demands are continually being made upon such materials. Furnaces and crucibles have to resist higher temperatures and the attack of more vigorous reagents; processes are conducted for longer periods continuously, and larger bulks of material, involving larger apparatus, and consequently increased pressure on its walls, are dealt with. Hence the testing of the materials of which furnaces, crucibles, retorts, &c. are made, is becoming a matter of wider scope, and one requiring more care and attention than was formerly the case.

Many things are required of a refractory material: and the nature of these requirements naturally varies with the particular service which it has to serve. One of the most important, and the most general, is of course that it should resist a high temperature without softening or melting: and the determination of the melting points of fireclays, silica bricks, and similar substances, is consequently a matter of some importance. To this point I propose to confine myself o-night.

It is perhaps hardly necessary to say that the basis of clays, kaolinite or "claystuff," is a silicate of aluminium having approximately the composition represented by $Al_2O_3.2SiO_2, 2H_2O$; and that china clay consists of practically pure kaolinite, while other clays contain in addition mall amounts of other silicates or metallic oxides—those of ron, manganese, calcium, magnesium, and the alkalis—ogether with more or less mechanically mixed sand or other mineral fragments. It was early recognised that great ifferences in refractoriness or fusibility existed among lays; and as, on the whole, the more impure clays were ound to be the more easily fusible, the idea gained ground hat the fusibility of a clay depended entirely upon the ercentage of these foreign silicates or oxides, which were ence spoken of as "Flussmittel" or "fluxing-stuff." The elative refractoriness of a clay was thus estimated from he amount of these "fluxing-stuffs" which chemical nalysis showed to be present. Cases which contradicted his assumption, however, were not long in accumulating; nd Bischof about 1860 undertook an experimental investi- ation into the question. He heated in a wind furnace lica, alumina, kaolin, and mixtures of this with alumina d with silica in various proportions, and determined their lative fusibilities. While recognising the influence of e "fluxing-stuffs" in a clay upon its melting-point, he me to the conclusion that the determining factor was the oportion of alumina, and that the greater the percentage alumina a clay contained the more refractory would it . He endeavoured to express the relative fusibilities of ays by "coefficients," calculated from the ratios between umina and silica, and alumina and fluxing stuffs, shown the analysis.

Richters, in 1868, published a long series of very care- ly conducted experiments on the question, as a result of ich he concluded that no one factor was determinative. hile agreeing with Bischof, that of the pure aluminium icates, those high in alumina were more refractory than ose high in silica, he found that the fusibility increased, a given clay, with increase of fluxing stuff: that quan- ies of different fluxing-stuffs proportioned to their emical equivalents produced equal effects in lowering the lting point: that the effect of a mixture of different xing-stuffs was the sum of the separate effects that each nstituent of the mixture would have produced alone: d that a given percentage of fluxing-stuff produced the eater effect in lowering the melting point, the greater the portion of silica in the clay. He calculated from the alyses formulæ expressing the relative molecular propor- ns of alumina to silica, and of both to fluxing-stuff—mulæ of the type $x(Al_2O_3.ySiO_2) + RO$; such a formula es, according to Richter's results, an indication of the ibility of the clay, which is the more refractory as x is eater or as y is less.

Seger, in several of his early writings on the subject, phasised strongly—what had indeed been recognised by chof and by Richters—the importance of the mechanical l "rational" analysis of the clay. He pointed out very arly that a quantity of silica present as sand was by no ans the same thing as an equal quantity already com- ed as silicate with the alumina present, and that the nature of the sandy particles or mineral fragments intermixed with the clay stuff proper had a considerable influence on the fusibility of the clay. A clay (still more a brick, made of a mixture of the clay with small fragments of the already burnt clay, or with similar refractory materials) is not a homogeneous substance, but a mixture of substances, which not only have different melting points, but which are more or less capable when melted, by reacting on one another, to form new substances, the melting points of which are different from, and usually lower than, those of the original substances. Accordingly, when such a clay is heated, liquefaction begins at the melting point of the most fusible constituent; and if this be present in large proportion the substance will run down at this temperature to a liquid containing in suspension the solid particles of the less fusible constituents. If the latter predominate, however, they will form a solid framework which will preserve the original shape of the piece, and will hold in its interstices the liquefied portion, as a knob of sugar will hold a drop of water. But as the water will gradually dissolve sugar till saturated, and may cause the disintegration and flow of the whole lump; so the liquefied portions of the clay, kept at the same temperature, may act chemically upon the solid portions, and if in doing so they form more fusible compounds may lead to the ultimate liquefaction of the whole. The rate at which this will occur must obviously depend, not only on the chemical nature of the materials, but also the fineness of the grinding, and the more or less intimate mixture of the different constituents. It will thus be clear that two clays or bricks may glaze or vitrify on the surface at the same temperature, but that while one may gradually at that temperature, and very rapidly if the temperature be but slightly raised, liquefy completely, the other may remain practically solid till a much higher temperature is reached.

The practical determination of the melting-points of clays is a matter of considerable difficulty, on account of the high temperatures involved; and for the most part investigators have contented themselves with ascertaining the order of fusibility, and have not ventured to state definite melting-points in thermometric degrees. Bischof in his earlier experiments compared clays by determining for each the proportion of pure quartz sand with which it must be mixed in order that it should run down to a liquid at the same temperature as a standard refractory clay: the greater the amount of quartz sand needed for this the lower the melting-point of the clay. But this method assumed that the physical or mechanical support afforded by the quartz sand was not interfered with by the chemical action referred to above; and it was later abandoned by Bischof in favour of the method of comparison with normal or standard clays. He collected a series of seven standard clays, each very uniform in character, and each melting at a higher temperature than that which preceded it. Prisms of these and of the clay to be tested were heated together in a crucible in a wind-furnace till the test-piece melted; an examination of the standards, melted and unmelted, then enabled him not only to place the test between two, but as a rule to say whether it was nearer to that below or that above it in the series. Richters used a method externally similar to Bischof's earlier one, but used a temperature—that at which wrought iron melts—at which reaction between the clay and alumina, or the clay and silica, will occur. The clay to be tested was intimately mixed with varying quantities of alumina or of silica, according as preliminary experiments had shown that it was readily fusible or highly refractory; and prisms made of these mixtures were submitted to the given temperature for two hours—long enough for complete reaction to occur. The amount of alumina or of silica needed to produce a test piece, which, under this treatment became completely glazed over the surface—neither running down on the one hand nor remaining unchanged on the other—afforded a measure of the refractoriness of the clay. Seger greatly facilitated these determinations by the introduction of his "cones." These are mixtures of kaolin with quartz, alumina, felspar, and other materials, graduated in such a way as to form a series, the melting points in which rise from member to member. These are made into little narrow triangular pyramids a couple of centimetres high, and the test-piece is heated in a crucible along with three or four of these, of melting-points above and below the expected melting-point of the clay. The principle is precisely similar to that of Bischof's method with standard clays, but the "cones" possess the advantages over the standard clays of being more closely graduated, of being reproducible indefinitely, and of thus allowing comparison between the results of different experimenters at different times and in different places. The melting-points of some of the cones have been compared by Hecht with the indications of the thermo-electric pyrometer; but the temperatures given for the higher cones are probably only rough approximations.

In my own practice I have hitherto used exclusively the Seger cones (or cones made from brick-clays the melting points of which had been previously determined by Seger cones) for ascertaining the melting points of clays and bricks; but I have been able to simplify and shorten the procedure very materially by using coal-gas and oxygen in the furnace. Bischof, Richters, and Seger used the Deville furnace, an air-blast furnace fed with coke or retort carbon. The temperature attained was roughly regulated by burning off at each operation a regulated weight of fuel; but this occupies a considerable time, the test-pieces cannot be examined during the operation, and the whole must be allowed to cool considerably before the crucible can be taken out and its contents examined. I have used with great advantage Fletcher's "oxygen injector" furnace. This is a small furnace with a modified "injector" burner, which is attached, however, not to an air-bellows, but to an oxygen cylinder. It is not an "oxy-coal-gas" burner, for the oxygen, issuing from the blowpipe jet under considerable pressure, entrains with it a large quantity of air, so that the gas is burnt with enriched air, and the consumption of oxygen is very small in comparison with the effect produced. A certain amount of practice and experience are needed to obtain the best results with the burner; in my early attempts I was unable in an hour and a half, and with an enormous oxygen consumption, to melt a clay at all; but now I can readily reach a sufficient temperature in from three to five minutes, though such a rapid rise is not as a rule desirable. The body of the furnace is lined with a specially refractory clay, but it will not long stand the temperature attained, and I line my own furnace with magnesia, by simply ramming it full of calcined magnesia while the blow-pipe hole is corked, and then cutting and scraping out as much as necessary. The magnesia shrinks and cracks when heated, but by cautiously filling the cracks after each operation a lining is very soon obtained which is practically free from cracks, and which, though it is very tender and will stand no rough usage, will last for weeks or months if carefully treated, and is readily renewed if it does get destroyed. I have made many attempts to manufacture crucibles which would stand in the furnace, but hitherto have not been quite successful. I work usually with those made for the purpose by the "Laboratorium für Tonindustrie" in Berlin, and find them fairly satisfactory; but though they are the best thing I have yet been able to obtain, they soften and crack when a very refractory clay or silica brick is under treatment. I am, however, still working at this question. In an actual trial, a "cone" of the clay or brick under test is bedded in a little pure alumina in the crucible along with two or three of the Seger cones—say Nos. 27, 30, 33 for a totally unknown clay. The crucible is placed in the furnace, the lid put on, the furnace covered, and a small Téclu or good-sized Bunsen burner allowed to heat the furnace up to its limit. In a quarter of an hour the furnace is red hot, and the Bunsen burner is replaced by the burner belonging to the furnace. Coal-gas and oxygen are regulated to get the best effect, and the temperature rises rapidly. After three or four minutes the gas and oxygen are turned off, the furnace cover is lifted, the crucible lid taken off, and the contents inspected. If the test-piece is not visibly affected, the lid and furnace-cover are quickly replaced, the gas and oxygen are turned on, and after one and a half or two minutes another inspection is made. This goes on till the test-piece is seen to be melting down, when the crucible is taken out, allowed to cool, and the test-piece carefully compared with the cones. It will be found quite easy to see that it is well below, well above, or very near to cone 30, say. A repetition of the experiment is then made with a new test-piece and three consecutive cones, say 29, 30, and 31; at the end of this the position of the clay will be fixed as, say, between 30 and 31. A single determination is not enough, however; it should be repeated with the test-piece and the cones occupying different positions in the crucible, so as to eliminate errors due to unequal heating. With the arrangement I have described, however, though the outer surface of the crucible itself is hotter where the blast impinges on it than in other places, yet I have not found sensible differences (not as much as one cone difference, or say 20° C.) at different points in the crucible, save when cracks have formed and allowed entrance to the flame. Sometimes a cone or the test-piece falls against the side of the crucible and fuses into it; and sometimes the temperature rises with unexpected rapidity, and all the cones are found melted. In either of these cases a repetition of the experiment is, of course, necessary. Three or four experiments can, however, be carried out completely in the course of an hour, and when the four determinations agree, as they usually do, we are fairly certain of the result. With refractory clays, when the temperature nears the softening point of the crucible, more time is often needed, for it is then not always possible to lift the crucible lid, which is half fused to the crucible, and the crucible must be taken out, cooled, and broken before an inspection can be made; and in this case, if the experiment has not reached its end, a new beginning must be made. [A demonstration of the use of the furnace was here given.]

Naturally, many other circumstances besides its melting-point influence the suitability of a clay, a fire-brick, or a silica-brick for particular purposes. On another occasion I may have something to say in regard to some of these; but the determination of the melting-point is at least a first and an important criterion, for if the substance melts at too low a temperature any virtues it may possess in the way of mechanical strength or chemical resistivity are of no avail in high-temperature operations.

Meeting held at Armstrong College, on Thursday, November 17th, 1904.

DR. J. T. DUNN IN THE CHAIR.

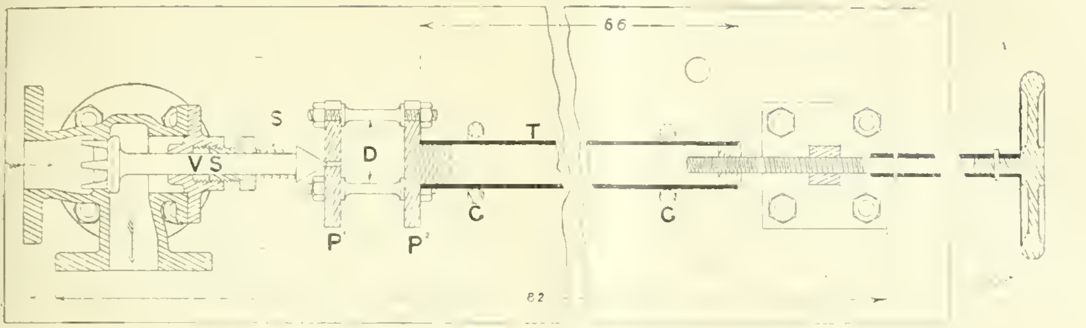
NOTES ON SOME TEMPERATURE REGULATORS.

BY WILLIAM H. SODEAU, B.Sc., F.I.C.

I. *A Steam Regulator with Expanding Tube.*—Five double-walled huts, each of about 400 cb. ft. capacity, had to be constantly maintained at different temperatures up to 60° C. by means of steam coils located beneath false floors. Each had been fitted with a commercial form of thermoregulator in which a $1\frac{1}{2}$ in. mitre valve was controlled by the expansion of a zinc tube 66 ins. in length, directly connected to the valve spindle by means of a wooden insulator. Such a tube expands rather less than 0·002 in. for 1° C. rise of temperature; hence all connections in such a device must be free from any appreciable play in order that a slight rise of temperature may occasion a reduction of the opening of the valve, and *vice versa.* The baseboards of these regulators were, however, of wood, and the bolts passing through them were continually becoming slack, whilst the wooden insulators led to similar trouble. When the author took over the charge of these huts all the regulators had failed, from these and other defects, and the heating was being controlled by means of the external stop-valves.

Three of the regulators were reconstructed (Fig. 1) so as to ensure accurate action. In each, the baseboard was replaced by a slab of slate to which the parts were attached by means of steel taper bolts, having about the same coefficient of expansion as the slate. Conduction of heat from the valve to the tube was greatly reduced by fitting the end of the valve spindle VS with a steel conical cap, the point of which rested in a hole drilled through a circular steel plate P_1. A similar plate P_2 on the end of the zinc tube T was connected to P_1 by means of three steel distance pieces D, slipped into slots in the plates, stiff paper being used to prevent metallic contact. All play was taken up by

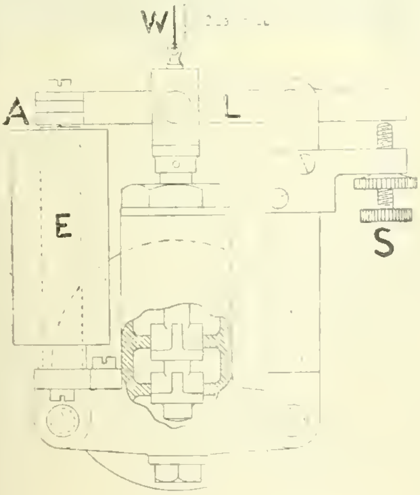
FIG. 1.



neans of a stiff spiral spring S, coiled around the external ortion of the valve spindle and tending to open the valve nore fully whenever the zinc tube contracted on account of fall of temperature. The zinc tube was supported by neans of guides G, and was prevented from rotating by a in sliding in a slot (not shown in the figure). The further nd of the tube was adjusted by means of a differential crew (16 and 12 threads), one turn of which made an lteration of $\frac{1}{48}$ in., equal to 16° C. change of temperature. By means of a piece of gas pipe, this screw was connected o a handwheel outside the hut so that the setting could be ltered without opening the door. Each regulator was onnected to a pipe conveying steam, at a pressure of about 0 lbs. to the square inch, which had been passed through a eparator in order to remove water and impurities which night tend to clog the valve.* These three regulators ran ontinuously for many months without giving any trouble. 'he temperature in each hut, as indicated by a long-stemmed hermometer having its bulb on the opposite side of the ut, was read every half hour throughout both day and ight, and rarely varied more than ± 1° C. from the intended eading. Any desired alteration of temperature could be apidly effected by turning the handwheel to the appropriate xtent as indicated above.

II. *An Electro-magnetic Steam Regulator* (Fig. 2).—'he two remaining huts (see Section I.) were fitted with ppliances constructed on a principle developed from that Scheibler's gas regulator. The lever, L, of a Dewrance in. reducing valve was extended at the end connected to e link, so that a screw, S, might be used to prevent the lve from closing beyond a certain point at which the amount of steam passing was just too little to maintain the hut at the desired temperature. To the opposite end of the lever was attached an iron cross-piece, A, forming the armature of an electro-magnet, E, fixed in the place where a dash-pot is sometimes fitted. The electro-magnet consisted of a pair of bobbins, each $3\frac{3}{8}$ ins. long by $1\frac{1}{2}$ ins. in diameter, wound with No. 22 S.W.G. double silk-covered wire. Each of the magnet poles ($\frac{5}{8}$ in. diam.) was provided with a small copper stud in the centre in order to prevent adhesion. By means of packing pieces the position of the magnet was adjusted until the amount of steam passing when the armature touched the magnet poles was markedly in excess of that required to maintain the temperature of the hut. The partial closing of the valve was brought about by means of a scale-beam and weight, which exerted a 2 lb. pull on a wire, W, *directly* connected to the valve spindle. It was found that under the actual conditions a movement of but little over $\frac{1}{64}$ in. at the valve spindle or $\frac{1}{32}$ in. at the armature was all that was required.

FIG. 2.



The electro-magnet was connected to two secondary cells in series with a relay. The relay was operated by means of a single dry-cell connected to the low temperature alarm contact of a long-stemmed creosote thermometer constructed on Sixe's principle. When the temperature fell contact was made, the relay circuit closed, and the armature pulled down to the magnet poles, the valve being thus opened more fully. On the temperature rising, contact was broken, and the valve once more closed to the minimum. The duration of the above cycle and the temperature range involved will of course depend largely upon the construction of the heating chamber and the closeness of the maximum and minimum positions of the valve. In a hut heated entirely by coils underneath a false floor the temperature range may be ± 1° C., but the cycle is of so short a duration that inside a box placed in such a hut the temperature may be regarded as constant. When a portion of the steam was blown into the air of the hut, in order to ensure saturation with moisture, the indications of the controlling thermometer rarely varied as much as 0·2° C. from the point at which the contact was sealed in. This form of regulator is more sensitive than the one described in section I., is cheaper to construct, and the thermometer bulb is the only portion which is inside the hut. The two electro-magnetic regulators ran constantly for many months without requiring much attention beyond the occasional recharging of the accumulators. It is, however, necessary to record that the creosote thermometers did not appear to be quite reliable, and, as time went on, a little gas developed in the tube, thus slightly altering the true values of the graduations. An ordinary mercurial contact thermometer may be employed instead of Sixe's form if the relay is arranged to close the circuit of the large electro-magnet when the thermometer circuit is broken, or if, using an ordinary relay, an iron disc is attached to the upper end of the valve spindle and the electro-magnet fixed immediately over this disc so that the magnet closes the valve instead of opening it.

III. *An Improved Electric Contact Thermometer.*—The ordinary thermometers with *adjustable* contacts for use with electro-magnetic thermo-regulators, alarm devices, &c., leave much to be desired. Those which are sealed up are usually

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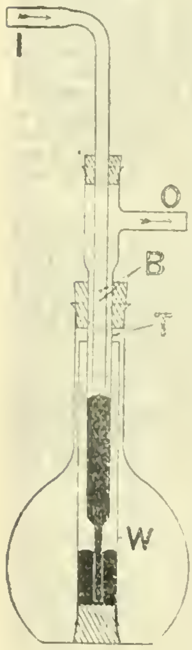
* If any clogging should occur, the obstruction may be dislodged turning the handwheel so as to permit the valve to open more ly for a few seconds.

troublesome to adjust and somewhat cumbersome, whilst fairly rapid deterioration is a decided drawback to the use of unsealed thermometers in which the mercury is protected by means of creosote. This defect of the latter can, however, be obviated by covering the mercury with purified petroleum instead of with creosote. A thermometer having one platinum wire sealed into the bulb and the other passing down the stem through a binding screw fixed just above the open top has been intermittently used during the past year, in conjunction with a Scheibler gas regulator, for controlling the temperature of a water oven. The surface of the mercury still remains bright and breaks contact sharply, whilst the petroleum ("Liquid Petroleum, B.P.," sp. gr. 0·882) has neither crept over the top nor undergone any apparent change.

It may be remarked that Scheibler's electro-magnetic gas regulator is in many respects an ideal one for accurate work, and should be widely used if placed on the market at a more moderate price than at present.

IV. *A Simple Regulator for use with Large Gas Burners* (Fig. 3).—Inside an ordinary Bohemian flask of about 16 oz. capacity is placed a tube, W, of not less than 20 mm. bore, having its lower end closed by means of a cork acting as a pad between the tube and the bottom of the flask. After completely filling the flask with methylated spirit, heated to a temperature rather higher than the regulator is likely to attain whilst in use, the neck is closed by means of an india-rubber stopper through which passes a tube, T, the lower portion of which is narrow and reaches nearly to the bottom of W, whilst the upper part is wider and provided with a side branch, O, for connection to the burner or stove. The internal diameter of the middle portion of T should be about 11 mm., *i.e.*, about 2½ to 3 mm. greater[*] than the external diameter of I (see below). A sufficient quantity[†] of mercury is next poured into T, the interior dried by means of a filter-paper, and the spirit allowed to cool to the temperature which the regulator is required to maintain. A well-fitting cork, through which passes a tube, I, of about 6 mm. bore, is inserted, and the lower end of I adjusted so as to just touch the surface of the mercury. The tube I serves as the gas inlet and has its lower end ground off obliquely. Two small holes, B, act as bye-passes, permitting the passage of sufficient gas to keep the burner or stove alight if the mercury should at any time entirely cut off the main stream. It is convenient to have two bye-pass holes of different sizes, say, 0·8 mm. and 1·2 mm. diameter respectively. Either of these can then be wholly or partially blocked with soap, or both can be left open, according to the nature of the work for which the regulator is being used. The regulator is easily made and has a high degree of sensitiveness. If the temperature increases to the extent of 1° C. the expansion of the spirit causes the mercury to rise about 5 mm. in the tube T, a height sufficient to make a very great difference in the amount of gas supplied. The preliminary adjustment is facilitated if a diminutive thermometer is suspended inside the flask in order to indicate the actual temperature of the spirit. The final adjustment for a given temperature is made by raising I about 5 mm. if the temperature is found to have settled down 1° C. below that required, or proportionately in other cases. The dimensions of the regulator may of course be varied in accordance with the size, &c., of the chamber to be heated and the accuracy required. Those given above are taken from a regulator which has proved very satisfactory in a greenhouse of about 3000 cub. ft. internal capacity and should answer well in a "constant temperature room" of moderate size or in a small drying chamber. Its capacity is about 10 to 20 times that of the ordinary Reichert regulator.

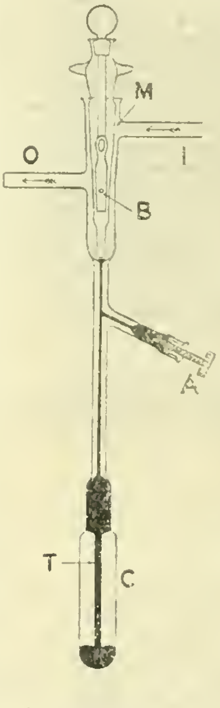
FIG. 3.



V. *A Highly Sensitive Modification of Novy's Gas Regulator.*—The ordinary forms of mercurial gas regulator give hopelessly inaccurate results if the gas pressure undergoes marked fluctuations, especially when it becomes great enough to give rise to bubbling after the end of the inlet tube has been covered. It seems a pity that such regulators should be so persistently retained for ordinary laboratory use, as their insensitiveness can be easily remedied by the employment of a larger bulb containing a liquid of high expansibility.

To work out one example in detail: Novy's gas regulator has various advantages over most of the others, but as ordinarily supplied has a bulb holding only about 1·5 c.c. of mercury. The modification shown in Fig. 4 has a cylindrical bulb C[*] of about 15 to 20 c.c. capacity, provided with an inner tube T reaching nearly to the bottom and continuous with the stem above. The bulb ordinarily contains toluene together with a little mercury, but hydrocarbons or alcohols of higher boiling point may be substituted for the toluene when desired. The bore of the lower part of the stem should be wide enough to hold 2 to 3 c.c. of mercury in order that no gas may be drawn into the bulb when the regulator is allowed to cool. The side branch containing the adjusting screw A should be inclined about 20° to 30° below the horizontal line in order that mercury may be retained in this tube after cooling, otherwise a bubble of gas may be entrapped when the regulator is again heated.

FIG. 4.



The bye-pass B, the adjustment for maximum supply M, the rigid gas inlet I, and the outlet O, remain unaltered. This modified regulator has proved very satisfactory in laboratory use. The coefficient of expansion of toluene being about five times that of mercury, and the volume of liquid having been increased about tenfold, it follows that the modification is about 50 times as sensitive to temperature changes as the original form. For certain special purposes it may be necessary to limit the external diameter of the bulb to that of the stem, but, even if the capacity of the bulb is not increased, the regulator is made nearly five times as sensitive by the substitution of toluene for mercury. The working of any regulator of this class is of course improved if a pressure regulator is attached to the supply pipe in order that there may not be a variable tendency for the gas to blow through the mercury.

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[*] In order that the annular space between the two tubes may have a rather greater sectional area than the interior of the tube I.

[†] 10° C. fall of temperature will cause the spirit to contract to the extent of nearly 5 c.c.

[*] The old pattern regulator may readily be altered by cutting off the bulb and sealing on the lower portion of a Tollens gas regulator.

Nottingham Section.

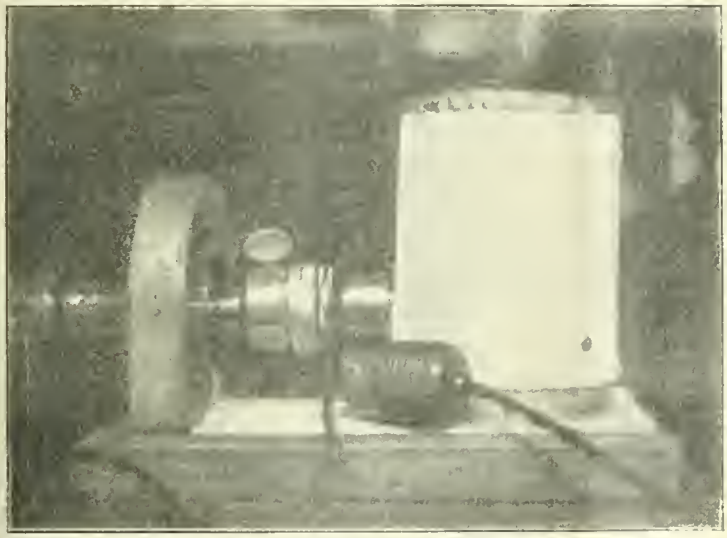
Meeting held at Nottingham, on Wednesday, October 26th, 1904.

MR. J. T. WOOD IN THE CHAIR.

AN ELECTRICAL HEATER FOR LABORATORIES.

BY S. R. TROTMAN AND J. E. HACKFORD.

The apparatus is a simple contrivance consisting of a tin some 6 ins. or 8 ins. deep, and of sufficient diameter to take a lamp of 16, 32, or 50 candle power. The exterior is covered with asbestos paper. The lamp is of the ordinary type, but the greatest heat is obtained from those lamps discoloured by continual usage, and which can be obtained at a trifling cost from dealers in electric light fittings. The lamp is fixed through a hole near the bottom of the tin, as shown in the diagram. The holder, lamp, and tin are placed on a wooden base, the top surface of which is covered with asbestos beneath the tin.



The lamp is useful for saponifications, fat extractions, nd the distillation of alcohol and ethers, the source of heat eing perfectly constant, not affected by draughts, and it is npossible for inflammable liquids to be ignited.

The apparatus may be conveniently made use of as a ethod of obtaining the necessary current for the electro-tic arsenic apparatus already described in this Journal Feb. 29, 1904, pp. 177—179), and also in the Journal of e Chemical Society, 1904, Vol. 85, CV.

The wires are so arranged that when the arsenic apparatus not in use each lamp may be switched on separately, but hen the apparatus is required one main switch will turn all the lamps, whether the separate switches for the mps are on or off.

Meeting held at Leicester, on Wednesday, November 23rd, 1904.

MR. J. T. WOOD IN THE CHAIR.

THE MINERAL CONSTITUENTS OF SUMAC.

BY S. R. TROTMAN.

The mineral constituents of sumac have hardly received e attention they deserve, and it appears to be the custom tanners to raise no objection to excessive ash so long as the tannin content passes muster. This seems somewhat unwise, since much damage may be done to skins by comparatively small quantities of iron, and the presence of sand in a wheel may also be dangerous from a mechanical point of view. The published information on the subject is somewhat meagre and inconsistent, for while, on the one hand, Andreasch gives 6·6 as the ash content of genuine Italian sumac, Gordon Parker, in a recent paper, places it so low as 2 per cent. Of over 50 commercial sumacs recently analysed, in only 10 cases did the ash fall below 7 per cent., and in two of these 10 below 6 per cent.

In the best methods of sumac manipulation the dried leaf is said to be ground between stone rollers of which all the iron portions are entirely below the level of the sumac. Further, the powder is subjected to a process of ventilation and treatment with powerful electro-magnets to remove iron and magnetic oxide. This is apparently a counsel of excellence only, since 75 per cent. of the sumacs on the market contain very distinct quantities of iron removable by the magnet, in several cases rising to 0·25 per cent. These facts seem to indicate that it is quite time a rigid limit were made, and a firm stand made by those interested in the matter.

My own experiments lead me to the conclusion that the following limits are easily attainable with only moderate ventilation: ash, 6·5 per cent.; silica, 0·75 per cent.; iron, 0·15. These figures were arrived at by taking a large number of sumacs whose ash was from 7·5 per cent. to 9·5 per cent., and subjecting them to a process of winnowing, and then redetermining the ash, silica, and iron. The difference between the ash of the winnowed and unwinnowed sumac is entirely due to the removal of silica, iron, and matter insoluble in hydrochloric acid. The following is a typical example: ash before winnowing, 8·85 per cent.; after winnowing, 6·60 per cent.; silica before winnowing, 2·25; after winnowing, 0·98 per cent. I have numerous other sets of figures reiterating these points. It is to be noted that the difficulties of properly winnowing a small quantity of sumac in a laboratory are considerable, and that much better results could be obtained on the large scale. Hence the standards suggested above should be very easily obtained in bulk.

The adulteration of sumac leaf with its own stem is fairly common, and in order to see whether the high ashes one frequently finds were due to stem I have, by sifting, obtained sumacs largely composed of stems, and find that the ash is practically never above 7 per cent., however large the proportion of stem may be, thus proving that a large proportion of stems do not necessarily mean a high percentage of ash.

The percentage of combined iron in sumac seems to be very small, not more than 0·1 per cent. The metallic iron as oxide is generally extremely finely divided, and can be almost entirely removed by means of a fine sieve, or, better, by stirring with an electro-magnet. It is quite easy to separate and weigh the magnetic iron by this means, and this method has the advantage that a large quantity of sumac can be used for the test, thus increasing its accuracy. It is a rare thing to find a sample quite free from uncombined iron, and this is a common cause of stains in goods.

Discussion.

The Chairman quite agreed with the author that a standard of ash for sumac should be fixed upon. The International Association of Leather Trades' Chemists had occupied themselves so far with the determination of tannin in sumac and other materials. The reason of that was not far to seek. Tannin was the most important constituent for the tanner, and the object of the association was to get chemists to agree in the analysis of that constituent. So they had devoted their attention principally to the estimation of tannin. He thought they might fix a maximum for the ash, iron, &c., in a pure sumac. Sumac was a material which lent itself very easily to adulteration. He could remember the time when manufacturers adulterated it with sand. This, of course, was discovered very easily. Nowadays the manufacturers were much more cunning in their methods. They adulterated it with the leaves of plants which grew wild and were cheap, such as *Tamarix* and *Lentisco.* From his experience of sumac analysis no sumac was free from iron. His firm stipulated that their sumacs should contain no free iron. In testing for this he used a powerful magnet. The chief source of the iron was volcanic sand. He had examined a good many particles under the microscope and they did not appear to be fragments of ordinary metallic iron. He had always believed that the stems contained more ash than the leaves, but Mr. Trotman's figures proved this was not the case.

Mr. HAWTHORN said that if it were a question of the difference in ash being due to a mixture of some other plant it only wanted a cute adulterator to so mix different leaves as to bring the ash to the required amount.

Mr. S. F. BURFORD inquired at what temperature the ash was obtained, since the percentage of ash depended very much upon the temperature of burning.

Mr. S. R. TROTMAN said, in reply, that the sumac was incinerated in the muffle at a low temperature. He had analysed specimens of *Tamarix* and *Lentisco* which had been sent as genuine samples and had found that the ashes were a trifle under 7 per cent. They also contained magnetic iron and possibly were adulterated. The ashes of the adulterants were not sufficiently high to raise the ashes of the sumac. They might take it as a general rule that the ash of any leaf was somewhere between 5·5 and 6 per cent. Giving the maximum at 6·5 per cent. the growers would get every benefit. A good many of the iron determinations had been made before and after stirring with the magnet, and in one or two cases the amount of iron before stirring was 0·5 per cent., and after stirring 0·2 per cent.; whether the iron was metallic or magnetic, it was an adulterant if left in. He had been looking through his records for three years and he found that the ash in sumacs had greatly risen, which would indicate that less trouble was taken in the process of refinement. It would be a good thing if the International Association of Leather Trades' Chemists would take up the matter with a view to standardising the regulations.

Obituary.

THOMAS MESSENGER DROWN, M.D., LL.D.

PRESIDENT OF LEHIGH UNIVERSITY;
PRESIDENT OF THE AMERICAN INSTITUTE OF MINING ENGINEERS (1897); MEMBER OF THE SOCIETY OF CHEMICAL INDUSTRY (1888—1904), &c.

Thomas Messenger Drown was born in Philadelphia, Pa., March 19, 1842. Graduating from the Philadelphia High School in 1859, he entered the medical school of the University of Pennsylvania, and received, in 1862, the degree of M.D. For a brief period he practised as a physician, making one or two voyages as medical officer of an ocean steamship. But chemistry, studied incidentally as part of his medical course, had a strong fascination for him, and, following this call, he abandoned his practice as a physician and returned to the position of student, taking special courses in chemistry at Yale and Harvard Universities. After this he spent some years under Bunsen and Kopp at Heidelberg, and in the Royal Mining Academy of Freiberg, Saxony. Returning to the United States thus equipped, he practised for some years in Philadelphia as an analytical chemist, and in 1875 he accepted the professorship of chemistry at Lafayette College, Easton, Pa. In 1885 he assumed and held a similar position in the faculty of the Massachusetts Institute of Technology, Boston. During this period he planned and executed what has been considered his most useful and memorable achievement, *viz.*, the systematic investigation of the spring-waters and well-waters of Massachusetts, and the preparation, on the basis of the analyses made, of the famous "chloride map" of that State, from which at a glance there may be determined how much chlorine found by the analysis of water from a given locality can be considered as due to the saline breezes of the Atlantic, and how much should be regarded as indicative of organic contamination.

Dr. Drown became a member of the American Institute of Mining Engineers at its first meeting in 1871, secretary in 1873, and in 1897 he was elected President. In 1895 he left the Massachusetts Institute of Technology to accept the presidency of Lehigh University, Pa., and in the same year Columbia University, in the city of New York, conferred upon him the honorary degree of doctor of laws. The position of President of the Lehigh University he occupied for the remainder of his days.

Dr. Drown died suddenly on Nov. 17th; and a former colleague and friend writes of him: "Would there were more like him, for us to love, to admire, and to imitate!"

Journal and Patent Literature.

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United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3^e).

I.—PLANT, APPARATUS AND MACHINERY.

English Patents.

Discharging Corrosive Acids and other Liquids from Carboys and other Receptacles by Pneumatic Pressure; Means for ——. E. H. and C. G. Boutcher, London. Eng. Pat. 22,845, Oct. 22, 1903.

In discharging liquid from a carboy one of two methods may be adopted, both of which methods are claimed. According to the first method, a cap, through which a pipe dipping into the liquid passes, the external portion serving to deliver the liquid in any desired direction, and having an inlet tube for compressed air, is fitted air-tight to the neck of the carboy. The second method consists in placing the carboy inside a vessel, forming a chamber or casing, which can be closed air-tight, through which an air-inlet pipe and a delivery pipe dipping into the liquid in the carboy, passes. In either case, on forcing air through the air pipe, the liquid is forced through and out of the delivery pipe. In combination with the means referred to in the first method, a carboy truck, having a swinging cradle, and to which the apparatus can be attached, is also claimed. The method may also be applied to the raising of a liquid from a well or tank, by immersing the air-tight vessel referred to in the second method, in and below the level of the liquid, alternately filling the vessel or chamber with the liquid through a valved opening and expelling the contents up through a delivery pipe.—W. H. C.

Regulating Temperature; Apparatus for ——. E. Paul, Seaforth, Lancs. Eng. Pat. 23,900, Nov. 4, 1903.

A bent and flattened tube, filled with liquid, is placed in contact with the fluid, the temperature of which is to be regulated. One end of the tube is fixed, the other being free to move, and controlled by an adjustable spring. The motion of the free end, under the influence of any variation of temperature is communicated to a valve which controls the supply of steam or other heating medium.—W. H. C.

Gas and Liquid: Apparatus for Bringing —— *into Intimate Contact.* A. Schneller, Ginneken, and D. Koeleman, Noordrinde, Holland. Eng. Pat. 24,379, Nov. 10, 1903.

See Fr. Pat. 336,644 of 1903; this J., 1904, 382.—T. F. B.

Incrustation in Steam Boilers; Compound for Preventing ——. T. Byrne, G. L. Scott, and W. Wheatley, Kingston-upon-Hull. Eng. Pat. 24,651, Nov. 13, 1903.

The compound is prepared by boiling 8 cwt. of oak blocks with 500 gallons of water. To the solution obtained, 0·5 cwt. of alkali (common soda) may be added. The compound is mixed with the feed water or introduced into the boiler.—W. P. S.

Evacuating Air; Method and Apparatus for ——. A. Pfeiffer, Wetzlar, Germany. Eng. Pat. 2291, Jan. 29, 1904.

When using several pumps, the best vacuum is most quickly reached by working them arranged first in parallel and then in series. A special form of cock or valve is used to effect this change of connection. The plug has a vertical outlet, *l*, Fig. 1, communicating with the external air. In this outlet is a sliding "displacer" with a rod extension projecting downwards through the bottom of the plug, as shown. Fig. 3 is a cross section along *m m* of Fig. 2; and Fig. 4 a section on the line *n n* of Fig. 3. When the plug of the cock is rotated, the inclined plane, Fig. 4, raises the "displacer," and so allows the sealing liquid to fall, as in Fig. 2. On rotating the plug in the reverse direction, the "displacer" falls, and forces the sealing liquid into the position shown in Fig. 1. Fig. 2 shows the cock in the "parallel" position, the outlet *o* being in connection with the air, and the "displacer" raised. Fig. 1 shows the cock in the "series" position, with the outlet *o* closed, and all access of air through *l* to the surface of the plug prevented by the rise of the sealing liquid.—W. H. C.

Fig. 1.

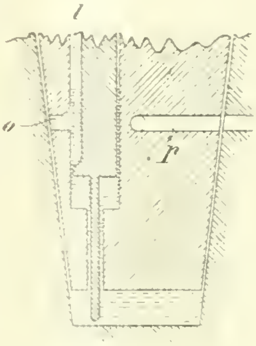
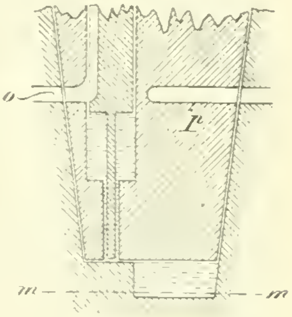


Fig. 2.



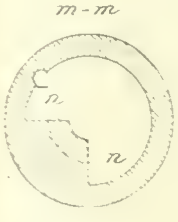


Fig. 3.

Fig. 4.

United States Patents.

Drying Apparatus. G. D. Harris, Bayshore, N.Y., Assignor to Condensed Pure Food Co., Cohocton, N.Y. U.S. Pat. 774,321, Nov. 8, 1904.

To prevent overheating, the cells of the drying apparatus are arranged in adjacent vertical rows, separated by air spaces open to the atmosphere, and independent of the conduit for the drying-current of air.—L. F. G.

Kiln. W. N. Weir, South River, N.J. U.S. Pat. 774,544, Nov. 8, 1904.

Round a chimney are grouped a number of kilns, each comprising a main chamber with perforated bottom and "flash-wall" for the ware to be burned, and an annular chamber in the wall of the kiln, opening into a space behind the "flash-wall." Beneath the perforated bottom is a main flue, communicating by means of valved passages, with the chimney and with the annular chamber of the next kiln. The kilns are provided with main fire-boxes discharging into the space behind the "flash-wall," and with a valved "bull-hole" in the top of the kiln, opening into a closed receiver, flues connecting the various receivers. —L. F. G.

II.—FUEL, GAS, AND LIGHT.

Luminiferous Salts and Illuminating Bodies. H. Bunte. J. Gasbeleucht., 1904, **47**, 1011—1013.

The temperature of the Bunsen flame was found to be considerably higher than that at corresponding places on the Auer mantle, showing that no appreciable increase of temperature is caused by a catalytic action of the rare earths of which the mantle is composed. The similarity in form of the curves showing the distribution of temperature, and of light-emission, indicates also that the intense light of the incandescent Auer mantle is not due to catalytic action. Spectrophotometric experiments showed that as the temperature of the Bunsen flame rises, the light emitted by pure thorium oxide becomes continually bluer; with cerium oxide on a thoria skeleton, the colour of the light remains the same at all temperatures. If gradually increasing amounts of cerium oxide, up to 0·5 per cent., be added to pure thorium oxide, then, at an approximately constant temperature, the colour of the light emitted becomes bluer, whilst the illuminating power increases. With larger additions (up to 1·5 per cent.) of cerium oxide, the number of red rays increases simultaneously with a rise in the illuminating power. If still larger amounts of cerium oxide be added, the colour of the light approaches nearer and nearer that of incandescent, pure cerium oxide, whilst the illuminating power decreases. The mass of the incandescence-body has an influence on the colour of the light; with a mixture of a given composition, the light emitted is bluer, the lower the weight of the mantle. In view of these experiments, the author rejects his former view that the intense light emitted by the Auer mixture is due to catalytic action (this J., 1898, 229; 1901, 791), and concludes that the thorium oxide merely acts as a vehicle for the particles of cerium oxide, which latter are the true light-emitting agents. The cerium oxide is maintained at a high temperature in the flame owing to its distribution and to its being present in only small quantities; its illuminating action is a consequence of selective radiation. (See also this J., 1898, 1129; 1901, 791; 1902, 1012.)—A. S.

English Patents.

Coking Ovens; Impts. in ——. C. G. Redfern, London. From Poetter and Co., Dortmund, Germany. Eng. Pat. 17,661, Aug. 13, 1904.

In these coking ovens a passage runs alongside the gas-distributing passage, and communicates through openings with the vertical heating flues in which are placed the gas nozzles. The openings are closed by plugs, and by removing these latter, access can be had to the nozzles and to the air-regulating dampers.—L. F. G.

Heat from Gases produced from Solid Combustibles; Apparatus for the Recovery of ——. L. Hertzog, Arbon, Switzerland. Eng. Pat. 22,546, Oct. 19, 1903.

The furnace is surrounded by a wall of sheet metal or brick-work, and the hot furnace gases are led in a downward direction through the space thus formed. Another wall surrounds the first wall, and a fluid which it is desired to heat, is passed through this second interspace. The fluid may be gas or air, which is then conducted into the furnace. —L. F. G.

Gas Retort Beds; Inclined ——. A. J. S. B. Little, Smethwick, Staffs. Eng. Pat. 24,995, Nov. 17, 1903.

In a bench of inclined retorts, the gas-producers and the regenerative passages are arranged in the space formed by the angle between the retorts and the ground level, the producers and their charging openings being situated beneath the charging ends of the retorts. Between every pair of retort-beds there is an elevator, working in an inclined tunnel, which delivers the coke from the discharging-ends of the retorts to the charging-openings of the producers. By this arrangement the height of the retort-house, and the amount of constructional work generally, are reduced, only one staging being required for charging both the retorts and the producers.—H. B.

Retort Benches for the Manufacture of Illuminating Gas. E. Derval, Paris. Eng. Pat. 15,860, July 16, 1904. Under Internat. Conv., Sept. 5, 1903.

See Fr. Pat. 339,015 of 1903; this J., 1904, 1081.—T. F. B.

Furnaces of Gas Producers [*for Gas Retort Settings, &c.*]. J. F. Bell, Derby, and R. Masters, Bedford. Eng. Pat. 28,342, Dec. 24, 1903.

The fire-bars of the producer are inclined from the front of the furnace to the back, and are made of angle- or other trough-like section. Water drips into these bars at the front of the furnace, from a series of nozzles on a horizontal water-supply pipe, which is adapted to be swung upwards, clear of the furnace door, during clinkering operations. The water furnishes the steam required by the producer, and keeps the fire-bars cool. An additional set of horizontal, trough-like bars, may be arranged beneath the fire-bars, to increase the generation of steam, the water drip-pipes which supply these lower bars, being attached to, and adapted to be swung up with, the water supply-pipe mentioned above.—H. B.

Gas from Coal or other Material; Apparatus for the Manufacture of Crude [*Producer*] ——. H. Heenan, Manchester. Eng. Pat. 23,616, Oct. 31, 1903.

The producer consists of two superimposed chambers having a contracted passage between them; a trough-like tuyère, partly filled with water, is situated round the passage, from which a hot blast of air and steam is forced up through the fresh fuel fed into the upper chamber; a flue which leads the "green" gases from the top of the upper chamber to another trough-like tuyère, situated beneath the incandescent fuel in the lower chamber; an injector, by means of which air and steam, intermingled with the "green" gases, are forced from the tuyère up through the incandescent fuel; flues round the top of the lower chamber, for leading off the gas; a bridge for supporting the fuel; and a water-sealed ash-pan. The fuel is fed through a hopper into the upper chamber, and descends into the lower chamber as required.—H. B.

Gas [*Water-Gas*]; *Manufacture of Combustible* ——. J. Bowing, Tilbury, Essex. Eng. Pat. 28,498, Dec. 28, 1903.

Water-gas is produced, without the intervention of an air-blast period, by the treatment of comminuted fuel with superheated steam in a retort, the retort charge being heated internally by means of the superheated steam only. Steam, at a pressure somewhat above that at which it is desired to be used in the retort, is passed through a superheater, which raises it to about 700° C., and is then led into the retort through a pipe having a perforated portion which is surrounded by the fuel. The steam-blast, in passing through the mass of fuel, is reduced to a quiet flow, and a mixture of carbon monoxide and hydrogen is produced. H. B.

Producer-Gas; Manufacture of ——, *and Apparatus therefor.* J. Armstrong, London. Eng. Pat. 544, Jan. 8, 1904.

The combustion chamber of the producer is divided by means of a vertical partition into two compartments, each provided with air-blast and steam-blast pipes. While the air-blast is being supplied to the fuel in the one compartment, steam is blown simultaneously through that in the other, the gases generated being allowed to mix at the top of the partition on their way to the furnace. The air-blast and steam-blast periods in each compartment alternate in the usual way. Instead of using one divided producer, two separate producers may be worked in connection with one another. Instead of steam, furnace gases rich in carbon dioxide may be used, with or without the addition of steam, the feed being reversed from time to time from air to furnace gases and *vice versa.*—H. B.

Illuminating Gas; Manufacture and Purification of —— [*from Naphthalene*]. A. Colson, Knighton, Leicestershire. Eng. Pat. 16,766, July 29, 1904.

Coal-tar, oil-tar, blast-furnace tar, or the like is distilled, either before or after removal of carbolic acid, naphtha, &c., and the portion which distils below 270° C. is collected and redistilled so as to yield a fraction boiling between 170° and 215° C. This fraction is used as a solvent for the removal of naphthalene from the gas to be purified, the cooled gas, free from tar, being treated preferably in a washer wherein the gas is compelled to travel through the liquid in fine streams.—H. B.

Oil-Gas; Production of ——. F. G. C. Rincker, Watergraafsmeer, and L. Wolter, Amsterdam, Holland. Eng. Pat. 20,371, Sept. 21, 1904.

Fuel is brought to incandescence in a producer, the air-supply is stopped, and oil is then fed upon the top of the fuel, the gas produced being led off at the foot of the producer to a scrubber, in which it is washed with water. —H. B.

United States Patents.

Peat Fuel; Process of Manufacturing ——. C. F. Schlickeysen, Steglitz, Germany. U.S. Pat. 773,992, Nov. 1, 1904.

See Fr. Pat. 327,873 of 1902; this J., 1903, 944.—T. F. B.

Fuel; Manufacture of Artificial ——. J. J. Shedlock, Little Bentley, England. U.S. Pat. 774,705, Nov. 8, 1904.

See Fr. Pat. 340,981 of 1904; this J., 1904, 816.—T. F. B.

Coke-Oven. G. S. Ramsay, St. Marys, Pa. U.S. Pat. 773,809, Nov. 1, 1904.

The oven is provided with a central, main, bottom flue communicating at one end with the stack; vertical flues at the front and rear, communicating at their upper ends with the interior of the oven; and bottom flues connecting the vertical flues with the main bottom flue. The bottom flues at the rear of the oven are shorter than those at the front, and the flues on one side of the main flue are independent of those on the other side and also of each other, the walls forming and separating them being continuations of the outer wall of the oven and acting as supports for the floor of the oven. These bottom flues each consist of an outer radial portion, a portion in the form of a loop or approximately U-shaped, and a short inner transverse portion.—A. S.

Coke Quenching and Bleaching Apparatus. E. A. Moore, Philadelphia, Pa. U.S. Pat. 774,330, Nov. 8, 1904.

The claim is for a receptacle for the hot coke, in combination with a trench containing water, means for supplying the water to the coke, and a pipe and jet condenser for the steam generated during quenching.—L. F. G.

Gas; Apparatus for the Manufacture of ——. H. A. Bradley, Assignor to the Bradley Universal Heat, Light, and Power Co., New York. U.S. Pat. 773,781, Nov. 1, 1904.

Within the furnace are arranged three casings, forming respectively a generator, a burner for heating the latter, and a second burner for heating the first-named burner. The generator consists of three intercommunicating compartments, *viz.*, a steam chamber, which receives steam from an external boiler, a carburetting chamber into which liquid fuel is fed, and a fixing chamber (communicating with a gas-holder) within which the mixture of steam and fuel is converted into fixed gas. The two burners are similar in construction to the generator, except that the fixed gas produced by them is allowed to issue into the furnace, where it is burned, instead of being led off to the gas-holder. —H. B.

Gas-manufacturing Apparatus. C. R. Ingham, Suffern, N.Y. U.S. Pat. 774,430, Nov. 8, 1904.

A steam-superheater, consisting of several connected pipes of small diameter, filled loosely with fragments of cast-iron or the like, is arranged within a furnace which is surrounded by a wall forming a space for the passage of the products of combustion. The steam from the superheater enters a mixer under pressure, and in doing so impinges upon a supply of liquid hydrocarbon, the vapour of which it carries into the mixer. The mixer consists of an elongated chamber, closed at one end, and having at the other an inlet for the steam and hydrocarbon, and an outlet for the gas produced. The gas is led through a fixing retort consising of a number of connected pipes of small diameter, filled loosely with refractory material, and situated within the combustion chamber of a secondary furnace. The resultant illuminating gas is led off from the fixing retort.—H. B.

Charger for Gas-Producers. E. H. Carroll, Assignor to Morgan Construction Co., Worcester, Mass. U.S. Pat. 774,561, Nov. 8, 1904.

The charger consists of a stationary top-plate, a fuel reservoir, and a rotating feed-casting interposed between the two, and provided with an opening eccentric to its axis of rotation, through which the fuel drops from the reservoir on to the top-plate, over the outer edge of which it is swept by the movement of the feed-casting. On the top of the latter a water-chamber is provided to keep it cool, and a water-seal is formed at the joint between the feed-casting and the reservoir. An agitator rotates in the eccentric opening, to loosen the fuel.—H. B.

Gas-Scrubber. A. Steinbart, Carlstadt, N.J. U.S. Pat. 774,207, Nov. 8, 1904.

A vertical cylindrical vessel is provided at the top with a concentric, rotary, spraying nozzle, fed with water. The spray falls on a series of concentric rings, the upper edge of each ring rising above the edge of the adjacent inner ring, and the lower edge of each ring being toothed. The rings convert the spray from the nozzle into a vertically falling rain, which, after descending through the stream of gas, is collected and run off at the foot of the scrubber.—H. B.

French Patents.

[*Fuel*] *Briquettes; Manufacture of* ——. H. S. Gerdes. Fr. Pat. 344,225, June 23, 1904.

Anthracite or coal, in small pieces, or in the form of powder, is mixed with fresh peat, or similar moist material, to which an alkali may be added, pressed into blocks, and dried.—L. F. G.

Producer Gas; Process and Apparatus for Producing ——. P. Stiens. Fr. Pat. 344,671, July 8, 1904.

See Eng. Pat. 14,971 of 1904; this J., 1904, 977.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

English Patent.

Petroleum and other like Hydrocarbons; Process for Saponifying ——. F. J. Lothammer, Paris, and C. Trocquenet, Colombes, France. Eng. Pat. 26,366, Dec. 2, 1903.

See Fr. Pat. 338,636 of 1903 and addition thereto; this J., 1904, 655.—T. F. B.

United States Patents.

Wood; Process of Deriving Products from ——. C. M. Dobson, New York, Assignor to The Wood Distillates and Fibre Co., Chicago. U.S. Pat. 774,135, Nov. 1, 1904.

Wood is heated by steam and external heat to a temperature sufficient to liquefy the gums and resinous matter, but not for a sufficiently long time to carbonise the fibrous portion; the heated mass is crushed by heated "mechanical means," and then macerated and heated simultaneously; the liquid portion is finally removed from the fibrous mass by pressure. —T. F. B.

Wood Distilling and Preserving Apparatus. F. S. Davis, Shirley, Assignor to J. C. Richardson, Robertsville, S.C. U.S. Pat. 774,649, Nov. 8, 1904.

Each member of a battery of horizontal cylindrical retorts is connected with a tank in which the "distilling and preserving fluid" is heated. The connections consist of a valved pipe for introducing the fluid into the retort, and another for discharging the fluid from the retort into the tank, a pump being so situated that a continuous circulation of the liquid between the tank and any one of the retorts may be maintained; thermometers are fixed in the inlet and outlet pipes near each retort. Valved vapour-outlet pipes are provided in the top of each retort, leading to a single condenser.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

1.5-*Diaminoanthraquinone; Bromination of*——. R. Scholl and H. Berblinger. Ber., 1904, **37**, 4180—4184.

2.6-*Dibromo*-1.5-*diaminoanthraquinone* is obtained both by the gradual addition of bromine to 1.5-diaminoanthraquinone suspended in cold glacial acetic acid and by direct bromination. The product is digested in bisulphite solution, washed, dried, and recrystallised from hot nitrobenzene. It forms blue, lustrous needles melting at 274° C. Experiments made to establish its orientation have shown both bromine atoms to be in ortho-position to the amino groups. 2.4.6.8-*Tetrabromo*-1.5-*diaminoanthraquinone* is prepared by brominating 1.5-diaminoanthraquinone in boiling glacial acetic acid or its disulphonic acid in water. It may also be obtained by direct bromination, as in the case of the dibromo derivative, allowing the resulting perbromide, however, to digest in water in the place of bisulphite solution. It crystallises in green lustrous needles, sparingly soluble in hot nitrobenzene, but insoluble in the usual solvents. —D. B.

Anthraquinone; Diazonium Compounds of——. F. Kačer and R. Scholl. Ber., 1904, **37**, 4185—4187.

Acid anthraquinone-1-*diazonium sulphate* was prepared from 1-aminoanthraquinone by diazotisation in presence of sulphuric acid. It forms a light yellow, crystalline powder, which is stable at the ordinary temperature, but decomposes on heating. When its sulphuric acid solution is heated gently with alcohol, anthraquinone is regenerated. *Acid anthraquinone*-1.5-*bisdiazonium sulphate* was obtained by diazotising 1.5-diaminoanthraquinone in presence of sulphuric acid. It is an orange-coloured crystalline salt, which is sparingly soluble in water and stable at the ordinary temperature, but decomposes at 172° C. Diazonium compounds prepared from 1.3- and 1.8-diaminoanthraquinones are readily soluble in water—a fact which may be utilised for obtaining from crude diaminoanthraquinone the azo dyestuffs of the 1.5-derivative in a pure form.—D. B.

Stilbene Group; The Colouring Matters of the——. *I.* A. G. Green. Chem. Soc. Trans., 1904, **85**, 1424—1431.

Two formulæ have been assigned to the stilbene dyestuffs, *viz.*, that of azoxystilbene derivatives by Bender and Schultz (Ber., 1886, 3234), and that of dinitrosostilbene derivatives by O. Fischer and Hepp (see this J., 1894, 29, and Ber., 1895, 2281). In addition to the fact that it is improbable that substances so constituted should possess dyeing properties, the following considerations show that the suggested formulæ do not correctly indicate their constitution:—Curcumine (Direct Yellow) does not give dinitrostilbenedisulphonic acid on oxidation with chromic acid (as Fischer and Hepp stated), but produces a greenish-yellow dyestuff apparently identical with Mikado Golden Yellow. In Eng. Pat. 12,922 of 1896 (this J., 1897, 531) it is shown that b condensing *p*-nitrotoluene-*o*-sulphonic acid with dehydrothiotoluidinesulphonic acid, a more soluble, yellowish dyestuff i produced, containing aldehyde groups (Curcupheníne), which is shown to be an imine of stilbene aldehyde, in the formation of which 4 mols. of *p*-nitrotoluene took part. It wa further proved that all stilbene dyestuffs contain a certain amount of aldehydic products (see Eng. Pat. 6760 of 1898; this J., 1899, 362), and that all stilbene derivatives on alkaline oxidation give rise to aldehydes (Eng. Pats. 21,825 of 1897, and 1431 and 4045 of 1898; this J., 1898, 91 and 1899, 133). By oxidising *p*-nitrotoluene-o-sulphoni acid with sodium hypochlorite, it was found possible t produce, according to the conditions, dinitrostilbenedi sulphonic acid or dinitrodibenzyldisulphonic acid (Eng Pat. 5357 of 1897; this J., 1898, 148). On heating th former with sodium hydroxide and a small quantity of som oxidisable substance, and the latter with sodium hydroxid alone, a yellow dyestuff was obtained which contained n aldehydic or alkali-sensitive product (see Eng. Pats. 21,39 and 21,553 of 1897; this J., 1898, 915). On reduction this gives rise to a series of yellow dyestuffs, and finally t diaminostilbenedisulphonic acid. In addition to these dye stuffs, the two dinitro acids form condensation product with primary amines, which appear to be mixed azo o azoxy dyestuffs, indicating a complex structure for stilben dyestuffs. *p*-Nitrotoluene and its *o*-substituted derivatives on treatment with alkali hydroxide, all give highly coloure unstable intermediate compounds, which, on further heating are transformed into analogues of Curcumine, the readines with which these intermediate compounds are formed bein found to depend on the nature of the *o*-substituent group Dinitrostilbenedisulphonic acid is not formed by direc oxidation of the *p*-nitrotoluenesulphonic acid, but is forme from the intermediate compounds mentioned above. Dinitrostilbenedisulphonic acid is also readily converted b alkaline reduction into this intermediate compound; henc it is probable that these two compounds are very similar i constitution, and that their formulæ only differ by two atom of oxygen. Some doubt, however, existed from the fac that it was never found possible to obtain a higher yiel than 65 per cent. of the dinitrostilbenedisulphonic aci (See next abstract.)—T. F. B.

Stilbene Group; The Colouring Matters of the——. *II.* A. G. Green, F. Marsden, and F. Scholefiel Chem. Soc. Trans., 1904, **85**, 1432—1438.

On heating phenyl-*p*-nitrotoluene-*o*-sulphonate with alka hydroxide, an unstable blue compound was produce which, on oxidation, gave what proved to be a mixture phenyl-*cis*- and *trans*-dinitrostilbenedisulphonates in almo theoretical yield. This mixture was separated into its com ponents, which are described. The corresponding *cis*- an *trans*-dichlorodinitrostilbenes were similarly produced i good yield from o-chloro-*p*-nitrotoluene. All these dinitr stilbene derivatives are readily reconverted into the highl coloured intermediate compounds on reduction. The fa that the above compounds are obtained in almost theoretic yield removes the doubt mentioned in the preceding abstrac whence there appears every reason to regard these inte mediate compounds as nitrosostilbene or stilbene nitrol acid derivatives, and since they are only coloured in alkali solution, they would have a quinonoid structure, *e.g.*, th crimson compound from *p*-nitrotoluene-o-sulphonic ac would have the constitution—

$$\begin{array}{l} \mathrm{CH{:}C_6H_3(SO_3Na){:}N(OH)ONa} \\ \mathrm{CH{:}C_6H_3(SO_3Na){:}N(OH)ONa} \end{array}$$

Further, the above work shows that Green and Wahl dinitrostilbenedisulphonic acid (this J., 1898, 146) really a mixture of the *cis*- and *trans*-isomerides, and it also probable that, since it is formed by oxidation of th crimson intermediate product obtained in the preparation Curcumine, this intermediate product and the stilbene dy stuffs to which it gives rise are all mixtures of the tw isomerides.—T. F. B.

Paranitraniline Red; Copper Compound of ——. W. Schaposchnikoff and V. Svientoslavski. Z. Farben- u. Textil-Ind., 1904, **3**, 422—426.

By boiling a mixture of Paranitraniline Red and copper sulphate together with ammonia in water for six hours, a deep brown product was obtained, containing 9 per cent. of copper oxide. A copper naphtholate solution was prepared according to Goldovsky's method and added to the diazo solution of paranitraniline; a compound separated out containing 3 per cent. of copper oxide. After boiling the mother-liquors for 20 hours, the precipitate contained 11 per cent. of copper oxide. When boiled with 10 per cent. hydrochloric acid it contained only 7 per cent. of copper oxide; but on extracting the unchanged oxyazo dyestuff with boiling toluol, the residue contained 11—12 per cent. of copper oxide. The formula of the copper compound is probably $Cu(O.C_{10}H_6.N:N.C_6H_4.NO_2)_2$, which requires 12·2 per cent. of copper oxide. Goldovsky's method is not suited for practical purposes, as only 3—3½ per cent. of copper oxide is taken up instead of 12·2 per cent. The best method is that of Müller, in which the ready-dyed material is passed three times through a boiling copper sulphate solution (1:1000). The brown is completely developed in two hours. The addition of a little acetic acid helps the process.—A. B. S.

Dyestuffs; Action of Low Temperatures on ——. J. Schmidlin. Comptes rend., 1904, **139**, 731—732.

Dyestuffs were exposed to the temperature of liquid air. In no case, when the dye was fixed on a textile fabric, was there any effect produced. In alcoholic solution, some dyestuffs, such as Methylene Blue and Malachite Green, were unaffected; but the rosanilines all exhibited a considerable diminution in the intensity of their colours, and there appeared a yellowish green fluorescence, the solution acquiring an appearance resembling that of Eosin. Possibly this fluorescence exists at ordinary temperatures, but is not noticeable on account of the intensity of the red or violet colour. Alcoholic solutions of Eosin cooled in liquid air also exhibit a diminution in the intensity of the colour viewed by transmitted light, whilst the fluorescence remains unchanged.—J. T. D.

English Patents.

Sulphur Colouring Matters [*Sulphide Dyestuffs*] *and Intermediate Products therefor; Manufacture of* ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine. Eng. Pat. 24,930, Nov. 16, 1903.

By oxidising a mixture of equimolecular proportions of a phenol and *o*-*o*-dichloro-*p*-phenylenediamine [2.6.1.4], large quantities of stable indophenols are produced, which are readily reduced to the corresponding diphenylamine derivatives. By melting these new indophenols or diphenylamine derivatives with sulphur and sodium sulphide, dyestuffs of great colouring power are obtained. These dye cotton from sodium sulphide solutions greenish-grey to bluish-grey shades, which are rapidly converted to deep violet on exposure to air.—T. F. B.

Dyestuffs Derived from Anthracene [*Anthracene Dyestuffs*]; *Manufacture of* ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst on the Maine. Eng. Pat. 26,182, Nov. 30, 1903.

According to Eng. Pat. 7387 of 1902 (see this J., 1903, 293), dyestuffs are obtained by condensing hydroxyanthraquinones with sulphonic acid salts of primary aromatic amines under pressure and at high temperatures. It is now found that hydroxy- or aminoanthraquinones can be condensed with the salts of sulphonic or carboxylic acids of primary aromatic amines, in presence of reducing agents (*e.g.*, stannous chloride), under normal pressures and at moderately low temperatures (100°—140° C.). Suitable anthraquinone derivatives are those in which the 1- and 4-positions are occupied by amino- or hydroxy- (or alkyloxy) groups, and the 5-, 6-, 7-, and 8-positions by hydrogen atoms or by hydroxy or amino groups. The resulting dyestuffs dye unmordanted wool in greenish-blue, blue, and bluish-violet shades. The dyestuffs obtained according to Eng. Pat. 23,927 of 1894 (see this J., 1895, 1041) by sulphonating the condensation products of hydroxyanthraquinones with primary aromatic amines are disclaimed. (See also U.S. Pat. 754,768 of 1904; this J., 1904, 368.)
—T. F. B.

French Patents.

Anthracene Series; Production of Dyestuffs of the ——. [*Anthracene Dyestuffs.*] Badische Anilin und Soda Fabrik. Addition, dated Sept. 17, 1903, to Fr. Pat 339,044, March 30, 1903.

See Eng. Pat. 20,151 of 1903; this J., 1904, 319.—T. F. B.

Dyestuffs Derived from Acridine Yellow; Process for Making Orange-Red ——. [*Acridine Dyestuffs.*] Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 339,051, Sept. 19, 1903.

See U.S. Pat. 756,540 of 1904; this J., 1904, 932.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Aluminium; New Use for ——. Elect. Review, 1904, **45**, 70.

The U.S. Consul at Frankfort, Germany, states that in spinning machines, aluminium is being substituted for wood, especially for the spools or bobbins. The aluminium bobbins are only two-fifths as heavy as the wooden ones, and are more durable, being less sensitive to alteration of temperature and to moisture.—A. S.

Cotton; Wetting of —— *by Water and by Water Vapour.* O. Masson. Proc. Roy. Soc., 1904, **74**, 230—254.

When dried cotton-wool is immersed in water, its temperature rises for some time, and afterwards slowly falls. The same phenomenon occurs when the cotton-wool is exposed to air saturated with aqueous vapour; and in both cases the courses of the curve representing the rise and fall are similar, and are similarly affected by previous moisture and other conditions. In the latter case the effect is due to the condensation on the cotton of vapour which it absorbs, for both absorption and heat-production occur for many hours, and the amount of heat is approximately that calculated from the quantity of vapour absorbed. In the former case, though absorption cannot be directly observed, it must occur, and the air adhering to the fibre maintains the separation necessary for distillation to occur. Medical or "absorbent" cotton-wool, though it behaves like ordinary cotton-wool in saturated air, does not show the same rise of temperature in water. The water condensed on the cotton certainly does not combine chemically with it; and it is not simply condensed as a film on the surface, for the quantity is too great for the recognised maximum thickness of such films. It probably undergoes osmotic diffusion into the fibre and forms a sort of solid solution of cellulose and water, having a vapour pressure always lower than that of water. Cotton in air saturated with alcohol vapour, or gun-cotton or glass wool in air saturated with water-vapour, showed similar behaviour, though to a slighter extent, and no effect was produced when cotton was immersed in absolute alcohol or glass wool in water, so that the air-insulation is necessary to produce the effect. This thermal effect is much greater than, and probably quite different from that investigated by Parks, occurring when finely divided solids are mixed with water; but the effects long ago observed by Pouillet when finely divided solids were placed in water were probably in part at least, due to distillation.—J. T. D.

Dyeing [*Mordanting*] *Processes. VII. For* [illegible] *in which Primary Metallic Mordants are Present in Mordanted Fibres.* P. Heermann. Färber-Zeit., 1904, **15**, 325—327 and 345—347.

Raw and boiled-off silks which had been mordanted with stannic chloride, basic ferric sulphate, chromic chloride, and aluminium acetate were examined with a view to ascertaining in what form the mordant was present in the fibre. The silk was mordanted by the method previously described (this J., 1903, 623, and 1901, 57), thoroughly washed with water, and titrated directly with standardised sodium hydroxide solution; this method gives a direct determination of the amount of acid radical present in the mordanted fibre in the form of basic salt; its accuracy was checked by fusing the fibre with alkali hydroxide, and determining the amount of acid radical in the usual manner. A deduction was necessary from these results, since traces of acid remain adhering mechanically to the fibre, even after most careful washing, and this was ascertained by substituting for the mordanting a treatment with a solution of the acid of which the radical was present in the mordant, the other conditions of the process, and the analytical method, being the same as above. It was found that considerable range in the concentration of the acid solution used had no effect on the amount of acid adhering to the fibre; *e.g.*, treatment with 1, 5, and 10 per cent. solutions of hydrochloric acid resulted in the same percentage of acid being retained in each case. The analytical data were completed by a determination of the amounts of metallic oxide present in the fibre. The results were as follows: in the case of the tin mordant, the raw silk was found to contain 155 mols. of stannic oxide to each atom of chlorine, corresponding to a formula of $SnCl_4 + 619Sn(OH)_4$, and a "basicity number" (see this J., 1904, 438) 0·0019; boiled-off silk contained 143 molecules of stannic oxide to each atom of chlorine, corresponding to $SnCl_4 + 571Sn(OH)_4$ and basicity number 0·0021. With the iron mordant on raw silk, 111 mols. of ferric oxide were present to each mol. of SO_3, *i.e.*, $Fe_{222}SO_3(OH)_{664}$, basicity number 0·008; on boiled-off silk, 91 mols. Fe_2O_3 to 1 mol. of SO_3, or $Fe_{182}SO_3(OH)_{544}$, basicity number 0·0096. Chromium mordant on raw silk, 40 mols. of chromic oxide to 1 atom of chlorine, or $Cr_{80}Cl(OH)_{239}$, basicity number, 0·009; on boiled-off silk, 44 mols. of Cr_2O_3 to each atom of chlorine, or $Cr_{88}Cl(OH)_{263}$, basicity number, 0·008. Aluminium mordant; in neither raw nor boiled-off silk could any acid radicle be detected, showing that the aluminium was present as hydroxide. It would thus appear that, for all practical purposes, the mordant is not present in the fibre in the state of a basic salt, but in the form of the hydroxide.—T. F. B.

Coal-Tar Dyestuffs; Behaviour of —— towards Starch, Silicic Acid, and Silicates. W. Suida. Monatsh. Chem., 1904, **25**, 1107—1143.

Pure potato starch, free from albumin, was shaken up in the cold with solutions of various dyestuffs. After about 15 minutes the liquid was poured off and the starch washed repeatedly by decantation with cold distilled water until the water was not coloured. It was found that basic dyestuffs dye the starch strongly, whereas acid dyestuffs do not. Basic dyestuffs, which have been sulphonated, dye less strongly than the unsulphonated dyestuffs, and if highly sulphonated show little affinity for the starch. Diamine Blue B B forms an exceptional case as in distinction to all other benzidineazo dyestuffs which were tried, it dyes starch strongly. In all cases the dyed starch granules, when examined under the microscope, were found to be uniformly dyed right through. Though water does not remove the dyestuff it is removed slowly by alcohol, more quickly by dilute hydrochloric acid and by acetone. By using sufficient starch, solutions of basic dyestuffs can be completely decolorised. Starch dyed with Magenta did not lose one-third of the intensity of coloration on being extracted with alcohol in a Soxhlet apparatus for several days. The amount of dyestuff taken up by starch is very small. Thus 100 parts of potato-starch can only take up 0·00228 grm. of Magenta, or rather remove the base from the same, for all the hydrochloric acid of the Magenta is left in the bath, which, however, remains neutral, the free acid being neutralised by the mineral matter in the starch. Thus potato-starch behaves towards basic dyestuffs in an analogous manner to animal fibres and hydro- and oxycellulose and not like ordinary cellulose. It is not dyed by direct cotton dyestuffs, in which respect it differs from both animal fibres and cellulose. Dyestuffs derived from diaminostilbene form an exception in this case. Inulin is not dyed by basic dyestuffs. Attempts were then made to dye the following materials with basic dyestuffs free from ash:—Flowers of sulphur, calcium, strontium and barium sulphates, calcium, barium, magnesium, manganese, and lead carbonates, aluminium oxide (partly hydrated), aluminium phosphate, kaolin, talc, pumice powder, zinc oxide, and kieselguhr. Only the kaolin, talc, pumice, and kieselguhr were dyed. The other materials took up no colour whatever, and the same results were obtained on using boiling solutions of the dyestuffs. Only the silicates were dyed, and these were dyed very strongly. Acid dyestuffs were tried, but did not dye the silicates, with the exception of some diamine colours which dyed them slightly. A large variety of pure minerals containing silicic acid were then tried, and it was found that only those silicates containing acid hydroxyl groups were strongly dyed by basic dyestuffs (Methylene Blue and Diamond Fuchsine), silicates which were neutral or basic, or which merely contained water of crystallisation not being dyed at all, or only very slightly. Hydrated forms of silicic acid such as opal and hyalite, were also dyed, but not quartz or flint. A dark augite, jadeite, and petalite formed apparent exceptions to the rule, being dyed, although they contain no free hydroxyl groups, but these minerals readily undergo change, accompanied by hydration. All the minerals which can be dyed in this way lose the property on ignition. When they are dyed, the acid radical of the dyestuff is left in the bath, but combined with basic constituents of the original mineral so that the bath remains neutral. The dyestuff can be extracted from the dyed mineral by hydrochloric acid, alcohol or acetone, but by no means quickly or completely. Both potato-starch and kaolin can be shown to possess weakly acid properties by shaking them with weakly ammoniacal phenolphthalein or cuprammonium solution, which they decolorise. Hydrocellulose also shows this reaction, whereas calcium carbonate, strontium sulphate, zinc oxide, natrolith, and vesuvian do not. Kaolin and other acid silicates can also be dyed by means of an aqueous solution of the carbinol-base of Magenta in an analogous manner to wool, but in the former case warming is necessary, and only little free ammonia must be present. Only 20 per cent. of the dyestuff could be extracted by alcohol from kaolin dyed with Magenta. From dyed wool only 10 per cent. of the dyestuff could be extracted in the same manner. Thus in both cases by far the larger part of the colour remained fixed in the material. Further experiments with kaolin showed that so long as excess of dyestuff was present in the vat, neither temperature, or concentration had any appreciable effect on the strength of the dyeing, also that the dyestuffs used (Magenta, Paramagenta, Methylene Blue and Crystal Violet) were absorbed in molecular proportions, within the limits of experimental error. Kaolin which had been treated with warm caustic soda and then thoroughly washed, acquired by this treatment the property of taking up twice the quantity of basic dyestuff, and also of absorbing acid dyestuffs from an acid bath. Treatment with hydrochloric acid was not found to alter the behaviour of kaolin towards dyestuffs. After treatment with hydrofluoric acid it is not dyed so strongly by basic dyestuffs, but absorbs acid dyestuffs vigorously from an acid bath. During the investigation the inaccuracy and unreliability of colorimetric methods of determining the strength of dyestuff-solutions were repeatedly proved. The effect of varying amounts of hydrochloric acid in the dyeing of wool with Magenta was also tried. Up to 5 molecular proportions of hydrochloric acid per molecular proportion of Magenta caused no diminution in the intensity of the dyeings, but 9 molecules of the acid already produced considerable diminution in the intensity of the dyeing, whilst 65 molecules reduced the intensity by 50 per cent.—E. F.

Zinc Oxide Reserves under Prud'homme's Black. E. Lauber. Z. Farben- u. Textil-Ind., 1904, **3**, 417—419.

The zinc oxide is ground up with its own weight of glycerin.

Standard White.—6 kilos. of zinc oxide paste (1:1) are well mixed with 6 kilos. of glycerin and 4 kilos. of gum tragacanth (75:1000), and passed through a fine sieve.

White Resist.—250 grms. of calcined sodium carbonate are dissolved in 1 litre of water, and well mixed with 5 kilos. of standard white.

Coloured Resists.—The dyestuffs are dissolved in glycerin on the water-bath, mixed with zinc oxide and the necessary thickening agents, and passed repeatedly through the wet colour mill, and then, before printing, through a fine silk sieve. The following is an example :—"*Green Lake*": 300 grms. of Brilliant Green are dissolved in 250 c.c. of water and 1750 grms. of glycerin, and 6000 grms. of zinc oxide paste (1:1) are stirred in.

Green Printing Colour.—830 grms. of Green Lake are well mixed with 200 grms. of glycerin, 200 grms. of tragacanth (50:1000), and 800 grms. of blood albumin (750:1000); passed through the mill; and sieved.

As these printing pastes have a great tendency to stick in the engraving of the printing rollers, revolving brushes are fitted to remove the residual colour from the rollers. The resists are printed on the white cloth, and the latter is hen passed into a hot chamber to coagulate the albumin in order to prevent the running of the colour in the subsequent padding. If the cloth is dried at a low temperature, t is passed for a few minutes through the Mather-Platt. The padding with aniline liquor is best done in a two-oller padding machine, the lower roller alone dipping nto the padding bath. The printed cloth is passed between he rollers with its printed side downwards, and in order to et a thorough impregnation, is pressed against the lower oller by a smaller roller which is fixed a short distance rom the gripping place. The after-treatment of the aterial in the hot flue and chrome-bath is the same as sual.—A. B. S.

English Patents.

Iultiple-Ply Woven Fabrics; Apparatus for Treating —— with Adhesive Compound. W. R. Smith, Buffalo, U.S.A. Eng. Pat. 13,471, June 14, 1904.

Iultiple-ply woven fabrics are first heated and stretched y a passage between a series of heated rollers, each pair of hich, after the first, has a greater velocity than the receding pair. The fabrics are then passed between a air of heated rollers, by means of which they are treated ith a "filling composition," the object of the process being produce machine belting.—E.B.

leaching Textile Materials; Process for ——. O. Venter, Chemnitz, Germany. Eng. Pat. 15,395, July 9, 1904.

order to obtain more even bleaching, the fabric is posed to the action of the bleaching liquid *in vacuo*, a completely spread out condition, without longitudinal lds, *e.g.*, hung loosely over a number of rollers fixed at a ort distance from one another. Ozonised air or liquid r can be used when necessary to facilitate the bleaching. —T. F. B.

ischarge of Halogenated Indigo Colouring Matters J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 1867, Jan. 25, 1904.

e U.S. Pat. 760,817 of 1904; this J., 1904, 659.—T. F. B.

rying or Carbonising of Fibrous or other Material; Machinery for ——. J. Fielden, Rochdale, Lancs. Eng. Pat. 23,607, Oct. 31, 1903.

is machine consists of a drying chamber furnished with oving carriers for the material, and heated by a hot-air ast. The material is fed into the tube of the hot-air pply by means of a light roller, which is arranged in ides, so as to rise and fall according to the thickness of the aterial which is fed into the machine. In its lowest position is roller entirely shuts the feeding inlet and so prevents e entry of cold air, and it only rises sufficiently for the aterial to pass. A pair of squeezing rollers can also be ted so as to close the inlet, the material passing between em being thrown into the air pipe by a stripper working ide the machine. The conveyers consist of horizontal ys, which are moved to and fro by connecting rods rking with eccentrics.—A. B. S.

United States Patents.

Dyeing, &c.; Apparatus for ——. O. Venter, Chemnitz, Germany. U.S. Pat. 774,407, Nov. 8, 1904.

See Eng. Pat. 15,395 of 1904, preceding these.—T. F. B.

Dry-Cleaning Garments; Process of ——. L. E. Barbe, Paris. U.S. Pat. 774,025, Nov. 1, 1904.

See Addition, of Nov. 5, 1902, to Fr. Pat. 321,542 of 1902; this J., 1903, 794.—T. F. B.

French Patents.

Straw Plait; Process for Producing Two-coloured Effects on —— by Means of Sulphide Dyestuffs. L. Cassella et Cie. Fr. Pat. 339,039, Sept. 12, 1903.

See Eng. Pat. 20,321 of 1903; this J., 1904, 932.—T. F. B

Dyeing Yarn; Vat for ——, with Device for Putting in and out of Gear a Windlass which Removes the Material to be Dyed from the Vat. E. I. Heuser. Fr. Pat. 345,030, May 3, 1904.

See Eng. Pat. 2062 of 1904; this J., 1904, 982.—T. F. B.

Cooling Metallic Dye Vessels; Apparatus for ——. C. Bath. Fr. Pat. 344,294, June 27, 1904.

A perforated pipe is fixed near the top of a metallic dye vessel, from which cold water is sprayed upon the outside of the vessel, for the purpose of rapidly cooling the dye-bath contained in this, after it has been heated in the course of use.—E. B.

Printing Warp Yarns; Process and Apparatus for ——. A. Hofmann. Fr. Pat. 344,740, July 9, 1904. Under Internat. Conv., July 10, 1903.

See Eng. Pat. 24,387 of 1903; this J., 1904, 59.—T. F. B.

Sizing Yarns [on Bobbins]. F. Möller-Holtkamp. Fr. Pat. 344,471, June 30, 1904.

Yarns are wound upon bobbins, and are sized thereon by means of a composition of thinner consistency than usual, which is forced into them by centrifugal action.—E. B.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

French Patent.

Printing Paper Intermittently; Apparatus for ——. J. Grantil. Fr. Pat. 344,380, June 15, 1904.

The pattern—*e.g.*, a multi-coloured one—to be reproduced, is engraved upon the requisite number of printing rollers, of the same circumference and geared together as usual, which are arranged round the cylinder of a printing machine at such a distance from this that they come into contact with a raised portion extending around it to a length equal to the circumference of the rollers. As the paper to be printed passes through the machine, those parts of it which lie upon the raised portion of the cylinder during each revolution of this, become printed, whilst a length, corresponding with that of the unraised portion of the cylinder, remains unprinted between every two successively printed lengths.—E. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Perborates; Action of Boric Acid on Alkaline Peroxides. G. F. Jaubert. Comptes rend., 1904, **139**, 796—798.

When 248 grms. of boric acid are mixed with 78 grms. of sodium peroxide and added gradually to 2 litres of cold water, the mixture dissolves at first, but later, a crystalline substance separates out, which may be filtered off and dried at a moderate temperature. This substance, when titrated with permanganate solution shows 4·17 per cent. of active oxygen, corresponding with the formula $Na_2B_4O_8 + 10H_2O$; the author terms it "perborax." It dissolves in water to the extent of 42 grms. per litre at 11° C. Its aqueous solutions have an alkaline reaction and contain free hydrogen peroxide; they are fairly stable at the ordinary temperature. When one-half of the sodium of perborax is saturated with a mineral acid, a crystalline precipitate of sodium perborate separates out; this salt has the composition corresponding to $NaBO_3 + 4H_2O$. Crystalline sodium perborate is a very stable substance and can be preserved indefinitely at the ordinary temperature. It is less soluble than perborax, but dissolves readily, with slight decomposition, in water at 50°—60° C.; vigorous evolution of oxygen takes place at 100° C. The cold aqueous solution of sodium perborate possesses all the properties of hydrogen peroxide, and the new salt affords a convenient means for the rapid preparation of that reagent. When powdered sodium perborate is added gradually to 50 per cent. sulphuric acid and the liberated boric acid is filtered off through guncotton, a very strong solution of hydrogen peroxide, at a strength of 150—200 volumes, is obtained.—J. F. B.

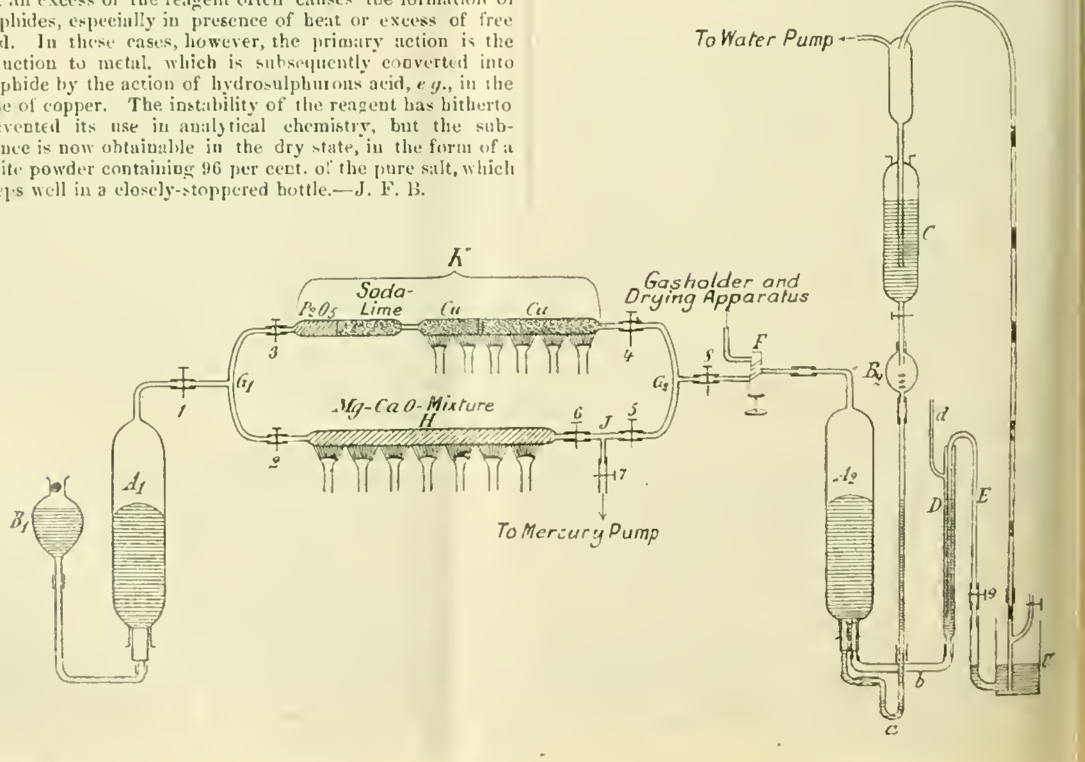
Sodium Hydrosulphite [*Hyposulphite*]; *Action of —— upon Metallic Salts. Second Communication.* O. Brunck. Annalen, 1904, **336**, 281—298. (See also this J., 1903, 710.)

The author has extended his investigations to the action of sodium hydrosulphite upon the salts of aluminium, indium, thallium, titanium, germanium, zirconium, tin, lead, arsenic, antimony, bismuth, chromium, molybdenum, tungsten, uranium, manganese, iron, nickel, cobalt, palladium, platinum, selenium, and tellurium. A survey of the general results shows that the hydrosulphite may react upon the salts of the metals in two different ways: in some cases it acts as a very powerful reducing agent, whilst in other cases it precipitates the sulphides of the metals, so far as these are capable of existing under the conditions in question. Frequently the direction of the reaction is determined by the conditions. The precipitation of sulphides takes place most readily in the case of the metals highest in the electrochemical series; these sulphides would appear to be the products of the decomposition of the corresponding hydrosulphites; their formation requires a certain time, and in many cases (*e.g.*, zinc, cadmium, and tin) the hydrosulphites or their double salts can be isolated. Towards the salts of the metals at the electropositive end of the series, sodium hydrosulphite acts primarily as a reducing agent, but an excess of the reagent often causes the formation of sulphides, especially in presence of heat or excess of free acid. In these cases, however, the primary action is the reduction to metal, which is subsequently converted into sulphide by the action of hydrosulphurous acid, *e.g.*, in the case of copper. The instability of the reagent has hitherto prevented its use in analytical chemistry, but the substance is now obtainable in the dry state, in the form of a white powder containing 96 per cent. of the pure salt, which keeps well in a closely-stoppered bottle.—J. F. B.

Nitrogen; Automatic Apparatus for the Absorption (*—— from Gaseous Mixtures.* F. Henrich. Zeit angew. Chem., 1904, **17**, 1755—1757.

The construction of the apparatus is shown in the figur In order to fill it with the gaseous mixture containin nitrogen, the vessels A_1 and A_2, are filled up to the capillar tubes with mercury, by opening the screw-clamps numbere 1 to 8, and raising the reservoirs B_1 and B_2. The thre way cock F is then put in communication with the ga holder, and the clamp 9 opened, whereby the gas flow into A_2, forcing out the mercury through the sipho E into U. Mercury is now run into B_2 from C, the thre way cock being turned till it communicates with the U-tub G_2, whilst the clamps 8, 4, 3, and 1 are opened, and 2, 5, and 7 are closed. When A_2 is about half-filled wit mercury, the clamp 9 is closed, but the mercury is allowe to run in until A_2 is filled up to the capillary tube. Tl stream of mercury from C is then cut off, the clamp 3 closed, 2, 6, and 7 are opened, and the gas in A_1 is di charged through H and J by raising B_1. When tl mercury in A_1 reaches the capillary tube, the clamps and 6 are closed, and the series of operations is repeat several times, to expel all air from the apparatus. If onl a small quantity of the gaseous material is available, A_1 filled with mercury up to the clamp 1, and A_2 up to tl three-way cock, F, and the apparatus is then evacuated b means of the mercury pump before admitting the ga When beginning the absorption of the nitrogen, A_1 and A should be about half-filled with the gaseous mixture. Tl clamps 3 and 7 are closed, 1, 2, 6, 5, 4, and 8 are opene and mercury is run fairly rapidly from C into B_2, wherel the gas is forced from A_2 through the tube H containin the heated mixture of lime and magnesium, into A_1. Whe the siphon E overflows, the gas is drawn rapidly from A back to A_2. It is then again forced from A_2 to A_1 by tl mercury flowing from C into B_2, and so on. If necessar a little air may be blown into *d*, or the rubber tubing may be pinched in order to completely expel the mercu from E each time the siphon acts. At suitable interval the clamps are so manipulated that the gas is forced pass through K in order to free it from moisture, &c.

—A. S.



Oxygen; Withdrawal of —— by Platinum. E. Goldstein. Ber. 1904, **37**, 4147—4148.

Wöhler's experiments (this J., 1903, 1246) on the oxidation of platinum, required for the most part many days or even weeks. The author has been able to show the same reaction is a much shorter time. The absorption of oxygen in vacuum tubes containing it, and the deposition of a film on the glass (no doubt platinum oxide, because different in appearance from the platinum film similarly deposited in a hydrogen tube) was long ago observed, but usually proceeds very slowly. This absorption, however, goes on very rapidly if the platinum cathode be heated almost to whiteness, either by the discharge alone, or by the discharge aided by a current from accumulators. In two or three minutes all the oxygen in a 50—100 c.c. tube thus disappears; the tube soon shows Röntgen effects, and shortly all discharge ceases. In an air tube a minute is sufficient to remove all the oxygen, and leave a residue giving the spectrum of pure nitrogen. This method can be used to remove traces of oxygen from a gas. Whether the wire oxidises and the particles of oxide are then cast off, or whether metallic particles are cast off and these fine particles are oxidised, is not yet decided. This oxidation connects itself with the author's former observation that during discharge the oxygen in vacuum tubes is converted into ozone.—J. T. D.

Sulphates: Volumetric Determination of Soluble ——. M. Monhaupt. XXIII., page 1161.

Sulphates and Chlorides; Use of the Chromates of Barium and of Silver in the Determination of ——. L. W. Andrews. XXIII., page 1162.

Perchlorate; Reduction [Determination] of —— in the Wet Way. B. Sjollema. XXIII., page 1162.

Strontium; Microchemical Detection of ——, and Strontium Chromate. W. Autenrieth. XXIII., page 1161.

Acetates, Cyanides, and Lithium; Methods for the Detection of ——. S. R. Benedict. XXIII., page 1161.

Carbon Dioxide; Decomposition of —— by Light. A. Bach. XXIV., page 1164.

English Patents.

Discharging Corrosive Acids and other Liquids from Carboys and other Receptacles, by Pneumatic Pressure; Means for ——. E. H. and C. G. Boutcher. Eng. Pat. 22,845, Oct. 22, 1903. I., page 1139.

Metallic Oxides; Process for the Preparation of —— by Direct Combustion of the Metal, and Apparatus therefor. L. Fink-Huguenot, Paris. Eng. Pat. 20,797, Sept. 27, 1904. Under Internat. Conv., April 19, 1904.

See Fr. Pat. 342,432 of 1904; this J., 1904, 936.—T. F. B.

Barium Manganate; Manufacture of a ——. A. Tixier, R. Cambier, and C. E. Adnet, Paris. Eng Pat. 28,585, Dec. 29, 1903.

See Fr. Pat. 337,629 of 1903; this J., 1904, 489.—T. F. B.

Air and Gaseous Mixtures; Method of Separating —— into their Elements, and Apparatus therefor. Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude) and R. J. Levy, Paris. Eng. Pat. 12,358, May 31, 1904. Under Internat. Conv., June 3, 1903.

See Fr. Pat. 333,842 of 1903; this J., 1904, 823.—T. F. B.

United States Patents.

Sulphuric Anhydride; Apparatus for Making ——. R. Knietsch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. U.S. Pat. 774,083, Nov. 1, 1904.

See Eng. Pat. 15,947 of 1898; this J., 1899, 831.—T. F. B.

Carbonic Acid; Manufacture of ——. J. Leslie, Belfast, Ireland. U.S. Pat. 774,092, Nov. 1, 1904.

See Eng. Pat. 9142 of 1903; this J., 1903, 1130.—T. F. B.

Ammonia from Distillation Gases; Process for Extracting ——. R. Brunck, Assignor to the Firm of Franz Brunck, Dortmund, Germany. U.S. Pat. 773,784, Nov. 1, 1904.

See Eng. Pat. 8287 of 1903; this J., 1903, 795.—T. F. B.

Lime; Apparatus for Slaking ——. B. C. White, Pittsburg, Pa. U.S. Pat. 773,834, Nov. 1, 1904.

The machine comprises two horizontal connected end compartments, and an intermediate compartment formed of two exterior and of two intermediate end walls, cast integral with each other, and having sheet-metal shells interposed between, connected at their end margins with the exterior and intermediate end walls. Rotating shafts carrying beaters extend longitudinally through the two end compartments.—E. S.

Nickel Oxide and Ammonia; Recovering —— [from Nickel-Ammonium Chloride]. H. A. Frasch, New York. U.S. Pat. 773,936, Nov. 1, 1904.

Nickel-ammonium chloride is "distilled" in presence of a dehydrating agent, such as a solution of calcium chloride saturated with sodium chloride. The resulting ammonium chloride with "the distilling fluid" from the precipitated nickel oxide is removed, treated with lime, and again distilled, the ammonia being recovered and nickel oxide precipitated. The process is repeated with fresh portions of nickel-ammonium chloride and lime, the "distilling fluid" being constantly enriched "with calcium chloride to any desired degree before finally removing it from the process." Compare U.S. Pat. 762,879, June 21, 1904; this J., 1904, 750.—E. S.

French Patent.

Alumina; Manufacture of ——. Cie. des Produits Chimiques d'Alais et de la Camargue. Fr. Pat. 339,049, Sept. 19, 1903.

See Eng. Pat. 19,924 of 1904; this J., 1904, 1088.—T. F. B.

VIII.—GLASS, POTTERY, ENAMELS.

English Patents.

Quartz Glass from Quartz Sand, Silica, and the like; Process for the Manufacture of ——. I. J. Bredel, Hoechst-on-the-Maine, Germany. Eng. Pat. 20,879, Sept. 28, 1904.

See Fr. Pat. 343,845 of 1904; this J., 1904, 1028.—T. F. B

Quartz Glass; Manufacture of Articles from ——. I. J Bredel, Hoechst on-the-Maine, Germany. Eng. Pat 20,880, Sept. 28, 1904.

See Fr. Pat. 344,170 of 1904; this J., 1904, 1090.—T. F. B

United States Patent.

Pot-Furnace for Melting Glass. W. T. Nicholls, Wellsburg, W. Va. U.S. Pat. 774,600, Nov. 8, 1904.

The furnace consists of a long narrow combustion chamber of tunnel form with reversing regenerators connected to opposite ends. A series of similar transverse pots with closed tops are set in the furnace chamber with their ends opening through the side walls of the tunnel, each pot having a feed-in opening at one side, and a work-out opening at the opposite side, and a transverse partition with a hole in its lower part to allow glass to flow from what constitutes the melting-chamber to the work-out chamber. The furnace-chamber allows the gases to sweep from end to end over the series of pots; means are arranged whereby the glass is cooled in the work-out chamber.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

Lime; Hydraulic ——. H. Seger and E. Cramer. Thonind. Z., 1904, **28**, 1535—1536.

The proportions of lime and silica in the best hydraulic limes, is such that whilst the burnt mass will set under water, there is sufficient lime to slake the whole to fine powder. The resistance of the product to water is not influenced by the quantity of alumina, but varies inversely with the amount of lime present. Undissociated silica reduces the value of the article. The assumption of Le Chatelier that the most suitable composition for hydraulic lime is 1 equivalent of silica to 4 of lime, is not confirmed by practical experience, a portion of the silica being left undissociated, and the product consequently containing an excess of lime. Iron oxide and alumina act as fluxes, and facilitate the dissociation of the silicates. The burnt lime is spread out in a thin layer, sprinkled with water, and then piled into heaps or bins for 10 days, the fine powder being sifted from the lumps. These, known as "grappiers," consist of the underburned and overburned portions, and when ground are mixed to a small extent with the hydraulic lime, to improve its water-resisting power, the rest being sold as grappier cement. The value of this latter depends on its content of calcium silicate; and too large a proportion of underburned material renders it useless. The composition of grappier cement from La Farge is: silica, 31·10; alumina, 4·43; ferric oxide, 2·15; lime, 58·83; magnesia, 1·09; alkalis; 0·94; sulphur trioxide, 0·60; carbon dioxide, 1·28 per cent. Owing to the irregular composition of these grappier cements, their use entails the adoption of special precautions.—C. S.

Refractory Materials in Electric Resistance Furnaces. F. A. J. FitzGerald. XI. A., page 1151.

English Patents.

Wood and other Fibrous and Porous Materials or Compounds; Solution for Treating [*Waterproofing*] ——. T. Gare, New Brighton, Cheshire. Eng. Pat. 23,786, Nov. 3, 1903.

Resin is first dissolved by heating with boiled linseed or castor oil, after which powdered vulcanised rubber or rubber composition is added in small quantities at a time. The mixture is then thinned, if desired, with petroleum, turpentine, &c., and applied to wood, cardboard, felt, or the like, either by immersing the articles in the solution, by forcing the solution through the material, or by simply coating the surface with the solution, in which case a hot roller may afterwards be passed over the surface. For treating wood or cardboard, equal parts of rubber and resin are mixed with 10 per cent. of boiled oil; for treating fibrous material like felt, the proportions of rubber and resin are increased by 25 per cent. In some cases, however, particularly when using a good quality of rubber, the oil may be omitted altogether. The quantity of thinning liquid used varies with the degree of porosity of the material to be treated.—A. G. L.

Refractory Material; Process of Manufacturing ——. R. Middleton, Leeds. Eng. Pat. 28,731, Dec. 31, 1903.

Portland cement is intimately mixed with 5 to 8 per cent. of starch, in the form of a concentrated solution, the mixing being preferably carried out in a steam-jacketed apparatus. The mixture is then moulded under pressure, and the resulting bricks, slabs, &c., are very carefully dried, after which they are burnt.—A. G. L.

Bricks, Tiles, Slabs, and the like; Manufacture of ——. C. H. Thompson, Stourbridge, Staffs. Eng. Pat. 28,733, Dec. 31, 1903.

Waste pieces of glass, either alone or mixed with blast-furnace slag, potsherds, pieces of earthenware or porcelain, sand, or clay, are ground and moulded by pressure, with or without preliminary damping, after which they are burnt for five hours at a temperature of 900° to 1200° C. During the burning the articles are prevented from adhering to each other by being encased in a refractory powder, *e.g.*, ground flint or, preferably, a mixture of equal parts of plaster of Paris and sand. In the case of very refractory materials, a flux, such as waste flint glass, lead borate, or felspar, may be added to the mixture to promote agglomeration. A composition giving good results is the following:—500 kilos. of opal and window glass, 250 kilos. of glazed china potsherds, $10\frac{1}{4}$ kilos. of lead borate.
—A. G. L.

Slag Wool, Silicate Cotton, or Mineral Wool; Manufacture of ——. G. A. Nelson, trading as F. McNeill and Co., London. Eng. Pat. 4275, Feb. 29, 1904.

As it is blown by the steam, air, or other pressure jet, the slag wool is deposited on a vibrating travelling band sieve or vibrating inclined riddle. By this means the different grades of the wool produced are intermingled, and the glassy particles, known as "shot," are caused to fall through the meshes of the sieve and separated.—A. G. L.

United States Patents.

Lime; Apparatus for Slaking ——. B. C. White. U.S. Pat. 773,834, Nov. 1, 1904. VII., page .

Fireproof Paint or Coating. E. R. Stowell, Portland, Ind., Assignor to A. B. Nettleton, Chicago, Ill. U.S. Pat. 774,003, Nov. 1, 1904.

The composition consists of about equal parts of finely-powdered silicon carbide and "semi-liquid" water-glass (sodium silicate), to which may be added calcium carbonate in such quantity that the product contains from 3 to 10 per cent. of this substance.—A. S.

X.—METALLURGY.

Dry Air Blast; Application of ——, *to the Manufacture of Iron.* J. Gayley. Iron and Steel Inst., Oct. 1904.

The author has effected considerable economy in the working of blast-furnaces by reducing the moisture in the air blast to a low and practically constant amount. The plant used for drying the air comprises two ammonia compressors (one in reserve), condensers, a refrigerating chamber, and a brine-tank. The compressors are of the following dimensions: high-pressure steam-cylinders, $28\frac{1}{2}$ ins. diam.; low-pressure cylinders, 56 ins. diam.; compressor cylinder, $22\frac{1}{2}$ ins. diam.; stroke, 36 ins. Each compressor has "a capacity of 225 tons ice-melting effect." The brine-tank contains 20 coils of double piping, the inner pipe of 2 ins. and the outer of 3 ins. diam., immersed in a calcium chloride brine of sp. gr. 1·21. The brine returning from the refrigerating chamber flows into the top of the tank, and is then forced by a pump through the inner pipe, wherein it is cooled below 32° F. by the ammonia flowing in the opposite direction through the annular space between the inner and outer pipes. The refrigerating chamber contains 60 vertical lines of coils, in each of which there are 75 pipes each 20 feet long, the whole representing 90,000 feet of 2-in. piping. The pipes in each vertical coil are placed in "staggered" position to insure better contact with the air. The series of coils is divided into three sections. The cooled brine from the brine-tank is fed into the coils through a 4-in. "header," and discharges into a 6-in "header," from which it passes to a stand-pipe, and thence back to the brine-tank. Air is forced into the refrigerating chamber by a blower, and in order to secure its uniform distribution, two electric fans are arranged in the space beneath the coils. The air deposits its moisture in the form of water or frost on the lower pipes and as frost on the upper pipes, and passes from the top of the chamber to the blowing engines of the blast-furnace at a temperature of 32° F., or below, and with a practically constant content of moisture. To remove the deposited frost, the supply of cold brine is cut off from several vertical lines of coil at a time, and brine which has been heated by means of steam is forced through by an auxiliary pump for a short time. In practice it is sufficient to thaw the frost off the pipes every three days. As showing the economy effected by the use of the dry air blast, it is stated that prior to its employment, in a period of 11 days, the daily production of iron in the blast furnace was 358 tons, with a consumption of 2,147 lb. of coke per ton of iron, whilst, after the introduction of the dry blast, in one period of 16 days, the production of iron was 447 tons with a consumption of 1,726 lb. of coke per ton; and, in another period of 14 days, 452 tons of iron with a consumption of 1,729 lb. of coke per ton. It was found necessary with the dry blast to reduce the speed of the blowing engine, whereby the efficiency of the latter was increased by 14 per cent. When the blowing engines were working at 96 revolutions per minute with the dried air, nearly 1 per cent. more coke was burnt and 89 tons more pig iron were produced in 24 hours than when the engines were working at 114 revolutions per minute with ordinary air. The author estimates that the saving in power consumption in the blowing-engine room would nearly or quite compensate for the requirements of the plant for drying the air. The gases from the furnace for 10 days prior to the introduction of the dry blast contained 22·3 per cent. of carbon monoxide and 13 per cent. of carbon dioxide, and had an average temperature of 538° F. When the dry blast was used, the gases contained 19·9 per cent. of carbon monoxide and 16 per cent. of carbon dioxide, and had an average temperature of 376° F. Other advantages resulting from the use of the dry blast are: the reduction of the loss of ore dust in the escaping furnace gases from 5 to 1 per cent; the possibility, with the saving in coke consumption, of the use of ores higher in phosphorus in the manufacture of Bessemer iron; the fact that owing to the absence of irregularities in the working of the furnace, the silicon can be kept low without increasing the sulphur, in the manufacture of basic iron; and the obtainment of a uniform product with respect to grade and composition. It is suggested that the application of the dry blast to the Bessemer converter and in other processes where air is used in large quantities, particularly in smelters and copper converters, in the open-hearth furnace and in cupolas, would also be advantageous. (See Eng. Pats. 11,091 of 1900 and 19,933 of 1903, and Fr Pat. 344,399 of 1904; this J., 1901, 27; 1904. 22 and 1095.)—A. S.

Cast Iron; Use of Manganese Ore as a Desulphurising Agent in the Smelting of ——. Wedemeyer. Stahl u. Eisen, 1904, **24**, 1316—1321.

Contrary to the statements of Reusch (this J., 1902, 861) and Wüst (this J., 1903, 1294), the author finds that small additions (1—1·4 per cent.) of manganese ore in the cupola furnace have little influence on the proportion of sulphur in the iron produced. Larger additions (4—4·5 per cent.) prevent the transference to the iron of the sulphur contained in the coke, but do not remove any of the sulphur contained in the pig iron used as raw material. The cost of desulphurisation by means of such large additions of manganese ore is, however, high, whilst at the same time the burning off of the silicon and iron is favoured. Moreover, the sulphur in the iron can be kept within the requisite limits by a suitable addition of limestone, a much cheaper material than manganese ore.—A. S.

Hard Steels; Microstructure of ——. W. J. Kurbatoff. Russ. phys.-chem. Ges., Oct. 1904. Chem.-Zeit., 1904, **28**, 1107.

The action of different etching materials was first tried, to ascertain which was the most delicate. Solutions of nitric and picric acids in water, alcohols, organic acids or anhydrides were used, and it was found that the etching was proportional to the ionisation. The most satisfactory reagent was a 5 per cent. solution of nitric acid of sp. gr. 1·3 in isoamyl alcohol. By means of this, differences in the structure of soft, brittle, and non-brittle steels, and lamellar nickel-steels were shown. A mixture of 1 part of a 4 per cent. solution of the same nitric acid with 1 part of methyl, ethyl, and amyl alcohol coloured the troostite and sorbite alone in 7—10 minutes. The hardness of austenite crystals varies in the groups themselves. The microstructures of steels specially rich in carbon, containing 1·9 per cent., show (1) that the texture depends on the different transformation periods of sorbite and cementite; (2) that with high temperatures, troostite with dark crystals on a bright ground results, with still higher temperatures, bright crystals on a dark ground; (3) that the texture of martensite alters in tempering; (4) that on tempering at high temperatures, troostite and cementite pass into ferrite and cementite, the latter decreasing.—F. S.

Gold Bullion; Notes on ——. A. C. Claudet. Inst. of Mining and Metall., Bull. No. 2, Nov. 10, 1904.

The author recommends that bars of bullion from the cyanide process, assaying below 800 fine, be "toughened" before being exported. For this purpose the bars are re-melted in clay crucibles holding 1000—2000 oz. of metal, and the molten bullion is stirred up after addition of sodium nitrate, the nitrate slag being removed by skimming. Successive additions of nitrate are made until the slag remains colourless. The cost does not exceed $\frac{1}{8}$—$\frac{1}{4}$*d.* per oz. of bullion. The nitrate slags may be dissolved and any gold present collected from the residues, or may be re-melted, or used in melting the cyanide precipitate in the first instance. The saving which might be effected by the mining companies is shown in the following table, in which the total fine gold in each case is taken as 500 oz.; the price of gold, 85*s.* per oz. fine: the penalty for cyanide bullion under 800 and above 700 fine, a deduction of 3 mils, and under 700 fine, a deduction of 4 mils; refining charge (in England), 2$\frac{3}{4}$*d.* per oz. of gross bullion; and melting charge, $\frac{1}{4}$*d.* per oz. of gross bullion.

Weight of Bar in oz.	Assay.	Fine Gold. contents in oz.	Gross Value.	Penalty.	Melting and Refining Charges.	Total Charges.	Net Value.	Value per oz. of Fine Gold.	Loss per oz. of Fine Gold.
			£	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	*d.*
625·0	800	500	2125	Nil	7 16 3	7 16 3	2117 3 9	4 4 8$\frac{1}{4}$	..
714·3	700	500	2125	6 7 6	8 18 6	15 6 0	2109 14 0	4 4 4$\frac{3}{4}$	4
833·3	600	500	2125	8 10 0	10 8 3	18 18 3	2106 1 9	4 4 3	5$\frac{1}{4}$
1000·0	500	500	2125	8 10 0	12 10 0	21 0 0	2104 0 0	4 4 2	6$\frac{1}{4}$

—A. S.

"White Precipitate" formed in the Zinc Boxes of the Cyanide Works. A. Prister and B. Bay. J. Chem. Metall. and Mining Soc., S. Africa, 1904, **5**, 75—78.

The authors have made a fairly complete analysis of an average sample of the "white precipitate" formed in the "weak" and "medium" zinc boxes of the cyanide works. The results are given as follows:—Zinc potassium ferrocyanide, $K_2Zn_3[Fe(CN)_6]_2$, 10·45; zinc cyanide, 22·73; zinc hydroxide, $Zn(OH)_2$, 54·79; copper oxide, 0·40; ferric oxide, 1·00; and silica, 1·03 per cent. Traces of calcium, aluminium, cobalt, magnesium, gold, and sulphuric acid were also detected. The loss on ignition amounted to 31·32 per cent. and probably consisted of moisture, including that from the zinc hydroxide, and cyanogen from the zinc cyanide, and the zinc potassium ferrocyanide. The authors point out that it would be advantageous to pass the vapours evolved when the "white precipitate" is treated with dilute sulphuric acid in the "clean-up," through working cyanide solution, in order to absorb the hydrocyanic acid they contain.—A. S.

Silver and Cadmium; Alloys of ——. T. K. Rose. Proc. Roy. Soc., 1904, **74**, 218—230.

The properties of silver-cadmium alloys were investigated, by determining freezing-point curves, and also micrographically, with the view of ascertaining whether those richer in silver were more homogeneous than the corresponding silver-copper alloys, and consequently better adapted for making trial-plates to be used in testing the fineness of silver coin and plate. The results are summarised as follows:—1. There is evidence of the existence of the compounds $AgCd_3$, Ag_2Cd_3, $AgCd$, Ag_3Cd_2, Ag_2Cd, and Ag_4Cd. 2. Alloys containing 0—25 per cent. of silver consist of crystals of $AgCd_3$ in a matrix of cadmium. These containing 25—40 per cent. are crystals of Ag_2Cd_3 in a matrix chiefly $AgCd_3$. The alloy containing nearly 50 per cent. consists of crystals of a silver-rich substance in a matrix chiefly $AgCd_3$, which solidifies at 420° C., nearly 300° below the freezing point of the crystals. Those containing 50—60 per cent. consist, above 420° C., of mixtures of two solid solutions, one chiefly composed of $AgCd$, the other of Ag_3Cd_2, with traces of the eutectic freezing at 420° C. Those containing above 80 per cent. are mixtures of two bodies at temperatures between the liquidus and solidus portions of the curve representing the equilibrium between the solid and liquid constituents of the alloys, but these unite to form a single solution at temperatures on the solidus. 3. The alloys containing over 80 per cent. of silver do not segregate under ordinary conditions, and are practically homogeneous and uniform. They are very suitable for the manufacture of trial plates.—J. T. D.

Sulphur in Irons and Steels; New Method for the Determination of ——. H. B. Pulsifer. XXIII., page 1162.

Aluminium; New Use for ——. Elect. Review, 1904, **45**, 70. V., page 1143.

English Patents.

Steel; Manufacture of ——. J. W. Duncan, Birmingham, Eng. Pat. 20,468, Sept. 22, 1904.

A known quantity of oxygen gas is mixed with the air-blast before the latter enters the converter. For this purpose an apparatus may be used in which an air-pump for supplying the blast has an inlet valve for the air and a balance valve for the supply of oxygen contained in a valved reservoir, so that the mixture is, on the down stroke of the piston, forced past a valve into a pipe leading to a chamber whence it passes into the converter.—E. S.

Minerals; Separation of —— *from Ores and Gangue.* H. L. Sulman and H. F. Kirkpatrick-Picard, London. Eng. Pat. 20,419, Sept. 22, 1903.

A current of steam, air, or other gas, charged with a vaporised or atomised oil, is introduced, preferably into the bottom of the finely-divided pulped ore. It is stated that the minute oil globules, or the condensed vapours of volatile oils, attach themselves to the metalliferous particles in preference to the gangue, and float them up, when they may be skimmed off the surface. Or the pulp may by other means be brought into intimate contact with "oil, and with air or other gas, while the oil is in a state of fine division."—E. S.

Ores; Furnaces for Calcining or Roasting Mineral ——, *and Desulphurising the same.* T. Edwards, Ballarat, Australia. Eng. Pat. 28,464, Dec. 28, 1903.

In a long, reverberatory furnace, with a plane hearth sloped from the receiving to the discharging end, a series of rotating rabbles, disposed in two or more lines longitudinally, and geared so as to be driven in unison, have paths intersecting on the furnace hearth. There are double water passages into, through, and out of the rabbles wherein water is circulated, and covered passage-ways in the arch of the furnace through which the rabbles can be removed and replaced.—E. S.

Ore Separators and Classifiers; Improvements in certain Descriptions of ——. E. J. Swyny and S. G. Plucknett, Sydney, N.S.W. Eng. Pat. 19,140, Sept. 5, 1904.

The inlet and outlet passages of the separator are arranged over the perforated cover of a chamber into which water under pressure is introduced. The ore passes, together with water, down the inlet passage, and meets the jets of water issuing through the perforated cover of the chamber beneath, whereby the lighter particles of gangue are driven upwards through the discharge passage, and are collected on an inclined shelf, whilst the heavier metalliferous particles settle into a channel leading to discharge spouts.—E. S.

Sulphides from their Ores; Apparatus to be used in the Separation and Recovery of ——. J. H. Gillies, Melbourne, Australia. Eng. Pat. 20,159, Sept. 19, 1904.

The process used is that in which particles of sulphides in powdered sulphide ores are acted upon by an acid or saline solution that may cause gas bubbles to attach themselves to such particles, causing them to float upwards and be thus capable of separation. The apparatus consists mainly of a metal tank, in the form of an inverted truncated cone, surrounded by an outer jacket, and communicating at its base with a funnel-shaped extension, leading to an outlet pipe. The receptacle is constructed in the form of annular steps having a fall from their outer towards their inner edges, and within it are arranged a number of annular and angular glass blocks, so as to form an annular series of rings arranged one above another and held in position by metal standards, and as a whole taking the shape of a filtering funnel or inverted cone. The tank is surmounted by a hood, down the outer inclined sides of which the powdered ore is delivered and falls on to an annular baffle, whence it falls step by step downwards, the tank having been filled with the chemical liquid and heated by steam or otherwise. The sulphide particles to which gas adheres work upwards under the annular blocks until they reach annular openings which admit them into the body of the tank, where, losing the gas, they sink, and are discharged by a flow of cold liquid into a receptacle below. The dross, on the other hand, passes down between the jacket and the tank to be separately discharged. There is a ball-and-cock system to maintain the level of the liquid in the tank, and there are means for supplying cool liquid to carry off the solid products from the bottom of the apparatus without disturbing the heated liquid above.—E. S.

Metals; Annealing ——, *and Apparatus therefor.* J. S. L. Alexander and A. Shiels, both of London. Eng. Pat. 23,457, Oct. 29, 1903.

The molten annealing bath used is mainly or wholly of aluminium, the container of which is heated from a furnace by flues arranged above as well as below the bath. The temperature of the bath is maintained constant, either by attention to the heater, or by means of a thermostatic regulator inserted at about the normal level of the molten metal, and operating a lever connected to a damper in the flue. The container is made deeper at one end than at the other end, so that the pipe or tube introduced for annealing may not lie flat, but at an angle, and also that it may have a tendency to move from one side of the bath towards the other side. Means are provided for introducing articles into, and moving them through, the bath.—E. S.

Zinc [free from Lead]; Extraction of ——. C. S. Brand, Knowle, Warwick. Eng. Pat. 263, Jan. 5, 1904.

See Fr. Pat. 341,345 of 1904; this J., 1904, 827.—T. F. B.

Zinc [free from Lead]; Extraction of ——. C. S. Brand, Knowle, Warwick. Eng. Pat. 3628, Feb. 13, 1904.

See Fr. Pat. 341,346 of 1904; this J., 1904, 827.—T. F. B.

Melting Furnaces. H. J. J. Charlier, Philadelphia, U.S.A. Eng. Pat. 4384, Feb. 22, 1904.

See Fr. Pat. 340,625 of 1904; this J., 1904, 827.—T. F. B.

United States Patents.

Sheet Iron or Steel; Method of Treating ——. H. H. Goodsell, Leechburg, Pa. U.S. Pat. 774,069, Nov. 1, 1904.

See Eng. Pat. 18,746 of 1904; this J., 1904, 1034.—T. F. B

Metallurgical Process [*for Manufacture of Steel*]. M. P. Boss, San Francisco, Cal. U.S. Pat. 774,301, Nov. 8, 1904.

Finely-divided iron ore is fed upon an inclined and heated hearth, discharging into a short vertical shaft, and thence into a basin which receives the molten product. In the heated hearth the ore is subjected to the action of a flame from a hydrocarbon, which is introduced in sufficient amount to present "free" hydrocarbon gas to the reduced metal, whereby it is converted into steel. Compare U.S. Pat. 732,263 to 732,269 inclusive, of June 30, 1903; this J., 1903, 914.—E. S.

Centrifugal Separator [*for Ores*]. F. B. Pettengill, Los Angeles, Cal., Assignor to S. L. Kistler. U.S. Pat. 774.104, Nov. 1, 1904.

The separator comprises a fixed framework supporting a movable frame to which a horizontal reciprocating motion is imparted, with sudden stops; and a rotating concentrating cylinder mounted in the movable frame, the frame being provided with annular flanges surrounding the ends of the cylinder, and forming therewith annular channels. Inside the cylinder are stirring and lifting blades, which rotate independently of, and more slowly than it. The plane of revolution of the blades and cylinder is vertical. The outer edges of the lifting blades are nearer the cylinder than the inner edges, and portions of the blades extending longitudinally have a sharp edge close to the surface of the cylinder. Means are provided for feeding the ore-pulp into, and for causing a cleansing liquid to flow through, the cylinder. The concentrate is discharged through the annular channel at one end and the gangue through the corresponding channel at the other end of the separator.—A. S.

Slime; Process of Filtering ——. H. R. Cassel, New York. U.S. Pat. 774,349, Nov. 8, 1904.

The slime-pulp is introduced into a tank containing filter-cells connected to a suction-pump, and is simultaneously agitated and circulated between the cells. The slime is deposited in the form of a "thickened layer" on movable mantles arranged at the sides of the filter-cells, any non-adhering pulp being discharged through the bottom of the tank, and introduced again at the top. Water is introduced into the tank to wash out the "values" from the "thickened layer" of adherent pulp, and finally this adherent pulp is dislodged from the movable mantles by agitation, and discharged through the bottom of the tank. Compare U.S. Pat. 769,938 of Sept. 13, 1904; this J., 1904, 939.—A. S.

Nickel Oxides; Furnace for Reducing and Smelting ——. R. R. Maffett, Bayonne, N.J., Assignor to International Nickel Co., N.J. U.S. Pat. 774,591, Nov. 8, 1904.

The furnace has an open-hearth smelting chamber from which an elongated reducing chamber leads to the chimney. Charging openings are arranged lengthwise in the reducing chamber, beneath which a flue extends, having a damper at each end, and communicating with the chamber at its rear end—E. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A*.)—ELECTRO-CHEMISTRY.

Cadmium Cell; Report on the ——. H. S. Carhart, G. A. Hamilton, E. B. Rosa, C. H. Sharp, and B. J. Arnold. Chem. News, 1904, **90**, 225—227.

The Committee appointed by the Board of Directors of the American Institute of Electrical Engineers to inquire into the preparation of materials for, and the construction of, the cadmium or Weston cell, have issued a preliminary report. Provisional specifications are given for the preparation of mercury, cadmium sulphate solution, cadmium amalgam, mercurous sulphate and the paste, and for the construction and filling of the cell. For the cell prepared in accordance with the specifications, the name "Weston Normal Cell" is proposed. The recommendations include the purification of mercury by treatment with a nitric acid solution of mercurous nitrate (Z. Phys. Chem., **33**, 611), and subsequent re-distillation in a vacuum at least twice; the preparation of pure cadmium sulphate by re-crystallising the pure commercial salt, and selecting only the clear crystals; and the preparation of cadmium amalgam and mercurous sulphate by electrolytic methods. The H-form of cell is recommended. (See also this J., 1904, 665.)—A. S.

Aluminium Anodes; Colloidal Precipitation upon——. W. R. Mott. Electrochem. Ind., 1904, **2**, 444—447.

The loose incoherent aluminium hydroxide which is formed at an aluminium anode in most electrolytes by the passage of a current, adsorbs acid from the solution, forming a hard, dense, insoluble solid of great insulating power. The thickness of film which would bring about perfect insulation, varies with different solutions. Electrolytes containing acid radicals of high valency (citrates, phosphates, &c.) give films of great specific resistance and high dielectric strength, consequently such films are thinner, and less coulombs are required for their formation.—R. S. H.

Refractory Materials in Electric Resistance Furnaces. F. A. J. FitzGerald. Electrochem. Ind., 1904, **2**, 439—444.

The author deals chiefly with the applications of "silicocarbides," which are compounds of silicon and carbon, sometimes with oxygen, and are characterised as being amorphous and highly refractory; they can be converted into crystalline carborundum at a very high temperature. It is shown that the heat conductivity of these materials is greater than that of good firebrick, so that they are more suitable as a lining for the latter than for replacing it entirely. The electrical conductivity of the heated material is not sufficient to cause much leakage of current when it is used as a furnace lining, at any rate for such temperatures at which it is otherwise suitable. Various methods of moulding and forming articles from silico-carbides are described. Glue, dilute sodium silicate solution and tar may be used as binding agents according to the particular application in view. For articles of great mechanical strength it is preferable to frit the material together by oxidation, a temporary binding agent, such as glue, being employed; the process requires prolonged heating since the oxidation is slow. Carborundum, which is to be preferred for the higher temperatures, may be formed into articles by similar methods or by "re-crystallisation," which is effected by heating the moulded material in the electric furnace to the temperature of its formation, when the grains are found to adhere strongly. The paper concludes with a description of methods suitable for the analysis of the silicocarbides.—R. S. H.

Flours; Bleaching of ——, *by Electricity.* Balland. XVIII. A., page 1157.

United States Patents.

Electrode; Storage Battery ——, *and Process of Making Same.* E. A. Sperry, Cleveland, Ohio. U.S. Pat. 773,685, Nov. 1, 1904.

Carbonate of lead produced by precipitation electrolytically, from a solution of a lead salt, is roasted to expel carbon dioxide and leave a highly porous mixture of oxides of lead, consisting of equal parts of litharge and minium. The oxides are mixed with a soluble substance capable of combining with and hardening the lead oxides, and the mixture is applied to a grid or support. The soluble substance is dissolved out, thereby leaving relatively large feeder-pores extending through the porous active material.—R. N.

Furnace; Electric ——. C. P. Steinmetz, Schenectady, N.Y., Assignor to General Electric Co., New York. U.S. Pat. 773,824, Nov. 1, 1904.

See Eng, Pat. 15,920 of 1900; this J., 1901, 977.—T. F. B.

Kiln; Electric ——. F. E. Dickinson, Kendallville, Ind. U.S. Pat. 773,853, Nov. 1, 1904.

The body of the kiln includes a treating chamber at its interior with an adjacent heating chamber, or with a series of heating chambers or boxes at its base. An auxiliary perforated floor is spaced from the base of the kiln, so as to form return flues communicating with the bottom of each heating chamber, the auxiliary floor extending into each heating chamber. Walls or partitions extend upwards from the auxiliary floor, forming flues leading from each heating chamber, and discharging into the top of the treating chamber, each wall also separating the treating chamber from one of the heating chambers. Electrodes are arranged within each heating chamber, and produce an arc or arcs for heating the gases, so as to cause a circulation through the treating chamber and back to the heating chambers. Means are used for controlling the circulation, and for preventing the admission of air for the support of combustion, and a continuous circulation of the same air is thus maintained through the several parts. An adjustable inlet to each heating chamber provides the latter with air, and an adjustable outlet in the return flue displaces a portion of the circulating gas.—B. N.

Accumulator Plates; Proces of Electrolytically Producing Lead Peroxide Layers upon Positive ——. J. Diamant, Raab, Austria. U.S. Pat. 774,049, Nov. 1, 1904.

See Eng. Pat. 6954 of 1903; this J., 1904, 376.—T. F. B.

Electrolytic Apparatus. A. Briebaux, Brussels, Assignor to the Solway Process Co., Syracuse, N.Y. U.S. Pat. 774,230, Nov. 8, 1904.

See Eng. Pat. 7471 of 1898; this J., 1899, 376.—T. F. B.

Flour; [Electric] Process of Treating [Bleaching, &c.] ——. J. M. Williams. U.S. Pat. 769,522, Sept. 6, 1904, XVIII. A., page 1158.

(*B.*)—ELECTRO-METALLURGY.

Lead, Commercial; [Electrolytic Determination of Impurities in ——]. A. Hollard and L. Bertiaux, XXIII. page 1162.

Tin; Commercial, and its Alloys; Analysis of ——. A. Hollard and L. Bertiaux, XXIII., page 1162.

English Patent.

Electrical Separation of Granular Materials; Process of, and Apparatus for the ——. F. O. Schnelle, Frankfort-on-the-Maine. Eng. Pat. 13,489, June 14, 1904. Under Internat. Conv., June 15, 1903.

See Fr. Pat. 344,068 of 1904; this J., 1904, 1098.—T. F. B.

French Patent.

Zinc; Process and Furnace for the Electrical Extraction of ——. A. Edelmann and N. Wallin. Fr. Pat. 344,832, July 16, 1904. Under Internat. Conv., July 23, 1903.

See Eng. Pat. 16,205 of 1904; this J., 1904, 1035.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Fats; Enzymic Hydrolysis of ——. S. Fokin. Chem. Rev. Fett- u. Harz-Ind., 1904, **11**, 118—120; 139—141; 167—170; 193—195; 224—226; 244—247.

There is no difference in the enzymic action of different varieties of castor seeds, the same amount of fatty acids being liberated from almond oil by seeds from different garden varieties and from the ordinary castor plant. Nor does keeping the seed for a long time appear to have any perceptible influence on its enzymic activity. Variations in the temperature between 20° and 35° C. have also no influence on the results in the case of liquid fats, but when treating solid fats it is advisable to keep the temperature near the higher limit. Connstein, Hoyer, and Wartenberg, stated (this J., 1902, 1541) that the amount of water required to obtain the maximum of hydrolysis stood in relationship to the amount of fat, but the author concludes that the quantity of seeds is the determining factor. If too much water be added, the excess is speedily separated from the emulsion, and the amount retained by the seeds can be calculated fairly closely. Thus in four experiments in which the proportions of seeds were as 8 : 4 : 2 : 1, the amounts of water in the seeds and emulsion were as the respective square roots of these numbers arranged in similar ratio. As regards the influence of the amount of water on the yield of fatty acids, the author concludes that when the castor seeds are used in the proportion of 20 to 40 per cent. the influence of this factor is not very great, but that with smaller amounts of seeds (5 per cent.), variation in the proportion of water has much more effect, this being attributed to the readiness with which small amounts of seed separate from the emulsion. If 40 per cent. of water be used (with 5 per cent. of seed) the glycerin solution will have a concentration of about 20 per cent., whilst if the water used for washing be included, the concentration will be about 7 to 8 per cent. The glycerin requires purification from albuminoid matters, &c. The concentration of the acid (sulphuric, hydrochloric, &c.), must fall within the limits of N/20 to N 120, corresponding to the limits (of seeds employed) 5 to 40 per cent. With small amounts of acid the process is slow, whilst a concentration greater than N 10 may completely destroy the enzymic action of the seed. When the mass is properly mixed the quantity of seed used has no influence, at all events within the limits of 5 and 40 per cent. Under the proper conditions, a yield of 90 to 95 per cent. of fatty acids can be obtained within two to three days. The more thorough the mixing and the greater the amount of fat used the higher the yield of fatty acids. Solid and old (rancid) fats are not so readily hydrolysed. The hydrolysis can be started by means of carbonic acid or by the addition of free fatty acids. The nature of the oil or fat makes little difference, except in the case of those containing fatty acids of low molecular weight. The author states that the fatty acids obtained by this process are susceptible of being rapidly bleached. It is not easy to separate the aqueous glycerin solution from the residue of seeds. The author was unable to obtain the enzyme in the form of a solution. Attempts to use pancreatic juice in a technical process were unsatisfactory, the objections being the cost, the slowness of the hydrolysis, and the constant attention needed for the addition of fresh alkali. Moreover, the final products are inferior to those obtained by the castor seed process, and the glycerin can only be separated by salting out with sodium chloride and alkaline lyes, and is then much more impure than that separated from ordinary soap lyes. (See also this J., 1904, 259, 614).—C. A. M.

Copra Oil; Saponification of —— *by Cytoplasm.* E. Urbain, L. Saugon, and A. Feige. Bull. Soc. Chim., 1904, **31**, 1194—1198.

The presence of free fatty acids in copra oil appears to exert a retarding influence on the saponifying action of cytoplasm. The rate of saponification is found to vary directly with the mean molecular weight of the free fatty acids present. It was ascertained, by arresting the saponification at different times, that the saponification value of the neutral fatty oil remaining, and also the molecular weight of the fats formed was practically constant throughout the operation, whence it is concluded that the saponifying action of the cytoplasm is independent of the nature of the glyceride. This is contrary to the conclusion of Connstein, Hoyer, and Wartenberg (this J., 1902, 1542), viz., that the glycerides of the lower fatty acids were the last to be saponified, but this conclusion was based merely on the saponification of tributyrin; in this case it is pointed out that it is the butyric acid which retards saponification, and experiments are described which show that in the presence of 10 per cent. of butyric acid (on the weight of oil used) no saponification was effected in 24 hours.—T. F. B.

Borneo Tallow; Composition of ——. J. Klimont. Monatsh. f. Chem., 1904, **25**, 929—932.

Borneo tallow is the name given to the fat obtained from the fruit of different varieties of *Dipterocarpus.* The fat examined by the author was hard, of a greenish-yellow colour, and gave the following numbers:—Acid value, 15·8; saponification value, 194·6; iodine value, 30·1; and m. pt., 34·5° to 34·7° C. A solution of the fat in ether yielded a crystalline deposit (with iodine value 31·3), when cooled to 16° C. On recrystallising the fat from acetone, after removal of free fatty acids, a compound crystallising in needles was eventually obtained. This melted at 44° C. (37° C. after once melting), and had a saponification value of 188·4 and iodine value of 28·6, and an elementary composition agreeing with the formula of oleodistearin, $C_3H_5.C_{18}H_{33}O_2.(C_{18}H_{35}O_2)_2$. Further crystallisation of the substances retained in the mother liquid yielded products with relatively high saponification values (213, 218). From one of the fractions with saponification value 198, oleodipalmitin (m. pts., 33—34° C. and 28°—29° C.) was isolated. It was also concluded that glycerides of still lower fatty acids combined with unsaturated acids were present in the other fractions.

Cacao Butter.—In addition to the oleodistearin found by Fritzweiler an oleodipalmitin has been separated from this fat by the author.—C. A. M.

Cottonseed Oil; Detection of —— in Olive Oil. E. Milliau. XXIII., page 1163.

Dégras; Notes on the Analysis of ——. G. Baldracco. XXIII., page 1163.

Cholesterol; New Reaction of ——. C. Neuberg and D. Rauchwerger. XXIII., page 1162.

English Patent.

Fats or Fatty Substances or the like; Cooling Melted ——. A. E. Iveson, Gainsborough, and A. R. Wilson, Brighton. Eng. Pat. 25,868, Nov. 26, 1903.

The fat is heated until liquid or semi-liquid and subjected in a stream to the action of a blast (*e.g.*, of chilled air), which projects it in a state of fine division on to a cooling surface, such as the periphery of a rotating drum, from which it is subsequently scraped. The stream of melted fat may fall vertically and meet the blast issuing from a nozzle at right angles. Claim is also made for special apparatus for this process, which is stated to effect uniform cooling of the fat and to a large extent prevent "seeding."
—C. A. M.

United States Patents.

Halogenised Fat; Solidified ——, and Process of Making same. H. Winternitz, Halle on the Saale, Assignor to the firm of E. Merck, Darmstadt, Germany. U.S. Pat. 774,224, Nov. 8, 1904.

See Eng. Pat. 3430 of 1903; this J., 1903, 751.—T. F. B.

Liquids [Crude Glycerin]; Process of Distilling ——. W. E. Garrigues, New York. U.S. Pat. 774,171, Nov. 8, 1904.

To prevent decomposition, the liquid (glycerin, &c.) is distilled in an atmosphere of steam. For this purpose the aqueous vapours from a previous distillation may be condensed. This "sweet water" is evaporated at less than atmospheric pressure; the steam produced is superheated and injected into the crude glycerin, or the like, in the still. The superheating is effected by the vapours rising from the still, the glycerin vapours, being simultaneously condensed, giving off their heat to superheat the water vapour.
—C. A. M.

Glycerin; Recovering —— from Spent Soap Lyes. W. E. Garrigues, New York. U.S. Pat. 774,172, Nov. 8, 1904.

The liquid is neutralised with a mineral acid, and after separation of the insoluble fatty acids it is concentrated and then freed from mineral salts and volatile fatty acids, and the concentrated glycerin solution treated with an alkaline substance and distilled. Thus the soap lye may be neutralised with sulphuric acid, and aluminium sulphate added to precipitate the insoluble fatty acids. The filtrate from these is concentrated and the separated mineral salts removed, after which barium chloride is added and then sufficient sulphuric acid to liberate the volatile fatty acids combined with the alkali. These acids are partially enveloped in the barium sulphate, with which they can be separated from the liquid by filtration, whilst the remaining portion can be expelled by evaporating the liquid in a vacuum evaporator. Finally the solution is treated with sodium carbonate, and the glycerin distilled.—C. A. M.

French Patent.

Fatty, Resinous, and other Substances; Process and Apparatus for Extracting —— by means of Hot Solvents, without Pressure, and with as great Safety as in Methods of Cold Extraction. F. Genoyer. Fr. Pat. 344,919, July 18, 1904.

The material is extracted by means of a solvent heated to a temperature below its boiling point. The apparatus claimed for this purpose consists of a cylindrical extractor heated by means of a steam coil and connected by means of a pump with a lower reservoir containing the solvent. The temperature within the extractor can be maintained at the required point by the introduction of more cold solvent. After the extraction the solvent is driven into an evaporating vessel containing a steam coil, where it is evaporated at a temperature lower than its boiling point. The vapours are condensed in an adjoining vessel and the recovered solvent falls into the reservoir, whence it can be pumped again into the extractor.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

English Patents.

Oxide of Iron; Kilns applicable for Use in the Manufacture of ——. H. W. Hemingway, Walthamstow, Essex. Eng. Pat. 23,550, Oct. 30, 1903.

The kiln is of the type described in Eng. Pat. 4001 of 1893 (this J., 1894, 163), in which the blocks of copperas to be calcined are placed in a series of calcining pockets or chambers having removable tile covers and hinged floors, the hinges being formed as a single frame. According to the present invention, the movable floor is "hinged to a piece of stout piping," through which water is constantly circulated, the effect of which is that the destruction of such hinge by burning is prevented. The heating is conducted on the regenerative system. There are passages for supplying air and gas alternately to each of two sets of flues, the front and rear flues alternating laterally with the calcining chambers. The waste gases discharged traverse refractory material, whereby in turn the incoming air is heated before mixing with the gaseous fuel. There is special apparatus to facilitate the charging of the kiln with the blocks of copperas, and the extremities of the calcining chambers are provided with protecting curbs, having grooves into which iron covers fit, in order to diminish the wear to which the brickwork round the upper extremities of the calcining chambers is subject.—E. S.

Lakes [from Azo Dyestuffs]; Manufacture of New Colour ——. H. E. Newton, London. From Farbenfabr. vorm. F. Bayer & Co., Elberfeld, Germany. Eng. Pat. 1389, Jan. 19, 1904.

See Fr. Pat. 339,606 of 1904; this J., 1904, 713.—T. F. B.

United States Patent.

Fireproof Paint or Coating. E. R. Stowell, Assignor to A. B. Nettleton. U.S. Pat. 774,003, Nov. 1, 1904. IX., page 1148.

French Patent.

Colours with a Base of Magnesium Carbonate (Giobertite). Mme. la Princesse Démidoff (*née* O. Lapoukhine). Fr. Pat. 339,045, Nov. 26, 1903.

The finely-powdered mineral, giobertite, can be used as the base for colours intended to resist a high temperature

on metallic surfaces, such as stoves or boilers. Oil varnish, glue, &c. are added according to the requirements.
—C. A. M.

(*B.*)—RESINS, VARNISHES.

English Patent.

Lac-Derivatives; Preparation of —— [for Lining Cans for Preserved Food]. W. S. Bucklin, Phalaux, N.J., U.S.A. Eng. Pat. 16,800, July 30, 1904.

The lac is heated in an inert medium, such as water or coal-gas, to a temperature above its melting point, so as to eliminate volatile constituents and leave a residue melting at a higher temperature and not imparting any flavour to food. A suitable method consists of heating the lac in water for 28 to 30 hours at a high pressure and temperature (320° to 352° F.). Ordinary shellac thus treated yields a tasteless product, which becomes slightly soft when heated, but is capable of resisting a very high temperature (*e.g.*, 590° to 600 F.) without charring or decomposing. Certain other lacs are converted into corresponding products in a much shorter time. For coating the interior of cans, &c. the substance is mixed in a finely-divided state with alcohol (in which it is only partially soluble) and inert colouring matters, &c. if required. The surface is painted with this preparation, which, on evaporation of the alcohol, leaves an adhesive coating of the solid material.
—C. A. M.

United States Patents.

Linoleum; Manufacture of ——. L. W. Seeser, Ragulin, Germany. U.S. Pat. 773,995, Nov. 1, 1904.

See Eng. Pat. 17,971 of 1903; this J., 1904, 906.—T. F. B.

Cement [for Securing Linoleum and the like]. F. Suter, Berlin. U.S. Pat. 774,286, Nov. 8, 1904.

The cement consists of molasses (*e.g.*, 55 kilos.), asphalt distillate (5 kilos.), rosin (25 kilos.), and alcohol (5 kilos.), with or without the addition of copal (10 kilos.).
—C. A. M.

French Patents.

Fatty, Resinous, and other Substances; Process and Apparatus for Extracting —— by means of Hot Solvents, without Pressure, and with as great Safety as in Methods of Cold Extraction. F. Genoyer. Fr. Pat. 344,919, July 18, 1904. XII., page 1153.

Cement for Linoleum and similar Substances. F. R. Suter. Fr. Pat. 344,820, July 15, 1904. Under Internat. Conv., July 21, 1903.

See U.S. Pat. 774,286 of 1904, preceding these.—T. F. B.

(*C.*)—INDIA-RUBBER, &c.

Latex of Castilloa Elastica and its Coagulation. C. O. Weber. Gummi-Zeit., 1904, **19**, 101—104.

The author, in reply to de Jong and Tromp de Haas (this J., 1904, 990, 1036), maintains his view that the rubber is not contained in the latex as rubber, but in the form of a fluid oil surrounded by an albuminous covering. That the covering is albuminous and not cellulose or of a resinous nature is proved by its giving the iodine reaction, no zinc iodide reaction, and in its being insoluble in alcohol. The author first observed the fluid nature of the rubber under the microscope, and verified it by shaking out with ether. On pressing the cover-glass the albuminous sac bursts and the contents are discharged, rapidly becoming a solid mass, owing, the author considers, to a polymerisation process, which view is confirmed by Harries' well-founded polymerisation of myrcene and dimyrcene, as well as by the author's observations of the ethereal extract of the *Castilloa* latex. De Jong and Tromp also state that solidified latex of *Castilloa* rubber is soluble in ether, but the author repeats his statement that ether does not dissolve it. He has found that incompletely polymerised india-rubber forms thick jellies with ether, which he regards as emulsions, not solutions, whereas highly polymerised qualities are absolutely insoluble in that solvent, simply swelling more or less. De Jong and Tromp de Haas, on shaking out the latex or milk, with ether, obtained 9 per cent. rubber solutions, which even then were thick and could not be filtered, whilst the author obtained 43 per cent. solutions, thin and easily filtered. The author also confirms his statement that *Castilloa* latex contains no tannic acid, but a considerable quantity of albuminous matter, up to 7 per cent. These bodies appear analogous to the caseins, and gave a strong biuret reaction. De Jong and Tromp de Haas quite fail to appreciate the difference between coagulation and precipitation, as they speak of the coagulation of rubber by means of alcohol, acetone, &c., which is purely precipitation and simultaneous polymerisation. The author is convinced that the sample of rubber examined by them cannot have been a genuine sample of *Castilloa elastica*.—J. K. B.

Caoutchouc; Study of Different Kinds of ——. Examination of some Latexes in Sicily. C. Harries. Ber., 1904, **37**, 3842—3848.

The author examined freshly-collected specimens of the latex of *Ficus magnolooïdes Borci* and *Ficus elastica*.

Latex of Ficus magnol. Borci.—On extracting the latex with ether a dark-coloured, aqueous liquid was left containing a reducing sugar. The ethereal extract was separated by filtration from mucous matter, probably consisting of albuminoid bodies, and, after evaporation of the ether, formed a bright yellow syrup, which on standing partially crystallised. By repeated treatment with small quantities of ether, the syrup was separated into a crystalline, oxygenated compound, $(C_{10}H_{16}O)_3$, and a white, elastic mass, possessing all the properties of pure Para caoutchouc, except that when first isolated it was soluble in ether.

Latex of Ficus elastica.—This latex behaved in quite a similar manner to the latex of *Ficus magnol. Borci*, except that the oxygenated constituent, $(C_{10}H_{16}O)_2$, had a lower molecular weight, and was present in smaller amount. In the latex of *Ficus elastica* the oxygenated compound and the caoutchouc are present in about equal amounts, but in the latex of *Ficus magnol. Borci* the oxygenated body forms the chief constituent. The author concludes that Weber's view (see this J., 1903, 1200), that the rubber-yielding constituent of the latex is probably an aliphatic diterpene, $C_{20}H_{32}$, which is readily polymerised, has no sufficient basis. (See also this J., 1904, 990, 1036.)—A. S.

India-Rubber Articles; Analysis of ——. W. Esch and A. Chwolles. XXIII., page 1163.

English Patents.

Substitute for India-Rubber; Manufacture of an Improved ——. H. Tichsen, Berlin. Eng. Pat. 17,579, Aug. 12, 1904.

The rubber substitute is prepared by heating a solution of amber resin in castor-oil with sulphur at a high temperature (180° C.), cooling the mass, and treating it first with ozone and then with sulphur chloride in presence of a solvent, such as benzol, and of calcium carbonate.—A. S.

Cork; Process of Making a Substitute for —— [from Rubber], and the Article Produced by said Process. H. Birkbeck, London. From F. H. Brooks, Baltimore, U.S.A. Eng. Pat. 21,101, Oct. 1, 1904.

See U.S. Pat. 774,645 of 1904, following these.—T. F. B.

United States Patents.

Cork Substitutes [from India-Rubber]; Process of Making ——. F. H. Brooks, Baltimore, Md. U.S. Pat. 774,645, Nov. 8, 1904.

Rubber is dissolved in a suitable solvent, the solution mixed with sulphur and then with a "pulverised base," after which the mass is heated at a low temperature to drive off the solvent. The mixture obtained is moulded, and finally vulcanised.—A. G. L.

Rubber; Process for Reclaiming and Regenerating ——. L. T. Petersen, Assignor to J. F. McGuire, Akron, Ohio. U.S. Pat. 774,727, Nov. 8, 1904.

Vulcanised rubber is regenerated by heating it in a 10—15 per cent. solution of caustic soda to a temperature near its boiling point, a pressure of about 200 lb. per sq. in. being applied, and then heating it further with a solution of a soluble hydrocarbon or hydroxy-hydrocarbon (*e.g.*, a 1—10 per cent. solution of phenol) in a closed vessel, to a temperature of 300°—375° F., whereby the fabric is dissolved.—T. F. B.

XIV.—TANNING; LEATHER, GLUE, SIZE.

Tannins; Preparation and Elementary Composition of some Technically Important ——. T. Koerner and A. Petermann. Deutsch. Gerber-Zeit., 1904, **47**, 115—126. Chem.-Zeit., 1904, **28**, Rep. 328. (See also this J., 1904, 1115.)

The substances were extracted with hot alcohol and the iltered solutions precipitated with ether. The first two fractions obtained by fractional precipitation, were found to differ considerably in composition, the last fractions very ittle. The following results were obtained from the last fractions :—

Tannin from	Carbon.	Hydrogen.
	Per Cent.	Per Cent.
Quebracho........................	63·79	4·81
Oak wood........................	53·05	4·81
Chestnut wood....................	51·28	4·40
Mimosa bark	57·37	5·57

Thus a quebracho tannin is easily distinguishable from others by its high percentage of carbon. Other tannins which contain catechu tannin (*e.g.*, gambier and catechu) were also found to contain about 62 per cent. of carbon, but can be recognised by the fact that they contain catechin.—T. F. B.

Tanning Infusions and Extracts; Action of Saline Substances on ——. E. Nihoul. Bull. Assoc. Belg. Chim., 1904, **18**, 185—198; 220—228.

The action of saline substances on infusions of tanning materials is slight in the case of sumach; but in the case of oak and pine, sodium sulphate causes a loss of tannin, without, however, increasing the turbidity, which is always present even when the extraction has been made with distilled water. This loss may be due to a partial conversion of the tannin into substances not assimilable by he hide, or to the formation, with the salt in question, of a compound that is not retained by hide powder Possibly also the salt modifies the osmotic power of the hide, though no trace of tannin is found in the liquid after passing hrough a Procter filter. Moreover, the salt acts differently with infusions of quebracho, no loss of tannin occurring n concentrated solutions of this material. In other instances the quantity of the precipitate formed is increased at the expense of the tannin, *e.g.*, with salts of lime and magnesia, though in some cases these also behave like odium sulphate, partially converting the tannin into oluble non-tannin. The latter sometimes plays a part n the formation of turbidity. Generally speaking, the presence of saline substances in natural waters increases he loss of tannin occurring during the process of extraction. This loss is increased by prolonging the exposure, precipitates being subsequently formed in the clear liquids hat have been used for analysis. For example, after the apse of a fortnight, all the oak solutions had become urbid, except the one containing calcium chloride, which xhibited traces of mycelial vegetation. In the case of pine infusion, however, the conditions were reversed; and f the sumach solutions, only that containing magnesium icarbonate gave a deposit, the others remaining clear. On he other hand, all the solutions containing this last-named alt deepened in colour. With regard to the loss of tannin sustained during the process of extraction, it is found to be advisable, when using water charged with mineral matters, to grind the tanning materials as fine as possible, in order to diminish the loss, though this treatment increases the number of fragments of cell-substance and therefore lowers the purity of the product. The tannin extracts examined gave results similar to those furnished by the infusions, though the proportion of loss was smaller. The slight irregularities observed with the extracts may be due to differences of manufacture.—C. S.

United States Patents.

Dégras; Note on the Analysis of ——. G. Baldracco. XXIII., page 1163.

Washing and Tanning Hides or Skins; Device for ——. R. Koentzer, St. Louis, Mo. U.S. Pat. 773,873, Nov. 1, 1904.

A drum capable of being rotated is mounted upon a tanning-vat. The periphery of the drum is composed of strips arranged at intervals apart. The strips have one edge bevelled and the other straight, and each alternate strip is detachable. The fixed strips are provided with pins for suspending the hides to be tanned.—A. S.

Leather; Method of Making ——. W. Macmillan, Palmerston North, New Zealand. U.S. Pat. 774,260, Nov. 8, 1904.

See Eng. Pat. 19,661 of 1902; this J., 1903, 876.—T. F. B.

French Patents.

Leather; Artificial ——, *and Process of Making same.* R. Piesbergen. Fr. Pat. 344,787, July 13, 1904.

See Eng. Pat. 15,629 of 1904; this J., 1904, 906.—T. F. B.

XVI.—SUGAR, STARCH, GUM, Etc.

Rowan Berries; A New Sugar from ——. G. Bertrand. Comptes rend., 1904, **139**, 802—805.

Vincent and Meunier (this J., 1899, 58) detected the presence of a substance in the mother-liquors from the crystallisation of sorbitol, which they regarded as an octite. The author has now prepared this substance, and finds it to be a hexavalent alcohol, a new isomeride of mannitol and sorbitol; he names it provisionally *sorberitol.* The mother-liquors are separated from the crystals of sorbitol, the sorbitol remaining in them is converted into sorbose by fermentation with the sorbose bacterium, the sorbose is precipitated by alcohol, and the residual syrup is treated with sulphuric acid and benzaldehyde. Sorberitol is regenerated from its benzal compound and recrystallised; it occurs in the form of anhydrous prisms, melting at 75° C. and is very deliquescent in moist air. Its rotatory power in 10 per cent. solution at 20° C. is $[\alpha]_D = -3\cdot53^\circ$. Two benzal derivatives are described: the dibenzal compound, fairly soluble in boiling alcohol and melting at 192° C., and the tribenzal compound, only sparingly soluble, and melting at about 240° C. The hexacetate of sorberitol is prepared by the action of acetic anhydride in presence of zinc chloride; it crystallises in hexagonal plates melting at 123° C., and possessing a rotatory power of $[\alpha]_D = -26\cdot66^\circ$ in 5 per cent. solution in chloroform.—J. F. B.

Reducing Sugars; Separation or Isolation of —— *by means of Aromatic Hydrazines.* G. Votoček and R. Vondráček. XXIII., page 1164.

Rhodeose and Fucose; Enantiomorphism of ——. G. Votoček. XXIV., page 1165.

Isomeric Glucosides and Galactosides; Hydrolysis of —— *by Acids and Enzymes.* E. F. Armstrong. XXIV., page 1165.

Sucroclastic Actions of Acids and Enzymes; Contrast between the ——. E. F. Armstrong and R. J. Caldwell. XXIV., page 1165.

English Patents.

Filters [for Sugar Solutions]. W. Kathol, Vailsburg, N. J., U.S.A. Eng. Pat. 11,854, May 24, 1904. Under Internat. Conv., July 3, 1903.

A rectangular bag of filter-cloth has a sleeve formed at one of the upper corners, the bag being otherwise completely closed. A delivery pipe is inserted into the sleeve and passes along inside the upper edge of the filter-bag to the opposite corner. The bag is caused to assume a series of vertical folds by placing a clip along the lower edge. Several of these bags are placed in a closed or open tank, the delivery pipes passing water-tight through a series of holes formed on the upper part of one side; the other end of the tube, inside the bag, resting on a ledge on the opposite side of the tank. The liquid to be filtered enters the tank by a pipe in the bottom, and the liquid passes through the filtering cloth into the bag, up the spaces formed by the folds and away by the delivery pipes to a trough on the outside of the tank, the insoluble matter remaining on the outside of the filter cloth.—W. H. C.

Gum Tragasol; Manufacture of —— from Locust Kernels. R. Gray, G. Osborn, H. B. Stocks, and H. G. White, Hooton, Cheshire. Eng. Pat. 27,186, Dec 11, 1903.

The kernels are boiled for about ten minutes in water, and, after draining off the water, are kept moist for about 24 hours. They are then passed through one or more ordinary brush decorticating machines until the shells are removed. If any colouring matter from the shells or the shells themselves are mixed with the kernels, the latter or the gum extracted from them must be treated with a soluble aluminium salt or a bichromate, in order to precipitate the colouring matter as a lake. The clear gum is then decanted off.—T. H. P.

United States Patent.

Starch, Soluble; Apparatus for Making ——. W. Browning and J. J. Barlow, Accrington. U.S. Pat. 773,783, Nov. 1, 1904.

See Fr. Pat. 336,903 of 1903; this J., 1904, 449.—T. F. B.

French Patents.

Molasses; Process for Separating —— from Non-Saccharine Substances. F. Hlavati. Fr. Pat. 344,969, July 19, 1904.

See Eng. Pat. 16,750 of 1903, this J., 1904, 874.—T. F. B.

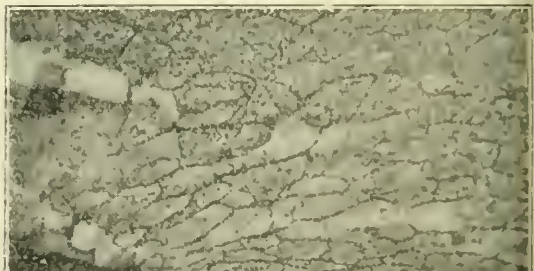
XVII.—BREWING, WINES, SPIRITS, Etc.

Malt; Presence of the Cell Wall in the Endosperm of Finished ——. A. R. Ling. Brewers' J., 1904, **40**, 741—742.

In their researches on the germination of the *gramineæ* (this J., 1890, 530), Brown and Morris explained the phenomenon of "modification" as being "co-terminous with the dissolution of the cell wall," *i.e.*, they concluded that, as germination progresses, the cell wall enclosing the starch granules of the endosperm is attacked and hydrolysed by the action of an enzyme which proceeds from the scutellum and gradually extends, throughout the whole endosperm, with the result that the "mealiness" of the latter, which is characteristic of full modification, is to be regarded as the consequence of the complete disintegration and solution of this cell wall. In 1896, Grüss (this J., 1896, 464) showed that this view is incorrect, at any rate, so far as Continental malts are concerned, and that the cell walls, although they are modified to some extent by the action of the enzyme and are made invisible except when suitably stained, are still present in the finished malt. Since the original view of Brown and Morris has remained to a large extent prevalent in this country, the author has conducted experiments in order to decide whether the longer germination which is given to English malts really does result in the complete dissolution of the cell wall in the endosperm, as suggested by those observers. For this purpose sections were cut from finished English malt corns, both in the longitudinal and transverse directions. When these sections were examined, after staining with Congo red, the cell wall was plainly discernible in all of them and was, moreover, practically continuous throughout the whole endosperm. This observation is illustrated by micro-photographs, two of which (Figs. 1 and 2) are here given.

Fig. 1.

Fig. 2.



Hence it is shown that the conclusions of Grüss are equally valid for English malts as for German malts, and it is suggested that the modification of the cell wall, which does undoubtedly take place, is confined to some less resistant constituent of this wall (*e.g.*, the araban), the products of the hydrolysis of which will probably be found as part of the carbohydrate constituents of the aqueous extract of the malt.—J. F. B.

Malt; Action of Formaldehyde on the Diastatic Power of——. Somlo and von Laszloffy. Oesterr. Chem. Zeit.; through Brewers' J., 1904, **40**, 735.

The authors steeped green malt for a short time in solutions of formaldehyde, afterwards washing out the latter and determining the diastatic power. In all cases the formaldehyde was found to have had a remarkable stimulating influence on the diastatic power of the malt, but on the other hand the addition of formaldehyde produced no increase in the diastatic powers of malt extracts. The reason for this influence is so far unexplained, but the treatment has been practised on the large scale in the distillery (see this J., 1904, 674), the malt being immersed for two hours in a 2 per cent. solution of formaldehyde. The authors consider that their observations tend to confirm the hypothesis that formaldehyde plays a part in the degradation of starch in the green plant.—J. F. B.

Saccharomycetes; A New Member of the Family of the——. H. Schiöning. Woch. f. Brau., 1904, **21**, 691—693 and 717—720. Comptes rend. trav. Lab. de Carlsberg, 1903, **6**, 103.

The author has isolated from the earth of a meadow on the St. Gothard a species of a new genus of yeast, which he has named *Saccharomycopsis capsularis.* It develops rapidly in wort in the form of ellipsoid and oval cells resembling those of *S. Pastorianus.* On the second day small surface growths of mycelial cells appear, and after about a month the film which has formed on the surface may have reached a thickness of 2 cm. In yeast-water media the mycelium readily develops asci, each ascus containing four spores. The individual spores are round in one direction and oval in profile; they possess a double membrane, a character which constitutes the chief differentiation between this new genus and that of the Saccharomyces. When viewed in profile, the spores show a fine line or seam which divides them into two unequal parts. When the spores germinate, the exosporium splits open down this seam, forming two capsules jointed together at one point, whilst the new cells grow out by budding from the open side and show an early tendency to assume the mycelial form. When the growth of yeast is treated with strong sulphuric acid, the whole of the mycelium and yeast cells dissolve, leaving behind the spores, which are resistant to the action of the acid but which show a characteristic rose-red coloration. This coloration is attributed to the presence of a cork-like constituent in the exosporium. Growths on solid substrata have a greyish-white, silky appearance; they liquefy gelatin and on some media they become red or brown in colour. This yeast ferments maltose, dextrose, levulose and *d*-galactose, but not arabinose, raffinose, milk sugar, nor cane sugar; it secretes no invertase. The optimum temperature for vegetative growth in beer wort and for sporulation is from 25° to 28° C. Sporulation does not occur above 35° C and no growth takes place above 32·5° C. In beer wort containing 13·5 per cent of total solids, this yeast produced 5·66 per cent of alcohol by volume after 27 days and 7·15 per cent. after 7 months at the ordinary temperature. The description of the new genus Saccharomycopsis is:—Budding and endosporogenous yeasts; the spore possesses two membranes and germinates by budding. The only species yet known are; *S. capsularis*, described above, and *S. guttulatus*, Robin, previously called *Cryptococcus guttulatus* or *Saccharomyces guttulatus*, first discovered by Robin in the intestine of the rabbit.—J. F. B.

Wort; Running off the —— from the Mash. Pankrath. Woch. f. Brau., 1904, **21**, 699—704.

In running off the wort from a decoction mash through the false bottom of the clearing-tun, a certain speed must not be exceeded, if the drainage is to be satisfactory, and for this reason means, such as pressure, suction, &c., intended to hasten the process have never met with success. If the wort be run off too rapidly, the flocculent matters of the grains are so compressed that portions of the bed do not part with their liquor readily. One method is worthy of further attention; it consists in agitating the mash during the whole of the running off of the main wort and disregarding the consequent turbidity of the latter, but removing this turbidity at a later stage by filtration. The author has plotted curves showing the variations of density of the main wort running from different taps. Theoretically the density should remain constant at all stages, but in reality it varies at different stages and different taps. This circumstance is attributed to the water used for rinsing various parts of the apparatus before and after the transference of the mash and to leakage of the sparging pipes; such water does not mix completely with the mash, but is localised mainly at the top and bottom. When all the main wort has drained off, the bed of grains is raked up and is then more permeable than before. The author has studied the principle of the sparging process in the laboratory, working by upward displacement. On varying the speed of the washing water it was found that a faster current of water gave a more rapid extraction but that it required a vastly greater quantity of water to complete the exhaustion. Hence the necessity of sparging slowly in order not to dilute the beer too largely. Curves were plotted showing the progress of extraction during sparging on the large scale, and the variations in the density of the liquors running from different taps according to the different areas drained by each and to variations in the permeability of the bed. These curves always descend very rapidly at first, but if the middle portion be too steep it shows that the taps are open too widely, with the result that irregularities will be encountered towards the end, when, owing to equalisations caused by the last liquors draining away, the density of the runnings will actually rise again after their collection has been stopped. So far as yield is concerned, it makes no difference whether the bed of grains be raked over once or several times, and the author shows that time is saved by not raking more than once, *i.e.*, at the beginning of the sparging; but if there are pockets of grains which are so compacted as not to yield up their wort to the sparging water, the bed may with advantage be raked up in the wet state without draining off.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Flours; Bleaching of —— by Electricity. Balland. Comptes rend., 1904, **139**, 822—823.

The author has examined a sample of flour produced by the ordinary methods, and one of the same flour bleached by treatment with electrified air. The colour of the latter was distinctly whiter, but its odour and flavour were less agreeable. The only modifications produced by bleaching capable of being detected by analysis were those of the fatty matters and the acidity. The fats, after the electrical treatment, had become slightly rancid, they were less fluid and paler in colour; the yellow oil of the wheat, which is highly aromatic in freshly ground flour, had been oxidised and partially converted into white fatty acids, soluble in absolute alcohol. The acidity of the flour had increased from 0·0147 per cent. before treatment to 0·0196 per cent. after treatment. The examination of the gluten and experiments on the bread-making properties of the flour showed that the electrical treatment had not only bleached the flour but had also "aged" it, with loss of flavour.—J. F. B.

Celery; Constituents of ——. M. Bamberger and A. Landsiedl. Monatsh. f. Chem., 1904, **25**, 1030—1034.

In addition to mannitol, the authors have found that asparagine and tyrosine are normal constituents of celery. The amount of asparagine isolated from the root stalks of different specimens of the plant was nearly the same, 62 grms. of the fresh material yielding 0·3 grm., whilst the amount of tyrosine was very small. Leucine could not be detected.—C. A. M.

English Patents.

Milk Powder; Production of Milk in the Form known as ——, applicable also to the Treatment of other Solutions containing Fatty Matter. R. R. F. Butler, Devizes, Wilts. Eng. Pat. 5946, March 10, 1904.

The milk, or any analogous solution, is first forced through fine sieves or bodies furnished with fine orifices or passages, and is then dried at a high temperature. The preliminary sifting process breaks up the fatty particles and fixes them in the liquid, so that, when the resulting powder is dissolved in water, the fat does not rise to the surface.—T. H. P.

Lac-Derivatives; Preparation of —— [for Lining Cans for Preserved Food]. W. S. Bucklin. Eng. Pat. 16,800, July 30, 1904. XIII B., page 1154.

United States Patents.

Flour; Process of Treating ——. [Bleaching, &c.] J. M. Williams, Guthrie, Okla. U.S. Pat. 769,522, Sept. 6, 1904.

The process consists in decomposing, by electrolysis, water or other liquid containing oxygen, and by means of a blast of air introduced below the level of the liquid, bringing the gaseous products formed into contact with the flour.
—W. P. S.

Vacuum Apparatus [for Milk]. M. Ekenberg, Assignor to Martin Ekenberg's Aktiebolag, Stockholm, Sweden. U.S. Pat. 774,054, Nov. 1, 1904.

See Eng. Pat. 23,770 of 1902; this J., 1903, 158.—T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

English Patents.

Liquid Sewage or Sewage Effluent; Apparatus for Distributing —— upon Filter-Beds. H. W. Taylor, Newcastle-on-Tyne. Eng. Pat. 28,379, Dec. 24, 1903.

The distributor consists of two parallel pipes placed between two water-wheels of comparatively long length and small diameter. The pipes and water-wheels extend across the filter-bed and are mounted at each end on a wheeled carriage, the carriages running on rails laid on the walls of the filter-bed. Openings are provided in the pipes for the delivery of the sewage to the wheels. The sewage supply trough is parallel to the side of the filter and is connected by means of a siphon to a valve box in communication with the parallel pipes. The ends of the latter are alternately opened and closed at each end of the filter-bed by a lever-valve. The carriage is caused to travel backwards and forwards over the filter by the movement of the water-wheels, the axles of the latter being extended to form the axles of the carriage wheels. The end of the siphon in the supply trough is automatically opened and closed, according to the flow of sewage, by means of a valve actuated by a lever and inverted bell, or by an ordinary ball-float. A tapped chamber at the top of the siphon is provided in order to start the action of the siphon.
—W. P. S.

Sewage; Method of and Apparatus for the Bacterial Purification of ——. C. Kremer and R. Schilling, Berlin. Eng. Pat. 20,889, Sept. 28, 1904.

The apparatus consists of a vertical rotating wheel, around the circumference and on the spokes of which boxes are suspended so that they always remain in an upright position. The boxes are filled with filtering or oxidising material, such as coke, slag, &c., and are so arranged that they can be automatically removed and replaced by fresh boxes. Sewage flowing into the boxes causes the wheel to rotate, the liquid drains through from each box into the next lower one, and finally into an outlet channel. The rotation of the wheel produces a strong current of air, and the filtering material is thus subjected to aeration both while covered with sewage and during the period between the draining of the filtered liquid and the reception of a fresh charge of sewage. When the sewage is under only a small "head," a horizontal wheel, rotated by external means, is used, with the boxes of oxidising and filtering material arranged around the rim.—A. S.

United States Patent.

Waste Liquors; Device [Straining Apparatus] for the Purification of ——. H. Riensch, Charlottenburg, Germany. U.S. Pat. 773,593, Nov. 1, 1904.

See Eng. Pat. 3896 of 1902; this J., 1902, 1064.—T. F. B.

French Patents.

Furnace; Refuse Consuming and Gas Producing ——. L. Tobiansky. Fr. Pat. 344,699, April 23, 1904.

See Eng. Pat. 12,361 of 1904; this J., 1904, 878.—T. F. B.

Garbage and other Organic Waste: Apparatus for Extracting the Oil from ——. C. S. Wheelwright and J. T. Fiske, jun. Fr. Pat. 344,811, July 15, 1904.

See Eng. Pat. 14,483 of 1904; this J., 1904, 879.—T. F. B.

Oil and Fatty Matters from Garbage and similar Organic Refuse; Apparatus for Extracting ——. C. S. Wheelwright and J. T. Fiske, jun. Fr. Pat. 344,812, July 15, 1904.

See Eng. Pat. 14,482 of 1904; this J., 1904, 879.—T. F. B.

Liquids from Solid Matters; Apparatus for Extracting ——. [Treatment of Refuse.] C. S. Wheelwright and J. T. Fiske, jun. Fr. Pat. 344,910, July 15, 1904.

See Eng. Pat. 14,484 of 1904; this J., 1904, 909.—T.F.B.

Oil and Fatty Matter from Garbage and other Organic Refuse; Process and Apparatus for Extracting ——. C. S. Wheelwright and J. T. Fiske, jun. Fr. Pat. 345,046, July 15, 1904.

See Eng. Pats. 14,709 and 15,235 of 1904; this J., 1904, 879 and 909.—T. F. B.

(*C.*)—DISINFECTANTS.

Mercuric Chloride; A New Cause of the Dissociation of —— and its Influence on the Antiseptic Properties of Solutions thereof. H. Wittenet. Bull. Soc. Chim., 1904, **31**, 1033—1038.

It is found that solutions containing mercuric chloride and ammonium chloride (as used for disinfecting purposes) when made with tap water, become turbid on dilution, and a white precipitate eventually forms. On washing this with cold water, a yellowish substance was obtained, having the composition NHg_3Cl_3. The conditions necessary for the formation of this precipitate are those associated with "temporary hardness," and solutions made with distilled or even with boiled water remain quite clear when diluted. By replacing the ammonium chloride by sodium chloride, the nature of the water used has no influence on the stability of the resulting solutions. The original white precipitate, which is obtained in quantity when sodium carbonate or bicarbonate is present, appears to have the composition $NHg_3Cl_3, 3NH_4Cl$. In contact with water it dissociates into NH_4Cl and NHg_3Cl_3, the latter oxidising in contact with air and moisture.
—T. F. B.

English Patent.

Disinfecting; Improved Method of ——. A. Morgan, London. Eng. Pat. 21,053, Sept. 30, 1904.

One part of paraformaldehyde and six parts of carbon, both in a finely-powdered condition, are mixed with sufficient gum tragacanth or other suitable gum to form a stiff paste, which is pressed into blocks and dried. When required, the blocks are ignited, whereby formaldehyde vapour is gradually and uniformly disseminated.—A. S.

XIX.—PAPER, PASTEBOARD, Etc.

Wood Fibre; Chemical Investigation of ——. V. Grafe. Monatsh. f. Chem., 1904, **25**, 987—1029.

From the results of experiments described in detail, the author concludes that Wiesner's reactions for woody fibre (*viz.*, yellow coloration with aniline salts, red coloration with phloroglucinol and hydrochloric acid, and colorations given by other phenols) are due to the action of these respective substances on certain constituents of the wood fibre, the hydrochloric acid playing an accelerating part. He finds that wood fibre is not a chemical individual, but consists, in the main, of vanillin, methylfurfural, and pyrocatechol, together with coniferin which is partly combined with the cellulose in the form of an ester, partly in the resin, and partly to a small extent in the free state in the membrane. He confirms the statement of Tiemann and Haarmann and of Höhnel as to the occurrence in wood of small amounts of coniferin, to which must be attributed the blue coloration in the test with phenol, hydrochloric acid, and potassium chlorate. Vanillin can also be detected in the refuse sulphite lyes from the cellulose manufacture. The green coloration given by wood with concentrated hydrochloric acid (or better with hydrobromic acid) is in all probability due to the methylfurfural in conjunction with the coniferin. The intensity of the colorations in the different reactions must be attributed to the fine state of diffusion of these bodies by means of the resin, and to the capacity of the cellulose to retain substances that have penetrated into it, as well as to the sensitiveness of the reagents. Wood fibre has on the average a methyl value of 48. The possibility of preparing methylfurfural and pyrocatechol in a simple manner from cellulose, and the fact that there is nothing against the vanillin in the ligneous membrane having a similar origin, render Wiesner's reactions uncertain tests of lignification. The reddish-brown coloration in the so-called Maule's reaction (which consists of treating chips of wood for five minutes with 1 per cent. potassium permanganate solution, washing them in water, then placing them in dilute hydrochloric acid, until the manganese dioxide disappears, and finally exposing them to the fumes of ammonia) is also attributed by the author to the same substances that give the colorations with Wiesner's reagents.—C. A. M.

Paper Pulp; Beating of —— and Longitudinal Splitting of the Fibres. E. Kirchner. Wochenbl. f. Papierfabr., 1904, **35**, 3411—3414.

By pressing and stamping the fibres of paper half-stuff in a porcelain mortar, it was found that the property of splitting up easily and completely in a longitudinal direction is characteristic of the class of bast fibres: linen, hemp, and jute. The production of these long fine filaments or fibrillæ, which are of such great value in paper-making, is due to the radial planes of cleavage and concentric ring structure of the bast fibres; the pointed ends of the fibres do not split so easily. The characteristic knots and cross markings of the linen and hemp fibres disappear in the process of stamping; these two fibres split up in an exactly identical manner. This property accounts for the three stages of disintegration which are the foundation of modern methods of beating, *i.e.*, "free" beaten stuff, in which the bast fibres are chopped up with sharp knives; "fine" beaten stuff, consisting of chopped fibres the ends of which are subsequently split up to a greater or smaller length into tufts of fibrillæ, and "wet" beaten stuff, in which a certain proportion of the fibres are completely split up into long fibrillae, which lie in tangled masses between the still perfect fibres. Each method of beating imparts definite characters to the paper. The structure of the cotton fibre is very different from that of the bast fibres. In cotton the cell wall consists of a resistant outer layer or cuticle which cannot be split, and an inner layer which is capable of yielding fibrillæ, which, however, are not axial, but interlaced together in spiral strands or network. This structure makes the splitting of the fibre difficult and always incomplete, since the interlacing presents no longitudinal planes of cleavage. The fibrillæ only appear after prolonged stamping and are confined to the ends of the fibres or to places where the cuticle has been chipped off. They always preserve their netted form and consequently do not extend for any great length. The fibrillæ of cotton have a coarser, softer character than those of the bast fibres and their edges are less sharply defined. In the case of those fibres which have been crushed very flat without breaking the cuticle, this latter and the spiral inner layers of the cell appear to be welded together in a gelatinous, shapeless mass. The fibre of wood-cellulose presents on disintegration an appearance similar to that of the cotton fibre, but it is far less capable of withstanding energetic mechanical treatment. Its structure consists of an outer layer which does not split, and an inner layer of spirally interlaced strands, but it breaks up into short pieces, when sharply beaten, far more readily than cotton. With more gradual treatment there is a slight tendency to form fibrillæ at the ends, similar to those of cotton, but the main bulk of the fibres are entirely broken down, the outer layer appearing in the form of irregular fragments and the inner layers as a slimy, cloudy mass which shows a filamentous, tangled structure under high magnification. The resulting paper is, however, transparent and brittle, though capable of withstanding a high tensile strain.—J. F. B.

English Patents.

Wood and other Fibrous and Porous Materials or Compounds; Solutions for Treating ——. T. Gare. Eng. Pat. 23,786, Nov. 3, 1903. IX., page 1148.

Celluloid Non-inflammable; Process for Rendering ——. W. C. Parkin, A. Williams, and T. Casson, Sheffield. Eng. Pat. 28,212, Dec. 23, 1903.

See Fr. Pat. 344,501 of 1904; this J., 1904, 1111.—T. F. B.

United States Patents.

Paper [and Ink]; Safety Commercial ——. J. Rowan, Ottawa, Canada. U.S. Pat. 774,535, Nov. 8, 1904.

See Eng. Pat. 3909 of 1904; this J., 1904, 453.—T. F. B.

Cellulose; Manufacture of ——. C. Kellner, Vienna. U.S. Pat. 773,941, Nov. 1, 1904.

See Fr. Pat. 326,313 of 1902 and Addition thereto; this J., 1903, 817 and 1304.—T. F. B.

Horn-like Substance; Elastic ——, and Process of Producing same [from Acetyl Cellulose]. L. Lederer, Sulzbach, Germany. U.S. Pat. 774,677, Nov. 8, 1904.

See Addition, of Aug. 22, 1902, to Fr. Pat. 319,724 of 1902; this J., 1903, 563.—T. F. B.

Cellulose Acetate [Horn Substitute]. W. H. Walker, Newton, Mass. U.S. Pat. 774,713, Nov. 8, 1904.

Substitutes for horn, celluloid, &c., are produced by heating under pressure a stable cellulose derivative, such as cellulose acetate, with a phenol, such as thymol. Other claims relate to "a new composition of matter" containing acetyl-cellulose, thymol, and chloroform. (Compare Lederer, Addition of Aug. 22, 1902, to Fr. Pat. 319,724 of 1902; this J., 1903, 563.)—T. F. B.

Cellulose Acetate. W. H. Walker, Newton, Mass. U.S. Pat. 774,714, Nov. 8, 1904.

A cellulose ester of a fatty acid (*e.g.*, cellulose acetate) is "modified" by addition of thymol and castor oil, and the mixture is "attached to a support."—T. F. B.

French Patent.

Paper Pulp or other Fibrous Pulp; Apparatus for Beating, Triturating, and Refining ——. J. H. Annandale. Fr. Pat. 345,044, July 11, 1904. Under Internat. Conv., Nov. 28, 1903.

See Eng. Pat. 26,012 of 1903; this J., 1904, 1040.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Colloidal Silver Salts. C. Paal and F. Voss. Ber., 1904, **37**, 3862—3881.

The authors describe the preparation and properties of colloidal carbonate, phosphate, sulphide, chloride, bromide, and iodide of silver. These colloidal salts were obtained by the action of the corresponding alkali salts on the adsorption compound of colloidal silver oxide (this J. 1904, 994) with sodium protalbinate or lysalbinate (this J. 1904, 996). —A. S.

Rare Earths of the Yttrium Group, near to Gadolinium. G. Urbain. Comptes rend., 1901, **139**, 736—738.

In separating fractionally the yttria earths, after the faintly rose-coloured europium oxide and the white gadolinium oxide, coloured oxides appear, each successive fraction being darker than the preceding one. The darkest fractions show with intensity the spectrum of dysprosium. Those nearer gadolinium give an absorption band at $\lambda = 488$ identical with that mapped by Lecoq de Boisbaudran in 1895, and attributed by him to an element provisionally designated $Z\delta$. By three separate methods of fractionation (nickel-earth nitrates, earth-nitrates with intercalation of bismuth nitrate, and ethylsulphates) the author has separated fractions showing only the band $\lambda = 488$. The oxides from these solutions are all brown, and contain peroxides; it has not yet been possible to decide whether these oxides are mixtures of dysprosium and the element $Z\delta$, or whether they also contain another element which shows no absorption spectrum.—J. T. D.

Alkaline Earth Tartrates; Solubility of —— in Water. H. Cantoni and Mlle. Zachovers. Bull. Soc. Chim., 1904, **31**, 1121—1124.

The solubility of the normal tartrates of strontium, calcium and barium was determined by heating the salt with water at a constant temperature for 10 hours; the amount dissolved was determined, in the case of strontium tartrate, by evaporation, and with calcium and barium tartrates, by precipitation with ammonium oxalate. The results obtained as the mean of several experiments are as follows:—

Temperature, °C.	Grms. of Salt dissolved in 100 c.c. of Water.		
	Strontium Tartrate, $C_4H_4O_6Sr + 3H_2O$.	Calcium Tartrate, $C_4H_4O_6Ca + 4H_2O$.	Barium Tartrate, $C_4H_4O_6Ba$.
2	0·12138	0·03664	0·02125
21	0·21280	0·04777	0·02905
22	..	0·04868	0·02842
39	0·31842	0·08765	0·03577
9	0·47885	0·12522	0·04398

Since barium tartrate is much less soluble than calcium tartrate, it is suggested that a barium salt might be used for decomposing the potassium tartrate in the manufacture of tartaric acid. A table of solubilities, calculated from the above figures, is given for temperatures from 0° to 60° C. inclusive, at intervals of 5°.—T. F. B.

Thioformic Acid. V. Auger. Comptes rend., 1904, **139**, 798—800.

Phosphorus pentasulphide, P_2S_5, does not react with formic acid even at the boiling temperature, but sodium metathiophosphate, $NaPS_3$, obtained by heating together equimolecular proportions of phosphorus pentasulphide and sodium sulphide, reacts readily with formic acid in the cold, with evolution of sulphuretted hydrogen. On distilling the product at 30°—40° C. *in vacuo*, and condensing the distillate at a temperature of about 20° C., crystals of unaltered formic acid are obtained, together with a very unstable liquid possessing the properties of a thio-acid, but which decomposes after a short time, depositing a white amorphous substance with evolution of sulphuretted hydrogen. Analysis indicated that this liquid contained about 35 per cent. of *thioformic acid*, H.COSH. Sodium thioformate was also obtained by Kekulé's method, by mixing phenyl formate with sodium hydrosulphide dissolved in absolute alcohol, the salt being precipitated by ether after the removal of some of the alcohol by distillation. Sodium thioformate crystallises in very deliquescent, long, white needles. Its aqueous solution gives coloured precipitates with salts of the heavy metals, which, however, are very unstable. The free acid was prepared by treating the sodium salt with formic acid in the cold, and distilling the product *in vacuo*, but a study of its properties was not possible, owing to its extreme tendency to polymerise, with loss of sulphuretted hydrogen.—J. F. B.

Papaverinium Bases. H. Decker, O. Klauser, and M. Girard. Ber., 1904, **37**, 3809—3815.

An account is given of the preparation and properties of the normal bromobutylate of papaverine, butyl-*iso*-papaverine, papaverinium chlorobutylate, the iodo-isobutylate, *p*-nitrochlorobenzylate, iodopropylate, and iodo-isopropylate of papaverine, monobromopapaverine, *N*-methylbromopapaverinium salts, *N*-methylbromo-*iso*-papaverine, bromopapaverine chlorobenzylate, and *N*-benzylbromo-*iso*-papaverine. By the oxidation of *N*-benzylbromo-*iso*-papaverine, *N*-benzyldimethoxy-*iso*-quinoline and 6-bromoveratric acid are produced. (See also this J., 1904, 336.) —A. S.

Terpenes and Essential Oils; 70th Communication; Compounds of the Thujone Series. O. Wallach. Annalen, 1904, **336**, 227—280. (Compare this J., 1902, 1244.)

The author has turned his attention to the possible existence in essential oils of more than one modification of thujone, and has isolated two physically different isomeric forms of this ketone from suitable fractions of various oils, by preparing the semicarbazones under conditions excluding the possibility of isomeric changes, and separating the semicarbazones by fractional crystallisation. α-*Thujone* is lævorotatory ($\alpha = -9$ to $-10°$); it forms two semicarbazones, one crystallising in rhombic prisms, m. pt. 186°—188° C. $[\alpha]_D = +59{\cdot}5°$, sparingly soluble in ether; the other amorphous, melting at 110° C., dextro-rotatory to about the same degree as the first, but very soluble in ether. β-*Thujone* is dextro-rotatory ($\alpha =$ about $+70°$); it forms a semicarbazone which is dimorphous, and which is obtained as hexagonal prisms, melting at 174°—175° C., which are stable at low temperatures, but which change at ordinary temperatures into rhombic prisms melting at 170°—172° C. The two isomeric thujones are partially converted, one into the other, under the action of alcoholic potash, but β-thujone is the more stable form. Both thujones are converted by alcoholic sulphuric acid into isothujone, but the α-thujone is first transformed into β-thujone. Both yield the same α-thujaketonic acid when oxidised by permanganate As regards the occurrence of these two forms of thujone in essential oils, the author has established the fact that thuja oil contains practically only α-thujone; tansy oil contains practically only β-thujone [tanacetone]; wormwood oil contains principally β-thujone together with a little α-thujone; the oils of *Artemisia barrelieri* and of sage contain mixtures of the two isomerides. The second part of the paper deals with the isoxime of thujone, the oxime of isothujone, the isoxime of thujamenthone, and the isoxime of hydroxythujamenthone.—J. F. B.

Morphine; Contribution to the Knowledge of Alkaloidal Reactions. IV. ——. C. Reichard. XXIII., page 1163.

Codeine in Opium; Determination of ——. C. E. Caspari. XXIII., page 1164.

United States Patent.

Chloral; Process of Continuously Producing and Rectifying ——. J. A. Besson, Caen, France. U.S. Pat. 774,151, Nov. 8, 1904.

See Eng. Pat. 17,202 of 1900; this J., 1901, 1139.—T. F. B.

French Patents.

Protocatechuic Aldehyde; Process for Preparing —— by Means of Heliotropin. Franz Fritzsche and Co. Fr. Pat. 344,837, July 16, 1904. Under Internat. Conv., Oct. 29, 1903, and March 10, 1904.

See Eng. Pat. 15,781 of 1903; this J., 1904, 1043.—T. F. B.

Alkylaminoacetopyrocatechols; Process for Preparing ——. Farbwerke vormals Meister, Lucius und Brüning. Fr. Pat. 344,930, July 18, 1904. Under Internat. Conv., Aug. 15, 1903.

See Eng. Pat. 26,180 of 1903; this J., 1904, 1043.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

United States Patent.

Photographic Process for the Reproduction [in Relief] of Plastic Objects. C. Baese, Berlin. U.S. Pat. 771,549, Nov. 8, 1904.

See Eng. Pat. 5381 of 1902; this J., 1902, 1469.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

English Patent.

Explosives; New or Improved ——. C. J. Rusher, Cape Town, and G. W. Baudinet, Cape Colony. Eng. Pat. 7490, March 29, 1904.

To a mixture of ammonium nitrate (5 parts) and dinitrobenzene (1 part) from 0·5 per cent. to 2·5 per cent. of ammonium carbonate is added. The ammonium nitrate is heated to 90° C. and the ammonium carbonate added. The dinitrobenzene is melted, and part is impregnated with ammonia gas, the whole being mixed together hot to form the finished explosive.—G. W. McD.

United States Patents.

Chlorate Powder. W. M. Spore, Argenta, Ill. U.S. Pat. 739,356, Sept. 22, 1903.

An explosive, consisting of chlorate of potash, white of egg, and pith of cornstalks.—T. F. B.

Blasting Powder. J. Tollner, Assignor to F. G. Dokkenwandel and H. M. Grant, New York. U.S. Pat. 757,693, April 19, 1904.

The explosive consists of potassium nitrate (15 per cent.), sodium nitrate (30 per cent.), sulphur (15 per cent.), spent tan bark (20 per cent.), horse manure (20 per cent.).

—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUALITATIVE.

Acetates, Cyanides, and Lithium; Method for the Detection of ——. S. R. Benedict. Amer. Chem. J., 1904, **32**, 480—483.

Acetates. — The method which is capable of detecting acetates at a dilution of N/500, and is applicable in presence of all strong acids, and of all weak acids having insoluble silver salts, is based upon the facts (1) that unlike most weak acids, acetic acid has a soluble silver salt, and (2) that the acidity or degree of ionisation of acetic acid is greatly reduced by the presence of an acetate. The solution to be tested is freed from all cations, except those of the sodium group, made just alkaline with sodium carbonate, and treated with excess of silver nitrate. After filtering, the excess of silver is precipitated from the perfectly neutral solution by N/1 sodium chloride solution, and after again filtering, the liquid is saturated with hydrogen sulphide, and added to 2 c.c. of N/1 cobalt nitrate solution, which has been acidulated with two or three drops of N/1 acetic acid, and saturated with hydrogen sulphide. (A slight precipitate of cobalt sulphide may be present in the latter solution, but may be disregarded.) A copious black precipitate of cobalt sulphide forms immediately if the test solution contained an acetate.

Cyanides.—For the detection of cyanides in presence of thiocyanates and ferrocyanides, a method based upon the action of cyanides on the freshly precipitated oxides of mercury is recommended. The solution to be tested is made alkaline with sodium hydroxide, and 0·5 to 1 c.c. of N/25 mercurous nitrate solution is introduced so as to form a layer above the alkaline solution, a ring of black mercurous oxide being produced at the junction of the two liquids. The whole is then gently agitated so that the precipitate slowly mixes with the solution. If cyanide be present, a portion of the precipitate will dissolve whilst the rest will become light gray in colour, owing to the formation of metallic mercury. The test is a more delicate one than the Prussian blue reaction.

Lithium.—The solution to be tested is made alkaline with ammonia, one-tenth of its volume of N/5 disodium-hydrogen phosphate solution is added, followed by enough alcohol to produce a fairly heavy precipitate, which remains permanent on shaking. The liquid is then heated to boiling. If lithium be absent, the precipitate will completely dissolve, but if present, lithium phosphate will be precipitated upon warming, and the precipitate will not dissolve even on boiling. If the amount of lithium present be small, the solution will first become clear, and the precipitate of lithium phosphate will form on boiling.—A. S.

Strontium and Strontium Chromate; Michrochemical Detection of ——. W. Autenrieth. Ber., 1904, **37**, 3882—3887.

Strontium chromate exhibits a strong tendency to crystallise, and is thus distinguishable from barium chromate, which precipitates in the amorphous form. If to a drop of N/4 strontium nitrate solution on a microscope slide, a drop of 10 per cent. potassium chromate solution be added, the precipitate under a magnification of 120 diameters shows bundles or brushes of fine needle-like crystals, highly characteristic. If the strontium solution be N/10 or weaker, the precipitate falls only after some time, and then consists of short single or modified hexagonal prisms, requiring a magnification of about 500 to exhibit them clearly. The same crystals are obtained when ammonia in excess is carefully floated on a solution of strontium chromate in acetic acid or a mineral acid. This form seems to be unstable, and tends to pass gradually into the needle-like form. Moist strontium chromate readily dissolves in acetic acid; dried at 120° C. it is more slowly attacked, but in time dissolves completely. When, for purposes of analysis, an acid solution of strontium chromate is reduced by alcohol and precipitated by ammonia, the hydroxide, even after re-solution and precipitation, obstinately retains such quantities of strontia as to make the chromium determination quite worthless. Stock's method of precipitation by potassium iodide and iodate is quite applicable to strontium chromate. For the detection of barium, strontium, and calcium together, the author recommends separation of the thoroughly dried chlorides by alcohol, and examination of the residue for barium, precipitation of a drop of the filtrate by potassium chromate, and microscopic examination for strontium; the rest of the filtrate is converted into nitrates, and these are separated by alcohol. Separation by potassium sulphate solution is not to be recommended.

—J. T. D.

Nitrogen; Automatic Apparatus for the Absorption of ——*from Gaseous Mixtures.* F. Henrich. VII., page 1146.

INORGANIC—QUANTITATIVE.

Sulphates; Volumetric Determination of Soluble ——. M. Monhaupt. Chem.-Zeit., 1904, **28**, 1125—1126.

The method given is for the determination of sulphates in alkali and alkaline-earth salts. A weighed quantity of the substance is dissolved in water, and a solution containing known quantities of sodium carbonate and of potassium hydrate is added in excess to precipitate lime and magnesia. The solution is then made up to a known volume, and filtered. An aliquot portion of the filtrate is neutralised with hydrochloric acid, using methyl orange as indicator. The solution is then boiled to expel carbon dioxide, and a known quantity of standardised barium chloride solution added. After cooling, the solution is made up to a known volume, and a portion of the filtrate titrated with sodium carbonate solution, phenolphthalein being used as indicator. The titration can be performed accurately, if about from one-third to one-half part of 80—90 per cent. alcohol be added to the solution, and the mixture warmed. The lime and magnesia originally present may be determined by using a known excess of standardised sodium carbonate and potassium hydroxide in the first instance, and titrating a portion of the filtrate with standard acid solution, using methyl orange and phenolphthalein as indicators. From the amounts of sodium carbonate and potassium hydroxide consumed, the quantities of lime and magnesia respectively can be calculated. For instance, a mixture of 15 grms. of salt (containing 0·31 per cent. of sulphuric anhydride), 5 grms. of magnesium sulphate, and 5 grms. of crystallised magnesium chloride, was dissolved in 250 c.c. of water. 40 c.c. of the solution were then precipitated with 50 c.c. of the caustic-carbonate liquor, made up to 200 c.c., the liquid filtered, and 100 c.c. (containing 2 grms. of the mixture) of the filtrate neutralised and boiled. 20 c.c. of N/2 barium chloride solution were added, and 100 c.c. of the cooled and filtered solution then required 6·75 c.c. of N/2 sodium carbonate solution. This corresponded to 6·50 per cent. of sulphuric anhydride and a gravimetric determination gave 6·65 per cent.—L. F. G.

Sulphates and Chlorides; Use of the Chromates of Barium, and of Silver in the Determination of ——. L. W. Andrews. Amer. Chem. J., 1904, **32**, 476—480.

Sulphates. — The author recommended some years ago (this J., 1890, 328) a method for the volumetric determination of sulphates, consisting in adding a reagent prepared by dissolving barium chromate in dilute hydrochloric acid, to the sulphate solution, neutralising, filtering, and titrating the chromate in the filtrate iodometrically. It has been pointed out, however, that the solution of barium chromate in hydrochloric acid does not maintain its strength on keeping (this J., 1892, 711; 1898, 694). The author now finds that this objection is completely removed if trichloracetic acid be substituted for hydrochloric acid. Trichloracetic acid in concentrations between N/1 and N/2 is capable of maintaining permanently in solution one-sixth of its own weight of barium chromate, and the solutions do not appreciably alter on keeping, so far as the concentration of chromate is concerned.

Chlorides.—The principle of using a re-precipitable salt can also be applied to the determination of chlorides, especially to the colorimetric determination of small amounts, as for example, in water-analysis. Finely-divided silver chromate is agitated with the dilute chloride solution, the liquid is filtered or decanted, and its colour matched with that of a solution containing a known amount of potassium chromate. —A. S.

Perchlorate; Reduction [Determination] of —— in the Wet Way. B. Sjollema. Z. anorg. Chem., 1904, **42**, 127—128.

Potassium perchlorate is quantitatively reduced to chloride by boiling with ferrous hydroxide in the absence of free alkali. 0·4 grm. of potassium perchlorate was treated with a solution of 40 grms. of ferrous sulphate crystals in about 100 c.c. of water and 25 c.c. of sodium hydroxide solution (sp. gr. 1·33), and the mixture boiled for three hours; 25 c.c. of nitric acid (sp. gr. 1·32—1·33) were then added, and, after heating for some time, a further 25 c.c., after which the boiling was continued for about half an hour. While the acid solution was being boiled, the flask was provided with a device by which the vapours were washed with water, the washings running into the flask. The solution was finally made up to 500 c.c., and 250 c.c. were titrated according to Volhard's method. In seven tests the amount of perchlorate found, varied from 0·398 to 0·110 grm.—A. S.

Sodium Hydrosulphite; Action of —— upon Metallic Salts. O. Brunck. VII., page 1146.

Sulphur in Irons and Steels; New Method for the Determination of ——. H. B. Pulsifer. Chem. News, 1904, **90**, 230—231.

Two and a half grms. of the sample are moistened with water in a broad 250 c.c. beaker, and 20 c.c. of chloric acid (sp. gr. 1·12) and a very small quantity of hydrofluoric acid are added. After the action has subsided, 5 c.c. of strong hydrochloric acid are added, the beaker is covered with a watch-glass, and the contents are heated to boiling. The residue is filtered off with the aid of the filter-pump, washed two or three times with a little water, drained, and fused with sodium peroxide in a nickel crucible. The melt, after cooling, is dissolved in water and hydrochloric acid, the solution filtered and the filtrate mixed with the main solution, which has, in the meantime, been treated with 20 c.c. of strong hydrochloric acid, and evaporated until its volume is less than 10 c.c., in order to expel the hydrofluoric acid. The volume of the mixed solutions should be about 100 c.c. The sulphur is now determined in the usual manner as barium sulphate. The method is stated to give accurate results, and it is much quicker than the usual processes, the time occupied from the weighing of the sample to the precipitation of the barium sulphate being only 20 minutes.—A. S.

Tin, Commercial, and its Alloys; Analysis of ——. A. Hollard and L. Bertiaux. Bull. Soc. Chim., 1904, **31**, 1128—1131.

The following methods are recommended for the determination of impurities in tin and its alloys:—*Arsenic* is determined by the method previously described by the author (this J., 1900, 563). *Lead, bismuth, and iron.*—The tin is dissolved in a mixture of hydrochloric acid and an extremely small quantity of nitric acid; excess of ammonia is added, and sulphuretted hydrogen is passed through the solution until all the tin sulphide has dissolved. The precipitate is dissolved in hot hydrochloric acid containing bromine, the excess of which is then removed by boiling; the bismuth, lead, and copper are precipitated as sulphides and the iron determined in the solution volumetrically. The precipitate of sulphides is again dissolved in hydrochloric acid containing bromine, excess of ammonia and a small quantity of potassium cyanide are added, and the lead and bismuth are precipitated as sulphides. The washed precipitate is oxidised to sulphate, and the lead and bismuth determined electrolytically (this J., 1904, 207 and 839). *Antimony* is determined by dissolving the tin in *aqua regia*, evaporating to dryness repeatedly with hydrochloric acid to remove all nitric acid, adding a little sodium carbonate to render the residue alkaline, dissolving in sodium hydrosulphide and potassium cyanide and electrolysing. *Copper and sulphur.*—The tin (5 grms.) is attacked with nitric acid, and the resulting liquid, &c., evaporated to dryness on the water-bath. The residue is treated with water acidified with nitric acid and washed on a filter; copper is determined by electrolysing the filtrate, the residual solution being precipitated with barium chloride solution. *Alloys of lead and tin* are preferably mixed with 10 times their weight of copper, and treated with dilute nitric acid, the lead being determined in the solution by electrolytic deposition, as peroxide, after the stannic oxide precipitate has been removed.—T. F. B.

Lead, Commercial [Electrolytic Determination of Impurities in ——]. A. Hollard and L. Bertiaux. Bull. Soc. Chim., 1904, **31**, 1124—1128.

The lead is dissolved in nitric acid and deposited on a platinum anode by using a current of about 0·2 ampère. Sulphuric acid is added to the residual solution, which is then evaporated and diluted; nitric acid is added and any remaining lead is filtered off as sulphate. The *copper* is determined in this solution by electrolysis. *Nickel, zinc, and iron* are determined by the method previously described (see this J., 1904, 762). *Sulphur* is determined by evaporating the solution, freed from lead as above, to dryness with hydrochloric acid, dissolving the residue in dilute hydrochloric acid, and precipitating with barium chloride. For the determination of *arsenic*, the lead is heated with sulphuric acid, and the solution distilled with ferrous sulphate and hydrochloric acid (see this J., 1900, 563). Zinc chloride is added to the residue from this distillation, and the mixture is distilled in a current of hydrochloric acid gas, antimony chloride passing over. The distillate is neutralised with ammonia and the antimony precipitated by means of sulphuretted hydrogen. The precipitate is dissolved in a solution of sodium hydrosulphide and potassium cyanide (see this J., 1903, 512) and the *antimony* determined by electrolysis, using a current of 0·1 ampère. *Silver* is determined by precipitating a nitric acid solution of the lead by hydrochloric acid, dissolving the precipitate in potassium cyanide solution and electrolysing with a current of 0·1 ampère. The deposited metal is dissolved in nitric acid and the silver determined volumetrically by the thiocyanate method. *Bismuth and tin.*—A solution of lead in dilute nitric acid is evaporated to dryness, and the residue mixed with water and evaporated again. Ammonium nitrate solution is added and the mixture filtered; the residue on the filter, which contains the bismuth, tin, arsenic, and antimony, is dissolved in hydrochloric acid, and precipitated by sulphuretted hydrogen; the arsenious sulphide is removed from the precipitate by treatment with ammonium carbonate solution, and the antimony and tin sulphides by ammonium sulphide; the residue is now oxidised to convert sulphide into sulphate, the *bismuth* being determined electrolytically (see this J., 1904, 839). The ammonium sulphide solution, containing the tin and antimony, is precipitated by means of hydrochloric acid, the precipitate dissolved in sodium hydrosulphide and potassium cyanide, the antimony being removed as above. The tin is precipitated from the solution by hydrochloric acid, the precipitate dissolved in alkali sulphide and the solution evaporated to dryness; the residue is oxidised by means of potassium chlorate, hydrochloric acid added, and the solution filtered, ammonium oxalate being then added to the filtrate and the *tin* determined by electrolysing the hot solution, using a current of about 1 ampère.—T. F. B.

ORGANIC—QUALITATIVE.

Cotton-Seed Oil; Detection of —— in Olive Oil. E. Milliau. Comptes rend., 1904, **139**, 807—809.

The adulteration of olive oil by cotton-seed oil is generally detected by the reduction of silver nitrate on warming in alcoholic solution, or else by Halphen's reagent [mixture of amylic alcohol and carbon bisulphide containing sulphur]. Since, however, kapok oil and baobab oil [Baobab tree: *Adansonia digitata*] also show both these reactions for cotton-seed oil, and since kapok oil is now a commercial product, it was necessary to distinguish between these two oils and cotton-seed oil. The author proposes the following simple method:—The fatty acids of the oil are prepared, washed, and dried; 5 c.c. of the fused acids are mixed in a test-tube with 5 c.c. of a 1 per cent. solution of silver nitrate in absolute alcohol: the mixture is shaken, and the reaction observed. The presence of even 1 per cent. of kapok oil produces a dark brown coloration after about 20 minutes, at the ordinary temperature, baobab oil behaves in an exactly similar manner, whereas cotton-seed oil causes no reduction until the mixture is warmed.

—J. F. B.

Cholesterol; New Reaction of ——. C. Neuberg and D. Rauchwerger. Festschr. für E. Salkowski, 1904, 279—285. Chem. Centr., 1904, **2**, 1434—1435.

The tests known at present for cholesterol are given by phytosterol, coprosterol and hippocoprosterol as well as by the typical cholesterol from gall-stones. With a mixture of δ-methylfurfural (or rhamnose) and concentrated sulphuric acid, however, the typical cholesterol gives a characteristic coloration. A very small quantity of cholesterol is warmed with about 1·5 c.c. of absolute alcohol and a trace of rhamnose added. After cooling, an equal volume of concentrated sulphuric acid is introduced so as to form a layer below the solution, whereupon a raspberry-coloured ring is produced almost instantaneously at the zone of contact of the two liquids. If the layers be now mixed while the tube is cooled by a current of cold water, the mixture becomes intensely coloured, and when diluted with alcohol, gives a characteristic dark absorption band in the green to blue region of the spectrum, between the lines E and b. If the liquid becomes warm, it acquires a brownish instead of a raspberry colour, and then gives a second absorption band near the line D. Amyl or methyl alcohol, acetone or glacial acetic acid may be used in place of ethyl alcohol. With phytosterol the reaction fails, or at most, a pink coloration is produced, with occasionally an absorption band in the yellow to green portion of the spectrum. Similar reactions are given by various hydro-aromatic compounds, among them, abietic acid and retenedodecahydride, $C_{18}H_{30}$ (compare this J., 1901, 1117).—A. S.

Morphine; Contributions to the Knowledge of Alkaloid Reactions. IV. ——. C. Reichard. Chem.-Zeit., 1904, **28**, 1102—1105. (See this J., 1904, 458 and 1116.)

Morphine when added in small quantities to a solution of arsenious or arsenic acid with sulphuric acid, produces a fine purple-red coloration. The colour changes to violet after 3—5 days. The colouring matter is not extracted by ether. Atropine can be detected in the presence of morphine by the production of a fragrant odour. Strychnine with these reagents gives a dirty yellowish-green coloration; with brucine the liquid turns black on warming; cocaine produces a black precipitate. Morphine sulphate added to a concentrated solution of antimony trichloride give a deep red coloration on warming. Added to stannous chloride solution it produces no change, even on warming, till sulphuric acid is added, when a fine violet-purple coloration is produced. With atropine there is no change. When morphine is warmed with bismuth chloride solution a yellow coloration is formed. Brucine interferes with this reaction, but atropine, strychnine and cocaine do not. Morphine added to a solution of cobalt nitrate and sulphuric acid yields a dark red colour slowly changing to brownish-yellow; brucine interferes with this reaction. If cerium dioxide is triturated with sulphuric acid, morphine added, and the mixture warmed, a strong bluish-violet colour appears. It is not advisable to make use of this reaction in the presence of strychnine, or brucine, either of which gives a strong yellowish-red coloration; but it may be used in the presence of cocaine or atropine.

—F. S.

ORGANIC—QUANTITATIVE.

Dégras; Note on the Analysis of ——. G. Baldracco. Collegium, 1904, 333—335.

There are two well-known methods for determining the unsaponifiable matter:—(1) Methods by which the grease is saponified and the unsaponified matters dissolved out from the solution of the soap by extraction with ether or petroleum spirit; (2) Methods by which the unsaponifiable matter is extracted from the dry soap. The author has compared these two methods for dégras, and finds that they always yield different results. The second method of the two, is the more accurate one.—F. D. T.

India-Rubber Articles; Analysis of ——. W. Esch and A. Chwolles. Gummi-Zeit., 1904, **19**, 125—126. (This J. 1893, 467; 1894, 986—988 and 476.)

Various modifications of Henriques' and Weber's methods for the analysis of rubber goods have recently been proposed. Chéneau (this J., 1900, 780) suggests the extraction of paraffin with light petroleum spirit or chloroform, after extractions with alcoholic soda, acetone, and cold nitrobenzene. The authors have satisfied themselves that paraffin is completely extracted by acetone if the samples are properly prepared (fine enough) and extracted for a sufficiently long time. Chéneau's unsatisfactory results with acetone were doubtless due to the samples not being rolled sufficiently thin. Pontio makes his first extraction with alcohol instead of acetone. There appears to be no advantage if asphaltum be present; as both solvents dissolve a small quantity (in the case of Syrian asphaltum about 1·5 per cent.). Acetone also dissolves the unsaponifiable oils completely, but alcohol only partially. Pontio, therefore, extracts the unsaponifiable oils, together with the asphaltum, by means of a mixture of spike oil and acetone. It appears to be immaterial whether the unsaponifiable oils are extracted with the paraffin or with the asphaltum. An experiment showed that alcohol extracted five-sixths of the paraffin in a specially prepared sample (containing 21 per cent. of paraffin) in five hours, whilst acetone extracted the whole in three hours. Henriques and Weber used cold nitrobenzene for the extraction of asphaltum; Pontio uses a mixture of 60 parts of spike oil and 40 parts of acetone, boiling for six hours. The great difference between the boiling points of the two solvents and the tendency to dissolve vulcanised rubber makes this latter method impossible. Henriques, after extraction of the sample with alcoholic soda, cold ether or hot acetone, and cold nitrobenzene, ascertained the combined sulphur and mineral constituents in the insoluble residue, and calculated from the difference the amount of rubber, with the aid of factors to correct for the loss of rubber due to small quantities dissolved by the various solvents used. This correction depends, of course, upon the solvents used, and the factor $\frac{100}{97 \cdot 5}$ quoted by him as an example is not to be taken as a general factor, as assumed by some investigators. For the extraction of unsaponifiable oils from samples of rubber which could not be finely powdered or crushed, Henriques used ether, on account of its penetrative power being superior to that of acetone: however. apart from this, and in all other cases, acetone is much the better solvent.—J. K. B.

Reducing Sugars; Separation or Isolation of —— by Means of Aromatic Hydrazines. E. Votoček and R. Vondráček. Ber., 1904, **37**, 3854—3858.

In the separation of reducing sugars from mixtures it is first ascertained by preliminary tests (colour reactions, distillation with hydrochloric acid, &c.) what types of sugar are present, *i.e.*, whether they are hexoses, pentoses, methylpentoses, or mixtures of these). The content of reducing sugar in the syrup is then determined by Fehling's solution, and water added in such quantity that the proportion of sugar is about 5 per cent. This solution is then treated with an equivalent quantity of a suitable substituted hydrazine or its acetate, and the deposited hydrazone filtered off; to the mother liquor direct (*i.e.*, without setting free the sugar by means of benzaldehyde or formaldehyde) another aromatic hydrazine is then added to convert the second sugar into either a hydrazone or osazone. This operation is repeated, should a third sugar be present. The method has been applied to various mixtures of pure sugars and also to the saccharine products of hydrolysis of arabinic acid (from sugar beets), gum arabic, and coffee beans.—T. H. P.

Codeine in Opium; Determination of ——. C. E. Caspari. Pharm. Rev., **22**, 348. J. Pharm. Chim., 1904, **20**, 458—460.

Fifty grms. of opium are extracted with water, the aqueous liquid is evaporated to 250 c.c., 5 grms. of barium acetate are added, and the solution is made up to 700 c.c. with water. The meconic acid and resinous substances which are precipitated, are filtered off and washed with cold water, and the filtrate and washings are concentrated, treated with a further 5 grms. of barium acetate, diluted and filtered. These operations are repeated until barium acetate produces no further precipitate. The solution is then concentrated, a slight excess of a 10 per cent. solution of sodium carbonate is added, and the solution is filtered. The precipitate which contains the thebaine, papaverine, and narcotine is filtered off and washed with water, and the filtrate and washings are acidulated with dilute hydrochloric acid, and concentrated by evaporation. The greater part of the morphine is precipitated by adding excess of a 2 per cent. solution of ammonia, filtered off, and washed. The filtrate is acidulated, concentrated, and again treated with ammonia to precipitate the remainder of the morphine, which is filtered off and washed. The filtrate is acidulated, concentrated to 70 c.c, rendered alkaline with weak ammonia, and shaken with benzene, which dissolves the codeine, but not the narceine. In the evaporation residue of the benzene extract, the codeine is determined by titration. By this method Smyrna opium was found to contain, in two tests, 1·12 and 1·33 per cent. respectively of codeine, $C_{18}H_{21}NO_3.H_2O$.—A. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Radio-active Gas in the Hot Springs of Wiesbaden; Presence of a ——. F. Henrich. Z. angew. Chem., 1904, **17**, 1757—1760.

The author finds that the gas and water from the hot springs of Wiesbaden are distinctly radio-active. The stalactites present in the springs are also radio-active, and, unlike the water and gas, do not become inactive on keeping, although fresh stalactites are more active than those which have been removed for some time. It is possible to make the water nearly inactive by freeing it from dissolved gases by boiling.—A. S.

Carbon Dioxide; Decomposition of —— by Light. A. Bach. Ber., 1904, **37**, 3985—3986.

The author found, some years ago, that when carbon dioxide was bubbled through uranium acetate solution in bright sunlight, reduction occurred, whilst no reduction was effected by exposure of the uranium solution alone to sunlight, or by bubbling carbon dioxide through it in the dark. Euler has stated that uranium acetate solution is reduced by sunlight, either alone or when nitrogen is bubbled through it. The author, however, confirms his original observation, and attributes the difference between Euler and himself to impurity in one or the other uranium solution. —J. T. D.

Aurous Iodide; Preparation of —— by the Action of Iodine on Gold. F. Meyer. Comptes rend., 1904, **139**, 733—736.

At the ordinary temperature, iodine is without action on gold; and aurous iodide, on the other hand, does not dissociate even in a vacuum. Between 50° C. and its melting point, pure dry iodine reacts on gold, forming amorphous aurous iodide; and above the melting-point of iodine the crystallised iodide is produced. The direct reaction is always limited by the inverse one, but by using a sufficient excess of iodine a given quantity of gold can be completely converted into iodide. The iodide is best separated from the excess of iodine by careful sublimation of the latter at 30° C., as most solvents of iodine decompose the iodide. The formation of iodide takes place, in closed vessels, in presence of water; but the reaction is limited, and in the open air, where iodine can escape, water completely decomposes aurous iodide.—J. T. D.

Fluorides of Boron and Silicon; Preparation and Physical Constants of ——. H. Moissan. Comptes rend., 1904, **139**, 711—714.

The substances formed by the direct reaction of fluorine on boron and on silicon were proved to be identical respectively with boron trifluoride and silicon tetrafluoride, prepared by the usual methods. The melting and boiling-points of boron trifluoride were determined and found to be − 127° and − 101° C. respectively, under atmospheric pressure. Silicon tetrafluoride is solid at − 97° C., under atmospheric pressure, and at that temperature volatilises rapidly without liquefying. (Olszewsky had already recorded a similar behaviour at − 102° C.) Under two atmospheres pressure it melts at − 77° C. to a transparent and exceedingly mobile liquid, which boils at − 65° C. when the pressure is 181 cm. of mercury. The critical point of silicon tetrafluoride is − 1·5° C., and the critical pressure 50 atmospheres.—J. T. D.

Hydrogen Peroxide; Effect of "Poisons" on Decomposition of —— by Hæmase. G. Senter. Proc. Roy. Soc., 1904, **74**, 201—217.

Quantitative measurements have been made of the effects of various substances on the rate of decomposition of hydrogen peroxide by hæmase, an enzyme obtained from blood. The probable mechanism of the catalysis is discussed, and reasons are given for supposing that what is actually measured is "the rate of diffusion of hydrogen peroxide to the enzyme." The author prefers a chemical explanation of the action of these poisons to those already advanced. From the results obtained with acids and alkalis, as well as from the results of other observers, it is concluded that at least some enzymes are amphoteric substances, *i.e.*, substances which are neutral in aqueous solution, but can combine with either acids or alkalis to form salts.—T. H. P.

Formaldehyde; Formation of —— during the Combustion of Tobacco. A. Trillat. Comptes rend., 1904, **139**, 742—744.

Cigars, cigarettes, and tobacco in wooden and clay pipes were burnt, and the products of combustion examined for formaldehyde (compare this J., 1904, 744). Amounts varying from 0·05 to 0·12 per cent. of the weight of the

tobacco were found. The amount varies but little with the origin of the tobacco; that formed with a clay pipe is, as a rule, greater than that with a wooden pipe or from cigars or cigarettes—possibly owing to catalytic action of the hot clay surfaces. The formaldehyde seems to exist, not in the free state, but in combination with nicotine and other bases formed at the same time. The physiological effects of the aldehyde are no doubt modified on this account.
—J. T. D.

Rhodeose and Fucose; Enantiomorphism of ——. E. Votoček. Ber., 1904, **37**, 3859—3862.

The author has expressed the view (Ber., 1904, **37**, 306) that the sugar rhodeose, obtained by the hydrolysis of the glucoside convolvulin, and fucose, isolated by Tollens from plants of the *Fucus* species and also from tragacanth, are enantiomorphously related methylpentoses. Since then, Tollens has found that the melting point of fucosephenylosazone is 158°—159° C., whilst that of rhodeosephenylosazone is 176·5° C. The author now shows that the former of these melting points is incorrect, fucosephenylosazone melting at practically the same temperature as the rhodeose derivative, namely, 178°. The two phenylhydrazides of the monocarboxylic acids of rhodeose and fucose also have identical melting points. A mixture of equal amounts of the two sugars forms a true racemic compound, which is optically inactive, melts at 161°, and has a solubility in water less in the proportion of 1 : 5·4 than that of either of the components. This is the first known example of the natural occurrence of two enantiomorphously-related sugars. The view that nature only produces one member of an enantiomorphous pair of sugars is hence erroneous. The author shows that rhodeose really exists as such in convolvulin, and is not produced by the action of the baryta used for the hydrolysis.—T. H. P.

Isomeric Glucosides and Galactosides; Hydrolysis of —— *by Acids and Enzymes.* E. F. Armstrong. Proc. Roy. Soc., 1904, **74**, 188—194.

The suggestion, put forward by Bourquelot and Herissey, that the action of emulsin on milk sugar is due to the presence of small quantities of lactase, together with the emulsin proper, is improbable owing to the facts:—(1) That the curve expressing the rate at which milk sugar changes is not of the form to be expected if only a very small quantity of enzyme (lactase) were present, as then a linear expression should apply during the early stages; actually the curve is only of this form when small quantities of emulsin are used. (2) The action of emulsin on milk sugar is most retarded by dextrose and only to a slight extent by galactose, whereas the latter alone affects the action of lactase. (3) The curves for emulsin fall off very much more rapidly than those for lactase, showing that the action of the products in removing the enzyme is greater in the former case. It would seem, therefore, that emulsin is capable of acting on β-galactosides, as well as β-glucosides. With the α- and β-glucosides and the α- and β-galactosides, where the stereo-isomerism in each pair of compounds is confined to the terminal carbon atom, the β-compounds undergo hydrolysis by acids much more readily than the corresponding α-compounds. Further, on passing from a glucoside to the corresponding galactoside—involving a change in the general configuration at the fourth carbon atom affecting only the nature of the attachment of the oxygen atoms within the ring—a marked influence is exerted on the activity of the group associated with the terminal carbon atom, the galactoside being far more readily hydrolysable than the glucoside. Maltose is hydrolysed more rapidly by yeast extract than α-methylglucoside, and, in both cases, the velocity coefficient of the change diminishes as action proceeds, but to a far greater extent with maltose; the value of K for the latter is about six times as great as that for the glucoside. The hydrolysing activity of the enzyme is much greater than that of acids.—T. H. P.

Sucroclastic [*Hydrolytic*] *Actions of Acids and Enzymes; Contrast between the* ——. E. F. Armstrong and R. J. Caldwell. Proc. Roy. Soc., 1904, **74**, 195—201.

The authors have determined the effects produced on the value of the velocity constant of the hydrolysis of cane-sugar by hydrochloric acid by the addition of one or both of the products of hydrolysis or cane sugar itself. 100 c.c. of a 17·1 per cent. solution of cane-sugar, containing 0·5 grm.-molecule of hydrochloric acid were taken, and the following amounts of sugar added:—

Sugar added.	Mean Value of K.
9·0 grms. of glucose ...	12·53
9·0 „ „ levulose	12·30
9·0 „ „ invert sugar	12·42
8·55 „ „ cane sugar	12·45

It will be seen that about the same increase in the value of K (the velocity constant) is produced by equimolecular proportions of glucose and levulose, whilst the molecular effect of the biose cane sugar is about twice the molecular effect of the monose. The acceleration brought about by the addition of sugars may be attributed to a withdrawal of water by the sugar and the consequent increase in the amount of the "active system."—T. H. P.

New Books.

Oils and Fats: Their Uses and Applications. Cantor Lectures. Dr. J. Lewkowitsch, M.A., &c. William Trounce, 10, Gough Square, Fleet Street, London, E.C. 1904. Price 1*s.*

The author's four Cantor Lectures are embodied in this pamphlet, which contains 52 pages, with 28 illustrations and 18 tables. The matter is subdivided and classified as follows:—I. Extent of the Oil and Fat Industries. Sources of Supply. Raw Materials and Modern Methods of Manufacture. II. Methods of Refining. Industry of Edible Oils and Fats. III. Burning Oils. Paint Oils, Lubricating, Blown, and Boiled Oils. Linoleum Industry. Turkey-Red Oils. Hydrolysis of Fats. IV. Saponification Processes. Candle Industry. Soap Industry. Glycerin, and its Recovery from Soap Lyes. (See also this J., 1904, 1098.)

Application of Some General Reactions to Investigations in Organic Chemistry. By Dr. Lassar-Cohn, Professor of Organic Chemistry at the University of Königsberg. Translated by J. Bishop Tingle, Ph.D. First Edition. John Wiley and Sons, New York. Chapman and Hall, Ltd., London. 1904. Price 4*s.* 6*d.*

12mo volume, containing translator's and author's prefaces, and 95 pages of subject matter, also an alphabetical index. The purpose of the book is to discuss, in a systematic and generalised manner, the application of certain reactions and methods to investigations in Organic Chemistry. The divisions of the subject indicate generally the method adopted. I. Fixation of labile Hydrogen Atoms. II. Modification of Reactions. III. Improvement in the Conditions of Reaction. Overstrain of Reactions. IV. Influence of neighbouring Atoms and Atomic Complexes.

Chemisch-technische Untersuchungsmethoden. Mit Benutzung der früheren von Dr. Friedrich Böckmann bearbeiteten Auflagen, und unter Mitwirkung von E. Adam, F. Barnstein, Th. Beckert, O. Böttcher, C. Councler, K. Dieterich, K. Dümmler, A. Ebertz, C. v. Eckenbrecher, F. Fischer, F. Frank, H. Freudenberg, E. Gildemeister, R. Gnehm, O. Guttmann, E. Haselhoff, W. Herzberg, D. Holde, W. Jettel, H. Kohler, Ph. Kreiling, K. B. Lehmann, J. Lewkowitsch, C. J. Lintner, E. O. v. Lippmann, E. Marckwald, J. Messner, J. Passler, O. Pfeiffer, O. Pufahl, H. Rasch, O. Schluttig, C. Schoch, G. Schüle, L. Tietjens, K. Windisch, L. W. Winkler. Herausgegeben von Dr. Georg Lunge Professor der technischen Chemie am eidgenössischen Polytechnikum in Zürich. Zweiter Band. 5te, vollständig umgearbeitete und vermehrte Auflage. Julius Springer's Verlag, Berlin. 1905. Price M. 16; bound, M. 18.

Large 8vo volume, containing 842 pages of subject-matter, with 153 illustrations, and an appendix with eight pages of tables. The subject matter treated of in this second volume is as follows:—I. IRON (Th. Beckert) (i) Analysis of the Ores. (ii) Analysis of Iron. II. METALS OTHER THAN IRON (O. Pufahl): (i) Silver. (ii) Gold. (iii) Platinum. (iv) Mercury. (v) Copper. (vi) Lead. (vii) Bismuth. (viii) Tin. (ix) Arsenic. (x) Antimony. (xi) Zinc. (xii) Cadmium. (xiii) Nickel and Cobalt. (xiv) Manganese. (xv) Chromium. (xvi) Tungsten. (xvii) Uranium. (xviii) Molybdenum. (xix) Aluminium. (xx) Thorium. (xxi) Metallic Salts. III. ARTIFICIAL MANURES (O. Böttcher): (i) General Methods of Examining Artificial Manures. (ii) Special Methods for Examining Individual Manures. (iii) Methods for Examining Products and Raw Materials of the Manufacture of Manures in International Commerce. IV. FEEDING STUFFS (F. Barnstein). V. EXPLOSIVES (Oscar Guttmann). A. Raw Materials. B. Explosives. C. Tests of Stability and Thermal Effect. VI. DETONATORS (Wladimir Jettel): A. Raw Materials. B. Matches. VII. GAS MANUFACTURE. AMMONIA (Otto Pfeiffer). VIII. CALCIUM CARBIDE AND ACETYLENE (G. Lunge): A. Raw Materials. B. Calcium Carbide as a Trade Product. C. Acetylene. IX. COAL-TAR INDUSTRY (H. Köhler): (i) Properties and Composition of Coal-tar. (ii) Investigation of Coal-tar. (iii) Practical Process and Control. (iv) Final Products. X. INORGANIC COLOURING MATTERS (R. Gnehm): (i) Blue Colours. (ii) Yellow Colours. (iii) Green Colours. (iv) Red Colours. (v) Brown Colours. (vi) Black Colours. (vii) White Colours. (viii) Bronze Colours. (ix) Colour Lakes from Artificial Colours. (x) Ultramarine.

DIE FABRIKATION DER SODA NACH DEM AMMONIAKVERFAHREN. Von H. SCHREIB. Julius Springer's Verlag, Berlin. 1905. Price M. 9.

8vo volume, containing 312 pages of subject-matter, and a series of three tables, filled with plans of apparatus and plant relating to the Ammonia-Soda Industry. The text is classified on the following lines:—I. Introduction: Development of the Ammonia-Soda Industry. II. Burning the Lime and Recovering the Carbon Dioxide liberated. III. Preparing the Ammoniacal Solution of Common Salt. IV. Precipitation of the Sodium Bicarbonate. V. Separating the Sodium Bicarbonate from the Mother Liquors, or Filtration. VI. Decomposing the Sodium Bicarbonate into Sodium Carbonate and Carbon Dioxide, or Calcining. VII. Regenerating or Distilling the Ammonia. VIII. Treatment and Utilisation of the Spent Liquors. IX. Calculating the Power required for the Manufacture of Ammonia-Soda. X. Materials required and Costs of Preparation of the Ammonia-Soda. XI. Review of Manufacturing Method, &c.

DIE DARSTELLUNG DES ZINKS AUF ELEKTROLYTISCHEM WEGE. Von Dr. ing. EMIL GÜNTHER. Wilhelm Knapp's Verlag, Halle a. S. 1904. Price M. 10.

THIS forms one of a series of monographs on applied electricity, and takes the form of an 8vo volume, containing dedication, preface, 241 pages of subject-matter, with 59 illustrations, and an alphabetical index of names and subjects. The matter is classified as follows:—I. Properties of Zinc. Production. Uses. Occurrence. Extraction by Metallurgical Methods. Review of Extraction by Electrochemical Methods. II. Electrolysis of Aqueous Solutions. Obtaining Zinc from Mixed Ores. Obtaining Zinc Chloride. The Hoepfner Process. III. Electrolysis of fused Zinc Salts. Appendix. Calculation and Comparison of Costs.

Trade Report.

I.—GENERAL.

THE PATENT RULES, 1905.

Statutory Rules and Orders, 1904. *No.* 1652. *Dated Oct.* 20, 1904.

By virtue of the provisions of the Patents, Designs, and Trade Marks Acts, 1883 to 1902, the Board of Trade do hereby make the following rules:—

Short Title.

1. These rules may be cited as the Patents Rules, 1905.

Commencement.

2. These rules shall come into operation from and immediately after the 31st day of December, 1904.

Interpretation.

3. In the construction of these rules, any words herein used defined by the said Acts, shall have the meanings thereby assigned to them respectively.

Applications for Patents.

4. The statement of the invention claimed, with which a complete specification must end, shall be clear and succinct as well as separate and distinct from the body of the specification.

5. For Rule 9 of the Patents Rules, 1903, the following rule shall be substituted:—

When a specification comprises several distinct matters, they shall not be deemed to constitute one invention by reason only that they are all applicable to or may form parts of an existing machine, apparatus, or process.

Where a person making application for a patent has included in his specification more than one invention, the Comptroller may require or allow him to amend such application and specification and drawings or any of them so as to apply to one invention only, and the applicant may make application for a separate patent for any invention excluded by such amendment.

Every such last-mentioned application may, if the Comptroller at any time so direct, bear the date of the original application, or such date between the date of the original application and the date of the application in question, as the Comptroller may direct, and shall otherwise be proceeded with as a substantive application in the manner prescribed by the said Acts and by any rules thereunder for the time being in force.

Where the Comptroller has required or allowed any application, specification, or drawings to be amended as aforesaid, such application shall, if the Comptroller at any time so direct, bear such date, subsequent to the original date of the application and not later than the date when the amendment was made, as the Comptroller shall consider reasonably necessary to give sufficient time for the subsequent procedure relating to such application.

Procedure under Section 1 *of the Patents Act*, 1902.

6. If after the leaving of any complete specification the examiner reports that the nature of the invention is not sufficiently disclosed and defined to enable him to make the investigation prescribed by subsection 1, and the Comptroller has required amendment of the specification and drawings, or either of them, the application shall, if the Comptroller at any time so direct, bear such date, subsequent to its original date and not later than the date when the requirement is complied with, as the Comptroller may consider reasonably necessary to give sufficient time for the subsequent procedure relating to such application.

7. When the Examiner in prosecution of the investigation prescribed by subsection 1, finds that the invention claimed in the specification under examination has been wholly claimed or described in one or more specifications within the meaning of the subsection in question,

he shall, without any further prosecution of the investigation, make a provisional report to that effect to the Comptroller.

If the provisional report of the Examiner made under this Rule be not revised or altered, it shall be deemed a final report, and the application shall be dealt with as provided by subsection 6. If, however, such provisional report be reversed or altered, the investigation prescribed by subsection 1 shall be continued, and a further report shall be made to the Comptroller, and the specification shall be dealt with as provided in subsection 5 or subsection 6, as the case may require.

8. The time within which an applicant may leave his amended specification under subsection 2 shall be two months from the date of the letter informing him that the invention claimed has been wholly or in part claimed or described in any specification or specifications within the meaning of subsection 1.

In any special case the Comptroller may, if he think fit, enlarge the time prescribed by this Rule.

9. When the applicant for a patent has been informed of the result of the investigation of the examiner, made under the provisions of subsection 1, and the time allowed by Rule 8 for amendment of his specification has expired, the Comptroller, if he is not satisfied that no objection exists to the specification on the ground that the invention claimed therein has been wholly or in part claimed or described in a previous specification within the meaning of that subsection, shall inform the applicant accordingly, and appoint a time for hearing him, and shall give him ten days' notice at the least of such appointment. The applicant shall, as soon as possible, notify the Comptroller whether or not he desires to be heard. The Comptroller shall, after hearing the applicant, or without a hearing, if the applicant has not attended a hearing appointed or has notified that he does not desire to be heard, determine whether reference ought to be made in the applicant's specification to any, and, if so, what, prior specification or specifications by way of notice to the public.

10. When under subsection 6 the Comptroller determines that a reference to a prior specification ought to be made by way of notice to the public, the form of reference shall be as follows, and shall be inserted after the claims :—

Reference has been directed in pursuance of section 1, subsection 6, of the Patents Act, 1902, to the following specification of Letters Patent No. , granted to .

Where the reference is inserted as the result of a provisional report under Rule 7, a statement to that effect shall be added to the reference.

Appeal.

11. Every decision of the Comptroller under the foregoing Rules shall be subject to an appeal to the law officer.

Sealing of Patent and Payment of Fee.

12. If the applicant for a patent desires to have a patent sealed on his application, he must, on or before the last day on which a patent can lawfully be sealed, pay the prescribed sealing fee ; and if such fee be not paid, no patent shall be sealed.

The prescribed sealing fee should be paid by leaving, at the Patent Office, Form X. in the Second Schedule to these Rules, duly stamped.

Fees.

13. To the fees specified in the First Schedule to the Patents Rules, 1903, shall be added the fee specified in the First Schedule hereto.

Forms.

14. To the forms contained in the Second Schedule to the Patent Rules, 1903, shall be added the Form X. contained in the Second Schedule hereto; and in the Form C, contained in the first-mentioned Schedule the following direction shall be added in a marginal note, namely :—" In the preparation of the claim or claims, careful attention should be paid to the terms of Rule 4 of the Patents Rules, 1905. Any unnecessary multiplicity of claims or prolixity of language should be avoided."

Size, &c. of Documents.

15. For Rule 17 of the Patents Rules, 1903, the following Rule shall be substituted : —

All documents and copies of documents, except drawings, sent to or left at the Patent Office or otherwise furnished to to the Comptroller or to the Board of Trade shall be written, type-written, lithographed, or printed in the English language (unless otherwise directed) in large and legible characters with deep permanent ink upon strong white paper, and, except in the case of statutory declarations and affidavits, on one side only, of a size of approximately 13 ins. by 8 ins., leaving a margin of at least one inch and a half on the left-hand part thereof, and the signatures thereto must be written in a large and legible hand. Duplicate documents shall at any time be left, if required by the Comptroller.

At the top of the first page of a specification a space of about 2 ins. should be left blank.

Drawings accompanying Specifications.

16. For Rules 18 to 24 of the Patents Rules, 1903, the following Rules shall be substituted :—

As the drawings are printed by a photolithographic process, the character of each original drawing must be brought as nearly as possible to a uniform standard of excellence, suited to the requirements of such process, and calculated to give the best results in the interests of inventors, of the Office, and of the public. The following requirements should, therefore, be strictly observed, as non-compliance therewith will be certain to cause delay in the progress of an application for a patent.

17. Drawings, when furnished, should accompany the provisional or complete specification to which they refer, except in the case provided for by Rule 24. No drawing or sketch such as would require the preparation for the printer of a special illustration for use in the letterpress of the specification when printed should appear in the specification itself.

18. Drawings may be made by hand or lithographed, printed, &c. They must be made on pure white, hot-pressed, rolled, or calendered strong paper of smooth surface, good quality, and medium thickness without washes or colours, in such a way as to admit of being clearly reproduced on a reduced scale by photography. Mounted drawings must not be used.

19. Drawings must be on sheets which measure 13 ins. from top to bottom, and are either from 8 ins. to $8\frac{1}{4}$ ins. or from 16 ins. to $16\frac{1}{2}$ ins. wide, the narrower sheets being preferable.

If there are more figures than can be shown on one of the smaller sized sheets, two or more of these sheets should be used in preference to employing the larger size. When an exceptionally large drawing is required, it should be continued on subsequent sheets. There is no limit to the number of sheets that may be sent in, but no more sheets should be employed than are necessary, and the figures should be numbered consecutively throughout and without regard to the number of sheets. The figures should not be more numerous than is absolutely necessary. They should be separated by a sufficient space to keep them distinct.

20. Drawings must be prepared in accordance with the following requirements :—

(*a*) They must be executed with absolutely black ink.

(*b*) Each line must be firmly and evenly drawn, sharply defined, and of the same strength throughout.

(*c*) Section lines, lines for effect, and shading lines should be as few as possible, and must not be closely drawn.

(*d*) Shade lines must not contrast too much in thickness with the general lines of the drawing.

(*e*) Sections and shading should not be represented by solid black or washes.

(*f*) They should be on a scale sufficiently large to show the invention clearly, and only so much of the apparatus, machine, &c., should appear as effects this purpose. If the scale is given, it should be drawn, and not denoted by words.

Reference letters and figures, and index numerals used in conjunction therewith, must be bold, distinct, and not less than one-eighth of an inch in height. The same letters should be used in different views of the same parts. Where the reference letters are shown outside the figure, they must be connected with the parts referred to by fine lines.

21. Drawings must bear the name of the applicant (and, in the case of drawings left with a complete specification after a provisional specification, the number and year of the application) in the left-hand top corner; the number of sheets of drawings sent, and the consecutive number of each sheet, in the right-hand top corner; and the signature of the applicant or his agent in the right-hand bottom corner. Neither the title of the invention nor any descriptive matter should appear on the drawings.

22. A facsimile or "true copy" of the original drawings must be filed at the same time as the original drawings, prepared strictly in accordance with the above rules, except that it may be on tracing cloth and the reference letters and figures should be in black-lead pencil.

The words "original" or "true copy" must in each case be marked at the right-hand top corner, under the numbering of the sheet.

23. Drawings must be delivered at the Patent Office so as to be free from folds, breaks, or creases, which would render them unsuitable for reproduction by photography.

24. If an applicant desires to adopt the drawings lodged with his provisional specification as the drawings for his complete specification, he should refer to them in the complete specification as those left with the provisional specification.

Dated the 20th day of October, 1904.

G. W. Balfour,
President of the Board of Trade.

The First Schedule.

Fee Payable on Sealing of Patent.

	£	s.	d.
13a. On sealing of patent; in respect of each application	1	0	0

G. W. Balfour,
President of the Board of Trade.

20th October 1904.

The Second Schedule prescribes the Form of Notice of Desire to have Patent Sealed. (Form X.)

Greece; Trade of ——.

Foreign Office Annual Series, No. 3302.

The following table gives the values, and, where obtainable, the quantities of certain Grecian imports and exports during the years 1902–3 :—

Articles.		Imports. 1902. Quantity.	Imports. 1902. Value.	Imports. 1903. Quantity.	Imports. 1903. Value.	Exports. 1902. Quantity.	Exports. 1902. Value.	Exports. 1903. Quantity.	Exports. 1903. Value.
			£		£		£		£
Oil, olives, &c.	Cwts.	..	49,368	235,389	117,869	..	308,359	189,776	197,278
Dyes and tanning material..........	..	..	25,735	32,811	26,972	..	843	1,020	626
Coal	Tons	193,952	372,888	232,446	363,848	..	..	..	..
Ores and marbles, raw, including emery	"	..	257,046	27,833	213,175	..	759,387	523,715	738,034
Medicines, chemicals, &c.	Cwts.	..	277,506	175,576	288,640	..	25,057	13,012	36,762
Hides and bones, manufactured.....	..	..	51,456	2,992	43,408	..	13,087	1,028	13,092
Sugar, &c................................	..	..	123,448	162,046	114,874	..	33,580	4,321	16,486
Wine and spirituous liquors.........	Galls.	101,313	20,138	124,951	17,417	4,239,403	211,855	10,435,819	159,459
Crockery and glass	Cwts.	58,138	68,479	61,334	75,902	..	1,914	1,415	1,176
Ores and marbles, manufactured (including gold and silver)	Tons	..	297,738	..	293,382	..	69,537	..	51,959
Paper, printed paper, &c.	Cwts.	..	149,238	70,445	125,008	..	953	123	1,104

III.—TAR PRODUCTS, PETROLEUM, Etc.

Oil Fields of India; Development of the ——.

U.S. Cons. Rep., No. 2104, Nov. 10, 1904.

During the fiscal year ended March 31, 1904, the importation of kerosene oil into India fell off nearly 10,000,000 galls. During the preceding year there was an almost identical decline, so that, compared with the fiscal year 1901–2, the reduction was nearly 20,000,000 galls., equal to 21·7 per cent. The decline in the import of Russian oil was 19·4 per cent. and of American oil 27 per cent. The rapid development of the Indian oil fields has caused this decreased import. The Indian oil is not yet of as good quality as most of the imported oil, but its cheapness secures it a market. American oil, it is said, has security for a limited market in its superior quality, but keen competition among all the common grades seems assured.

Petroleum Production; Decline in Russian ——.

Bd. of Trade J., Nov. 17, 1904.

The production of petroleum in Russia has diminished from 85 million barrels in 1901 to 75 million barrels in 1903. In 1902 Russia's share in the world's production was 43·5 per cent., and in 1903, 38·7 per cent. This decline is attributed to the lack of proper organisation, and to the frequent and disastrous fires at Baku.

VII.—ACIDS, ALKALIS, Etc.

Sodium Nitrate; Reasons for Advanced Prices of ——.

Montgomery and Co., London.

The following reasons are given for the continued advance in price of sodium nitrate :—(1) Partial failure of the sugar-beet crop on the Continent, causing a considerable rise in price of sugar. (2) Decreased shipments of nitrate from Chili during the last two months; these are not in keeping with the quantity permitted by the combination agreement, whence it is feared that the maximum quotas will not be nearly reached, which would probably result in a scarcity during the coming agricultural season.

Bauxite in the United States.

Eng. and Mining J., Nov. 10, 1904.

According to the Geological Survey, the quantity of bauxite produced in the United States last year was 48,087 long tons, an increase of 18,865 tons over the previous year. During the year the Pittsburg Reduction Company completed its mining plant at Bauxite, Ark., and a refining plant at East St. Louis. At the present time, Georgia, Alabama, and Arkansas, in the order of their outputs, furnish the total supply of bauxite in the United States. The mineral occurs in other States, notably North Carolina and South Carolina, but the deposits are not of sufficient extent or purity to be of commercial value.

Sulphur Combination; Progress of the Anglo-Sicilian ——.

Eng. and Mining J., Nov. 10, 1904.

In 1897, the first fiscal year of the sulphur combination, exports from Sicily showed an increase of over 16 per cent., resulting in a net profit of 49,350*l.*, or about 6*s.* per ton on the business done by the Anglo-Sicilian Company. Three years later, in 1900, when the high record in exports was established at 557,668 tons, the profits of the company were more than doubled. In the fiscal year ended July 31, 1904, the net profits were the largest yet, amounting to 158,430*l.* From profits earned during the eight years from 1897 to 1904 inclusive, the company paid annually a regular dividend of 6 per cent. on its 700,000*l.* preferred stock, and sometimes made an extra distribution; and in 1903 and 1904 declared a total of 100 per cent. on the 35,000*l.* common stock. At the same time there was accumulated 397,680*l.* in reserve funds, of which 144,900*l.* is held against any depreciation of stocks of sulphur, an amount equivalent to 9*s.* 10*d.* per ton on the 293,188 tons at the seaports in Sicily on July 31, 1904.

In the eight years under review the exports from Sicily to the United States aggregated 1,122,241 tons, which constituted about one third of the total exported to all countries. These imports, duty free, supplied about 36 per cent. of the consumption in America in the form of brimstone or sulphur recovered from pyrites.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Stone Industry of the United States.

Bd. of Trade J., Nov. 24, 1904.

The figures collected by the Geological Survey put the value of the stone quarried in the United States in 1903 at 73,384,200 dols., an increase of 3,553,649 dols. over 1903, in spite of troubles in the building trades. The values of the output of the different kinds of stone are as follows:—

—	1902.	1903.
	Dollars.	Dollars.
Granite	16,076,787	15,703,793
Trap rock	2,181,157	2,732,294
Sandstone	9,437,646	9,482,802
Blue stone	1,163,525	1,779,457
Marble	5,041,182	5,362,686
Limestone for building	24,959,751	26,642,551
„ flux	5,271,252	5,123,732
Slate	5,696,051	6,256,885

Pennsylvania surpassed all other States in the product of its quarries during 1903. The value of its stone amounted to 13,913,220 dols. Second on the list is Vermont, with a value of 6,605,060 dols. New York is third, with a stone product valued at 5,742,833 dols., and Ohio is fourth, with a product worth 5,114,051 dols. The production of every other State was considerably less.

X.—METALLURGY.

Egypt; Revised Tariff Valuation for Metals and Metal Manufactures.

Bd. of Trade J., Nov. 24, 1904.

According to the *Journal Officiel* of Nov. 2, the valuation tariff for metals and manufactures of metal has been revised. Copper, in all forms except wire, is rated at an increase of 2 milliềmes* per kilo.; tin and zinc are also increased, the former 5 mill., the latter ½ mill. per kilo. Manufactures of iron and steel are valued at slightly reduced rates in some cases, others remaining stationary. Other metals and manufactures are unaffected by this revision. The rate of duty remains at 8 per cent. *ad val.*

Pig-Iron Production of Russia. First Half of 1903.

Bd. of Trade J., Nov. 24, 1904.

The following statistics of the production of pig-iron in Russia during the first six months of 1904 are taken from the *Messenger of Finance* (St. Petersburg) of the 24th October/6th November:—South Russia, 54,229,726 pouds; Ural, 21,344,248; Moscow District, 3,193,799; North Russia, 416,408; Poland, 10,943,493; Total, 90,157,674 pouds.

Comparative figures for the first six months of 1903 are not available, but the following statistics of the production of pig-iron during the past four years are published by the *Messenger*:—1900, 177,518,615 pouds; 1901, 172,778,274; 1902, 156,496,981; 1903, 149,154,927 pouds. The production for 1904 is estimated at 180,000,000 pouds. (Poud = 36 lb.)

Platinum; Reduction in the Price of ——.

Bd. of Trade J., Nov. 24, 1904.

The *Journal de St. Pétersbourg* states that, although the price of platinum is quoted at 14,500 roubles per poud, the actual price obtained for this metal by the mine owners in the Ural District is considerably less. One large proprietor sells platinum at 11,351 roubles per poud, while another has recently entered into a contract with an American firm for the sale of the whole output of the Taghilsk mines for the next ten years at rate of 10,000 roubles per poud, or about 29*l.* per lb.

XII.—FATS, FATTY OILS, Etc.

Insect White Wax; Production of —— in Szuch'uan, China.

Bd. of Trade J., Nov. 17, 1904.

The annual production of insect white wax in Szuch'uan varies with the climatic conditions. Wind and rain are destructive to the insects. During the present year the rains have been exceptionally continuous and heavy; the estimated output of the Chia-ting Prefecture is 58,125 piculs. The price of each picul is T.45, so that the total value of the Chia-ting production is T.2,250,000. Ch'êngtu is credited with an annual consumption of 1000 piculs. Other parts of Szuch'uan yield small quantities of white wax, but they are too insignificant to be of any commercial importance. The wax is mainly used in candle making and paper-glazing.

XIII. B.—RESINS, VARNISHES, Etc.

Turpentine in India.

Chem. and Druggist, Nov. 19, 1904.

The turpentine industry in India is confined to the pine forests of the Himalayas in the United Provinces (formerly called the North-West Provinces) and the Punjab. In the United Provinces the first distillery was erected in the Imperial Forest School, Dehra Dun, in 1881. The crude turpentine is collected from the Chir pine (*Pinus longifolia*) in Jaunsar and the leased forests of the Tehri-Garhwal, chiefly at Daragadh, Ninur, Obra, Sangared, and the Mantar and Sunar working circles. The trees are tapped soon after the rains are over in October, and cuts or "blazes" are made in the stem, at the base of which pots are placed to catch the exuding resin. In the lower forests of Kumaon the oleoresin begins to flow in March, and as the warm weather advances the flow increases, the greatest amount being obtained in June. One disadvantage of the factory at Dehra Dun is that it is situated more than 100 miles away from the forests, and the oleoresin has to be be brought partly by pack animals and partly by country carts. The cost of the crude resin is R. 1·1 to R. 1·11 per maund of 82·6 lb. The distillation is carried on during the greater part of the year, and five large copper stills are capable of treating 10 maunds per day. In 1900–01, 1701 maunds were distilled, in 1901–2 1628 maunds, and in 1902–3, 1602 maunds. The crude oleoresin yields from 72 to 77 per cent. of resin or colophony and from 14 to 18 per

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* 1000 milliềmes = £E 1 = £1 0*s.* 6*d.*

cent. of turpentine oil. Until three years ago the works at Dehra Dun were running at a profit, but recently there has been a loss on account of the prices of colophony falling from Rs. 5·2 to Rs. 2·7 per maund, and the larger quantities placed on the local markets by the Forest Department in other districts. The Conservator in his report for 1902–3 reviews the financial results of the whole undertaking from the year 1888–9, when the work was started. The total receipts were Rs. 79,417; capital and working expenses, Rs. 81,033; value of buildings, apparatus, and stock in hand, Rs. 15,252, leaving a surplus of Rs. 13,636. In 1895 arrangements were made for the introduction of the turpentine industry in Naini Tal, where the proximity to the railway and the shorter distance the material would have to traverse were important considerations. In the report for 1900–1 the manufacture of turpentine and colophony was pronounced a success, the prices realised were equal to those obtained for the imported article, and no difficulty was experienced in disposing of the outturn. During the year 22,267 trees were tapped, yielding 1154 maunds of oleoresin, which is equal to about 5 lb. per tree. The output of the factory was 1625 galls. of turpentine and 817 maunds of colophony, and the profit of the year's working was Rs. 5765. The next year the manufacture was prosecuted with greater success. Improvements were made in the factory; 38,632 trees were tapped, affording 2711 maunds of oleoresin. The output was 2204 gals. of turpentine and 1084 maunds of colophony, and a substantial profit remained at the close of the year. During 1902–3, on account of the additional still and the larger demand for the products, the manufacture was more than doubled, 42,979 trees being tapped, yielding 2989 maunds of oleoresin. The profit at the end of the year was Rs. 4467. The results were considered most satisfactory, allowing, as they did, for the low market value of the colophony, which fell from Rs. 5 to Rs. 2·12. The third factory was established in 1899 in Nurpur, in the Kangra Division, Punjab. It is estimated that the possible yield of the resin in the Kangra forests within reach of the distillery is 10,000 maunds, which should produce 15,000 gals. of turpentine and 7500 maunds of colophony. Reductions on the freight for the oil and resin have been obtained, and it is hoped these concessions will enable the product to compete with the imported article as far as the seaports. The resin tapping and distillery operations have continued to be a success from the commencement, and economies have been practised in the extraction of the resin from the forests and the working of the distillery at Nurpur. The whole of the turpentine is readily disposed of, and over 3000 maunds of colophony are sold regularly to local merchants. Last year it was reported that a purchaser had been found for all the colophony made. The price obtained was considered low (Rs. 3·10 in Calcutta).

XVI.—SUGAR, STARCH, Etc.

Sugar Industry of Greece.

Foreign Office Annual Series, No. 3302.

The cultivation of the sugar beet was started in Thessaly some 12 years ago, and is making headway against the difficulties which attend the introduction of a new and difficult industry.

On a property favourably situated as regards water supply on the edge of the Thessalian plain and under the Pindus mountain range, M. Zographos sows yearly 1,500 acres of beet. The land has been gradually brought into a constantly improving state of fertility, yielding at present 8,000 kilos. per acre. To convert the beets into sugar a large factory has been established, which produces sugar of a satisfactory quality, though not quite as white as that imported from abroad. This defect, however, it is hoped to remedy by improved machinery. The sugar finds a ready sale in the country at a price slightly below that of the imported article.

The amount produced last year was about 1,250,000 kilos. (about 2,750,000 lb.), and the enterprise paid its expenses for the first time. With the constantly increasing yield of beets per acre, as the fertility of the land increases, it is hoped to realise substantial profits.

With a perhaps erroneous idea of the profits realised from the undertaking, the Government proposed at the beginning of the year 1904 to impose an excise duty of 50 lepta per oke on home-produced sugar. In deference to well-founded representations the idea appears to have been dropped, at any rate for the present.

M. Zographos sometimes employs as many as 1,500 hands. The chief difficulties to be contended with consist in the frequently-prevailing drought, an evil which extensive irrigation does not altogether remedy, and in the difficulty of disposing to advantage of the by-products, since their conversion into alcohol is prohibited in the interests of the currant and grape producers, and there is little scope for their use as food for cattle, there being few cattle to feed or fatten.

Gum Arabic from the Sudan, Egypt.

U.S. Cons. Reps., Nos. 2102, *Nov.* 8, 1904.

The gum arabic trade of the Sudan shows an enormous increase during the last few months. In July, 1904, the exports were 2,318,778 pounds, valued at 23,396*l.* Of this amount, the United States took 3,531*l.* worth. The price of gum is very low, but is now advancing, having risen to 31 cents a pound.

There were exported from Egypt 4,160,100 pounds in 1899, 6,042,050 pounds in 1900, 16,937,550 pounds in 1901, 21,791,000 pounds in 1902, and 18,939,747 pounds in 1903.

All Sudanese products are under a great disadvantage from the present high freight charges in the Nile Valley. It is believed that the new railway from Berber to the Red Sea will materially reduce this expense. The gum from Senegal is admitted duty-free into France, since Senegal is a French colony.

Gum is gathered in the forests of the Sudan and is brought to Omdurman, opposite Khartoum, and is there packed, weighed, and forwarded to Cairo, or to one of the seaports. There are at present three grades of gum recognised by the Sudan government. The first is the "kashab genuine gedaref." This pays to the government a royalty of 13*s.* 2*d.* per 99·05 pounds. The second grade, the "gezira," pays 9*s.* 3*d.*, and the third, the "talh," pays 5*s.* 2*d.* per 99·05 pounds. The first quality is soft and white in colour, and is valued in Europe at 10 to 12 per cent. more than the second grade, which is hard and reddish in colour. The gum of this second quality is packed in parcels of from 370 to 385 pounds, and is shipped in double sacks. The first grade, which is bought chiefly by chemists and druggists, is packed in wooden cases of 100 pounds each.

A very recent decree of the Sudanese government has fixed the highest duty which can be levied on gum at 20 per cent. *ad valorem*, but it has not yet arranged the sliding scale on the inferior qualities.

The trade in Egypt is chiefly in the hands of a few merchants of Cairo and Alexandria, who forward the gum to their agents in large consignments. These agents, as they sell the gum, forward the proceeds to their principals and retain a small commission of from 2 to 2½ per cent.

Beet Crop and Estimated Sugar Production of Russia.

Bd. of Trade J., Nov. 17, 1904.

According to the latest reports, the beet crop of Russia up to the 16th October amounted to 4·8 million tons, which should produce 625,000 tons of sugar. As 76 sugar refineries have not sent in their reports, and according to the yield of the beet fields per acre a further crop of 1·5 million tons is counted on, the total production of sugar in Russia for next season is estimated at about 820,000 tons.

XVII.—BREWING, WINES, SPIRITS, Etc.

Tartaric Materials: Exports of —— from Italy.

Bd. of Trade J., Nov. 24, 1904.

The following statement shows the export of tartar materials from the Italian continent during the period 1st October 1903 to 30th September 1904.

To	Half-refined Argols.	Vinaccia Argols.	Crude Argols.	Wine Lees.	Total.
	Tons.	Tons.	Tons.	Tons.	Tons.
United Kingdom ..	136½	1,000	150	100	1,386½
Germany	319	..	182	135	636
France	157½	..	10	1,990	2,157½
United States......	3½	894	2,462	100	3,459½
Austria and sundries	52	1,083½	312	1,383	2,830½
Total { Tons ..	668½	2,977½	3,116	3,708	10,470
Total { Value £	40,100	157,800	152,700	85,800	436,400

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 24,641. White, Cobbold, and McNeal. Slime and sediment extractors.* Nov. 14.

„ 24,670. Imray (Meister, Lucius und Brüning). Extraction of water or other liquid from mineral, vegetable, and animal substances. Nov. 14.

„ 24,686. Lillie. Evaporating apparatus.* Nov. 14.

„ 24,785. Wilton and Wilton. Furnaces. Nov. 15.

„ 24,826. Mavor. Means for heating chambers used in the process of manufacturing linoleum, coated fabrics, and the like, and in the construction of gas furnaces. Nov. 16.

„ 24,870. Southworth. Apparatus for condensing liquids especially adapted for removing the albuminous matter from serum, &c.* Nov. 16.

„ 24,903. Capell. Washing gases and apparatus therefor. Nov. 16.

„ 24,986. Sugg. Apparatus for pressing gas. Nov. 17.

„ 25,079. Kunick. *See under* XVIII. A.

„ 25,204. Macquisten. Method of separating solid particles from each other, and apparatus therefor. Nov. 19.

„ 25,213. Mathys (Gayley). Method of treating gases. Nov. 19.

„ 25,216. Mackenzie (Lloyd). Apparatus for making solutions.* Nov. 19.

„ 25,272. Dunton. Apparatus for circulating liquids in tanks. [U.S. Appl., Nov. 25. 1903.]* Nov. 21.

„ 25,310. Rappel. Protected earthenware cocks for use with acids, lyes, and the like.* Nov. 21.

„ 25,414. Lang. *See under* VIII.

„ 25,507. Blundell. Furnaces. Nov. 23.

„ 25,601. Stavenhagen and Geiler. Process of and apparatus for manufacturing filter bodies. Nov. 24.

[C.S.] 25,589 (1903). Sewell. Evaporating apparatus. Nov. 30.

„ 967 (1904). Murphy. Apparatus for indicating the temperature of kilns or other hot-air chambers used in drying hair and like material. Nov. 23.

„ 1144 (1904). Parkes. Process and apparatus for evaporating gelatinous and the like solutions. Nov. 30.

[C.S.] 1694 (1904). Morgan Crucible Co., Ltd., and Fox. Muffles. Nov. 30.

„ 3490 (1904). Branson. Apparatus for measuring quantities of highly volatile liquids. Nov. 23.

„ 16,316 (1904). Hantke. Process and appliance for raising liquids by means of compressed air. Nov. 23.

„ 21,776 (1904). Dodge. Gas and air mixing apparatus. Nov. 23.

„ 22,469 (1904). Howl, Wood, and Wright. Forced draught furnaces and the like. Nov. 30.

II.—FUEL, GAS, AND LIGHT.

[A.] 24,694. Nusch (Mortimer-Sterling). Incandescent light mantles.* Nov. 14.

„ 24,787. Spencer. Regenerative furnaces for gas retorts, &c. Nov. 15.

„ 24,826. Mavor. *See under* I.

„ 24,975. Bennet. *See under* XXIII.

„ 24,987. Newton (Bayer and Co.). Flash light. Nov. 17.

„ 25,404. Marconnet. Process of and apparatus for producing gas from pulverisable fuel. [Fr. Appl., Dec. 8, 1903.]* Nov. 22.

„ 25,527. Koppers. Coke furnaces.* Nov. 23.

[C.S.] 25,698 (1903). Ladd. Bodies adapted for lighting purposes and rendered incandescent by heat or electricity. Nov. 23.

„ 27,496 (1903). Mond. Gas producers. Nov. 23.

„ 753 (1904). Johnson and McKean. Mantles of incandescent gas burners. Nov. 23.

„ 966 (1904). Feld. Treatment of coal gas and other gases containing ammonia and cyanogen for the extraction of ammonia and cyanogen therefrom, and the partial regeneration of the agents employed in the extraction. Nov. 30.

„ 3136 (1904). Conti and Levy. Manufacture of fuel briquettes. Nov. 30.

„ 6972 (1904). Gerard and Fiedler. Electrodes for arc lights. Nov. 23.

„ 22,092 (1904). Robson. Gas producers. Nov. 23.

„ 22,815 (1904). Boult (Cie. pour la Fabrication des Compteurs et Matérial d'Usines à Gaz). Gas purifiers. Nov. 30.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 24,840. Macknight. *See under* VII.

[C.S.] 1881 (1904). Schulze and Chem. Fabr. Ladenburg. Manufacture of *m*-cresol from crude cresol. Nov. 30.

„ 22,238 (1904). Koellner. *See under* XII.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 24,669. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of 1.6- or 1.7-arylnaphthylaminesulphonic acid. Nov. 14.

„ 24,840. Macknight. *See under* VII.

„ 24,869. Newton (Bayer and Co.). Manufacture of anthraquinone derivatives. Nov. 16.

„ 25,505. Lake (Oehler). Manufacture of chloronitranisol.* Nov. 23.

„ 25,506. Lake (Oehler). Manufacture of sulphur dyes. Nov. 23.

[C.S.] 1581 (1904). Lake (Oehler). Manufacture of colouring matters. Nov. 23.

„ 3108 (1904). Johnson (Badische Anilin und Soda Fabrik). Preparation of indigo paste for direct use in the fermentation vat. Nov. 30.

„ 4998 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Nov. 30.

[C.S.] 13,941 (1904). Lake (Oehler). Manufacture of mordant dyes. Nov. 30.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 24,630. Tomlinson (Haas). Apparatus for treating materials with air or other gases for drying, bleaching, conditioning, or other purposes. Nov. 14.

„ 24,826. Mavor. *See under* I.

„ 24,995. Thomson, Shearer, and O'Brien. Process for retting flax. Nov. 17.

„ 25,165. Calico Printers' Association, Ltd., and Warr. Mordanting vegetable fibres for dyeing and printing. Nov. 19.

„ 25,166. Calico Printers' Association, Ltd., and Warr. Treating vegetable fibres to render them less inflammable. Nov. 19.

„ 25,167. Calico Printers' Association, Ltd., and Warr. Treating vegetable fibres to render them less inflammable. Nov. 19.

„ 25,208. Détré. Apparatus for subjecting textile or other materials or substances to the action of liquids under pressure for dyeing, mordanting, bleaching, washing, exhausting, extracting, or performing other operations thereon.* Nov. 19.

„ 25,252. Spears. Method of printing textile fabrics, paper, and other materials. Nov. 21.

„ 25,284. Johnson (Badische Anilin und Soda Fabrik). The discharge of dyed textile fabrics. Nov. 21.

„ 25,296. Todtenhaupt. Process for the preparation of artificial silk or hair. Nov. 21.

„ 25,702. Watson. Means for the manufacture of fibrous fireproof sheet.* Nov. 25.

„ 25,703. Scharmann. Apparatus for treating textile fabrics and other goods with liquids. [Fr. Appl., Feb. 26, 1904.]* Nov. 25.

„ 25,704. Scharmann. Apparatus for treating textile fabrics and other goods with liquids. [Fr. Appl., Feb. 26, 1904.]* Nov. 25.

„ 25,728. Howorth (Soc. Anon. Cooperativa Per La Stagionatura E. L'Assaggio Delle Sete ed Affini). Processes for dyeing or charging silks with tin compounds.* Nov. 25.

[C.S.] 25,000 (1903). Wright, Poulson, and Mackintosh. Manufacture of compounds for waterproofing textile and other fabrics, string, ropes, and the like, and apparatus therefor. Nov. 23.

„ 1466 (1904). Smith and Schute. Cylinders used in treating or cleansing wool, hair, and other fibres. Nov. 30.

„ 4626 (1904). Norton and Hellewell. Means for and method of treating or finishing pile fabrics. Nov. 30.

„ 19,007 (1904). Barbour and Montgomery. Preparing machinery for flax, hemp, and similar fibres. Nov. 30.

„ 21,397 (1904) Cadgène. Machinery used in dyeing, bleaching, or washing fabrics in the piece. Nov. 30.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

[A.] 25,252. Spears. *See under* V.

„ 25,594. Becher. Colouring, darkening, or staining wood, and means employed therein. Nov. 24.

[C.S.] 22,547 (1904). Lake (Chem. Techn. Fabrik Dr. A. R. W. Brand und Co.). *See under* IX.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 24,731. Plummer. Process to obtain magnesium oxide and hydrochloric acid. Nov. 15.

„ 24,798. Lamprey. Apparatus for the production of ozone. Nov. 15.

[A.] 24,840. Macknight. Process of treating soot to recover ammonia, pyridine, and aniline dye therefrom, and the production of a black pigment. Nov. 16.

„ 24,885. Simons. Apparatus for treating pyrites for the recovery of sulphur fumes.* Nov. 16.

„ 24,978. Wultze, and Gebr. Heyl G. m. b. H. Process for magazining and transporting carbonic acid in solid form. Nov. 17.

„ 25,010. Westdeutsche Thomasphosphatwerke Ges. m. b. H. *See under* XI.

„ 25,107. Tcherniac. Manufacture of sulphocyanide. Nov. 18.

„ 25,354. Garroway. Manufacture of sulphate of iron from waste iron and tin scrap iron. Nov. 22.

„ 25,394. Watson. Means for obtaining a dissolution of sodium silicate.* Nov. 22.

[C.S.] 27,888 (1903). Gutensohn. Compound for treating sea water to prevent incrustation and corrosion in vessels in which it is evaporated. Nov. 30.

„ 295 (1904). Blackmarr and Wilford. Method of and apparatus for converting oxygen into ozone. Nov. 30.

„ 966 (1904). Feld. *See under* II.

„ 1452 (1904). Grossmann. Manufacture of alkali nitrites. Nov. 30.

„ 3349 (1904). Bloxam (Administration der Minen von Buchsweiler). Manufacture of sodium ferrocyanide. Nov. 30.

„ 14,431 (1904). Pictet. Apparatus for the separation of nitrogen and oxygen from atmospheric air. Nov. 23.

„ 22,940 (1904). Reaney. Manufacture of hydrated lime from quicklime. Nov. 30.

VIII.—GLASS, POTTERY, AND ENAMELS.

[A.] 24,626. Sankey. Enamelling metallic surfaces. Nov. 14.

„ 25,414. Lang. Crucibles suitable for the manufacture of glass. [Fr. Appl., May 19, 1904.]* Nov. 22.

[C.S.] 26,363 (1903). Cunynghame. *See under* X.

„ 1933 (1904). Marzin. Ceramic printing and the like. Nov. 30.

„ 15,866 (1904). Arbogast. Method of manufacturing glassware. Nov. 30.

„ 19,067 (1904). Baudoux Glass-melting furnaces. Nov. 30.

„ 20,444 (1904). Forster. Manufacture of glass, and apparatus therefor. Nov. 23.

„ 22,065 (1904). Imray (Window Glass Machine Co.). Manufacture of sheet glass, and apparatus therefor. Nov. 23.

„ 22,655 (1904). Imray (Pressed Prism Plate Glass Co.). Manufacture of glass sheets or slabs. Nov. 23.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 24,712. Kwiatkowski. Process of making bricks, artificial stone, and similar products.* Nov. 15.

„ 24,892. Ford. Manufacture of artificial stone or sand-lime bricks. Nov. 16.

„ 24,916. Latham. Utilisation of old plaster casts and other hydrated sulphate of lime, and apparatus therefor. Nov. 16.

„ 25,128. Marga. Fireproof, acid-proof, and electrically insulating material.* Nov. 15.

„ 25,187. Von Prunk'l. Process for producing durable street pavements and railway sub-structures.* Nov. 19.

„ 25,189. Starke. *See under* XI.

„ 25,227. Hamblet. Brick kilns and the like. Nov. 21.

[A.] 25,424. Ebers. Process for manufacturing cements from hot fluid slag by the addition of lime or calcareous substances. Nov. 22.

[C.S.] 199 (1904). Mathesius. Process for manufacturing slag powder. Nov. 30.

„ 22,423 (1904). Fairweather (Nettleton). *See under* XIII.A.

„ 22,547 (1904). Lake (Chem. Techn. Fabr. Dr. A. R. W. Brand und Co.). Process for colouring natural stone. Nov. 30.

„ 22,730 (1904). Shoppee. Facing bricks. Nov. 30.

X.—METALLURGY.

[A.] 24,622. MacArthur. Removal of antimony from alloys of gold and other metals containing it. Nov. 14.

„ 24,626. Sankey. *See under* VIII.

„ 24,645. Duncan. Production of iron and steel. Nov. 14.

„ 24,781. Blackmore. Process of reducing aluminium and other metals, and making alloys thereof.* Nov. 15.

„ 24,820. Craig. Metal-melting furnaces. Nov. 16.

„ 24,823. Webb, Brettell, and Adamson. Smelting of and operating by air upon iron and other metals. Nov. 16.

„ 25,116. Moore. Apparatus for separating particles of gold, &c., from the gaugue or material with which it is associated. Nov. 18.

„ 25,270. Jackson. Solder for aluminium and other metals. Nov. 21.

„ 25,796. Drojecki. Reverberatory furnaces.* Nov. 26.

„ 25,799. Wynne. Apparatus for atomising molten blast furnace slag. Nov. 26.

[C.S.] 24,924 (1903). Neo-Métallurgie. Metallic alloy or compound. Nov. 23.

„ 25,550 (1903). Clotten. *See under* XI.

„ 26,363 (1903). Cunynghame. Furnaces or kilns for enamelling, melting, or baking metals, glass, porcelain, pottery, and the like. Nov. 30.

„ 755 (1904). Foster. Manufacture of iron in blast furnaces. Nov. 23.

„ 1323 (1904). Sharpe and Raine. Utilisation of scrap iron and steel. Nov. 30.

„ 1365 (1904). Talbot. Regenerative furnaces. Nov. 23.

„ 6945 (1904). Jacobsen. Manufacture of alloys. Nov. 23.

„ 20,242 (1904). Canivé. Welding and annealing furnace. Nov. 23.

„ 21,766 (1904). Siemens und Halske A.-G. Purification of tantalum metal. Nov. 23.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 24,689. Roselle. Electric storage batteries. [Fr. Appl., Nov. 16, 1903.]* Nov. 14.

„ 25,010. Westdeutsche Thomasphosphatwerke Ges. m. b. H. Process for producing nitric acid by aid of electricity. [Ger. Appl., Oct. 19, 1904.]* Nov. 17.

„ 25,095. Jungner. Electric accumulators.* Nov. 18.

„ 25,114. De la Croix and Joel. Electric accumulators.* Nov. 18.

„ 25,189. Starke. Composition for electrical conduits. Nov. 19.

„ 25,265. Boult (Accumulatoren und Electricitätswerke Act.-Ges., vorm. W. A. Boese and Co.). Manufacture of storage battery or accumulator electrodes. Nov. 21.

„ 25,282. Siemens und Halske Act.-Ges. Electrode for apparatus producing radiant electric energy. [German Appl., Nov. 24, 1903.]* Nov. 21.

[A.] 25,331. Hargreaves. Treating the contents of electrolytic cells. Nov. 22.

„ 25,376. Csanyi, Klupathy, and von Bárczay. Electric batteries. Nov. 22.

[C.S.] 25,550 (1903). Clotten. Process and apparatus for the electrolytic recovery of tin from materials, and for the simultaneous recovery of other metals. Nov. 30.

„ 214 (1904). Kamperdyk. Electric batteries. Nov. 23.

„ 1036 (1904). Pescatore. Accumulators. Nov. 23.

„ 20,003 (1904). Birkeland and Eyde. Process and furnace for subjecting solid materials to the action of the electric arc. Nov. 30.

„ 20,896 (1904). Bosquet. Manufacture of water jackets, casings, &c., by electrolytic means. Nov. 23.

„ 21,403 (1904). Jungner. Method for increasing the activity in electrode masses of badly conductive metallic oxides or hydrates in accumulators with invariable electrolyte. Nov. 23.

„ 21,913 (1904). Ziegenberg. Manufacture of galvanic cells. Nov. 23.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 24,713. Lewkowitsch. *See under* XVIII. A.

„ 24,913. Lucas. Detergents. Nov. 16.

„ 25,683. Harrison, Wild, and Robb. Means and process for extracting oil from cod livers and the like.' Nov. 25.

[C.S.] 18,152 (1904). Nusch (Chem. Werke, vorm. Dr. C. Zerbe). *See under* XVIII. C.

„ 22,238 (1904). Koellner. Apparatus for purifying oil and the like. Nov. 23.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(*A.*)—PIGMENTS, PAINTS.

[A.] 24,733. Bennett and Mastin. Manufacture of pigments. Nov. 15.

„ 24,840. Macknight. *See under* VII.

„ 24,989. Schobert. Antifouling and preservative paint.* Nov. 17.

„ 25,092. Flack (Williams). Writing ink. Nov. 18.

[C.S.] 22,423 (1904). Fairweather (Nettleton). Composition of matter for fireproof paint or coating. Nov. 30.

(*B.*)—RESINS, VARNISHES.

[A.] 24,826. Mavor. *See under* I.

(*C.*)—INDIA-RUBBER.

[A.] 24,691. Kite. Rubber vulcanising apparatus. Nov. 14.

„ 24,966. Jacobs, Jacobs, and Brockwell. India-rubber substitute. Nov. 17.

„ 24,548. Gittings. Manufacture of india-rubber substitute. Nov. 26.

[C.S.] 4200 (1904). Frost. Vulcanising apparatus. Nov. 23.

XIV.—TANNING; LEATHER, GLUE, SIZE, ETC.

[A.] 18,514A. Amend. The de-acidifying and oxidising of hides and skins. [U.S. Appl., Nov. 6, 1903.]* Nov. 26.

[C.S.] 1144 (1904). Parkes. *See under* I.

„ 22,395 (1904). De Marneffe. Process of and apparatus for tanning leather. Nov. 23.

„ 22,774 (1904). Smith. Method of preparing leather in the manufacture of the soles of boots and shoes. Nov. 30.

XV.—MANURES, ETC.

[C.S.] 25 (1904). Tivey and Andrews (Wardle). Manufacture of artificial manure from sewage and other like matter. Nov. 30.

XVI.—SUGAR, STARCH, GUM, Etc.

[C.S.] 4792 (1904). Reynaud. Manufacture of achroodextrin. Nov. 23.

„ 22,863 (1904). Moullin and Doubtfire. Brilliant glaze for use with starch. Nov. 30.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 24,944. De Kerchove and Lebbe. Fermentation and clarification of alcoholic liquids.* Nov. 17.

„ 25,744. Gates. Brewing. Nov. 26.

[C.S.] 28,184 (1903). Claussen. Manufacture of English beers or malt liquors, and the production of pure yeast cultures for use therein. Nov. 23.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—Foods.

[A.] 24,713. Lewkowitsch. Refining oils and fats for edible purposes. Nov. 15.

„ 25,076. Hatmaker. Dry compound of coffee and milk and process of making same. Nov. 18.

„ 25,077. Hatmaker. Drying blood and fluid extracts and preparations of animal tissue with or without the addition of other substances. Nov. 18.

„ 25,514. Breckwoldt. Process for the preservation of food or other perishable substances.* Nov. 23.

„ 25,546. Robinson and Backhouse. Apparatus for treating flour, &c., for bleaching or improving the quality thereof. Nov 24.

„ 25,624. Székely and Kovác. Process for making an easily digestible milk preparation free from germs. Nov. 24.

„ 25,660. Crocker. Food preparation. Nov. 25.

„ 25,767. Hatmaker. Dry compounds of cacao or other nuts and milk in flaky form, and process for making same. Nov. 26.

[C.S.] 20,273 (1904). Bromhead (Chem. Fabrik Helfenberg, Ltd.). *See under* XX.

„ 22,453 (1904). Rust. Process of making butter. Nov. 30.

(*B.*)—Sanitation; Water Purification.

[A.] 24,808. Robins. Method and means for treating smoke, steam, sewer gas, impure air, and other fumes for the prevention or mitigation of a nuisance. Nov. 15.

„ 24,906. Garle. Treatment of impure air. Nov. 16.

„ 25,067. Oates. The aerating and drainage of filter beds, sewage or trade effluent tanks, &c. Nov. 18.

„ 25,147. Bolton and Mills. Revolving sprinklers used for sprinkling sewage on bacteria beds. Nov. 19.

„ 25,591. Neilson. Process of and receptacles for the treatment of sewage. Nov. 24.

„ 25,611. Brooke. Apparatus for purifying fluids. Nov. 24.

„ 25,691. Guy. The treatment of sewage and means therefor. Nov. 25.

[C.S.] 28,586 (1903). Cambier, Tixier, and Adnet. Process of sterilising liquids, particularly water. Nov. 23.

„ 25 (1904). Tivey and Andrews (Wardle). *See under* XV.

„ 22,235 (1904). Wicks and Dodd. Distribution of sewage effluent or other liquid over bacteria or filter beds. Nov. 23.

(*C.*)—Disinfectants.

[A.] 25,308. Gauthier. Process and apparatus for the manufacture of a gas for disinfecting purposes. [Fr. Appl., Nov. 21, 1903.]* Nov. 21.

[C.S.] 18,152 (1904). Nusch (Chem. Werke, vorm. Dr. C. Zerbe). Process for making durable soap preparations for use in preventing poisoning by compounds of lead, copper, arsenic, mercury, and other metals. Nov. 22.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 25,726. Tailfer. Paper-making machines. [Fr. Appl., Dec. 21, 1903.]* Nov. 25.

[C.S.] 8885 (1904). Von Schmaedel. Manufacture or treatment of paper for printing. Nov. 30.

„ 16,281 (1904) Werle. Grinding wood for the manufacture of paper. Nov. 30.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 24,672. Imray (Meister, Lucius und Brüning). Manufacture of crystallised methyl and ethyl salicylglycollates, and of a product therefrom for use in therapeutics. Nov. 14.

„ 24,685. Boake, Roberts, and Co., Ltd. (Allen). Production of formaldehyde. Nov. 14.

„ 24,870. Southworth. *See under* I.

„ 24,990. Imray (Meister, Lucius und Brüning). Manufacture of alkylbarbituric acids. Nov. 17.

„ 25,221. Boult (Boebringer und Sohn). Manufacture of pure lactic acid. Nov. 19.

„ 25,369. Williams (von Forell). Products suitable for external medical use and process for manufacturing the same.* Nov. 22.

[C.S.] 20,273 (1904). Bromhead (Chem. Fabr. Helfenberg). Production of a stable non-alcoholic solution of iron peptone or iron manganese peptone. Nov. 30.

„ 21,047 (1904). Darzens. Manufacture of certain aldehydes and intermediate products. Nov. 30.

„ 22,064 (1904). Meister, Lucius und Brüning. Manufacture of phenylmethylamidochloropyrazole. Nov. 30.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 24,774. Bry. Films for photography.* Nov. 15.

„ 25,718. Soc. Anon. des Plaques et Papiers Photographiques, A. Lumière et ses Fils. Sensitised plates for a process of colour photography. [Fr. Appl., Jan. 13, 1904.]* Nov. 25.

„ 25,752. Gittings. Colour photography. Nov. 26.

[C.S.] 925 (1904). Abel (A.-G. f. Anilinfabr.). Films for use in photography. Nov. 23.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 24,782. Duttenhofer. Manufacture of explosives.* Nov. 15.

„ 25,398. The New Explosive Co., Ltd., and Ody. Explosive compositions. Nov. 22.

„ 25,797. Johnson (Soc. Anon. des Poudres et Dynamites). Manufacture of explosives.* Nov. 26.

[C.S.] 27,515 (1903). Lake (Cyanid-Ges. m. b. H.). Explosives. Nov. 23.

„ 4742 (1904). Miners' Safety Explosive Co., Ltd., and Levett. Safety explosives. Nov. 30.

„ 21,398 (1904). Luciani. Machine for use in the manufacture of gunpowder sheets. Nov. 30.

„ 22,805 (1904). Parker. Art of making matches. Nov. 30.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[A.] 24,975. Bennet. Apparatus for comparing the illuminating effects or consumption of gas burners. Nov. 17.

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Hon. Local Secretary and Treasurer:
T. Fairley, 17, East Parade, Leeds.

Official Notices.

THE NOBEL PRIZE AND THE LAVOISIER MEDAL.

The Nobel Prize for Chemistry for the current year, vhich amounts to nearly 8000*l*., has been awarded to Sir Vm. Ramsay for his researches on the atmosphere.

The Lavoisier Gold Medal has been awarded by the French Academy of Sciences to Sir James Dewar for his esearches on the liquefaction of gases.

THE JOURNAL.

From the beginning of next year the Society's Journal vill be printed and published by Messrs. Vacher and Sons, reat Smith Street, Westminster, S.W., to whom all comunications regarding subscribers' copies and advertisements hould be sent.

SUBSCRIPTIONS FOR 1905.

Members are reminded that the subscription of 25*s*. for 905, payable on January 1st next, should be sent in good ime to the Hon. Treasurer (Mr. Samuel Hall), in order to nsure continuity in the receipt of the Society's Journal. ny changes of address to appear in the new List of lembers now in course of preparation should reach the eneral Secretary not later than January 15th, 1905.

COMMUNICATIONS.

Authors of communications read before the Society, or ny of its Local Sections, are requested to take notice that nder Rule 43 of the Bye-laws the Society has the right of riority of publication for three months of all such papers. nfringement of this Bye-law renders papers liable to be ejected by the Publication Committee, or ordered to be bstracted for the Journal, in which case no reprints can furnished to the author.

List of Members Elected

22nd DECEMBER 1904.

artsch, Chas. A., 6803, Woodland Avenue, Philadelphia, Pa., U.S.A., Chemist.

arr, Francis H., Kelvin, Church Avenue, Sidcup, Kent, Manufacturing Chemist.

lark, Arthur W., c/o J. Ellwood Lee Co., Conshohocken, Pa., U.S.A., Chemist and Bacteriologist.

lark, Dr. Friend E., Pennsylvania State College, State College, Pa., U.S.A., Chemist.

uncan, R. A., P.O. Box 509, Honolulu, Hawaii, Chemist.

vans, James Rittenhouse, 87, Fourth Street, Troy, N.Y., U.S.A., Assistant in Chemistry.

azdar, J. J., 5, Wroxham Mansions, 38, Canfield Gardens, South Hampstead, N.W., Barrister-at-Law.

ooding, E. Claude, Willow House, Washford, Taunton, Somerset, Chemical Student.

arvey, John G., Todmorden, Ont., Canada, Manufacturing Chemist.

uckley, J. F., c/o Jones Bros., Pearl and Water Streets, Brooklyn, N.Y., U.S.A., Chemical Engineer.

ckson, Ernest W., 11, Queen's Terrace, Middlesbro', Analytical Chemist.

nes, J. Shirley, c/o Giant Powder Co., Giant, Contra Costa Co., Cal., U.S.A., Chemist.

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nnedy, Fred. J., 493, Lexington Avenue, New York City, U.S.A., Chemist.

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Meyer, Prof. Dr. Richard, Technische Hochschule, Braunschweig, Germany, Professor of Chemistry.

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Wolf, August S., Laboratory E.L.A.S., 120, Broadway, New York City, U.S.A., Chemist.

Changes of Address.

When notifying new addresses, members are requested to write them distinctly, and state whether they are temporary or permanent. Multiplication of addresses is also to be avoided as tending to create confusion. When sending subscriptions, the use of the form attached to the application helps in the verification of addresses, on which the safe delivery of the Journal depends.

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Chemical Trade Journal; one copy to Blackfriars Bridge, Manchester; and one copy to 265, Strand, London, W.C.

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Gilchrist, P. C.; Journals to Hôtel de France, Pau, France.

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Möckel, Alf., l/o St. Louis; retain Journals after Dec. 31st issue.

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Pearson, Frank P., l/o North Adams; 178, Pawtucket Street, Lowell, Mass., U.S.A.

Rosenblatt, Alf.; communications to 55, East 92nd Street, New York City, U.S.A.

Rostosky, Dr. L.; all communications to Thiergartenstrasse 28, Dresden, A., Germany.

Spence, D.; Journals to Sendig Hotel, Europaeischer Hof, Dresden, A., Germany.

Tanaka, K., l/o St. Louis; Matsuba Hotel, Kudansaka, Ue, Tokyo, Japan.

Weston, T. W., l/o York; c/o Jos. Watson and Sons, Whitehall Soap Works, Leeds.

White, W. G., l/o Bay Street; Springhill, Port Glasgow.

CHANGE OF ADDRESS REQUIRED.

Riley, Fred., l/o 43, Grampian Way, Savin Hill, Boston, Mass., U.S.A.

Deaths.

Bell, Sir Lowthian, Bart., F.R.S., Rounton Grange, Northallerton. Dec. 20.

Pooley, Thos. A., Beverley, Walton-on-Thames. Dec. 8.

Rademacher, H. A., 5, Craven Street, Methuen, Mass., U.S.A. Nov. 16.

Richmond, W. H., Stalheim, Eccleston Park, Prescot, Lancs. Aug. 11.

London Section.

Meeting held at Burlington House, on Monday, December 5th, 1904.

MR. A. GORDON SALAMON IN THE CHAIR.

RASCHIG'S THEORY OF THE LEAD-CHAMBER PROCESS.

BY E. DIVERS, M.D., D.Sc., F.R.S.

These are probably the closing years of the active life of the most celebrated and important process of chemical manufacture ever invented, namely, that by which sulphur dioxide is made into sulphuric acid by the use of a little nitre. Yet it is only a few months ago that a paper, by a distinguished investigator and successful manufacturer of chemical products—Herr Dr. F. Raschig, of Ludwigshafen am Rhein—appeared in the *Zeitschrift für angewandte Chemie*, re-stating and upholding a remarkable theory of the process, which, though published seventeen years before, may still be styled a new theory, so old is the process to which it refers. This theory is now being actively discussed in the *Zeitschrift* just named, and a good abstract of it has already appeared in our own Journal. The following exposition of its nature may interest many of the members of this Society, for, simple enough in principle, it is based upon facts the knowledge of which is not widely diffused among chemists.

What is wanted, in order to understand the nature of the lead-chamber process, is to know how it happens that the presence of a little reduced nitric acid effects with extraordinary rapidity that atmospheric oxidation of sulphur dioxide, $2SO_2 + O_2 + 2H_2O = 2SO_4H_2$, which otherwise scarcely takes place at all. The pair of equations, $N_2O_4 + 2SO_2 + 2H_2O = 2NO + 2H_2SO_4$ and $2NO + O_2 = N_2O_4$, may express what happens, but tell nothing as to how it happens. From them it appears that nitric oxide and oxygen unite into nitric peroxide, but as it cannot be assumed in reading the first equation that, with equal facility and as a matter of fact, nitric peroxide decomposes into oxygen and nitric oxide, these equations fail to give the required information. Lunge's pair of equations, $2SO_2 + NO + NO_2 + O_2 + H_2O = 2ONO.SO_2.OH$, and $2ONOSO_2OH + H_2O = NO + NO_2 + 2HO.SO_2.OH$, are open to the same criticism. An advance is, indeed, made, by the recognitio of the necessity of there being some combination betwee the sulphur dioxide and one of the oxides of nitrogen. But still, it is not to be seen from Lunge's equation, in wha way the atmospheric oxygen goes to the sulphur dioxide When, in presence of air, sulphur dioxide and nitrous aci or nitric peroxide are brought together in water, they unite without oxidation to form compounds which, thoug unstable, are not oxidisable by the air. So far, therefore, i remains unexplained how the sulphur dioxide gets oxidise into sulphuric acid. According to Raschig's theory, th sulphur dioxide does *not* get oxidised by the air: ther is only a condensation or union of the sulphur dioxid with the nitrous acid. The compound hydrolyses, an thus sulphuric acid comes into existence. Then only doe aerial oxidation intervene, in order to oxidise the reduce nitrous acid.

Raschig's theory of the lead-chamber process runs, i effect, as follows:—Nitrous acid and moist sulphur dioxid combine together to form the substance, nitrososulphoni acid, $ONSO_3H$; this interacts with a second molecule o nitrous acid to form sulphuric acid and nitric oxide; an this nitric oxide, with the aid of air and water, regenerat the nitrous acid set out with. Here are the equations:—

$$(1)\ 2ONOH + 2SO_2 = 2ON.SO_2.OH;$$

$$(2)\ 2ONOH + 2ON.SO_2.OH = 4NO + 2HO.SO_2.OH$$

$$(3)\ 4NO + O_2 + 2H_2O = 4ON.OH.$$

Here, for the first time, is given a theory as to ho sulphur dioxide passes into sulphuric acid in the nitre process of its manufacture. It may be claimed for it that expresses the facts of the process, and is not merely hypothetical view of it.

The lead-chamber process has long held the position, i the exposition of chemistry, of the standard example o catalytic action. Now, a true catalytic action is one in whic there are, between the substances consumed—say, sulphu dioxide, oxygen, and water—and the substances produce from them—in this case, sulphuric acid—two other substances, whose lines of existence cut each other, so to speak at a critical point. At that point the one substance is ther facing the substances to be consumed, and equally there a that point is the other substance of the catalytic pair, facin the substances produced. Where catalytic action is goin on, the existence of both of its acting substances is almo limited to a point in time; when either attains a line o existence, the catalytic action is at an end, and the othe ubstance no longer exists. In the resent case, this state f things may perhaps be symbolised, thus :—

$$\overbrace{\mathrm{HO - NO}}\hspace{-1.3em}\underbrace{\hspace{1.3em}\mathrm{{} - SO_4H}},$$

here the brackets include nitrous acid and nitrososulphonic cid, respectively. During catalytic action, both have an xistence which is intangible, which defies direct observa- on. Only when, by changed conditions, the catalysis is isturbed, can we expect to find the one or the other. In e lead chamber itself, we find the nitrous acid (or the roducts of its break-up), when the catalysis is over, under e conditions which prevail. In his beaker glass, under ther conditions, Raschig gets evidence of the existence of itrososulphonic acid. But in the lead-chamber itself, in the egion of full activity, there should be no detectable pre- ence of this body or of nitrous acid. Admitting, with unge, that nitrososulphuric acid is one of a catalytic pair of bstances in the lead-chamber process, the same argument olds good concerning the form of existence of that sub- ance also. He may be right in believing that it is present vast quantities in the lead-chambers—return to this point ill be made later on,—but, even so, its existence may be kened to that of a twinkling star—there and not there at ery alternate moment, without any tangible presence, ntil the catalytic action proper to normal working is sturbed. It, therefore, does not really affect Raschig's eory, to deny that nitrososulphonic acid, with which may associated nitrous acid and nitric oxide, is to be found in e normally working parts of the chamber. But, before llowing up these considerations with some others of portance, the subject of the existence and nature of trososulphonic acid requires to be discussed.

Nitrososulphonic acid has not been isolated and probably ever will be. Almost as much may be said of nitrous acid. ut there is abundant evidence of the existence of the latter dilute solution, whilst its salts are common substances. he evidence of the existence of nitrososulphonic acid, and e relations of this body to certain salts, will now be briefly one into.

The earlier evidence brought forward, first by Claus and en by Raschig, of the existence of salts of nitrososulphonic id, or of its hydrate, dihydroxylaminesulphonic acid, as et indistinguishable from it, has been proved to be wrong by aga and the author. When an alkali nitrite is sulphonated the gradual addition of metasulphite, the product is not dihydroxylaminesulphonate, but hydroxylaminedisulpho- ite, $2NaNO_2 + 3Na_2S_2O_5 + H_2O = 2HON(SO_3Na)_2 + 2Na_2SO_3$. ut by a very interesting, though somewhat recondite, alytical procedure, Raschig has convinced himself that, hen the nitrite is put from the first in contact with the hole of the metasulphite, there comes into brief existence hat should be nitrososulphonate or else its hydrate, hydroxylaminesulphonate, produced thus: $NaNO_2 +$ $a_2S_2O_5 = ONSO_3Na + Na_2SO_3$.

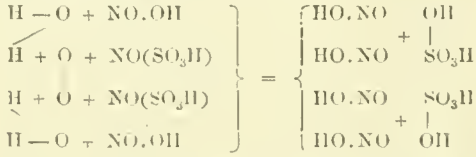
Next, experimenting with dilute titrated solutions of lphur dioxide and nitrous acid, Raschig poured sulphur oxide solution into highly dilute nitrous acid solution in rying proportions, and found that interaction was con- ned within molecular proportions, $ONOH : SO_2$. But he us got sulphuric acid and no trace of nitrososulphonic id. When, however, he poured the nitrous acid solution to the sulphur dioxide solution, kept in excess, he und that more than a molecule of sulphur dioxide was ed up, proving that hydroxylaminedisulphonic acid and trilosulphonic acid, $N(SO_3H)_3$, must have been formed. ere, it may be mentioned, that Carpenter and Linder, two ars ago (this Journal, **21**, 1400), found that sulphur oxide produced hydroxylaminedisulphonic acid with trous acid. Raschig concludes that these two experi- ents prove that dihydroxylaminesulphonic acid or its hydride, nitrososulphonic acid, is produced and then comes hydroxylaminedisulphonic acid by further sulpho- ation. The author cannot admit that that is the conclu- on which must be drawn, but he sees not the least reason r refusing to grant that, in presence of other reagents, e sulphonation may go so far only as to produce nitroso- lphonic acid.

Raschig's third point of evidence is decidedly satisfactory. On mixing the highly dilute and cooled solutions of nitrous acid and sulphur dioxide in molecular proportions, the mixed solution gives no blueing with potassium iodide and starch, thus showing the disappearance of all nitrous acid; no bleaching of iodine solution, thus showing the disappearance of all sulphur dioxide; precipitation of all sulphur as sulphate by barium chloride; and, lastly, considerable bleaching activity upon potassium permanganate. Therefore, although nitrous oxide is obtained by heating the solution, the primary interaction cannot be that expressed by $2HO.NO + 2SO_2 + H_2O = N_2O + 2SO_2(OH)_2$, since nitrous oxide has no action upon permanganate. The interaction can only have produced nitrososulphonic acid, which must have hydrolysed into nitrosyl hydride, $H.NO$, thus :—$ON.OH + SO_2 = ON.SO_2.OH$, and $ON.SO_2.OH + H_2O = ON.H + HO.SO_2.OH$. Working with stannous chloride, in place of sulphur dioxide, upon nitrous acid, much stronger solutions of this substance, nitrosyl hydride, are obtainable—solutions much too concentrated to be merely solutions of nitrous oxide. The action of stannous chloride upon nitrous acid is so definite that, were it needed, it could be used for its quantitative determination. Nitrosyl hydride stands as anhydride to dihydroxylamine, $(HO)_2NH$, and it is difficult to avoid coming to the conclusion that either nitrosyl hydride or dihydroxylamine is temporarily present in the solution in which nitrous acid has been sulphonated. But, if this is granted, it follows that either nitrososulphonic acid or dihydroxylaminesulphonic acid is produced by this sulphonation, however fleeting its existence. Raschig has obtained evidence that nitrosyl hydride is also produced by oxidising hydroxylamine.

Nitrosyl hydride interacts with nitrosyl hydroxide, that is, nitrous acid, though not readily, to form nitric oxide and water :—$ON.H + HO.NO = 2NO + H_2O$. In presence of air dissolved in the water, it proceeds quickly enough, but then nitrous acid appears in place of the nitric oxide, in accordance with the third equation. It has still to be shown that the conditions of the lead-chamber are appropriate for the occurrences formulated in Raschig's equations.

The solutions experimented upon have so far been aqueous, but the addition of sulphuric acid to them, far from being detrimental, actually determines that activity of nitrous acid upon the nitrososulphonic acid, in the presence of air, which in aqueous solutions only slowly manifests itself. When the nitrous acid is dissolved in 10/N sulphuric acid, instead of in water, sulphur dioxide and air can be blown rapidly into the solution, with complete conversion of the sulphur dioxide into sulphuric acid and no escape of nitric oxide and peroxide, although the sulphuric acid is still too weak to be a solvent of nitrososulphuric acid (nitrosyl sulphate). Indeed, the addition of enough sulphuric acid to make the solution similar to chamber acid, makes the solution such a poor solvent of nitrous acid that this then becomes gaseous to some extent. The effect of still stronger sulphuric acid, which would have generated nitrososulphuric acid, appears not to have been tried. But it has at least been shown that the lead-chamber process can be imitated in a beaker glass, in accordance with Raschig's theory and without any material production of nitrososulphuric acid.

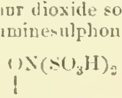
Bearing in mind the essential nature of catalytic action, it will be evident that the series of equations drawn up of represent its cycle of changes are not to be regarded as expressing interactions which proceed, independently to each other, to actual completion. Thus, in Raschig's equations, the product of the first interaction, namely, nitrososulphonic acid, is already reacting as in the second equation, before it is out of the reaction represented by the first equation. The same holds true of the active product (nitric oxide) of the second equation, which is being formed only so far as to be able to pass into the third reaction and there disappear. We have also to remember that the ordinal numbers attached to these equations, first, second, and third, serve only to mark their sequence, not to indicate a beginning and an end. The product of the reaction shown by the third equation, the nitrous acid, passes in the moment of its formation into the reaction as shown by the first equation. It was incumbent upon Raschig to give reality to the existence of the nitrososulphonic acid, or of a substance equivalent to it, but not to show that it might be isolated from the contents of the lead chambers. The same is true of his nitric oxide, but this being so well-known a substance, the above considerations seem not to have been applied to it. Raschig may be found saying that Lunge will yet have to come back to the recognition of nitric oxide as taking part in the process, and also making no attempt to meet Lunge's well-founded contention that nitric oxide is only present in the lead chamber in association with enough nitric peroxide to negative the possibility of its taking part in the process. Yet Raschig himself recognises quite well that the NO of his equations has only a catalytic existence as nitric oxide. He has done some admirable work towards establishing the existence of pernitric acid, HNO_4, and allows himself to speculate whether this substance, as well as NO, may not play a part in the process shown in equation 2. However that may be, it is in any case to be understood that nitric oxide, as we know it, has not been shown by Raschig's experiments to be a factor in the sulphuric acid process. His second equation must hardly be taken to express something which actually goes on of itself, for his experiments show that this reaction depends largely, if not wholly, for its occurrence upon the co-operation of the reaction formulated by the third equation. Equation 3 must be imagined to be subjoined to 2, something in this way:—



$$\left.\begin{array}{l} H-O+NO.OH \\ H+O+NO(SO_3H) \\ H+O+NO(SO_3H) \\ H-O+NO.OH \end{array}\right\} = \left\{\begin{array}{l} HO.NO \quad OH \\ \qquad\quad + \;| \\ HO.NO \quad SO_3H \\ HO.NO \quad SO_3H \\ \qquad\quad + \;| \\ HO.NO \quad OH \end{array}\right.$$

in which the radical, NO, is seen to be everywhere active, without once coming out into existence as nitric oxide.

Raschig's surmise that, in passing from the reaction formulated in his second equation to that expressed by his third, there may be generated pernitric acid, HNO_4, as well as NO, may puzzle those who see in the action of sulphur dioxide only that of a reducing agent upon nitrous acid. It may be well, therefore, for this and other reasons, to call attention to the fact that, in presence of the monohydrate of sulphuric acid, sulphur dioxide so acts upon nitrous acid as to generate peroxylaminesulphonic acid—



$$\begin{array}{l} ON(SO_3H)_2 \\ | \\ ON(SO_3H)_2 \end{array}$$

This substance, which gives a beautiful purple colour to the sulphuric acid, is undoubtedly a peroxide, such as pernitric acid would be, $HO.ONO_2$, with an $-O_2-$ group in it (J. Chem. Soc. 1904, **85**, 108). There is another point of interest in peroxylaminesulphonic acid in connection with the sulphuric acid process. It is the support which its production gives to Raschig's conception of the process as being dependent upon the sulphonation of nitrous acid. Can sulphazotised acids, it has in effect been asked, have anything to do with the sulphuric acid process, in which they are not to be found, at least when it is properly working? The prejudice which dictates such a question will hardly be able to withstand the evidence of such a fact as this:—Whether nitrous acid and sulphur dioxide react in presence of water or in presence of monohydrated sulphuric acid, H_2O, H_2SO_4, they produce sulphazotised substances, that is, sulphonated nitrous acid compounds. For, that being the case, can the least objection any longer be raised to the assumption that they also form such substances in presence of that more dilute sulphuric acid which is present in the lead-chambers?

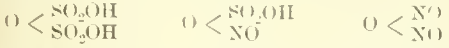
What next is to be said is offered as a contribution to the theory of the lead-chamber process. The author has long been convinced that, in those regions of the chamber where the process is in active operation, where, therefore, there is dense white mist, the really gaseous part of the contents of the chamber contains no significant quantity of any oxide of nitrogen. One part of that mist consists of its liquid particles of sulphuric acid, having with it something more than one molecule and something less than two molecules of water, and holding in solution all the nitrogen oxides, one or more as the case may be. The other part of the mist is gaseous, and made up of atmospheric nitrogen and oxygen, sulphur dioxide, and vapour of water. In regions where the activity is much less, nitrogen peroxide is, indeed, among the gases, and with very little sulphur dioxide present, but this nitric peroxide is already out of the sphere of activity, and waiting to be carried off from the chambers. If it had work to do, it would not be there as gas. Whether any of the oxides of nitrogen enter the chamber from the Glover-tower in the form of mist, or whether everything is at that time gaseous, cannot, perhaps, be told, but, quickly and almost at once, the whole of the nitrogen oxides, together with water and sulphur dioxide, and probably some volatilised or mechanically carried sulphuric acid, will condense into a mist. It is difficult to conceive of another state of things, consistent with the conditions which prevail. What follows next in the process seems to be equally certain. Sulphur dioxide, oxygen, and water condense together upon the liquid particles of the mist, there uniting, under the catalytic influence of the nitrous acid present in the particles, with a rapidity limited only by the time needed for diffusion of the gases over to the particles and for dissipation of the heat caused by their condensation. But, no doubt, that rapidity of the process is seriously interfered with by the unequal distribution of the steam or water-spray through the chambers, the condensation being checked in one place because the nitrous acid loses much of its activity in consequence of the sulphuric acid of the mist-liquid being too concentrated, and in another place because, through the sulphuric acid of the mist being too much diluted, the nitrous acid escapes from the liquid particles, and, therefore, gets out of its field of greatest activity.

Perhaps, to a large extent, the language of Raschig is consistent with the assumption that he believes in the confinement of the nitrogen compounds to the liquid part of the mist, but he distinctly refers to the necessity of having more oxides of nitrogen present than can be held in solution by sulphuric acid of the dilution he takes it to have in the mist, which is surely much less than that of chamber-floor acid. Besides this, he tries to lead us back to a belief in the existence of gaseous nitrous anhydride, for short periods of time, even in presence of oxygen—a matter which would be of no interest in connection with his theory did he suppose that all his nitrous acid was in the liquid of the mist.

Unless the nitrous acid is held dissolved in the liquid of the mist in the form of nitrososulphuric acid, it is hardly possible to grant the demand of Raschig's theory for nitrous acid to be ever present in local excess of the sulphur dioxide at the seat of activity; that is, in the proportion of $2NO_2H$ to every SO_2.

Yet Raschig fails to find any place for nitrososulphuric acid in the process of sulphuric acid manufacture. If it is present at all in the chambers, it is there, he considers, injuriously, and as the result of imperfect working. According to Lunge, its presence in the chambers is certain and of prime importance. But, before proceeding further, it is desirable to say something respecting the chemical relationship of nitrososulphonic acid to nitrososulphuric acid. The propriety of what is now going to be said on this subject is unlikely to be gainsaid, but disregard of its argument leads to lamentable confusion in nomenclature. The formula of nitrososulphonic acid is $ON.SO_3H$; that for nitrososulphuric acid is $ON.O.SO_3H$. The relationship of nitrososulphonic acid to nitrososulphuric acid is, therefore, that of the almost unknown sulphurous acid, $H.SO_3H$, to sulphuric acid, $HO.SO_3H$. Nitrososulphuric acid is often named nitrosyl sulphate, but that is a practice not to be commended, because it suggests that this acid is a salt, whereas a salt it is not, nitrosyl being no basic radical. By a sulphonic derivative is meant a compound in which the radical, $-SO_3H$, plays a part analogous to that of cyanogen in a cyanide, or of chlorine in a chloride. A sulphuric compound is what is held to be a derivative, in certain ways, of sulphuric acid. When that derivation is through the substitution of a hydrogen radical by some other, it is absolutely unallowable to call the compound a sulphonic derivative, as is so frequently done in the case of nitroso-sulphuric acid. This substance is a mixed acid oxide, that is, an anhydride of two acids. It is intermediate to pyrosulphuric acid and nitrous anhydride, as thus shown :—

Pyrosulphuric Acid. Nitrososulphuric Acid. Nitrous Anhydride.



$$O < \begin{array}{l} SO_2OH \\ SO_2OH \end{array} \qquad O < \begin{array}{l} SO_2OH \\ NO \end{array} \qquad O < \begin{array}{l} NO \\ NO \end{array}$$

That sulphuric acid charged with nitrososulphuric acid will quickly absorb moist sulphur dioxide has been long known, but it was left for Raschig to discover what then happens. What does happen is expressed by his equations when, for the nitrous acid there shown, is substituted its anhydro compound with sulphuric acid. His three equations then become—

$$(1) \qquad 2H_2O + \overset{\text{Nitrososulphuric Acid.}}{2ON.O.SO_3H} + 2SO_2 =$$

$$2SO_2(OH)_2 + \overset{\text{Nitrososulphonic Acid.}}{2ON.SO_3H} \; ;$$

$$(2) \quad \overset{\text{Nitrososulphonic Acid.}}{2ON.SO_3H} + \overset{\text{Nitrososulphuric Acid.}}{2ON.O.SO_3H} = 4NO + \overset{\text{Pyrosulphuric Acid.}}{2O(SO_3H)_2} \; ;$$

$$(3) \qquad 4NO + O_2 + \overset{\text{Pyrosulphuric Acid.}}{2O(SO_3H)_2} = \overset{\text{Nitrososulphuric Acid.}}{4ON.O.SO_3H}.$$

What, then, goes on between the liquid and the gaseous parts of the mist appears to be this. The particles of the mist, consisting of strong sulphuric acid holding nitrososulphuric acid in solution, continuously absorb sulphur dioxide and oxygen, which, by the catalytic action of the nitrososulphuric acid, become sulphuric acid as fast as they are absorbed. Water is taken up in such quantity, in the normal working of the process, as serves to effect incipient hydrolysis of the nitrososulphuric acid into its constituent acids. Two molecules of sulphur dioxide and one molecule of oxygen are absorbed simultaneously, for the reason that they find between themselves, the radical of the catalyser, nitrosyl, one moment as nitrososulphuric acid and the next moment as nitrososulphonic acid. Or, leaving out all mention of the radical, nitrosyl, but remembering that the substance, nitric oxide, plays no part, the catalyser is nitrososulphonic acid and nitrososulphuric acid, alternately. Then, since a catalyser cannot be represented in an equation for a productive change, because it is neither consumed nor generated, the equation comes back to $2SO_2 + O_2 + 2OH_2 = 2SO_4H_2$, conditioned by the words "in presence of a catalyser."

The importance of the theory now advanced, that the production of sulphuric acid in the lead-chambers is due to action going on between a liquid and a gas, will be quickly evident on consideration. That state of things is the counterpart of what is actually observed to go on in Raschig's experiment in a beaker, in which sulphur dioxide and oxygen are rapidly absorbed by the nitrous acid solution, without evolution of any nitric oxide or peroxide. It renders meaningless the otherwise pertinent question raised by Lunge against Raschig's theory, why the nitric oxide does not oxidise to nitric peroxide, instead of stopping at nitrous anhydride, as required of it by Raschig. It, in this way, removes almost the sole objection that Lunge has to any theory of the process, which rests on a production of nitric oxide. But, above all, it should perhaps serve to end the rivalry between Lunge's and Raschig's theories, because it makes them to be, with some excrescences, parts of a more comprehensive theory.

There is much more in Raschig's account of his theory and of the elaborate experimental work upon which it is based, which might with advantage have been described and commented upon, but it is hoped that what has been here said will be sufficient to excite interest in the theory.

Discussion.

Prof. Tilden said that it had yet to be shown that these various substances, and the reactions expressed in these equations, were essential parts of the process, the object of which was the production of sulphuric acid. No one denied, for instance, that nitrososulphuric acid was formed to some extent in the chambers, but it did not seem to him that the production of that compound was a necessary condition of the production of sulphuric acid from the oxides of nitrogen, the oxygen of the air, sulphur dioxide and the water which were present. He was glad to hear that the author held the view that a great number of these substances expressed in the equations probably did not exist under the conditions of the chambers, because they were at a temperature in which they were to a large extent dissociated into gaseous products. He should certainly agree with him that in so far as these reactions took place, they took place on the surface of the spherules of water due to the condensation of the steam. It would be interesting if some experiments could be made at temperatures a little higher, above the boiling point of water, when there would be no condensed spherules of water at all, but where all the materials were entirely gaseous. Such a temperature was of course beyond that which prevailed generally in the vitriol chambers. He was not afraid to express the action of the peroxide of nitrogen which was present in the chambers by a very much simpler hypothesis. They had no hesitation in assuming that when nitric oxide combined with oxygen the process was very simple. He had never seen any form of complicated expression written as an equation to express this combination and he thought it would be extremely difficult to express it by anything more complicated; it might be written as $NO + O$ or $2NO + O_2$. He saw no difficulty about assuming that oxygen was capable of directly combining with nitric oxide, but he felt more difficulty in assuming that oxygen directly combined with the elements of the sulphurous acid which were present in the gases. Those who had not specially studied these substances were frequently a little confused about the oxides of nitrogen, but his belief was that there was only one coloured gaseous oxide of nitrogen and that was the peroxide, the formula of which was NO_2. His reason for the statement was this: N_2O and NO were well known colourless gases, N_2O_3 was a blue liquid which on conversion into vapour produced a yellow coloured gas. That gas consisted of a mixture of equal volumes of nitric oxide and nitrogen peroxide. It had been shown a few years ago that in all probability when these two gases were brought together there was a small amount of nitrous anhydride produced, something like 5 per cent. of the whole, as represented by Dixon's experiments; the rest was entirely dissociated. If the red gas were examined with the spectroscope the lines of the absorption spectrum were identical with those of the spectrum of peroxide of nitrogen, made in some other way. Peroxide of nitrogen obtained, for example, by heating lead nitrate was by cooling condensed first to a yellow liquid and at a lower temperature to a perfectly colourless solid. This white solid was N_2O_4 or some multiple of it. Directly it volatilised it gave the yellow gas the colour of which appeared because it was continually accumulating, the dissociation increasing as the temperature rose. On examining these bodies with the spectroscope the only one which gave the peculiar absorption spectrum was the nitrogen peroxide, NO_2, so that N_2O_3, if it existed in the gaseous state, did not give the absorption spectrum. Now in the vitriol chambers the atmosphere was generally a deep red, showing an abundance of peroxide of nitrogen. It seemed to him that in the chambers where the sulphuric acid was chiefly produced there would always be an abundance of this gas. He could not see any great difficulty in believing that just as oxygen was known to be capable of combining with nitric oxide by simple combination, so an atom of the oxygen of the nitric peroxide attached itself to the elements of the sulphurous acid here present. In nitrogen peroxide the nitrogen had an unsatisfied affinity, and it was easy to conceive of an arrangment by which the oxygen of the air united with the nitrogen of the peroxide of nitrogen, at the same moment that another atom of oxygen was detached by entering into union with the sulphur dioxide and water which together made up the molecule of the sulphuric acid. He could not see any objection to the idea that that was the essential part of the process. Of course the occasional production of hydroxylamine and other compounds could not be denied, but it seemed to him that was sufficiently explained by the fact that moderately strong sulphuric acid was present in the spherules of liquid and on the walls and floors of the chambers in the presence of sulphur dioxide and nitrogen peroxide in varying proportions. There, at any rate, were the materials for the production of some of the substances represented in these equations.

Mr. R. Forbes Carpenter said he was not prepared for the author accepting the nitrososulphonic acid as an existing body, even under the transient form described, for, in conjunction with Prof. Haga, Dr. Divers had shown that what Raschig described in earlier experiments as a salt of dihydroxylaminesulphonic acid was actually a double salt which could be produced by crystallisation of hydroxylamine disulphonate and potassium nitrite. The combination of the theories of Lunge and Raschig might be happily effected by the equations Dr. Divers had given. That not only the raw materials, but at any rate one product, of the intervention of the two named by Dr. Divers (nitrososulphonic and nitrosulphuric acids) existed through the working of the chambers was evident, as solutions of nitrososulphuric acid could be collected in the drips in the chambers as an indication of how the chamber was working. He had searched for hydroxylaminedisulphonic acid, and only on one occasion was it found as a transient body in a particular part of the chamber plant, viz., in a tower between No. 1 and No. 2 chambers, which was condensing the mist of sulphuric acid still uncondensed, and produced in No. 1; nitrososulphuric acid was there also at times, although at other times it was absent. The presence of this hydroxylaminedisulphonic acid was indicated in alkaline solution on testing with copper sulphate, a canary coloured precipitate being formed, a compound that Dr. Divers had shown them how to obtain. He had unsuccessfully looked for this acid in several other parts of the chamber. He should be glad if Dr. Divers could tell them the temperature at which Raschig's reactions took place in the solutions with which he experimented.

Dr. Veley said that he had observed that nitric acid exposed to light escaped decomposition when it almost filled the bottle, but suffered decomposition when it only partly filled the bottle. These results seemed to show that the initial decomposition of the nitric acid was a decomposition not of the liquid itself, but of the vapour proceeding from that liquid at the ordinary temperature.

Mr. F. H. English said in the first chamber the temperature was as a rule about 160° F. and in that chamber the bulk of the sulphuric acid was formed. The second chambers were generally about 120° to 130° F.; and the third chamber, where practically no action at all took place and which was filled with nitrogen peroxide, was a little above the air temperature.

Mr. Oakden said he had found that about 45 per cent. of the total acid was produced in the Glover tower where there could not possibly be these bodies present in the gaseous state. It was produced in contact with the liquid nitrososulphuric acid passing down the Glover tower, independent of the chambers altogether.

Dr. L. F. Guttmann asked the author why he had called the compound NOH, nitrosyl-hydride; he thought Angeli, its discoverer, had named it nitroxyl.

Dr. Divers, in reply, said that his theory being that no nitrous gases were present in the very active part of the chambers, because of the large quantities of sulphur dioxide there, he had only one comment to make upon Prof. Tilden's view of the activity of nitric peroxide. That was that that substance could only furnish sulphur dioxide with oxygen indirectly, that is, by the decomposition of some compound which it might form with the sulphur dioxide. Dr. Tilden's conception of the sulphuric-acid process was admittedly based on hypothetical activities, whereas Raschig's theory rested on facts experimentally determined. To illustrate that, it might be mentioned that Raschig had been led to believe that the substance, pernitric acid, was indeed formed in the reaction of nitrous acid with sulphur dioxide, but had omitted from the details of his theory the assumption of its production, because he was as yet unable to convince himself on the point, so desirous was he to have a foundation of fact for every statement. With regard to the evidence for the existence of nitrososulphuric acid in the lead-chamber, he would mention, what Raschig had pointed out, that chamber acid did not contain more nitrous acid than the same volume of water would easily hold dissolved. It could not, therefore, be assumed that that quantity of nitrous acid was proof of the presence of nitrososulphuric acid. The evidence for its presence in the lead chamber was indirect.

Dr. Veley's experience with nitric acid had its parallel in what happened to a concentrated solution of hydrochloric acid exposed to bright daylight. In a bottle practically full, that acid remained unchanged, whereas, with only a little of its solution in the bottle, chlorine was produced. Since moist hydrochloric acid gas, apart from a liquid solution of it, did not decompose (Richardson), it would seem that, so far as it applied to the case, the behaviour of either nitric or hydrochloric acid in a partly filled bottle favoured the theory put forward in the paper as to what went on in the lead-chamber.

In answer to Dr. L. F. Guttmann, "nitroxyl," used already for a radical, appeared to him to be an impossible name for a substance, and particularly inapplicable to one having the composition assigned to nitrosyl hydride.

THEORY OF THE ACTION OF METALS UPON NITRIC ACID.

BY E. DIVERS, M.D., D.Sc., F.R.S.

Introductory.

There being no explicit and connected theory of the action of metals upon nitric acid, which has general acceptance, what follows is submitted for consideration and adoption as such a theory. By theory, it may be wise to point out, is meant not some fanciful and imaginative view, based upon hypotheses, but an exposition of the real order and dependence of the facts presented in the action of the metals upon the acid. Therefore, if this theory is well founded, it should have some value in technological pursuits. It is not new, having been published in 1883 in a paper read before the Chemical Society (J. Chem. Soc., **43**, 443), in an incomplete form, and as subsidiary to the subject of the paper, which was on the production of hydroxylamine from nitric acid.

Nor is its existence unrecorded in the proceedings of this Section of the Society of Chemical Industry, it having in 1891 been subjected by Dr. Veley to adverse criticism, which was illustrated by experiments. The occasion for presenting the theory in a more developed form to the Society this evening has been given by the reading last month to the Chemical Society, of an important paper on mercurous nitrite by Prof. Rây, of the Presidency College, Calcutta.

The most convenient and most satisfactory method of treating the subject seems to be to enunciate it without prefatory remarks, and then to develop its points, and endeavour to show that they are well taken.

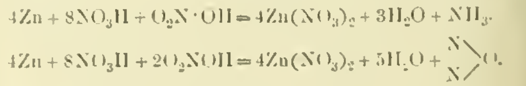
The Theory.

Silver or mercury is only active upon nitric acid in presence of nitrous acid as catalyser, and then converts it into molecular quantities of silver or mercurous nitrite and nitrate, and nothing else besides water:—

$$2Ag + 2HNO_3 = AgNO_2 + AgNO_3 + H_2O.$$

Zinc or tin acts upon nitric acid to produce zinc or stannous nitrate and, independently of each other and without intermediate products, ammonia, nitrous oxide, and nitrogen:—

$$4Zn + 8NO_3H + O_2N \cdot OH = 4Zn(NO_3)_2 + 3H_2O + NH_3.$$



$$4Zn + 8NO_3H + 2O_2NOH = 4Zn(NO_3)_2 + 5H_2O + \left.\begin{matrix} N \\ N \end{matrix}\right\rangle O.$$

$$5Zn + 10NO_3H + 2O_2NOH = 5Zn(NO_3)_2 + 6H_2O + N_2.$$

It tends also and principally to convert the nitric acid into hydroxylamine as the primary product, along with zinc or stannous nitrate. But that tendency is defeated, unless a stable acid, such as sulphuric or hydrochloride acid, be present to combine with the hydroxylamine, nitric acid itself being obviously unfitted for the purpose :—

$$6Zn + 7SO_4H_2 + 2O_2NOH =$$
$$6ZnSO_4 + 4H_2O + SO_4(NH_3OH)_2.$$

Evidence as to the Truth of the Theory.

Two Orders of Metals.—As is well known, one metal may act very differently from another upon nitric acid and also upon sulphuric acid. But, although no two act exactly alike, a division of the metals may be made into two classes, one represented by silver and mercury, and the other by tin and zinc. In the former class are included bismuth and copper, and in the latter class all other metals having strongly marked basic characters. Of the action of copper upon nitric acid it is, however, not yet possible to formulate a satisfactory and convincing theory. For, although, more than that of any other metal, the action of copper comes under the attention of chemists, there is still wanting a sufficient basis of fact to work upon. Probably, Acworth and Armstrong (J. Chem. Soc., 1877, **2**, 68) are right in attributing the production of nitrous oxide and nitrogen in this case to a secondary effect peculiar to copper. The division of metals into two classes, according to their behaviour towards nitric acid and sulphuric acid, corresponds with that into metals which cannot decompose water at all and metals which can do so in certain circumstances.

Silver and Mercury inactive upon Nitric Acid in absence of Nitrous Acid and active in its Presence.—The experiments by Russell and, above all, the quantitative experiments by Veley, have established what had already been qualitatively recognised by Millon, that the activity of silver or mercury, copper or bismuth upon nitric acid is hardly measurable, unless and until a sensible quantity of nitrous acid is present, when it is proportionate to the amount of this acid, other things being equal. In this connection, as well as in contrast with the activity of the metal, zinc or tin, it is interesting to note that silver or mercury is also inactive upon its own nitrate, that is, upon the acid radical of its own nitrate; mercury acts, it is true, upon mercuric nitrate, but only to the extent of changing it into a mercurous salt, whilst leaving it as a nitrate. Copper tends, apparently, to act similarly upon cupric nitrate.

Silver or Mercury not permanently inactive upon Nitric Acid.—Silver or mercury, notwithstanding its inactivity at first, can seldom, if ever, remain long in contact with the purest of obtainable nitric acid without action being set up; but then that is because of the dissociation which goes on, however slightly, in which the nitric acid becomes nitrous acid and oxygen, except perhaps when the acid is highly diluted. It is well known to those who have tried it, that nitric acid of moderate concentration cannot be kept free from nitrous acid, and the limit of dilution beyond which no dissociation whatever occurs is as yet unknown, if it exists.

The action of Silver or Mercury upon Nitric Acid in presence of Nitrous Acid.—When silver or mercury is converting nitric acid into molecular quantities of nitrite and nitrate, there will be present a constant quantity of nitrous acid, determined by the degree of dilution of the nitric acid and by its temperature—conditions which must be kept within limits, in order to prevent the occurrence of secondary changes. From Rây's experiments with mercury, it seems that a temperature of 35° and nitric acid of sp. gr. 1·11 at 15° are together suitable conditions for the purpose. The solution in close contact with the mercury then contains about 0·05 grm. of nitrous acid (or its equivalent of nitrite) per c.c. of solution, with from 4·5 to 5 times its equivalent of nitric acid and nitrate. That mercurous nitrite in this case, or silver nitrite in the case of silver, is freely formed, is shown by its abundant separation in the crystalline form, when the solution is of sufficient depth and is left undisturbed over the mercury or silver. That nitrate and nitrite are produced in molecular proportions is a deduction from the fact that, when the action is steadily proceeding, there is no other product than these (not counting water), and, therefore, no material change in the proportion of nitrous acid to nitric acid. It was Rây's happy thought to examine the mother-liquor during the production of mercurous nitrite under such circumstances as these, that is, when no nitric oxide is escaping from the solution. In that case there is no equation for explaining the action other than that already given, modified to suit the valency of mercury :—

$$4Hg + 4HNO_3 = Hg_2(NO_2)_2 + Hg_2(NO_3)_2 + 2H_2O.$$

Nitrous Acid, Nitric Oxide, and Nitric Peroxide as Secondary Products.—*Nitrous acid* is actually formed as a secondary product when some of the nitrite actually produced, that is, produced in the primary action, is decomposed by nitric acid. This decomposition occurs (*a*) when, as at first, there is not the requisite proportion of nitrous acid already present, and (*b*) when there is not enough water present to preserve the nitrite from the action of the nitric acid. *Nitric peroxide* appears as a secondary product when the proportion of water is so low that nitrous acid interacts with nitric acid. Lastly, *nitric oxide* results as a secondary product when the proportion of water to nitric acid is so large that the nitric acid fails to prevent the nitrous acid decomposing into this substance and nitric acid :—$3HNO_2 = HNO_3 + 2NO + H_2O$. The accordance of these assertions with well-known facts is incontrovertible

Nitrous Acid as Catalyser.—In the steady conversion of silver or mercury into nitrite and nitrate, in presence of adjusted proportions of water and nitrous acid, the nitrous acid is ever being consumed and regenerated at the same rate, thus :—

$$HNO_2 + 2Ag + HNO_3 = AgNO_2 + H_2O + AgNO_2, \text{ and}$$
$$AgNO_2 + HNO_3 = AgNO_3 + HNO_2.$$

Nitrous acid is therefore the catalyser, a substance active without being consumed, in that interaction between the metal and the nitric acid by which nitrite and nitrate are simultaneously produced in molecular proportions.

Silver or Mercurous Nitrate is a Primary Product.—It may be suggested, and, indeed, has been (Millon, Russell, Veley), that nitrate of the metal is produced only as a secondary product, that is, by the action of nitric acid upon the nitrite. That it can be and is so produced at times is, of course, the fact. But, surely, it is an unconsidered statement that, in the dissolution of silver in nitric acid containing nitrous acid, the first act is the production of nitrite only, and then that nitrate is produced from it by the action of nitric acid. This way of putting the matter involves, apparently, such inconsistencies as the following :—Nitrous acid multiplies itself in this reaction; it can only act unaided upon silver by generating nitric oxide, yet no nitric oxide is produced; nitric acid in contact with silver stands by inactive, whilst the silver and nitrous acid interact to form nitrite and nitric oxide, and only then develops activity, in order to convert this nitrite and nitric oxide, as well as some of itself, into nitrous acid again. It is true that a catalyser must be assumed to pass backwards and forwards from the state of one substance to that of another, but, then, in so doing, the catalyser neither increases nor diminishes in quantity; it is to all appearance inactive and unchanged. When silver is dissolving, the nitrate and nitrite formed are together equivalent to the nitric acid consumed, nitrous acid, the catalyser, contributing nothing to the accumulating quantity of nitrite.

What change, if any, silver or mercury would effect upon an aqueous solution of nitrous acid free from nitric acid is as yet unknown. Dr. Veley, indeed, before a meeting of this Section, performed experiments upon metals, in which he used three solutions, one of them described and shown as a solution of nitrous acid prepared from silver nitrite, another being nitric acid, and the third a mixture of nitric acid with the solution of nitrous acid, and employed words in describing them which seem to have implied that only the last was a mixture of the two acids. Also, in his memoir on the same subject, published in the *Philosophical Transactions*, and in the abstract of it in the *Proceedings* of the Royal Society, similar language was employed by him; the two solutions being there contrasted as the "water-nitrous acid" solution and the "nitric-nitrous acid" solution. Nevertheless, he did not mean to imply that the water-nitrous acid solution contained no nitric acid, for, in a paper on the chemical changes between lead and nitric acid, read before this Section of the Society, he clearly indicates the presence of nitric acid in it. But it must be said that his demonstration and description were very liable to be misunderstood, and to be taken to mean the absence of nitric acid. Since it really was present, and in good quantity too, one fails to see how these experiments and demonstrations serve to establish that nitrous acid by itself in water is very active upon copper and other metals. To show to what extent nitric acid must have been present in his solutions of nitrous acid, one of his experiments may be quoted from the *Philosophical Transactions*, in which, in half an hour, 0·0942 grm. of nitrous acid in 15 c.c. of water dissolved 0·1398 grm. of copper. It is not clear from the text whether nitric oxide escaped, but, if it did, 0·14 grm. of copper would have needed 0·414 grm. of nitrous acid, that is, more than four times as much as was present. The amount of copper dissolved proves that there must have been present, along with the 0·0942 grm. of nitrous acid, at least 0·43 grm. of nitric acid, and more than that, if all the copper was in the solution as nitrate. Dr, Veley found that, when much more nitric acid was added, the metal became much less active. The reason for this was not clear to him, nor is it so to the author; but this is a matter of secondary importance here, the point of interest in connection with the present paper being that, in any of Veley's experiments, much more nitric acid was present than the quantity equivalent to the nitrous acid in the solution. In an experiment with lead, and the only one in which the amount of nitric acid present is given, Veley found the metal very active, when the ratio of nitric acid to nitrous acid was less than that of two molecules to one (2·5:1 by weight). Could he have experimented with a still less proportion of nitric acid, doubtless he would have found molecular proportions of the two acids to be the most active mixture of all.

The Primary Products of the action of Zinc or Tin upon Nitric Acid. Nitrous Acid, or a Nitrite not a Primary Product.—When zinc acts upon nitric acid, not nitrate and nitrite or nitrous acid are the primary products, but nitrate and either hydroxylamine, or ammonia, or nitrous oxide, or nitrogen, or, rather, all these together, but independently and each associated only with the nitrate. If zinc is left in nitric acid, there is undoubtedly a production of nitrite or nitrous acid, which may at last be considerable, but only as a secondary product. Zinc acts freely upon its own nitrate in aqueous solution, the products being hydroxide and nitrite. Therefore, only in proportion as nitrate increases in quantity and, before all, nitric acid decreases in quantity, does nitrite or nitrous acid make its appearance. Just at first, only the most delicate tests can detect its presence in the solution, and for some time after, when already the true primary products have been copiously formed, its amount is still very small. All this was fully stated in the author's first paper, but Dr. Veley misconstrued the meaning of what was there said, and was at some pains to demonstrate at the meeting of this Section in 1891 (this J., **10**, 204) already referred to, that zinc acting upon nitric acid produces enough nitrous acid to respond to the metaphenylenediamine test. By this demonstration he refuted nothing that the author had said, but showed, perhaps that to say that only traces of nitrous acid are produced at first, traces sometimes doubtful to find (J. Chem. Soc., **43**, pp. 450 and 458), was a slight exaggeration, when judged by the metaphenylenediamine test. But Dr. Veley's statement, that, according to Dr. Divers' experiments, zinc does not yield an appreciable quantity of nitrous acid when it dissolves in nitric acid, is one that cannot be accounted for, since, in that paper, the author records that he even went so far as to try to estimate the amount of nitrous acid produced. Besides, it should be clear from the paper that the author's statements referred almost exclusively to the action of zinc upon nitric acid in presence of sulphuric or hydrochloric acid. Veley quotes Prof. Armstrong as stating (1883) that he finds that the primary product of the reaction of nitric acid is nitrous acid, and that this body is invariably formed when any metal is dissolved in nitric acid. He then goes on to say that his own results show that all metals dissolve in nitric acid to form nitrous acid as the primary product of the reaction. In reply to this, the author would point out that what Armstrong did state was that he had satisfied himself by experiment that N_2O_4 is produced during the dissolution of metals in nitric acid by the reaction formulated by Dr. Divers, and that, concerning the primary product of the reduction of nitric acid being nitrous acid, his statement only was that he believed there was no doubt of it, which is another thing than saying that he had found it to be the primary product. Veley's published experiments evidently do not prove that nitrous acid is the primary product of the reaction of zinc upon nitric acid, as has been already explained. It has never been denied that nitrous acid is produced, but it has been pointed out that, since it only becomes present in quantity with the using up of the nitric acid, and in the absence of another acid, the conclusion must be drawn that all along its occurrence is sufficiently accounted for by the knowledge that it is abundantly formed in the action of zinc upon zinc nitrate in the absence of much nitric acid. If the minute quantity found, at first and for some time after, represents what has escaped reduction, there seems to be no way of accounting for its greatly increasing quantity much later on, notwithstanding the presence of a superabundance of the metal. If nitrous acid be less stable than nitric acid in contact with zinc, then it should be impossible for zinc to produce it, since it could no more exist in contact with zinc than could nitric acid itself.

Hypothetical Analysis of the Action of Zinc or Tin upon Nitric Acid. "Nascent" Hydrogen.—The presentation, to oneself or to others, of the process of reduction of nitric acid to hydroxylamine, or to ammonia, or to nitrous oxide, or to nitrogen, as occurring in a succession of changes, is proper and valuable as a mental analysis of the phenomenon, but such a presentation must not be taken to be that of reality, unless the facts seem to justify and call for this assumption. In such an analysis we come, in two stages, to $N'OH$, and then see that each of several events must happen, $N'OH + 2H = H_2NOH$, or $= HN' + H_2O$; or, else, $N'OH + N'OH = N'''_2O + H_2O$. In these ways, the independent production of hydroxylamine and of nitrous oxide is accounted for. Nitrogen monohydride, $N'H$, becomes ammonia by further hydrogenisation. Nitrogen hydroxide, suffering at once both reduction and condensation, $2N'OH + 2H = N'''_2 + 2H_2O$, will in that way yield nitrogen. That is probably a correct conception of the process of reduction; nevertheless, it is only speculation. The 2H is to be understood as an abbreviation for $Zn + 2HNO_3$, what is meaninglessly called "nascent" hydrogen, made into an entity, and then endowed with activity varying in kind and degree, according to what else is substituted for the zinc.

The Production of Hydroxylamine when a Second Acid is present.—The production of hydroxylamine in the reduction of nitric acid is hardly observable, except in presence of either sulphuric or hydrochloric acid in excess, when nearly half the nitric acid may be converted into this substance. A sufficient explanation of the mode of operation of the second acid is found in its action, simply as an acid, by which, for one thing, all the nitric acid is presented as such to the zinc for reduction, instead of much of it being left as nitrate, and by which, for another thing, the hydroxylamine is rendered stable as sulphate or hydrochloride in contact with zinc and acid. It seems probable that the second acid may, by acting as such, tend also to prevent nitrogen hydroxide, which presumably would be feebly basic, from suffering condensation into nitrous oxide and water. That the second acid, along with zinc, acts as a hydrogenising agent is improbable and not borne out by observation. St. Claire Deville was also of this opinion. For example, sulphuric acid is very effective in bringing about the production of hydroxylamine, yet it is very much less acted upon by zinc than is nitric acid, and can hardly take its place, therefore, in supplying hydrogen. If it did so, then with nitric acid in excess in contact with the zinc, and in presence of sulphuric acid, no hydrogen from the latter should be set free, if it were really active, yet, as a matter of fact, hydrogen does escape. Further, since nitric acid, unaided, is reduced to nitrous oxide and ammonia, it is hard to believe that sulphuric acid can be wanted to furnish hydrogen.

Ammonia, Nitrogen, Nitrous Oxide, Nitric Oxide, and Nitric Peroxide as Secondary Products.—Since ammonia and nitrous oxide are freely produced, from the first, when zinc acts upon nitric acid, there seems to be no reason to believe them to be not primary products. But that they are also, to some extent, secondary products is certain. In the absence of much free acid, hydroxylamine salts are reduced by zinc to *Ammonia*. So is zinc nitrite. *Nitrous Oxide* may arise from the interaction of hydroxylamine with nitrous acid, provided that one of these substances is formed at a later stage and thus finds the other present, but they can hardly be supposed to be produced together, only to become nitrous oxide and water. The same is true as regards *Nitrogen* being derived from nitrous acid and ammonia. *Nitric Peroxide* and *Nitric Oxide* are undoubtedly secondary products, being derived from the decomposition of nitrous acid by nitric acid and by water respectively.

Hyponitrous Acid.—Hyponitrous acid is never found as a product of the action of zinc or tin upon nitric acid. It is only produced as a salt by the action of an alkali metal upon its nitrate, which then in definite stages becomes nitrite and hyponitrite. But in this case, hydroxylamine and nitrous oxide are produced, and, as a secondary product, ammonia. (Trans. Chem. Soc., 1899, **75**, 87.)

Discussion.

Prof. Rây said that a considerable quantity of nitrous oxide was produced when copper dissolved in nitric acid. Nitrogen and nitrous acid were also formed. In Dr. Veley's experiments on the action of nitric acid upon metals, a ball of copper had been kept rotating in the acid, so that the products of the reaction should be removed as soon as possible from the field of action at the surface of the metal. But in the usual preparation of nitric oxide by the action of copper on nitric acid, he had often noticed, when the Woulff's bottle had been left undisturbed, that the solution next the copper became of a deep green colour—a fact which seems to show that nitrite, as well as nitrate, was being produced. Copper nitrite had not yet been isolated, and probably never would be. The apparent production of copper nitrite indirectly confirmed the results obtained by the action of nitric acid on silver and mercury.

Dr. Veley said that if nitric acid had been purified by fractional distillation and finally brought over by some process analogous to the Carré still (the method adopted by Kohlrausch and Heydweiler for the purification of water), few metals were acted upon by it. Indeed, he looked forward to the time when an experimenter would obtain nitric acid of such purity, and a metal—sodium—also of such degree of purity, that, working under suitable conditions, the metal sodium would float peaceably on the nitric acid. They were brought face to face with the problem as to why did the reaction ever commence. Supposing it had begun, and supposing the conditions were such that there was formed some small quantity of nitrous acid, then the reaction would proceed rapidly and the equations represented on the board might or might not be accurate representations of the real facts. With regard to Dr. Divers' statements as to the action of zinc on nitric acid, he would like to say that he had, himself, not worked sufficiently on the subject to be able to express an opinion; all that he had desired to prove (by his demonstration on a former occasion) had been that, if the conditions were such that the zinc dissolved in the nitric acid, nitrous acid was formed. With regard to the experiments, concerning which Dr. Divers had cited certain numbers, he should explain that, of course, nitric acid was present in both the nitrous acid mixture and in what he had called the nitrous-nitric acid mixture. The object of the experiments had been to show that, instead of nitric acid facilitating the reaction between the acid liquid and the metal, it impeded it; the nitric acid present was a something in the way, and therefore he had argued, perhaps incorrectly, that the so-called nitrous acid, and not nitric acid, was the real substance which reacted with the metal. He hesitated to term certain of the equations (those in column 2, page 1184) put forward by Dr. Divers even working hypotheses.

Dr. Divers, in reply, said that he had been gratified by hearing Dr. Veley refer to nitrous acid as a substance of uncertain, shadowy existence, because in 1891 Dr. Veley had brought it against him that he had spoken of it in much the same way, in a paper published in 1885. It was important to have had it cleared up that Dr. Veley's experiments with nitrous acid and metals had established the fact that, in very dilute aqueous solutions, a mixture of nitrous acid with little more than its equivalent of nitric acid was very active upon metals, for that was quite in accordance with the view set forth in the paper as to the combined action of the acids, $NO_2H + HO.NO_2 + 2Ag = 2AgNO_2 + H_2O$. Further, that somewhat more nitric acid greatly impeded that action, although, with much more of it present, it itself became very active, with the nitrous acid as catalyser.

*LUMINESCOPE FOR COMPARING SUBSTANCES UNDER THE INFLUENCE OF RADIUM RAYS.

BY C. S. STANFORD WEBSTER, F.I.C.

The value of the method adopted in the pocket spinthariscope of Sir William Crookes, for observing the scintillating effects produced by the radium rays on sulphide of zinc, has become so generally recognised that a further extension of the method, with the object of rendering it applicable for comparing different substances, both as regards "glow" as well as scintillating power, appears desirable. It is to meet this want that the luminescope has been designed.

The instrument consists of a light circular metal box A (Fig. 1) perforated in the lid where the cylindrical piece B is attached, carrying the draw tube with the system of lenses, the latter in a similar manner to the spinthariscope, except that the pointer, with the radium salt beneath the ocular, is fixed to the inside of the lid, about the position C. The box contains a circular metal disc, shown in plan (Fig. 2) resting on leather, and having a short tube or rod fixed to the centre, which passes loosely through the bottom of the box, thus forming both the axle and the handle D. The disc is kept in place by a flange of leather, which presses on its edge, and is fixed to the lining of the box. The lid of the box is conveniently fastened by the adoption of bayonet joints. By turning the handle D, the disc is made to rotate, bringing the screens into position under the pointer as required. The disc carries four screens, one of which is temporarily fixed by means of the wire spring clips E, and can be removed at will and any other screen of a finely divided substance substituted for comparing the scintillating power, or, in the case of mounted fragments of minerals, &c., for observing the comparative glow.

Fig. 1.

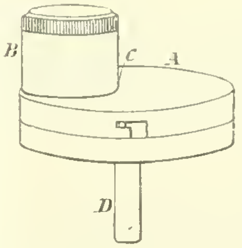
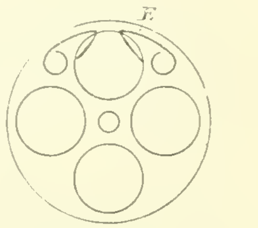


Fig. 2.



Scale = half actual size.

To obtain the best results with the instrument, the various substances should not all be placed at the same distance from the radium salt. A good plan is to give the screens a

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* The instrument was originally styled "Fluorescope," but as there is already an instrument termed a "Fluoroscope" in existence, used for direct observations with the Röntgen rays, to prevent confusion the name Luminescope is preferred.

foundation of cork—a thick base, for instance, being used under a mounted fragment of diamond, and a thin one under the screen of sulphide of zinc. The diamond is thus brought near the pointer to obtain the maximum glow; the sulphide of zinc being farther away, the scintillations are consequently seen to the greatest advantage. It is hardly necessary to add that the draw tube must be adjusted for each observation.

I cannot conclude the description of this little instrument without acknowledging the advantage which I have had of the friendly criticism of Sir William Crookes.

METHOD FOR THE DETERMINATION OF PHOSPHORUS IN IRON ORES.

BY J. S. ROWLAND, F.I.C., AND LLEWELLYN J. DAVIES, F.C.S.

The importance of estimating the percentage of phosphorus in iron ores intended for the manufacture of steel, more especially those used in the acid process, is perhaps more necessary at present than formerly, owing to the fact that the low phosphoric ores are becoming more difficult to obtain. Works chemists generally are obliged to keep a watchful eye on all cargoes in order to prevent unsuitable ores going into the blast furnace.

The ordinary molybdate and magnesium methods are quite accurate for all purposes if carefully conducted, but they take a considerable amount of time, and for low percentages of phosphorus require a fairly large bulk of material. Oxidation has to be done with concentrated acids and these evaporated, the residue taken to dryness, and again taken up with acid, washed, &c., which all require attention.

In order to economise labour and save time, we have devised a method which has, in our hands, worked satisfactorily, and given results which agree amongst themselves, and also agree, within allowable margin of error, with those obtained by other analysts on joint samples taken from cargoes of ore.

The chief points of the method are as follows:—

(*a*) The ore is oxidised by incineration with magnesia and then boiled with dilute nitric acid. A solution is thus obtained which contains all the phosphorus, and saves the evaporation and reduction necessary in the other processes.

(*b*) The determination of the phosphorus by titration of the yellow precipitate with standard sodium hydrate and nitric acid solutions.

Method.

Mix one or two grams of the finely ground sample of the dry ore with one gram of calcined magnesia (free from phosphorus). This can be done on a piece of glazed paper. Heat the mixture in a porcelain incinerating dish (2 in. by 1 in. by ¼ in.) at a bright red heat for one hour in a muffle furnace. Allow the dish to cool and then transfer the mixture into a beaker and slowly add about 25 c.c. of 50 per cent. nitric acid and boil for 10 minutes. Allow to settle and decant the clear liquid into a Erlenmeyer flask of 12 oz. capacity, using a good filter paper; add about 25 c.c. of water to the residue in the beaker, boil for five minutes, and filter into the flask and wash till free from acid. All the phosphorus is now in solution.

Add 5 c.c. of ammonia and heat up the solution to boiling, add 50 c.c. of molybdate solution, and wrap in towel, after inserting rubber stopper (or put in shaking box), and shake for 10 minutes. Filter immediately, using a good paper and moderate suction, wash out the flask on to the filter paper five times with 1 per cent. nitric acid solution and also five times with 1/10th per cent. potassium nitrate wash (1 grm. per litre), and wash filter till free from acid. Place the filter paper and contents in the flask, add from 10 to 20 c.c. of standard sodium hydrate solution and shake a moment until the yellow precipitate is dissolved. Dilute with water to about 50 c.c., add three drops of phenolphthalein solution, and titrate with standard nitric acid solution until the pink colour disappears. The cubic centimetres of standard sodium hydrate solution used in dissolving the yellow precipitate represents the hundredths per cent. of phosphorus in the sample analysed when 1 grm. is taken for analysis.

Sodium carbonate can be used in the place of magnesia, but we have found that the latter is more convenient, owing to its infusibility.

In the above method the molybdate precipitate is treated with slight modifications according to the directions given in "A Rapid Method for Phosphorus Determination in Iron, Steel, and Ores," by James O. Handy, in the Amer. J. Analytical and Applied Chemistry, 1892.

Reagents.

Molybdate Solution (*E. F. Woods* 1898 *Formula*).—One quarter pound of molybdic acid is mixed with 300 c.c. of water in a stone jar; 175 c.c. of ammonia (0·90 sp. gr.) is stirred in and the stirring continued until all the matter is dissolved; 75 c.c. of concentrated nitric acid (1·42 sp. gr.) is added to partially neutralise the ammonia solution.

In a 2½ litre bottle is placed 500 c.c. of nitric acid (1·42 sp. gr.) and 1,200 c.c. of water. Pour the molybdate solution into the bottle and mix with a rotary motion. If the stream of molybdate flows quickly and continuously into the acid mixture no separation of molybdic acid takes place. Both solutions may be hot when mixed.

Pure Yellow Precipitate.—This can be prepared from acidified ammonia or sodium phosphate by precipitating with molybdate solution. Wash the precipitate with 1 per cent. nitric acid wash. Dry at 100° C. Keep in a glass-stoppered bottle for use.

Standard Sodium Hydrate.—7·2 grms. of sodium hydrate are dissolved in 100 c.c. of water. Saturated barium hydrate solution is stirred into the sodium hydrate solution until no further precipitation occurs. It is filtered at once and made up to 2 litres with distilled water.

Standard Nitric Acid.—10 c.c. of nitric acid (1·42 sp. gr.) is made up to 2 litres with distilled water.

Standardising Solutions.—Run the standard acid and alkali against each other, and having ascertained their relative strengths add sufficient water to the stronger to make the solutions equal in value. Next run the sodium hydrate solution against 0·100 grm. pure yellow precipitate which equals 0·00163 grm. of phosphorus. If its strength is too great (*e.g.*, if 1 c.c. equals 0·000106 grm. of phosphorus) add to the 2 litres of standard sodium hydrate 60 c.c. of water. In order to preserve the equality of the acid and alkali solutions, add to the 2 litres of standard nitric acid 60 c.c. of water and mix. The solutions will then be equal, and 1 c.c. equals 0·0001 grm. of phosphorus.

Phenolphthalein Indicator.—0·5 grm. of phenolphthalein are dissolved in 200 c.c. of 95 per cent. alcohol. Three drops are used for each titration.

Table of Results.

Description of Ores.	Gravimetric Result.	New Method Results.	
	P.	P.	P.
	Per Cent.	Per Cent.	Per Cent.
Calcined spathic	0·0095	0·01005	0·00905
Magnetic	0·01287	0·0126	0·01352
Hematite*	0·0190	0·0191	0·0191
"	0·034	0·0361	0·0351
" red	0·0531	0·0516	0·0521
Micaceous	0·2000	0·1996	0·1996

* This sample contains 0·060 per cent. of arsenic.

DISCUSSION.

Mr. SPILLER referred to a paper he read entitled "The Estimation of Phosphorus in Iron and Steel" (J. Chem. Soc., 1866, **19**, 148), which was equally applicable to the examination of iron ores, and described how he would treat a spathic ore or clay ironstone. He never went to the length of being able to apply a volumetric process to the method as the authors had done. It was only an everyday method of getting a result which was undoubtedly accurate, and he had heard of its being used in later times.

Mr. GRANT HOOPER asked if Mr. Davies would state the object of igniting the ore with magnesia, and whether, apart from the question of the possible presence of a trace of silica, there was any reason why the molybdate precipitate should not be strictly weighed on a Gooch crucible. He further asked whether on the solution of the molybdate precipitate, with the object of removing any silica that might be present the author had any experience of the process by which the molybdate was then precipitated and weighed as lead molybdate. This process was far more rapid than the ordinary one, and he had found it very useful, though, where a large number of analyses were being made, he could understand that a titration was more rapid.

Mr. Davies, in reply, said, with regard to the condition of the phosphorus in the incinerated residue, that the magnesia in combination with oxygen from the air oxidised all the phosphorus into a form of magnesium phosphate. They had not tested in which form it was in the incinerated residue. In answer to the question of the effect of any silica in the weighing or titrating of the yellow precipitate, he would point out that the yellow precipitate was not weighed in the above process. Any silica that might be present during the process did not appear to affect the results obtained by titrating the yellow precipitate. They always filtered the molybdate solution before use. They had no practical knowledge of the lead method. By the method he had described they could get a result, allowing five minutes for weighing, in 45 minutes. Of course, they did not count the hour for burning, because once the ore was placed in the furnace it required no further attention until roasted, and other work could be done. They knew of no other process for the estimation of phosphorus that could be completed in so short a time, and they had found the results very accurate.

New York Section.

Meeting held at the Chemists' Club, on Friday, October 21st, 1904.

MR. RUSSELL W. MOORE IN THE CHAIR.

PRESENT METHODS OF TANNIN ANALYSIS AND THEIR INFLUENCE ON THE MANUFACTURE OF LEATHER.

BY JOHN R. MARDICK.

The introduction of extract tannins into American tanneries is a new feature and requires very careful mechanical attention in order to make good leather. It is our duty as chemists to exercise a scientific supervision over chemical processes in tannery practice, to manufacture extracts of good quality and to show, by careful analyses, that these extracts contain the true percentage of those tannins which actually combine with hide fibre.

The present methods of tannin analysis are all empirical. The tannins do not form a definite chemical compound with the hide matter; in fact, the absorption of tannins by hide is mostly a physical phenomenon, very closely related to osmosis. Originally, these empirical methods were devised for the benefit of the tanner; now the tanner is only a small factor in tannin analysis. Researches on tannin analysis have now so little direct bearing on the manufacture of leather that they may be said to be made altogether from the standpoint of the extract manufacturer. We know now how much tannin there is in an extract, and we leave the tanner to find out how much leather can be made from that extract.

The tannins reported on paper differ from those of the yard, because the conditions under which the tannins are analysed differ from those of the tannery. For instance, the tannin determinations in the laboratory are made in very weak solutions, containing 3 grms. of tannin to a litre, while most yard liquors are several times stronger than that amount. The result is that while reds and non-tannins go into solution under the conditions of laboratory analysis, to be subsequently taken up by the spongy hide powder and thus raise the percentage of tannins in the report, the same reds and non-tannins remain in the yard as insoluble and are thus not absorbed by the hide. Again, the temperature of a yard in normal conditions runs between 45°—75° F., while the analysis is made between 68°—100° F. Because in the analytical work the concentration of solutions, the temperature and quantity of hide powder differ from tannery conditions, so the percentage of tannins do not agree at all. In the laboratory 15 grms. of hide powder (45 grms. wet) is violently shaken with a solution containing 1 grm. solid, out of which 6 grms. is tannin. Naturally, this large quantity of hide powder absorbs not only the tannins, but also a part of non-tannins, such as gallic acid and soluble matters introduced into the extract for the purpose of preventing the precipitation of reds in the liquid extracts. All this absorbed matter is reported as tannin. Consequently, the tanners cannot make leather to correspond with the percentage of tannins found by the chemist. If methods of tannin analysis are to be empirical and made for the advancement of the leather industry, the conditions of analysis ought to correspond with actual tannery practice.

Tanning in vats involves a loss of 15 per cent. of tannin, while in modern quick tannage the loss is only 5 per cent. Why should there be such an enormous loss in tannins when the entire mechanical loss amounts to only 3—4 per cent.? A definite quantity of an extract, dissolved in a measured vat and made up to 10° bark. liquor and allowed to stand for four days, then analysed according to the American official method, without heating the liquor, but simply diluting, would not give the original percentage of tannins, but the reds and non-tannins are increased. By the official method of analysis only 5—6 grms. of solid matter is dissolved in a litre, and accordingly reds and non-tannins go into solution. In analysis much of the reds and non-tannins is absorbed by the hide powder; hence the high results. In modern quick tannage, where the extracts are heated to 100°—125° F., and then applied in a wheel to the partially-tanned skins, the loss is small, because some of the reds and non-tannins are incorporated with the hide. We cannot apply, however, this temperature to the green stock or the liquors in the vats.

There are two definitions of tannin. According to the extract manufacturer it is any vegetable principle that can be absorbed by hide powder at laboratory temperature and concentration. According to the tanner it is any bark or other astringent liquor that combines with the fibre under the normal conditions of the tannery and forms leather. Do all the tannins reported in analysis really go to make leather? Since some of the non-tannins, gallic acid and reds in these extracts are calculated as tannins, and sold as such, the tanners have always failed to secure results commensurate with the amount of extract used. For example, 100 lb. of 25 per cent. extract, which should make 60 lb. of sole leather (taking oil and moisture into consideration), in actual practice hardly makes 50 pounds, even under the most favourable conditions. This discrepancy led us to investigate the subject, and we have come to the conclusion that extracts contain from 1 per cent. to 5 per cent. less tannin than is guaranteed.

A 5° barkometer liquor was prepared from a chestnut extract, and 100 c.c. of this were treated by the maceration method with 20 grms. (containing 75 per cent. of moisture) of wet hide powder, stirred thoroughly, and large particles on the side of the glass crushed with a spatula. In 15 minutes the hide powder had absorbed all the available tannins that make leather. The clear filtrate was tested with 1 per cent. of gelatine and 10 per cent. of salt solution (this solution being accurate to 0·005 per cent). No tannin reaction could be obtained. Another 100 c.c. of the same liquor treated with 20 grms. of hide powder, shaken for 10 minutes in a milk shaker, and analysed according to the official method, gave from 0·75 per cent. to 1 per cent. more tannins than the former. Since there was no tannin in the filtrate from the maceration method the excess given by the latter method must be something else than tannins.

Again, six solutions of the same strength were macerated respectively with 20 grms. of hide powder, for $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, and 2 hours respectively. The absorption of non-tannins in the last five cases increased successively from $\frac{1}{4}$ per cent. to 1 per cent. In the case of solid extracts the difference was from 1·5 per cent. to 3 per cent. The following were analysed by the maceration method :—

	Guaranteed.	Found.	Found.
	Per Cent.		
Total solids	..	35·00	40·21
Total soluble solids	..	33·88	38·77
Non-tannins	..	9·80	14·23
Tannins	25	24·05	24·56
Insoluble reds	..	0·50	1·43

These experiments were repeated with other extracts from different houses. Of these extracts it was found that those guaranteed as 25 per cent. tannin contained 24 per cent., while those guaranteed as 26 per cent. tannin contained not quite 25 per cent.

We think that the maceration method gives more reliable results than the shake method, but the greatest difference arises from the concentration of the solutions or amount of sample taken for analysis, as we have pointed out before. In the following results we have used three times more extract than the usual official amount, and we find that our method comes within 0·25—0·50 per cent. of actual tannery practice.

	Chestnut Extract.		Mixed Extract.	
	Modified Method.	Official Method.	Found.	Guaranteed.
Total solids	40·82	40·92	78·52	79·00
Total soluble solids	36·87	39·00	76·58	79·00
Non-tannins	14·00	15·02	15·03	10·60
Tannins	22·87	23·98	61·55	68·40
Insoluble-reds	4·65	1·92	1·94	..

	Quebracho.	
	Modified Method.	Official Method.
Total solids	47·76	47·76
Total soluble salts	39·50	43·55
Non-tannins	8·13	7·97
Tannins	31·57	35·58
Insoluble-reds	8·16	4·21

Of all methods of tannin analysis, the official method of the Association of American Official Agricultural Chemists is the simplest and most promising. Recently Parker and Payne have outlined a method by which tannin solutions are titrated with lime, forming an insoluble compound with digallic acid. Again (Zeits. angew. Chem., May 1904), Wislicenus advocated the use of alumina instead of hide powder. The accuracy of these last two methods has not yet been definitely tested, so we may turn our attention to the official method :—

Objections to the American Official Method.—(1) During shaking, the hide powder in some cases goes into solution (this depends on the strength of the solution), and non-tannins are absorbed.

(2) The quantity of material used for analysis (*i.e.*, 3 grms. of tannin for 1000 c.c.), is too little, and the hide powder too much. The result is that more gallic acid and non-tannins are absorbed by the hide powder. The tannin solution ought to contain 10 grms. of tannin per litre.

(3) There is an appreciable error in making the analysis at room temperature. The solution ought to be measured at 20° C., which corresponds to the temperature of the average tannery.

(4) In the chroming of the hide powder, 3 grms. of chrome alum for 100 grms. of hide powder is not sufficient to make it insoluble. For chroming it is better to use basic chromium, sulphate, or chloride in quantities containing 1 per cent. of chromic oxide (Cr_2O_3) per 100 grms. of hide powder.

F. Kopecky (Collegium, 1904, 211—214) says : "The absorptive power of this hide powder diminishes as it is more highly chromed, but if under chromed, the solubility is greater, especially for acid liquors."

Hide powder absorbs non-tannins under any circumstances ; but we would improve the method of manipulation so that the error from the absorption of non-tannins and gallic acid will be reduced to its lowest limit. We suggest the following improvements in the analysis of tanning materials.

Preparation of Hide Powder.—Digest 100 grms. of hide powder in 1000 c.c. of water for two hours, add 8 grms. of chrome alum, changed previously to chromium basic sulphate by boiling in 50 c.c. of water to 25 c.c. with 1 grm. of soda crystals, after 12 hours squeeze through linen and wash five times with distilled water. In the last washing add 10 c.c. of formaldehyde, and let it stand two hours before squeezing. By a press, get as much water out of it as possible, and use 25 grms. of this hide powder for analysis, and from 1—2 grms. for moisture determination.

Quantity of Material.—For the purpose of analysis the following quantities are recommended :—

Bark.	Grms.	*Extracts.*	Grms.
Hemlock	50	Chestnut wood	40
Oak bark	50	Quebracho (solid)	15
Oak wood	100	„ (liquid)	30
Quebracho wood	35	Gambier	20
Sumac	25		
Spent tan	100		
Amazona	25		

After extracting the tannin materials from the above, the solutions might be made up to 1000 c.c., and measured at 20° C.

Total Solids.—Shake the solution thoroughly, and measure out at 20° C. 50 c.c., evaporate in a weighted dish (6 ins. in diameter, 1 in. high), and dry at 102° to 103° C. for three hours.

Soluble Solids.—To 1 grm. of washed kaolin add 5 c.c. of tannin solution, stir until thoroughly mixed, then add 100 c.c. of the same solution, stir and pour on filter (S. and S. No. 590, 15 cm.). Keep the filter full, reject the first 100 c.c. of the filtrate, and evaporate the next 50 c.c. on water bath, and dry at 102° to 103° C. for three hours in the drying oven.

Non-Tannins.—To 25 grms. of hide powder, in a shake glass, add 100 c.c. of tannin solution, stir, and crush with a spatula the large particles on the side of the glass; after it has stood 10 minutes stir one half minute ; after 15 minutes further standing stir again, and throw on a double folded cheese cloth ; squeeze out as much liquid as possible, filter in same way as in soluble solids, evaporate 50 c.c. on water bath, and then dry at 102° to 103° C. for three hours.

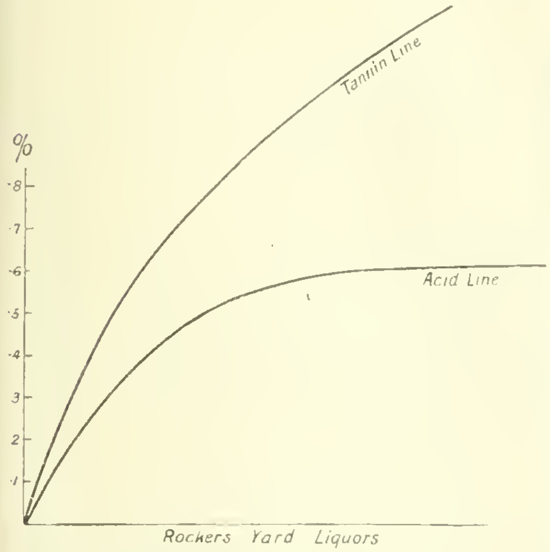
Tannins.—Soluble solids, less corrected non-tannins, give tannins.

Moisture.—100, less total solids, gives moisture.

Testing Non-Tannin Filtrate.—To 5 c.c. of clear non-tannin filtrate add 5 c.c. of 10 per cent. salt solution in a test tube ; add slowly a few drops of 1 per cent. of Nelson's gelatine solution on the side of the test tube. A slight milky cloudiness indicates the presence of tannin.

Precautions.—(*a*) In all quantitative work of tannin analysis, evaporation during filtration must be guarded against, both in the funnel and in the receiver of the filtrator. (*b*) After evaporating the solutions on water bath, the dishes which contained the tannin must be dried at from 102° to 103° C. for three hours, and must be weighed only once. (*c*) In the analysis of gambier, sumac, myrobalans, quebracho, and other sour liquors, let the tannin solution stand with the hide powder for a longer time (about 60 minutes instead of 30), with occasional stirrings.

Acidity in Tan Liquors.—In tanning, the proportion of tannins to the acids in a liquor is of paramount importance, as the success of leather manufacture depends on rightly adjusting the proportion of these two constituents. Brittle leather is obtained when the tannins are less than twice the amount of acids in the rockers and handlers, and again, when the tannins are less than three times the acids in the sapped liquors. To make this more plain, the acids and tannins rise gradually from the rockers and handlers up to the lay-away liquors, then the acids remain stationary, and the tannins increase up to 3 per cent. to 4 per cent. (See diagram.)



The best results are obtained when there is not more than from 0·5 per cent. to 0·6 per cent. acid in the rockers, while the tannins ought to be more than 1 per cent. in the rockers or handlers.

In leaching the bark, some of the extract manufacturers use alkali salts, which diminish the astringency of liquors, and sodium bisulphite, which checks the production of organic acids by fermentation when the liquors are standing in vats; consequently, they require additional acids to restore the tannins to active conditions. The alkali salts combine with the gallotannic and ellagitannic acids, and form the alkali salts of the same acids. In order to free these acids, fresh quantities of acids are required, and this additional item is a large bill of expense in tannery practice. This explains why certain extracts, which are not apparently alkaline, absorb acetic and lactic acids when added to them.

Acid Analysis.—The analysis of acids in tannin liquors is another important element for serious consideration.

The official method of determining acidity in tan liquors (rockers, handlers, &c.) by decolorising with animal charcoal, and then titrating with alkali (with phenolphthalein as indicator) is slow and faulty. Both animal charcoal and filter paper absorb acid; the decolorisation is not complete without heating the solution with a return condenser; the dark coloration produced by titration with alkali and the carbonic acid in the solution make phenolphthalein less accurate as an indicator, and this interferes with the accuracy of the determination. The following, which already is used on the Continent, and to a certain extent in this country (Deutsche Gerber-Zeitung, 1900, No. 45), is suggested as a quick and reliable method for acid determination:—

Take 25 c.c. of tannin solution and titrate with $N/10$ KOH; add alkali, $\frac{1}{2}$ c.c. at a time, and with a glass rod put a drop of the solution on blue litmus paper; observe the change of colour in the paper; in this way, repeat the testing until the solution produces no change in the shade of the paper (the litmus paper should be very sensitive and of good quality). The solution gradually assumes a dark colour as it is neutralised, and the original intensity of the acid colour produced on the litmus paper decreases correspondingly until it shows no change, and this is the end point. Or still better, the end point might be taken between the red and blue papers. In this way a determination can be made in from five to ten minutes. This method is accurate to 0·02 per cent.

Nottingham Section.

Meeting held on Wednesday, December 14th, 1904.

MR. S. F. BURFORD IN THE CHAIR.

NOTES ON GLUE AND GLUE TESTING.

BY H. J. WATSON.

Originally it was intended that these notes should deal exclusively with the analysis of glue, but in view of the many sources from which glue is obtained, and the different methods employed in treating the raw material, it has been thought essential to the proper grouping of experimental results to classify the samples, in the first place to the sources of material, and in the second to their order of derivation. Upon the quality of glue desired depends the material and process a manufacturer will adopt.

In the first place under glues, we have skin, bone, and fish glues, and again under gelatines, skin, bone, and fish gelatines, these being subdivided according to method of treatment and order of derivation. In the first group under the subdivision, I place what I term osseine glues, being those glues which are produced by the reduction, fully or partially, of the material to a form of osseine. The term is one well known in the trade, there being in existence some factories wholly engaged in its production. From osseine thus prepared, high-class colourless glues and gelatines are manufactured. In the production of this class of glues and gelatines the preparation of the material has been carried to the highest pitch of perfection known, and the extractive period under heat has been reduced to the shortest possible, probably not more than two hours. We may assume, for all practical purposes, that this is an ideal standard. The samples, however, produced from one osseine material may represent 13 or 14 grades, all of successively lower qualities and representing in each case successive stages of extraction, each of increasing duration under heat. With regard to skin glues under this group there is a deviation in grades according to the requirements of the factory. In any case the first extractive quality will not amount to more than 25 to 30 per cent. of the total product.

In the second group I designate original glues, in that they are composed of 60 per cent. of the material contents of gelatine, and contain the total practicable extractive value of the material. Skin and bone glues come under this group.

In the third group I designate reinforced glues, and include in this class those samples which are prepared from the lower grades of the osseine glues, blended with a certain proportion of original extractive gelatine from lower classes of material.

In the fourth group I designate average glues. I place those samples which are prepared on a continuous system in which the later extraction results are passed into fresh material, and which, therefore, contains a result from a number of extractions of the same material in different stages of exhaustion.

In the fifth group I place successive glues, inclusive of these glues, which, although produced on a system similar to the third group, are reinforced from the same class of material. This grouping does not by any means exhaust the variations in these products. Under each group-heading there will be found a number of minor modifications due to special blends of materials operated upon, the particular market catered for, and also to some extent upon the individual caprice and inherited traditions of a manufacturer.

In French glues the majority may be placed under groups No. 1 (osseine) and No. 3 (reinforced). In Germany and Austria the bone glues are principally group No. 4 (average), the skin glues group No. 2 (original). The foregoing applies to the bulk, but all the groups are individually represented in each country. I would, however, emphasise the fact that there is no standard method in the manufacture of glue as in the case of, say, alkali or other well-known industrial products, and, therefore, the utter failure up to the present to set up some effective standard of valuation of glue is not difficult to understand. In my opinion this failure is due in no small measure to the absence of any attempt to apply different physical tests to samples from the different groups.

Analysis.—Practically the valuation of glue by analysis to the manufacturer is one thing and to the consumer quite another. It must be borne in mind that it is to the consumer that the ultimate decision is valuable, and chemical analysis not giving him any appreciable data of service, reliance is placed almost wholly on one or more of the many physical tests invented. I may here say that the four principal points of value to the consumer are: (1) adhesiveness; (2) strength or cohesion; (3) rate of setting; (4) carrying power or medium absorption. Adhesiveness is best shown by viscosity: strength or cohesion, by consistency jelly test; rate of setting, time taken to congeal. Of course it is impossible to generalise in this matter, as the special value to one consumer is quite a different physical property to another. As an example of what is required by a consumer, one of our customers specifies that the glue shall be submitted to the following tests:—(1) Percentage of water in original glue at 110°—115° C.; (2) percentage of ash and quality; (3) acidity (total and volatile); (4) capacity for drying; (5) percentage of foreign matters not glue; (6) viscosity, along with the physical test of smell of glue size with water absorption, &c.

The principal physical and chemical tests applied to glue were enumerated at the first meeting of this Section by Messrs. Trotman and Hackford, and will be found in the Journal for November 30th.

After numerous experiments with the various methods of glue testing, I place most reliance upon the consistency test, described by Messrs. Trotman and Hackford, and Fels' viscosity test. From personal experience I can affirm that the consistency test does not depend upon individual idiosyncracy, and that a short experience only is necessary to enable one to obtain reliable comparative results which have been found to be of great value in the manufacture of glue. The only objection to the general adoption of this test is in the selection of a standard glue which would have to be the standard of both manufacturers and consumers alike. I have found in many cases it is quite necessary, in addition to the consistency test, to know the viscosity of the glue under examination. For this test I use Fels' method with an Engler's viscometer. In the Journal 1901, page 139, Fels recommends in the application of his test that the temperature be raised from his originally prescribed one of 30° C. to 35° C., because he had met with a glue whose viscosity was 6·24, while the highest limit permissible is 4. Even at this higher temperature I have met with a number of samples which have viscosities higher than 4, one sample showing a higher viscosity than 11. It would appear therefore that a weaker solution ought to be recommended. I am aware that Rideal uses a 1 per cent. solution at 18° C., but I prefer a stronger solution.

Coming now to chemical analysis and excluding moisture, ash, acidity, and the saponification process, the only other constituent which any attempt has been made to determine is nitrogen, and by multiplying by a factor to obtain gelatin. It will perhaps be better to here explain that I prefer to adopt the recommendation of Rideal, and when speaking of the pure substance to spell it *gelatin* and the commercial article *gelatine*. It is generally accepted that the manufacture of glue or gelatine is one of hydrolysis. Collagen, the substance in osseine, which forms the principal basis of all glues and gelatines, is capable of undergoing several stages of hydrolysis, first into *gelatin*, then into *gelatoses* (analogous to albumoses), next into *gelatones* (analogous to peptones), and finally into amido acids. In the process of manufacture the whole of these reactions must take place to a more or less extent, according to duration of the process under heat. It follows, therefore, that these compounds must all be present in commercial glue or gelatine. Besides these substances there must be in the commercial product, according to the source of material and selection and treatment of same, previous to boiling, other nitrogenous bodies, as chondrin, which has gelatinising properties, mucin, albumoses, and other complex nitrogenous compounds. Messrs. Trotman and Hackford, in the paper already referred to, attempt to differentiate between the different forms of nitrogen in glue by using Bömer's method for albumoses. An attempt is made to compare the consistency jelly test with the nitrogen precipitated by zinc sulphate, and which they term albumose nitrogen. In my opinion, any attempt to place a valuation on glue by simply estimating either the total nitrogen or the nitrogen precipitated by zinc sulphate is useless. In the first place, in the total nitrogen is represented all the hydrolysed compounds of collagen and chondrigen, and other complex nitrogenous compounds. In the second place, the precipitate by zinc sulphate is of uncertain composition, because it may contain gelatin, gelatoses, and possibly chondrin; by multiplying the nitrogen found by the factor used by Allen, 5·42, we get gelatin, whether the precipitate is gelatin or gelatose. Messrs. Trotman and Hackford use the terms albumose nitrogen and peptone nitrogen. I make objection to the use of these terms to differentiate between gelatin and nitrogenous compounds not gelatin, because they are somewhat out of place when dealing with gelatin, and because the real albumose can only be a negligible quantity. If there is to be any attempt to differentiate, we ought to keep to the terms used to distinguish the different stages of hydrolysis. Albumin, albumoses, and peptones should only be used for that special group of proteids. A notable point in Messrs. Trotman and Hackford's paper is that the difference between the total nitrogen and the nitrogen precipitated by zinc sulphate can only be due to over boiling. While admitting that over boiling does to some extent destroy the gelatinising properties of glue previous to drying, the adhesive qualities are not impaired in proportional extent, if at all. The points raised by the authors already referred to are of immense interest to the manufacturer and consumer alike: to the manufacturer perhaps more so, because, if, as they state, he is losing gelatin to the extent of 1 to 15 per cent., as shown in their table, it is a serious loss which ought to be easily overcome and at the same time add to the commercial value of his glue. On account of its great importance a number of samples of commercial glue from known sources were selected and examined by the consistency jelly test, Fels' viscosity test at 35° C., total nitrogen and nitrogen by zinc sulphate. With the explanation of grouping given in the opening part of these notes and the table here set out, it will be seen that selection of material and mode of treating same before boiling are the leading factors in the differences shown between the two nitrogen tests. It will be noticed on comparing the consistency test with the viscosity test in every case they are not analogous. I mean the viscosity does not always rise and fall with the consistency. This shows the necessity for having the two methods, and is accounted for from the fact that gelatin and gelatose have not the same gelatinising properties, therefore a method which precipitates and treats both as one for calculation cannot be regarded as a method upon which reliance can be made in valuing glue or gelatine. In the table here given, Nos. 1, 2, 3, and 4, go through almost precisely the same boiling period, and the only difference is a selection of material. No. 1 is a very inferior material, and undergoes little or no treatment prior to boiling. No. 5 is a glue which undergoes the longest period of boiling, and is what is known as a medal glue. No. 6 is a celebrated Scotch grade noted for its adhesive properties, but, according to zinc sulphate test, is not greatly superior to No. 1. No. 11 certainly shows the least difference in the nitrogen tests, but has much less gelatin, according to the zinc sulphate test, than some of the much inferior grades. I have not given an osseine glue in my table, but No. 1 in Messrs. Trotman and Hackford's table is a very good example of a bone osseine glue or gelatine.

—		Viscosity of 15 per cent. Solution at 35° C. Water = 1.	Consistency Jelly Test.	Total Nitrogen × 5·42 = Gelatin by Kjeldahl.	Nitrogen precipitated by ZnSO₄ and Kjeldahl × 5·42 = Gelatin.	Difference between Gelatin by Total N and Gelatin by Zn SO₄.
No. 1	Average glue bone	1·44	53	78·26	58·53	19·73
„ 2		2·07	108	79·56	72·19	7·37
„ 3		2·01	108	78·26	72·19	6·07
„ 4		1·96	123	81·08	70·13	10·95
„ 5	Reinforced glue bone.	1·61	58	76·5	65·25	11·28
„ 6	Successive glue skin	1·81	100	74·36	61·89	12·47
„ 7		2·45	150	75·55	71·97	3·58
„ 8		1·94	130	74·14	72·52	1·62
„ 9		4·91	250	78·26	75·88	2·38
„ 10	Original glue skin.	3·68	219	78·26	77·18	1·08
„ 11		11·58	325	73·71	72·84	0·87

In conclusion, it appears to me to be entirely impossible, in the absence of further research and improved methods of distinguishing between hydrolysed forms of collogen, to attempt to place any valuation upon glue or gelatin by chemical methods. The action of heat is different from peptonisation by bacteria, and, although it tends to lessen gelatinising properties, it does not decrease the adhesive properties. Rideal states, after elaborate experiments, that after 12 hours' heating, all the prominent physical properties of value decline, while the chemical reactions are little altered.

Discussion.

Mr. S. R. **Trotman** said that the author's admission of the absence of a standard method of manufacture appeared to be the same thing as admitting a want of control of the different processes, while recognising that a glue might be spoilt by over boiling. These points seemed to point to the value of the method, proposed by himself and Mr. Hackford, at the last meeting of the Section, as a means of differentiating between the different forms of nitrogen and controlling the different processes. If, for instance, the zinc sulphate determination were made on the liquor as at first extracted, any decrease in this figure during the subsequent operations would undoubtedly point to peptonisation and loss of gelatine; for it was absolutely certain that the zinc sulphate figure was inversely proportional to the time of boiling. Mr. Watson's objection that the peptone figure depended upon original materials probably only pointed to the fact that these materials had undergone peptonisation previous to manufacture owing, possibly, to faulty storing. He agreed with Mr. Watson that the total nitrogen figure contained a large number of nitrogenous bodies, and that alone it was useless, but still held firmly to his opinion that, when taken in conjunction with the zinc sulphate figure, it was of considerable value from a manufacturer's point of view. Mr. Watson appeared to have somewhat misunderstood the authors when he stated that they laid much stress upon the ratio between these two figures. The terms albumose and peptone nitrogen were of course merely used as a convenient way of expressing the facts of precipitation. Since the last meeting many samples of glue had been analysed in his laboratory which appeared to him to fully confirm the opinions expressed at the last meeting. In each case where he had two glues, one of which was of good quality and the second of low grade, he had found that by mixing them in certain proportions he was practically able to control both the zinc sulphate figure and consistency at will.

Mr. H. S. **Garry** thought that they were indebted to both Mr. Watson and Messrs. Trotman and Hackford for the earnest endeavours they had made to throw some additional light on the complex nature of the problem in arriving at some standard of measurement of the value in glue samples. While there was much in both papers to which he took exception from a practical point of view, he emphasised the great necessity which existed for some method by which the value of a glue to the consumer could be readily ascertained. One great fault with most of the physical tests referred to was that they were cold tests and the consumers generally used their glue hot. The consistency test was probably the best of its kind, but to get the best comparative results more than one standard glue was necessary. The range given in Mr. Trotman's table should run from 400 downwards instead of 150 to give the necessary adjustment of values, and the standard for 250 to 400 should be of a higher gelatinising power than the standard from 100 to 250 and so on. Another great difficulty with physical tests was that the solutions used did not approximate to those actually in use by the consumer. The comparison in 5 per cent. solutions was not readily applicable to the 30 to 50 per cent. solutions in everyday use as glue. He did not attach the same value to the viscosity test as Mr. Watson. He had an opportunity some little time ago of discussing this test with Dr. Fels in Berlin, and the impression received was that it was as yet in a somewhat immature condition, and, as a comparison of value, left much to be desired. He thought that the consistency test, while giving good comparative results of the cohesion of glue, did not express the value of the adhesive qualities, and that further research would be found to negative the reliance which Mr. Trotman placed on the consistency test and, along with it, the zinc sulphate test of nitrogen as indicative of adhesive properties. It might be taken that the gelatinising power of a glue over a certain limit was obtained at the expense of its adhesive properties and *vice versâ*, and the two characteristics were neither proportional nor relative. The table given by Mr. Watson appeared to him to bear out the criticism he made at the time on Mr. Trotman's paper that the content of nitrogen and also the relative value did not depend so much on the method of manufacture as on the source from which the glue was derived. Mr Trotman assumed that the proportion which the total nitrogen content bore to the percentage shown by the zinc sulphate test was an indicator of value. This would only be correct if the value of the albumoses were the same in each case. Taking the figures given in Mr. Watson's table, he found that the value of the zinc sulphate figures varied from 27·5 per unit to 5·5 per unit, and that in the case of three of the samples, in which the percentage of albumoses was equal, the value of the albumose units was 23·9, 13·9, and 8·4 respectively per unit. This was, of course, the positive side of peptones as a reduction of value in the glue, the basis of the calculation would give, in the case of the lower grades, a minus result greater than the actual price of the product altogether. It appeared, therefore, that if Mr. Trotman's claim were carried to its logical conclusion some separation and classification of the albumoses would require to be made, and he saw no other alternative but the classification of these to source from which they were derived.

Dr. F. S. **Kipping** remarked that the figures given by Mr. Watson seemed to him to coroborate the conclusions drawn by Mr. Trotman at the last meeting.

Mr. H. J. **Watson** could hardly agree with Mr. Garry in his remarks regarding the temperature of the physical tests, for, while the consumer usually used his glue at temperatures higher than those obtained in the physical tests, the real test of adhesiveness or breaking strain was with a set or cold glue. Perhaps this would be a point in favour of the consistency test, which was a comparison of glues under set and not in the liquid state as in the viscosity test. Referring to Mr. Garry's remarks on the viscosity test, it would be quite as easy to take a standard glue as the basis of comparison, as was the case in the consistency test, as to use water as the basis. His own objection to the viscosity test was that, when dealing with a large number of samples, considerable time and attention was required, while with the consistency tests it was a comparatively simple matter to deal with 40 to 50 samples at once without much attention. In a glue factory this was a considerable advantage. Referring for a moment to the table by Messrs. Trotman and Hackford, and accepting the theory that the consistency of a glue increased 10 for a difference of 1·4 in the zinc sulphate precipitate, according to the total nitrogen gelatin, the highest possible consistency would be 171 and would be attained by No. 4 sample. Further, if one took a gelatin with an average moisture and low ash, say 15 per cent. moisture and 1 per cent. ash, and called the difference (84 per cent.) gelatin, then the highest consistency test attainable would be 231. He was aware that the units of their test might be entirely different from those in his, owing to using a different standard glue, but it would be interesting to know what was the highest consistency test they had attained by experiment and whether it had exceeded the highest possible calculated consistency test, as calculated from the zinc sulphate precipitate in their experiments.

Mr. S. R. Trotman, in reply to Mr. Watson's observation as to the standard used in the consistency test, agreed with his conclusions, and stated that he had never found a consistency number greater than 170. Of course this merely indicated that he used a different grade of gelatin as his standard from that which Mr. Watson used.

Scottish Section.

Meeting held in Glasgow, on Tuesday, October 25th, 1904.

MR. R. T. THOMSON IN THE CHAIR.

HIGH-TEMPERATURE MEASUREMENTS (WITH DEMONSTRATION OF PYROMETER).

BY THOMAS GRAY, PH.D., D.SC

Of the numerous instruments which have been devised for the measurement of high temperatures, only those which have proved of practical value and with which the writer is personally familiar will be described and discussed in this paper. As he has no practical experience of the working of the Uehling pyrometer, which is widely used in the United States, and which has also found a limited application in this country, no further reference will be made to this form of instrument.

Pyrometers based on the Expansion of Solids, Liquids, and Gases by Heat.—Numerous attempts have been made to utilise the expansion of solids, more particularly of various metals, as a means of measuring temperature, but none of these have been successful on account of the alteration of structure and consequent change of the coefficient of expansion caused by exposure to high temperatures.

The application of the expansion of liquids is limited to low-temperature work; but a comparatively recent extension of the range of the mercury thermometer is noteworthy. Certified thermometers, constructed of boro-silicate glass, graduated in single degrees up to 550° C. (1022° F.), can now be obtained from any dealer in chemical apparatus.

The expansion of gases, or, more correctly speaking, the increase of pressure at constant volume due to rise in temperature, is the principle utilised in the well-known "air" thermometer, the standard to which all the other methods are referred. The apparatus employed is fragile, and the skill and care necessary for its manipulation render it unsuitable for technical work. Attempts have been made to give the instrument a more practical form by attaching an ordinary pressure gauge to a porcelain or metal bulb by means of a capillary tube. The difficulty of obtaining a material which will withstand the pressure and at the same time be impermeable to the furnace gases at high temperatures has proved insurmountable. The Thalpotassimeter, a pyrometer of a similar type, consisting of a steel reservoir containing mercury, connected by a capillary tube to a pressure gauge, has been used to a limited extent; in this case the increase of the vapour pressure of mercury with rise in temperature is measured by the gauge, which is empirically graduated in degrees centigrade or Fahrenheit. Leakage of air at the joint, which always takes place sooner or later, renders the indications of the instrument untrustworthy.

Change of State.—The melting points of the metals, their alloys and salts have long supplied a familiar means of measuring temperature, but the difficulty of procuring a sufficient number of substances of ascertained melting point has, until recently, prevented the general application of the method. This difficulty no longer exists: Seger "cones" having melting points ranging from 590 to 1850° C., with intervals of about 20° C., are now procurable from any dealer in chemical apparatus. They consist of triangular pyramids composed of kaolin, mixed with silica, boric acid, and various metallic oxides in the necessary proportions to form a graduated series. The melting points of the various compositions have been determined by Hecht with the help of a standard thermo-couple. In applying the method, a number of cones, having a range of melting points which includes the temperature to be measured, is placed on a fireclay plate and introduced into the furnace. If the cones have been properly chosen the first members of the series will be observed to melt, whilst the last will remain unaffected. The melting point of the cone which just softens sufficiently to cause the apex of the pyramid to bend down to the base-plate is taken to be the temperature of the furnace.

The Calorimetric Method.—A cylinder or ball of metal is heated in the furnace and dropped into a measured quantity of water; from the rise of temperature of the water the temperature of the furnace is calculated. The metal used may be platinum, nickel, copper, or wrought iron. Platinum is to be preferred, as it does not oxidise when heated, and has no chemical action on water. The total heat of platinum up to 1600° C., *i.e.*, the amount of heat which 1 grm. of the metal gives out when cooled from the various temperatures down to 0° C., has been carefully determined. From a chemical point of view nickel is more suitable than iron, but the determinations of the total heat of nickel by different observers do not show a very satisfactory agreement. Iron is the least suitable metal chemically, as it oxidises, scales, and decomposes water at high temperatures; but it possesses the advantage of being always available, and the cylinder is thus easily replaced if lost. A large number of determinations have been carried out in the author's laboratory, using an iron cylinder; of these the results of two students chosen at random may be given to illustrate the degree of accuracy which may be expected:—

—	A.			B.		
	1.	2.	3.	1.	2.	3.
	C.	° C.	C.	° C.	° C.	° C.
Temp. by thermo-couple.	812	748	724	734	661	796
Temp. by calorimeter	805	740	725	745	690	790

The calorimeter vessel which was used for these experiments is constructed of thin sheet copper, and has the form of a cylinder with a flanged top; a perforated tube soldered on to the inside serves to protect the thermometer from fracture when the iron cylinder is dropped into the water. The capacity of the vessel is approximately 150 c.c., and the weight of the iron cylinder about 18 grms. The calorimeter vessel hangs supported by the flange in a wider cylinder of metal or wood, leaving an air space of about 1 in. to minimise loss of heat by radiation. The vessel is covered by a lid having a small hole through which the thermometer passes, and a larger one for the introduction of the heated metal cylinder; the rod of a stirrer also passes through the latter opening. A thermometer graduated in $\frac{1}{10}$° C. is used. A very useful table, which gives the total heat of wrought iron at various temperatures up to 1100° C., appears in Fischer's "Brennstoffe," pp. 62 and 63.

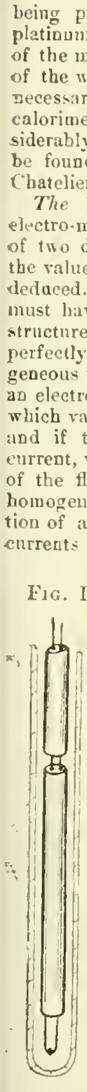
The figures given above show that the method is capable of giving results sufficiently accurate for most practical purposes. It should, however, be noted that it becomes less accurate at higher temperatures on account of the increased loss of heat in carrying the crucible containing the metal cylinder from the furnace to the calorimeter.

By using a fixed ratio between the weights of metal and water, as in the well-known Siemens' form of calorimeter, some labour in calculation is saved; but the advantage is doubtful, except in the case of platinum, as the change of weight due to oxidation and scaling necessitates frequent renewal of the metal cylinders. In the Siemens form, 1 pint (568 c.c.) of water is used, and the weights of the metal cylinders are so adjusted that their heat capacity at ordinary temperatures is exactly one-fiftieth of that of the calorimeter vessel filled with 1 pint of water. The weights used are, copper, 137; wrought iron, 112; nickel, 117; and platinum, 402·6 grms. The high temperatures are graduated on a brass scale, which slides on the thermometer, allowance being made for the increase of the specific heats of the metals with rise of temperature. In using the pyrometer, exactly 1 pint of water is poured into the vessel, and, when the temperature has become constant, the sliding scale is set so that the pointer attached to it is on a level with the top of the mercury thread of the thermometer. The heated metal cylinder is then dropped into the water, and when the maximum is reached the readings of the thermometer and on the sliding scale at the level of the top of the mercury thread are noted; the sum of these gives the temperature to which the cylinder was heated. This form of the apparatus has the advantage of being practically direct reading, but the high price of platinum almost precludes the use of such a large quantity of the metal. If copper or iron be used, frequent checking of the weights and correction for loss due to scaling are necessary. The labour of calculation, using a home-made calorimeter such as the one first described, is lessened considerably by the use of tables of total heats; these may be found in "High Temperature Measurement," by Le Chatelier and Boudouard; translated by Burgess.

The Thermo-Electric Method.—In this method the electro-motive force which is generated when the junction of two dissimilar metals is heated, is measured, and from the value of this the temperature of the heated junction is deduced. The metals which are suitable for this purpose must have a high melting point, and should not alter in structure and composition when heated; they must also be perfectly homogeneous. When a wire which is not homogeneous throughout its length is heated locally by a flame an electro-motive force is generated the value and sign of which vary according to the position at which it is heated, and if the two ends of the wire are joined, an electric current, varying in intensity and direction with the position of the flame, will flow through the wire. If the wire is homogeneous it may be heated at any part without formation of an electric current. The absence of such parasitic currents is obviously a necessity, as these will increase or diminish the intensity of the current due to the heated junction to an extent which will vary with the length of the wire heated in the furnace. The metals which most nearly fulfil the conditions referred to above are platinum and the metals of the platinum group; and the thermo-couples used practically are composed of wires of platinum opposed to an alloy of platinum either with 10 per cent. of rhodium or with 10 per cent. of iridium. The E.M.F. of the platinum—platinum-iridium couple is greater than that of the platinum-rhodium, but the latter gives more constant results, as it is less easily hardened mechanically, and is therefore to be preferred. It may be here noted that an electro-motive force results on heating the junction of a metal in the soft state with the same metal in the hardened state: any local hardening which may be caused mechanically will give rise to parasitic currents.

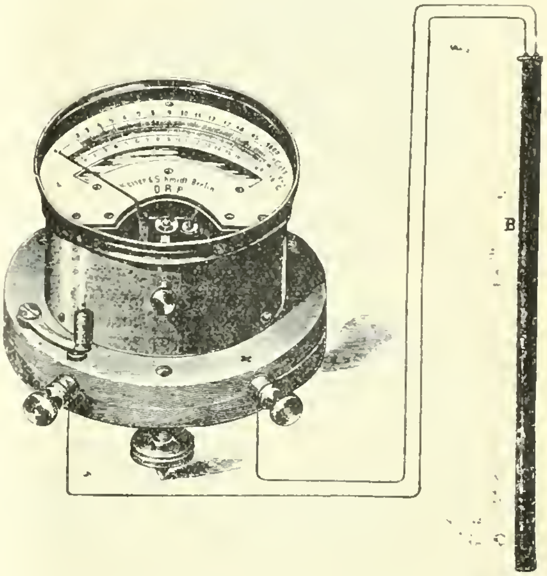
The wires of the couple are joined by fusion in the oxyhydrogen flame, insulated by threading through perforations in a porcelain rod about ¼ in. in diamater, and the free ends of the wires are connected to terminals in a wooden handle. As the composition of the wires is rapidly altered by exposure to heated furnace gases, the couple is enclosed in a porcelain tube glazed within and without, which is sometimes encased in a wider iron tube to minimise the risk of fracture. Fig. I. shows the method of insulating the wires, with the porcelain protecting tube in section

Fig. I.



The couple is used in conjunction either with a potentiometer or with a direct-reading galvanometer, the scale of which is graduated in millivolts and also in degrees centigrade or Fahrenheit up to 1600° C. The latter arrangement is the one more frequently employed, as it is more convenient and less costly. The instrument is of the D'Arsonval type; it consists of a coil of insulated wire of comparatively high resistance (100 to 200 ohms) suspended by a phosphor-bronze strip or spiral suspension between the poles of a powerful permanent magnet; a needle attached to the coil plays over the scale, and indicates the intensity of the current passing through the instrument. The galvanometer may be placed at any distance from the furnace, containing the couple, provided that the resistance of the connecting leads does not exceed 1 ohm. Fig. II. shows the instrument connected to the couple.

Fig. II.



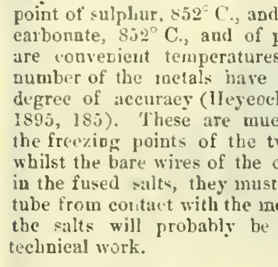
To convert this into a recording instrument the ordinary method of attaching a pen to the needle cannot be employed. Coils of high resistance must be used in the galvanometer, so that the resistance of the leads may be negligible, and the currents thus available are much too small to enable the needle to overcome the friction of the pen on the paper. It may be made to record photographically by attaching a mirror to the coil; light, passing through a slit, is reflected from the mirror and falls on a moving photographic plate or sheet of sensitised paper, thus recording the movements of the coil. The Roberts-Austen photographic recorder, an instrument of this type, has been successfully used for a number of years (see this J., 1892, 840). The record is made on a sheet of sensitised paper fixed on a drum, which revolves once in 6, 12, or 24 hours. An ingenious method of recording is employed by Messrs. Baird and Tatlock, Glasgow. The galvanometer is similar to that shown in Fig. II., but the scale of the instrument consists of a movable stirrup, which is depressed by clockwork every minute. The indicating needle, which is provided with a sharp point, plays under the scale, and when the latter descends this point is brought into contact with an inked strip of cloth, and thus marks the position of the needle on the paper below it. The paper, which has a graduation similar to that of the galvanometer scale, has also the time in hours and minutes marked along its edge, and is made to travel slowly forward by the clockwork mechanism. An examination of this paper shows the position of the galvanometer needle at intervals of one minute during the whole 24 hours, and, unless the temperature is varying very rapidly, a continuous record may be obtained by joining the various points. Another form of instrument, which traces a continuous record on a revolving drum, is made by the same firm.

Each division on the scale of the galvanometer represents about 20° C., and the temperature may be estimated to the nearest 5° C. This does sufficient justice to the method at the higher temperatures, as an accuracy greater than 5° in 1000° C. is not guaranteed. As the couple is standardised with the cold junction at 0°, the temperature of the latter should be observed: if under 30° C., a sufficient correction for practical purposes is made in the case of the platinum-rhodium couple by adding $0·5 \times t^\circ$ to the reading, where t° is the temperature, on the centigrade scale, of the junction of the leads with the wires of the couple.

If the porcelain protecting tube fractures, and the couple is exposed to the action of reducing gases at a high temperature, the wires soon become brittle, and the indications of the instrument then become untrustworthy. Vapours of the metals and substances which act chemically on platinum have a similar effect. Concerning the extent of the variation of the electro-motive force of thermo-couples, caused by exposure to the action of various chemicals, little information is available, but if the platinum has been obviously altered in composition through fracture of the porcelain tube the couple must either be replaced or re-standardised. The boiling and melting points of a number of substances have been accurately determined, and these may be utilised for standardising the couple. The boiling point of sulphur, 852° C., and the freezing points of sodium carbonate, 852° C., and of potassium sulphate, 1066° C., are convenient temperatures. The freezing points of a number of the metals have been ascertained with a high degree of accuracy (Heycock and Neville, J. Chem. Soc., 1895, 185). These are much more sharply defined than the freezing points of the two salts mentioned above; but whilst the bare wires of the couple may be placed directly in the fused salts, they must be protected by a porcelain tube from contact with the molten metals. On this account the salts will probably be found more convenient for technical work.

For the determination of the E.M.F. at the boiling point of sulphur, the apparatus used by Heycock and Neville (*loc. cit.* 197) in the standardisation of the platinum resistance thermometer is convenient. This consists of a hard glass tube about 18 ins. long by 2 ins. wide, with a bulb at the bottom, of diameter about 3 ins. To minimise loss of heat by radiation, the tube is surrounded by an asbestos cone with its base, diameter 6 ins., resting on the bulb. The space between the cone and tube is packed with asbestos wool. The level of the molten sulphur should be from 1 in. to 2 ins. above the base of the cone, to prevent superheating of the vapour. A thin-walled glass tube about ½ in. in diameter, and closed below, is supported in the wider tube, as shown in the accompanying sketch (Fig. 111.). On the bottom of this tube a a thin asbestos cone is fixed with iron wire, to prevent the liquid sulphur from condensing and collecting on the bottom of the tube. The cone is perforated at the base and sides, so that the sulphur vapour passes through and heats the tube, whilst the liquid condensed in the higher parts of the apparatus flows back over the sides of the cone. The base of the cone is shown at B. The sulphur is kept boiling by means of a large Bunsen flame protected from draughts. The insulated couple is suspended in the inner tube, and when the temperature has become stationary the position of the needle is noted.

FIG. 111.



For the freezing-point experiment the sodium carbonate or potassium sulphate is fused in a large covered platinum crucible; in the former case a gas blowpipe supplies sufficient heat, but a small blast furnace is required for potassium sulphate. When the salt is completely fused the gas is turned off, the junction of the couple is immersed in the molten salt, and the galvanometer needle is observed. The temperature falls very quickly at first, but when solidification begins the needle halts momentarily on account of the liberation of the latent heat; when solidification is complete the cooling again takes place rapidly. The position at which the needle remains stationary is noted as the value of the E.M.F. at the temperature in question.

The graph representing the relation of E.M.F. to temperature is very nearly a straight line, but it is advisable to determine more than two points experimentally, unless the range over which the couple has to be used is small. If the interval between the two points does not exceed 300° to 400° C. a line between these will represent the relation with sufficient accuracy for most technical purposes. It is scarcely necessary to add that the temperature to be measured must be within the range of the points determined, or if outside these limits it must lie close to them.

The method described above is convenient, as the necessary materials are always available, and if used with a standard couple it also serves to check the indications of the galvanometer; but it will be found more suitable in practice to have the means of fixing a larger number of points by testing the couple against a standard which is reserved for this purpose. In using this method the two couples—the standard, and the couple to be tested—are stretched out so that each forms a continuous wire, and threaded through the insulators so that the two junctions are as near together as possible. They are then placed in a porcelain tube and inserted into a furnace; the free ends (the so-called cold junctions) are gathered together and wrapped in cotton-wool, taking care that they remain insulated from one another; or, if greater accuracy is required, the cold junctions are immersed in melting ice. The free ends are connected, through a two-way switch, to the galvanometer in such a way that the standard couple is in circuit in one position of the switch and the couple to be standardised in the other. By switching in the standard couple, the temperature of the furnace is obtained with the help of the table of E.M.F.'s supplied, and the value for the other couple at this temperature is then ascertained by bringing the switch into the second position and noting the reading on the galvanometer. Any number of points within the range of the furnace can thus be readily determined, and these are subsequently plotted out on squared paper in the usual way; a convenient scale is 1 mm. = 5° C. = 0·05 millivolt. Care should be taken to close the ends of the furnace well, to prevent draughts of air, which might cool one of the couples to a greater extent than the other. For temperatures up to 1400° C. a convenient form of electric furnace, wound with platinum foil, is supplied by Heraeus, of Hanau. A resistance furnace for temperatures up to 1200° C. is cheaply constructed by winding nickel wire, 16 to 18 B.W.G., closely round a porcelain tube about 1 ft. long by 2 ins. to 3 ins. in diameter; the nickel wire is covered over with a paste of magnesia and water to prevent oxidation. When dry it is surrounded by a piece, about 3 ins. thick, of the magnesia covering which is used for insulating steam pipes. The furnace is connected with the electric mains through a suitable resistance, which admits of varying the temperature to the desired extent.

The Platinum Resistance Thermometer.—The utilisation of the increase of the resistance of a platinum spiral due to heating was first proposed and applied practically by Siemens as a means of measuring temperature. The construction of the thermometer was subsequently improved by Callander, who replaced the porcelain cylinder on which the spiral was wound by two slips of mica set at right angles to one another, so that the wires of the spiral touched the edges of the mica only, and thus reduced to a minimum any change of resistance due to the action of silica on platinum at a high temperature. The law connecting the resistance of platinum with temperature was determined by Callander and Griffiths up to 600 C., with the help of an air thermometer. The accompanying illustration (Fig. IV.) shows the construction of the platinum resistance thermometer made by the Cambridge Scientific Instrument Co. It consists of a spiral of thin platinum wire wound double round a framework composed of two strips of mica, which in section have the appearance of a cross. The free ends of the spiral are joined to stout platinum leads, which, near the top, are fixed to copper wires connected to binding screws in the wooden handle. As the resistance of the platinum wires increases with rise in temperature to an extent which varies with the length heated, a compensating arrangement is introduced. This consists of a continuous platinum wire of the same dimensions as those of the leads, which is doubled on itself and fixed so that the bend reaches the beginning of the spiral. The four wires are arranged symmetrically, and are insulated and held in position by a number of perforated mica discs, through which they pass.

Fig. V.

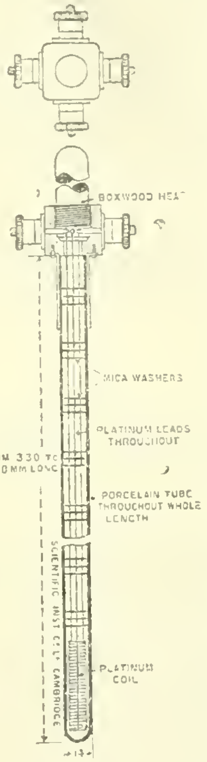
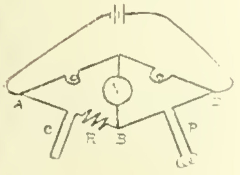
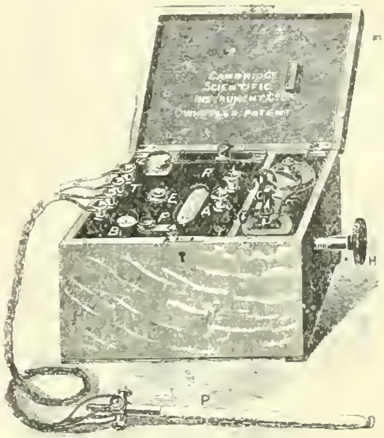


Fig. IV.



The ends of the compensator are connected with the two additional terminals shown in the illustration. The spiral and wires are enclosed in a porcelain tube, diam. ½ in., glazed outside and in. The method of measuring the increase of resistance is that of the familiar Wheatstone bridge shown in the accompanying diagram (Fig. V.). For the sake of clearness, the compensator, which lies alongside the platinum leads within the porcelain tube, is represented apart from them in the diagram. The resistance of the arm A B, which includes the compensator C and the rheostat R, is equal to that of the arm B D when the thermometer P is at 0° C., and in this condition no current passes through the galvanometer when the battery circuit is closed. This equality is disturbed when the thermometer is heated, and the increase of resistance of the spiral is measured by determining the resistance which must be added by the rheostat to re-establish equilibrium. This additional resistance represents that due to the heating of the spiral alone, as the increase of resistance of the leads is exactly compensated for by an equal increase in that of the compensating wire C. Fig. VI. illustrates the Whipple indicator, a convenient portable form of this apparatus suitable for technical work. The rheostat consists of a continuous wire, wound on the inside of a drum, provided with a contact, which slips over the wire as the drum is rotated by the handle H; the position of this contact is indicated by a pointer A outside the drum. On the outer surface of the drum, visible at A, the temperatures corresponding to the added resistances are marked in degrees centigrade or Fahrenheit up to 1400° C. In making an observation, the four binding screws T of the indicator are connected with the terminals of the thermometer by means of four insulated copper wires, as shown in the illustration, and the handle of the rheostat is turned till no movement of the galvanometer needle B is observed when the battery circuit is closed by depressing the key F. The temperature is then indicated on the drum by the pointer A. The indicator may be placed at any convenient distance from the thermometers, and by means of a suitable switchboard can be connected to any one of them. The resistance of the flexible leads has no effect on the accuracy, as that of the pair from the platinum spiral is exactly counterbalanced by the resistance of the pair connecting the compensator to the indicator. The apparatus is very sensitive, and readily indicates differences of temperature of less than 1° C. A recorder for use with the platinum resistance thermometer is made by the same firm.

Fig. VI.



Optical Pyrometers.—These instruments utilise the increase of intensity of the luminous radiations of a heated body with rise of temperature as a means of measurement. The intensity of the radiations emitted by different bodies at the same temperature varies with the nature of the heated substance; so-called "dark" bodies, of which lampblack is the best example, have a high emissive power, whilst that of highly polished metallic surfaces is small. A pyrometer based on the ascertained law which governs the relationship between the intensity of the luminous radiation and the temperature will only give correct indications in the case of substances which have the properties of a dark body, *viz.*, the power of absorbing completely the light which falls on them, and consequently of radiating light of every colour and wave-length. Iron in the incandescent state reflects very little light, and consequently approximates to the condition necessary. Polished platinum, on the other hand, reflects a large proportion of the light which falls on it, and consequently does not satisfy the necessary condition. Lampblack approximates most closely to the theoretically dark body. According to Kirchhof, however, the intensity of radiation of a closed space provided with an opening through which it may be viewed, is the same as that of a dark body, so that all closed furnaces comply with the necessary conditions.

The gradual change of colour from dull red to dazzling white which is observed when a body is heated, serves as a rough gauge of the temperature. If the substance which is being gradually heated is viewed through a spectroscope, a dark red band is first seen; this gradually broadens, and at higher temperatures the colours yellow, green, blue, and violet successively appear, forming a continuous spectrum. Simultaneously with this extension of the spectrum there is observed an increase in the intensity of each of the individual colours, and this increase may be utilised as a measure of the temperature.

The Wanner Pyrometer.—In this instrument the light emitted by the heated body, the temperature of which is being measured, is broken up by a train of prisms, and the spectrum is screened off so that only the red portion corresponding to the Fraunhofer C line is visible. The intensity of this is compared with that of the red radiation from a small 6-volt electric lamp. The pyrometer has the external appearance of a telescope about a foot long; at the end which is directed towards the furnace there are two slits, one half of which is covered by the small electric lamp. When the instrument is directed towards the furnace, the field, as viewed through the eye-piece, is seen to be composed of two semicircles; one of these is illuminated by the lamp, and the other by the light from the furnace. The two halves of the field can be adjusted to equal intensity by rotating the analyser, which forms the eye-piece of the instrument; and, from the angle through which the eye-piece has been turned to produce equality of colour, the temperature is ascertained by reference to a table.

FIG. VII.

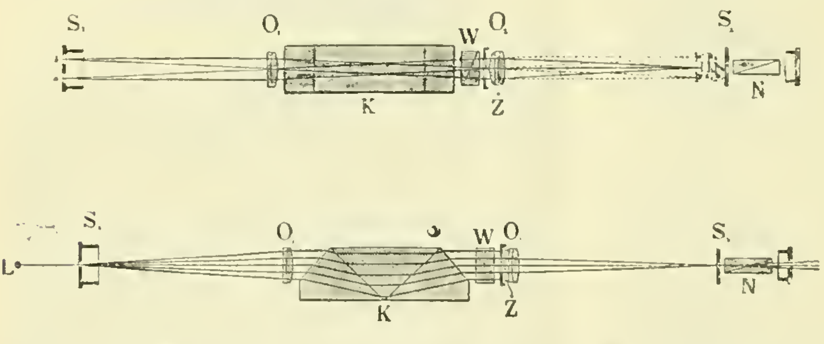
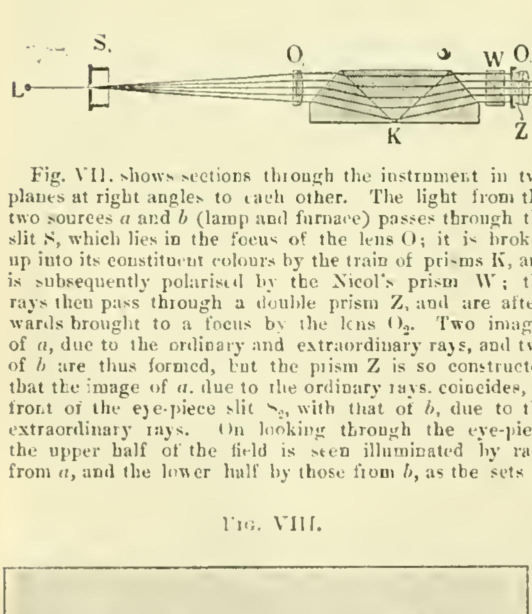


Fig. VII. shows sections through the instrument in two planes at right angles to each other. The light from the two sources *a* and *b* (lamp and furnace) passes through the slit S_1 which lies in the focus of the lens O_1; it is broken up into its constituent colours by the train of prisms K, and is subsequently polarised by the Nicol's prism W; the rays then pass through a double prism Z, and are afterwards brought to a focus by the lens O_2. Two images of *a*, due to the ordinary and extraordinary rays, and two of *b* are thus formed, but the prism Z is so constructed that the image of *a*, due to the ordinary rays, coincides, in front of the eye-piece slit S_2, with that of *b*, due to the extraordinary rays. On looking through the eye-piece the upper half of the field is seen illuminated by rays from *a*, and the lower half by those from *b*, as the sets of rays are polarised in planes at right angles to each other. Rotation of the analyser N has the effect of intensifying one half of the field and weakening the other.

The electric lamp must be adjusted periodically by comparison with the flame of a lamp burning amyl acetate. For this purpose it is placed on the stand with the slit directed to the flame of the amyl acetate, as shown in the illustration (Fig. VIII.). The analyser is set at zero, and the resistance in circuit with the lamp is adjusted so that the upper half of the field, illuminated by the electric lamp, has the same intensity as that of the lower half, lit by the amyl acetate flame. The instrument is then ready for use. The standard is the flame of amyl acetate, but as it would be impossible to apply it practically, on account of the flickering caused by draughts of air, an electric lamp is adjusted to this standard and used in its place.

FIG. VIII.



Two forms of this instrument are made — one for measuring temperatures from 900° to 2000° C., and the other for the range 900° to 4000° C. The adjustment to equality of illumination can be easily and quickly made; the error is approximately half a degree of rotation, which corresponds in the first of these instruments to about 5° at 1300° C., and 14° at 1600° C.

Discussion of the Various Types.—For occasional observations of temperatures up to 1000° C. the calorimetric method, using an iron cylinder, will be found serviceable. The comparatively trifling cost of the apparatus is its chief recommendation. For higher temperatures a platinum cylinder may be used, but care must be taken to avoid loss of heat in transferring the cylinder from the furnace to the calorimeter. On account of this possible source of error, the writer would prefer to rely on the use of Seger cones for occasional determinations within the range 1000° to 1800° C. As a continuous means of indicating and recording temperatures up to 1600°, the thermo-electric method is the most generally useful. The fragile character of the porcelain protecting tube is a very decided drawback, as the cost of frequent renewals is high. If care be taken to avoid rapid change of temperature by warming the tube slowly before introducing it into the furnace, and by allowing it to cool gradually during the withdrawal, such a tube may last for months. If it were possible to produce quartz tubes of the necessary size at a reasonable cost, the adoption of this material would add greatly to the utility of the method. When fracture of the porcelain tube does take place, the wires of the couples are easily joined if broken, and restandardisation is a very simple operation when the necessary arrangements are available. In cases where a very long couple is used the increase of resistance due to heating may introduce an appreciable error; on this account, galvanometers with high-resistance coils should be employed.

Where a close indication of temperatures up to 1000° or possibly to 1200° C. is required, and for all low-temperature observations, such as in cold storage, the platinum resistance thermometer may be recommended. It is much more sensitive than a thermo-couple, and, when combined with the Whipple indicator, readily shows differences of less than 1° C. In situations where the porcelain protecting tube is liable to fracture, the thermo-couple will be found more satisfactory. The platinum spiral is readily affected by hot furnace gases, and if damaged is much more difficult to repair and less easily standardised; the cost of renewal is also considerably greater. For temperatures above 1600° C. some form of radiation pyrometer is necessary, and here the Wanner pyrometer will be found serviceable. Its accuracy is now certified, if desired, by the Physikalische technische Reichsanstalt, Charlottenburg. Although it does not indicate directly, the observation is easily and quickly made, and where a number of measurements of the temperatures of various furnaces have to be made, it is possible to operate more quickly than with a thermo-couple, on account of the necessity to allow the latter to heat and cool slowly, in order to prevent fracture of the porcelain tube. If the unprotected couple is used, or if a couple is kept permanently fixed in each furnace with a suitable switch to bring it into connection with the galvanometer, this advantage disappears; but the cost of upkeep of the couples and tubes, and the labour of standardising or renewing the couples, are greatly increased. The fact that the instrument itself is not heated is a strong recommendation, as the destructive action due to exposure to high temperatures is in some cases excessive with the other forms of pyrometer. The limitations to the use of the instrument referred to in the description should be noted.

Meeting held in Edinburgh, on Friday, December 6th, 1904.

DR. HUGH MARSHALL IN THE CHAIR.

THE EXAMINATION OF LINOLEUM AND THE COMPOSITION OF CORK.

BY DR. HARRY INGLE.

In the past the testing of the fabrics known as linoleum, inlaid linoleum, cork carpet, &c., for their suitability as a floor covering has been mostly based upon appearances and rule of thumb. The only exception to this rule, so far as the writer is aware, are the tests applied by the British, German, and French Governments, for the most part not published. H. Burchartz, of the Königlich Preussische Techn. Versuchsanstalt at Charlottenburg (this J., 1900, 255), gives the tests applied by the German Government. These tests will be noticed later, as well as others applied by various users.

Before proceeding to a detailed discussion of the tests it would be best to clearly define the varieties of linoleum, &c., met with in the trade. A detailed description of the linoleum manufacture, with the history of the industry, was read by W. F. Reid before the London section of our Society (this J., 1896, 75). Since then, however, the trade has developed, and many new varieties of linoleum are to be met with. These fabrics may be grouped into the following classes:—Linoleum, Plain and Printed; Inlaid Linoleum; Cork Carpet. Plain and printed linoleums, apart from the jute canvas, and backing, consist essentially of cork, pigment and a cement. The cement is obtained from linseed oil either by oxidation or polymerisation. In the oxidation processes, introduced by Walton, the inventor of linoleum, the linseed oil is converted into a semi-solid subtance by exposure to air, either by running it when charged with a drier over thin cotton (the scrim process) or by exposing it to air in the form of finely divided drops (as in Walton's later patents). This semisolid is then melted with a certain proportion of kauri gum and resin to produce the cement.

In the polymerisation process (Taylor-Parcacott patents) the oil is converted by the action of heat into an elastic rubber-like substance. This may be used as the cement or in combination with resin. The plain linoleum thus obtained from the cement, cork, and pigment, may be printed with oil colours to produce designs (printed linoleums).

Inlaid Linoleums.—In these the design permeates the body of the material. They are made by a variety of processes; for detailed information on which the patent literature in the Society's journal may be consulted. Granite linoleums also belong to this class. The composition varies from that used in plain or printed linoleum, inasmuch as it contains in place of some of the cork a varying proportion of wood-dust, and usually a larger percentage of pigment. The cement used in inlaid linoleum, so far as the writer is aware, is always made by the Walton oxidation process.

Cork Carpet.—In these the cork grains used are larger. Wood-dust is never employed, and the quantity of pigment is usually, though not always, smaller than in plain and inlaid linoleums. Both kinds of cement are used.

Having thus described the various kinds of linoleum and linoleum-like products, I will now devote some space to a discussion of the methods of examination already proposed and to the description of my own experiments.

Determination of Ash.—The ash obtained on incineration of linoleum gives a roughly approximate indication of the quantity of pigment present. This is only the case, of course, when inorganic pigments, such as oxides of iron, have been used to colour the linoleum. Organic, or partly organic pigments, such as the colour-lakes and Prussian blue, leave only their mineral ingredients behind as ash. Another source of error arises from the fact that ochres used lose their water of hydration. Compensating these errors are the facts that the cement leaves behind the driers used, and that cork itself is not absolutely free from mineral matter. Cork gives an ash content of from 1·8 to 3 per cent.

The quantity of ash given by different makes of linoleum varies very much. Inlaid linoleums usually give the most ash, although I have found some samples of German-made plain linoleum almost as high in ash content. One sample of plain green linoleum made by a German firm gave 27·4 per cent. of ash. Light-coloured linoleums usually contain more ash than those of dark colour, as more pigment has to be used to cover the colour of the cork.

Now, as to the value of a determination of the ash content in gauging the quality of a sample of linoleum, the following considerations may help us:—

(1) A large ash content indicates an increase in weight per square yard, a harder and less resilient, and consequently a more noisy, linoleum to the tread. It also shows that the linoleum is a better conductor of heat and less warm to the feet.

(2) As pigments do not possess the elasticity of cork, a linoleum containing a large amount of ash, anything above 20 per cent., is apt to be brittle. This was shown by the above-cited German sample. In the manufacture of inlaid linoleums which contain light colours this is corrected by an additional amount of cement.

(3) With regard to the wearing properties of a linoleum containing a large amount of ash, I have no reliable data, but I am inclined to think that the ash content would not have any important influence.

Attrition Test.—At the Königlich Preuss. Techn. Versuchsanstalt at Charlottenburg the linoleum is subjected to a certain number of revolutions of a loaded leaden disc of known area and fed with a given quantity of emery powder, and the weight lost per 50 sq. cm. is determined (Burchartz, *loc. cit.*).

This method is doubtless a valuable one, but the results obtained are largely dependent on the nature of the machine used, and the method, moreover, is somewhat difficult to carry out, requiring apparatus such as is not usually available in the chemical laboratory.

Bending Tests.—Burchartz (*loc. cit.*) recommends the testing of linoleum by bending it over mandrels of 23, 25, 30, &c., mm. diameter. Such tests require to be carried out with discretion. Their value obviously depends upon the use to which the linoleum is to be put. Stair cloth should of course withstand the most severe test in this respect, but for linoleum which is to be laid flat the test is of less importance, except in so far as it shows how far the linoleum is likely to suffer in the handling before it is laid and is a partial measure of certain other properties of the linoleum.

Speaking generally, the thinner qualities of these fabric will stand bending over a smaller mandrel than the thicker, but they do not on that account wear longer. Printed linoleums usually crack more easily than plain goods, and inlaid linoleum does not stand bending so well as printed linoleum, but it wears longer. Obviously the test requires caution in its application. Applied to samples of the same class of fabric it is valuable as an indication of adhesion between the grains of cork pigment and cement, but it is of little use in differentiating between the wearing qualities of two dissimilar fabrics.

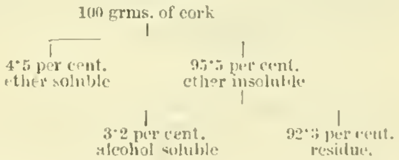
Tensile Strength.—This may or may not be a factor of importance in the valuation of linoleum for use under ordinary circumstances. As usually linoleum is not subjected to any stretching strains. I must confess I fail to see its value. However, H. Burchartz (*loc. cit.*) tests the strength of linoleum in the direction of calendering and at right angles to it, and for his results the reader is referred to the original paper.

Determination of Cork and Cement Content.—At first sight this seemed an easy problem; all that appeared necessary was to treat the linoleum with an alkali, when the oxidised oil and resin in the cement would be converted into soaps which could be removed from the cork by filtration, the acids precipitated in the filtrate and weighed. Knowing that cement contained about 80—90 per cent. of fatty and resin acids, the result of the experiment should show the cement content.

On carrying out the experiment with a linoleum of known composition it gave a result 19 per cent. too high It was thus seen that this method was unreliable. I consequently determined to examine the matter *da capo*, namely, cork itself and the chemistry of this substance.

Composition of Cork.—Very little appears to be known as to the composition of cork. Chevreul found in it a white waxy substance soluble in alcohol and ether which he called cerin or cork wax. From this Siewert isolated a substance called by him phellyl alcohol, deca-acrylic acid and another acid. The amount of ether extract is given at 1·8—2·5 per cent. of the cork. There remains a substance insoluble in ether termed by Chevreul suberine or cork proper. By the action of nitric acid (20—30 per cent.) a residue of from 3—5 per cent. of cellulose was obtained, the main mass of the cork being oxidised to a mixture of fatty acids of which suberic acid is the chief. By heating cork with sodium sulphite solution to 166° C. a residue of from 9—12 per cent. of pure cellulose was obtained. For other information on cork see Watts' Dictionary, Vol. I., page 72. I was unable to find any their information in the literature on the subject of cork.

The following experiments were carried out. Ordinary ground cork such as is used in the manufacture of linoleum was dried and extracted in a Soxhlet extractor with ether and then with alcohol:—



The ether soluble portion was crystalline and yellowish-white in colour. The alcohol soluble portion was a reddish-brown, amorphous solid.

The action of alcoholic potash on cork is of interest in this connection. 10 grams. of dried cork were treated with alcoholic potash on the water-bath for six hours in a flask provided with a reflux condenser. The contents of the flask were filtered, the residue washed with alcohol, dried, and weighed, and the alcoholic filtrate and washing kept for examination. The residue was then ignited, and the ash, consisting mainly of potassium carbonate weighed. Another 10 grms. were saponified in the same way, the precipitate washed with alcohol and then with hot water, and the two washings kept separate. The residue, consisting of cellulose and ash, was dried and weighed and the ash determined by ignition.

In the table at foot of page the two experiments are combined. Collating these results it appears that the saponification of cork produces the following:—

(*a*) Cellulose	24·4
Ash	1·8
(*b*) and (*f*) Ether-soluble acids	22·68
(*e*) Ether-soluble unsaponifiable	3·45
(*d*) Alcohol-soluble, but ether insoluble, unsaponifiable	7·4
(*c*) Ether- and water-insoluble, but alcohol-soluble acids	5·9
Alcohol- and ether-insoluble, but water-soluble acids and loss	34·37
	100·00

(*a*) consists of cellulose and lignin.

(*b*) is a dark brown sticky resinous substance of an acid character, soluble in ether and alcohol.

(*c*) is a dark-red brown amorphous brittle resinous substance of acidic character.

(*d*) is a white semi-crystalline substance of a neutral character. It is very insoluble in cold, but slightly soluble in hot alcohol, the solution of which gelatinises on cooling; m. pt. 210°—230°.

(*e*) consists of more or less white needles which are not acid in character.

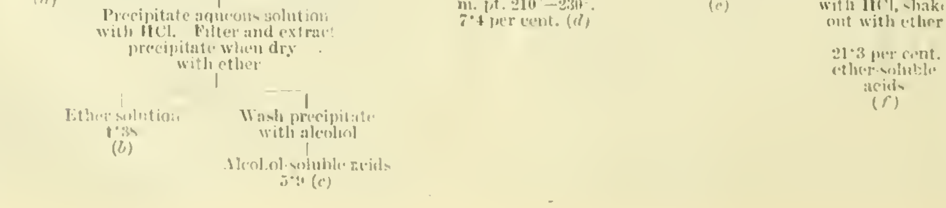
(*f*) consists of a sticky waxy substance of light brown colour and acidic character. It has an iodine value of 45 (Wijs), and would thus appear to be unsaturated. It is soluble in ether and alcohol, partly in petroleum ether.

An examination of these substances is in hand. From the above it is clear that any attempts to determine either the amount of cork or of cement in linoleum by saponification is futile, because the acids precipitated from the soaps and dissolved in ether must contain not only the oil and resin acids, but also all the ether-soluble substances derived from the saponification of the cork present, every 100 parts of which yield 25 parts of ether-soluble substance, leaving only 24·4 parts of cellulose behind.

However, cork varies very much in composition, the cellulose varies from 20 to 35 per cent., and consequently the ether-soluble portion must also vary very much.

From what has been said it is clear that it is impossible to determine the quantity of cement and cork present in a linoleum by the saponification method.

Ether Extract.—Pinette (this J., 1892, 550) considers that the linoleum giving the most ether extract is the most valuable because, he says, it contains the most oil.



Lewkowitsch (Oil, Fats, and Waxes, 2nd edition, p. 741) disputes Pinette's conclusion, because he considers that a large amount of extract shows that the linoleum cement has not been sufficiently oxidised in stoving, since linoxyn, the final product of oxidation of the cement, is insoluble in ether.

There is an element of truth in both these contentions; but again, before deciding upon the value of this constant as a criterion of the quality of the linoleum, several factors have to be taken into account.

Of what does the extract consist? The non-oxidised or non-oxidisable portion of the linseed oil and of the gum and resins used in the manufacture of the cement. It is also swelled by the ether-soluble constituents of the cork, which we have seen may reach as high as 4·5 per cent.

Now, if the linoleum be made solely from polymerised linseed oil (Taylor's cement), then we have only the non-oxidisable portions of the linseed oil and the cork extract. Samples made in this way I have found to give an extract of from 8 to 10 per cent. Sometimes the cement thus prepared is afterwards mixed with resin (the presence of which in the extract is readily recognised by the Liebermann-Storch reaction) and then the ether extract may rise to as high as 17·8 per cent.

If the linoleum be made from cement made by the oxidation process, then it contains in addition the non-oxidisable portions of the gum and resin. Consequently, linoleums thus made must always give a larger ether extract than those made with Taylor cement only. In examining such linoleums I have found extracts varying from 16·9 up to 23·3 per cent. (see table below). It is thus clear that with the same class of cement the linoleum which yields the most extract contains the most cement, but that it is not right to compare two linoleums made from different kinds of cement.

Moisture Content.—A determination of the moisture present is of importance, as it reveals the amount of surface presented by a given weight of linoleum, and hence is proportional more or less to its porosity. It is determined by drying for one hour in the water-oven. The amount is only small, varying from 1·3 to 4·3 per cent. (for details, see table below).

The importance of non-porosity of linoleum will be treated below.

Action of Water.—Burchartz cemented a glass tube on to the surface of linoleum, filled it with water, and observed if the level sank. He came to the conclusion that linoleum is practically waterproof, and did not observe any difference between different makes. This method does not recommend itself to me on account of the very limited area examined. Some foreign governments subject the linoleum to the action of salt water at 80° C. for six hours and observe the appearance of the treated material, which they stipulate should not show any blisters. It is difficult to see what bearing this has upon the everyday applications of linoleum. In my opinion such a treatment would give a premium to the poorer and more porous qualities of linoleum, for if the linoleum presented a closed and impervious surface, then the heat, by expanding the gases and air enclosed in the linoleum, would cause blisters. I think I have devised a method for the examination of the action of water upon linoleum, which gives more reliable results and which enables one to detect differences in samples of which the already discussed tests, with the exception of the moisture present test, give no indication: differences which, however, show themselves very distinctly when the linoleum is in actual use.

Water Absorption Test.—This consists in soaking pieces of linoleum in water at say 15° C. for a given period, 24—48 hours, and for a longer period, two to seven weeks. In carrying out the test the canvas back is removed, and the back of the linoleum layer rasped smooth with a file. A piece of the linoleum of about 50 sq. cm. area is dried in the water oven and weighed. The drying renders any wax which may have been used in facing the linoleum fluid, and causes it to sink into the interior of the fabric, thus opening up the pores for the freer action of the water. The linoleum is then placed in water for a given period, removed, dried between filter paper and weighed. The increase in weight gives the water absorbed, and other things being equal, this is a measure of its value.

In carrying out the tests all the samples to be examined should as far as possible be immersed together so that the results may be comparative, avoiding any disturbing influences arising from fluctuation of temperature.

Sample.	Kind of Linoleum and Cement used.	Weight per square inch in		Total thickness in	Lino thickness in	Moisture present.	Ash content.	Ether extract.	Water absorption per cent. in			
		Total.	Lino. only.						24 hours.	48 hours.	15 days.	7 weeks.
	Plain:—	grms.	grms.	mm.	mm.							
1	Oxidised oil	2·29	2·03	3·6	3·10	1·3	13·6	19·5	2·2	2·9	7·4	12·6
2	" "	2·47	2·07	3·3	2·70	1·46	24·2	16·9	2·5	3·5	10·4	18·0
3	" "	2·60	2·21	3·7	3·15	1·60	17·65	18·2	2·2	2·9	7·4	12·6
4	Polymerised oil	2·42	2·01	3·5	3·1	1·58	14·9	17·8	2·7	3·7	10·2	17·2
5	Oxidised oil	3·30	2·87	4·8	4·4	1·30	15·1	..	2·5	3·3	8·5	14·5
6	" "	1·50	1·27	2·2	1·75	1·5	18·1	17·7	3·7	4·9	12·0	18·5
7	" "	1·52	1·15	2·2	1·80	2·5	10·5	23·3	7·3	9·5	20·0	30·5
8	Polymerised oil	1·52	1·08	2·2	1·75	2·5	?	..	5·5	7·1	15·8	20·3
	Cork Carpet:—											
9	Polymerised oil	2·65	2·35	7·4	7·1	1·78	7·6	..	7·8	10·8	29·0	43·5
10	Oxidised oil	3·52	3·21	7·05	6·65	1·26	14·9	..	3·75	4·6	16·2	24·5
11	" "	2·70	2·34	5·35	4·8	2·25	13·3	22·3	8·0	10·5	27·5	46·2
	Printed Lino:—											
12	Oxidised oil	2·53	1·90	3·7	2·9	1·6	..	..	3·45	4·75	11·0	..
	Inlaid:—											
13	Oxidised oil cement	2·56	1·7	3·15	2·2	1·7	15·8—34 per cent.	17—19·5 per cent.	4·8	6·3	16·0	21·5
14	" "	2·48	1·54	3·10	2·1	1·85			..	8·5	18·0	..
15	" "	2·28	1·65	3·0	2·3	1·5			3·0	5·5	11·9	..
16	" "	1·98	1·25	2·45	1·7	1·4			5·4	7·1	17·7	24·2
17	" "	1·64	0·93	2·1	1·2	1·6			7·3	9·8	21·3	26·5
18	" "	2·35	1·88	2·9	2·45	1·46	16·8—29 per cent.	19—22 per cent.	..	8·3	18·0	..
19	" "	1·53	1·03	2·15	1·45	2·6			..	16·0	28·5	..
20	" "	2·25	1·70	3·0	2·3	2·25			..	16·0	23·6	..
21	" "	2·91	2·10	3·6	2·7	1·96			..	12·9	23·5	..
22	" "	2·00	1·41	2·8	2·15	4·1			..	23·4	32·3	..
23	" "	1·98	1·51	2·7	2·15	2·6			..	18·0	26·5	..
24	" "	2·68	1·54	3·55	2·40	4·3			..	26·4	37·0	..

It has been said that the results are a measure of the value of the linoleum. This is the case because they are an indication of its porosity. A large water absorption means a high porosity, and great porosity may indicate that the granules of the linoleum are not cohering sufficiently and consequently may be more easily removed by wear. It also shows that there is a likelihood of a free entrance of particles of dirt into the material, causing it to wear dirty. As many soaps are more or less alkaline in character a porous linoleum when washed stands a greater chance of having its binding material, oil and resin, dissolved by those alkaline fluids and thus is more likely to disintegrate.

When used in places where weight is an important factor, as on board ship, it is obvious that a porous linoleum is likely to retain more moisture than a less porous one, and hence is less suitable. In judging the linoleums by this test it is important to bear in mind that only those kinds of linoleums which belong to the same class should be compared, and not only that but the thickness should also be the same. I have found that the thicker qualities absorb less per cent. of their weight than the thinner, as they present less surface.

It would also be absurd to compare inlaid or plain goods with printed goods, because the water absorption is in this case given by the linoleum mass and is not a measure of the wearing qualities of the paint layer, which is practically waterproof. Neither would it be fair to judge the wearing qualities of cork carpet as against plain or inlaid on this test. The larger grains of cork used in cork carpet present a greater surface to the action of the water and hence more is absorbed, but the very fact that the cork grains are larger makes the fabric more resilient and therefore less likely to wear. Cork carpet as a matter of fact wears practically as long as plain or inlaid linoleum.

With these reservations the writer considers that a determination of the water absorption of two samples of linoleum belonging to the same class is one good means of determining their relative wearing properties and values.

In the table the results of the examination of samples representing the makes of eight different firms (six British, one American, and one German) are given. They were obtained from samples which the author still retains and must be considered as applying to these only, although in selecting them he has as far as possible made them representative of all the samples he has examined.

In conclusion he would urge that the result of no single test is sufficient to rely upon. Before coming to a decision as to the suitability of a sample of linoleum for any purpose the conditions under which it is to be used should be considered and the tests applied to this end.

In conclusion the author has to thank his assistant, Mr. Ernest Wake, for valuable practical help.

DISCUSSION.

Mr. S. STEWART said that when a large amount of pigment was necessarily used to get the desired colour, a greater proportion of cement would also be used, and so to a certain extent neutralise the tendency to harden the goods. In regard to the attrition test, he drew attention to the results given in this J., 1895, p. 587, by Burchartz, where, under equal conditions of experience, the following amounts of material were removed from 50 sq. cm. :—Linoleum, 1·8 c.c.; granite, 4·4 c.c.; marble, 24·3 c.c.; and oak, 7·8 c.c. These results showed the absurdity of comparing such different materials by such a test. Referring to the attempt to determine the amounts of cork and cement in linoleum samples, the problem at first also appeared to him easy, but his experience had been the same as Dr. Ingle's, and it was evident, from the results obtained that it was impossible to ascertain with any degree of accuracy, or even approximately, the relative proportions of cork and cement in linoleum by the saponification process, or by simple extraction with ether. In this connection he might supplement Dr. Ingle's results by giving the following figures obtained by treating the same sample of dried ground cork with alcoholic potash in an open basin, evaporating off the alcohol and treating with water :—

Insoluble after above treatment.	Insoluble in Ether after acidifying filtrate.	Soluble in Ether.	Soluble in Water (by diff.)	Ash.
Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
36·80	10·80	27·60	23·15	1·65
33·30	11·65	25·80	27·60	1·65
33·45	7·80	26·20	30·90	1·65

By treating the same dried cork with alcoholic potash in flask, with reflux condenser, and washing with alcohol, the following results were obtained :—

Dried Cork treated with Alcoholic Potash and washed with Alcohol.

Per cent.	Per cent.
Insoluble matter 71·92. Treated with water gave 32·52 insoluble, of which 29·92 was organic. Filtrate treated with acid and ether gave 7·82 insoluble and 1·56 soluble in ether.	Soluble matter treated with acid and ether gave 37·92 soluble in ether.

The fact that the sum of the insoluble in alcohol, 71·92, and the soluble in ether, 37·92, was 109·84, indicated that the insoluble in alcohol probably contained a considerable amount of potash. He had not separated the various products of the decomposition of cork so thoroughly as Dr. Ingle had done, as he was more concerned to discover a process for the analysis of linoleum than to undertake an investigation of the properties of such products. He agreed with Dr. Ingle as to the value of the determination of the ether extract when the class of cement used was known, as cements of different composition would give different amounts of ether extract. He had also made experiments on the absorption of water by linoleum, but found that the application of the test to the surface was no indication of the quality of the goods after the surface was removed. Removal of the canvas and paint from the back and immersion in water was better, as it was in a way the measure of the porosity of the material; but although that was the case he could not agree that it was a criterion of quality, because upon the porosity of the cork depended its resiliency, and consequently the special quality which linoleum had as a floor covering, unless fabrics of the same class were compared.

Mr. BRODIE said that he had found that, if linoleum were porous, the paint used in printing it dried dull, and the linoleum layer under the paint was brittle. He could confirm Dr. Ingle's experience in regard to the variations in the porosity of different samples.

Mr. R. T. THOMSON said that, like the previous speakers, he had experienced great difficulty in analysing linoleum, and the results recorded in the paper explained this. He asked whether polymerised oil gave the same analytical results as the oxidised oils.

Dr. L. DOBBIN asked whether there was any test for the quality of linoleum that was really reliable. He also commented upon the saponification of cork, and thought that decomposition might take place. He, too, had been unable to get any reliable results with linoleum. He did not consider the water-absorption test a measure of the wearing power as Dr. Ingle applied it; it should be applied to the surface only. Could not the cellulose content of the cork be used as a guide to the amount of cork present in a sample?

The CHAIRMAN mentioned that chloroform extracted a considerable amount of material from cork, and pointed out how unsuitable corks were to close bottles for containing such substances as alcohol, ether, and chloroform. He considered that the attrition test was probably the best test to apply, if sand or some less drastic substance than emery were used. In saponifying cork, probably the alcoholic potash decomposed the cellulose itself.

Dr. INGLE, in reply, said he agreed with the chairman with regard to the attrition test, but it was so difficult to apply, and required so costly machinery as to put it out of court. He was glad to have Mr. Stewart's confirmation of his experience with regard to the saponification of cork. Mr. Stewart's results did not altogether agree with his own, but that was doubtless due to variations in the composition of the cork examined. With regard to the difference between saponification in the open test and with a reflux condenser, he considered that suberine was probably more closely allied to the resins than to cellulose, and, as Fahrion had observed, when resin was saponified in an open vessel, different results were obtained than when the operation was carried out with a reflux condenser, the oxygen of the ir oxidising the resin at the double linkages. Cork gave, on reatment with potash, an unsaturated compound which would probably suffer similar oxidation. Hence the difference in the results. In reply to Dr. Dobbin, he was afraid that, as cork varied so much in composition, the cellulose present in a sample of linoleum was an uncertain guide. He knew of no single test that could be used to determine the value of a sample of linoleum. The water absorption test had been criticised. He did not lay too great a stress upon it, as it did not take into account the resilience of the material. It was, however, a measure of the porosity. As to the relationship between porosity and wearing power, that was an arguable matter. Dr. Dobbin considered it should only be applied to the face, but he would point out that after the facing had worn away the interior portions of the linoleum became exposed, and the test, as applied, seemed to him to give an average result for the porosity of the goods. In reply to Mr. R. T. Thomson, fabrics made from polymerised oil gave less ether extract than those made from oxidised oil cement. With regard to the action of chloroform upon cork, he had not tried it, but he did not think the results would be materially different from those obtained with alcohol and ether.

Journal and Patent Literature.

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—PLANT, APPARATUS, AND MACHINERY.

egistering Pyrometer; New Form of ——. N. S. Kurnakow. Z. anorg. Chem., 1904, **42**, 184–202.

HE apparatus described is claimed by the author as simpler ian that of Roberts-Austen (this J., 1892, 840; 1897, 5), id the process consists in principle in measuring the temrature by means of a thermo-element connected to a irror-galvanometer, and recording the temperature by using the light reflected from the mirror-galvanometer to ll on to a silver-bromide paper fixed to the surface of a tating cylinder. The cylinder is caused to revolve by ockwork, and by means of cog-wheels of different sizes the ne occupied by a complete revolution can be varied from hour to 24 hours. The divisions on the scale are reflected om the movable mirror-galvanometer, and are read off by eans of a telescope. At one end of the cylinder of the gistering device a strip of metal is fixed, which, at the end each revolution, comes in contact with two brass springs, d thus completes an electric circuit, in which a bell is cluded. In a branch of the same circuit is an electrognetic key, which starts or stops the clockwork.—A. S.

English Patents.

Drying Apparatus; Impts. in ——. A. Van Steenkiste, Schaerbeek-Brussels, Belgium. Eng. Pat. 27,935, Dec. 19, 1903.

The arrangement of the frames in the drying chamber in an inclined position is claimed, this arrangement being effected by applying to the top and bottom of the frames, rollers travelling on guides or rails fixed to the floor and roof of the chamber. The claims also extend to cross-bars, which are arranged on the fronts or faces and backs of the frames of the drying apparatus, for holding the material to be dried, and for supporting the frames one against the other.
—W. H. C.

Separating Liquid from Solid Matter; Apparatus for —— and for partially Drying the Solid Matter. T. Houghton and the United Alkali Co., Ltd., Liverpool. Eng. Pat. 28,791, Dec. 31, 1903.

The rotating dish with filter-bottom, described in Eng. Pat. 7957 of 1903 (this J., 1904, 434), has the dish divided into compartments, which are alternately in communication with the suction device, to carry away the filtrate, and with a supply of mother liquor, water, &c., to wash the solid matter and filtering medium, this device and arrangement being the subject of the claims.—W. H. C.

Centrifugal Separators; Impts. in ——. S. C. Hauberg, Copenhagen. Eng. Pat. 2002, Jan. 26, 1904.

In a centrifugal separator, in which the bowl rests freely on the head of the revolving spindle, a pawl is arranged on the head of the spindle in such a manner that, when the spindle is revolving faster than the bowl, the pawl comes into action by centrifugal force and both are connected together. If, however, the bowl revolves faster than the spindle, the pawl ceases to act. This arrangement is claimed.—W. H. C.

Volatile Liquids; Apparatus for Measuring Quantities of Highly ——. F. W. Branson, Leeds. Eng. Pat. 3490, Feb. 12, 1904.

A graduated tube, intended to receive and measure the highly volatile liquid, is sealed at its rim to the edge of an enclosing tube, and the space between the two tubes is rendered vacuous, thus supplying a vacuum jacket, and protecting the liquid to be measured, from access of heat. A removable delivery stopper is fitted into the inner tube, and the outer tube is enlarged below so as to form a foot, so that the apparatus may be set to stand upright.—E. S.

Raising Liquids by Means of Compressed Air; Process and Appliance for ——. G. Hantke, Warsaw, Poland. Eng. Pat. 16,316, July 23, 1904.

See Fr. Pat. 345,204 of 1904, following these.—T. F. B.

Vacuum Evaporating Apparatus. T. Suzuki, Sunamura, Japan. Eng. Pat. 19,186, Sept. 6, 1904.

A series of cylindrical chambers are superposed one upon the other, and are provided with a base and top piece. Each chamber is provided with an easily removable, vertical series of horizontal heating coils, so arranged that the liquid falls between the pipes of an upper coil on to the surface of the pipes forming the coil immediately below. A distributing disc is arranged above the series of coils in each chamber, and is provided with overflow pipes and impact surfaces, so that the inflowing liquid, impinging on the latter, causes the distributor to rotate. Means are provided for feeding the apparatus with liquid, for allowing the liquid to flow from chamber to chamber, for withdrawing the same when concentrated, for connecting the apparatus to the vacuum pump, and for utilising the heat of the vapour produced in one chamber to evaporate the liquid in another. Seven claims cover the foregoing.—W. H. C.

United States Patents.

Centrifugal Machine. J. J. Berrigan, East Orange, N.J., Assignor to F. J. Arend, New York, and to J. Bernstrom, Stockholm. U.S. Pat. 774,821, Nov. 15, 1904.

The rotating drum of a centrifugal machine is provided with an outlet for the liquid separating, and with an outlet situated in its circumference for solids. The outlet for the solids is surrounded by bars projecting inwards, and the solids are swept towards it by arms carried by a rotating shaft fixed eccentrically in the drum.—L. F. G.

Centrifugal Machine. A. C. Van Kirk, Tiffin, Ohio. U.S. Pat. 775,320, Nov. 22, 1904.

A vertical conical chamber is mounted so as to rotate, and within it is a screw-blade arrangement rotating concentrically with the chamber, but at a different speed. At the bottom is a discharge opening for the solid matter, whilst the liquid is discharged from an opening in the top, near the centre. The material to be treated is led into the top of the chamber, a shield being arranged to prevent any solid matter being discharged through the liquid outlet. Means for rotating the chamber and screw, and for varying the speed and controlling the same, are provided, the whole forming the subject of the claims set forth.—W. H. C.

Discharge-regulating Device for [Centrifugal] Separators. J. J. Berrigan, East Orange, N.J., Assignor to the De Laval Separator Co., New Jersey. U.S. Pat. 775,510, Nov. 22, 1904.

Secured to and passing through the wall of the rotating bowl of the separator is a tube, inside which a liquid-discharge tube is loosely mounted, extending inside the bowl beyond the outer tube. A ring is so arranged that, when the bowl rotates, the vertical movement of the ring in one direction forces the liquid-discharge tube against the action of centrifugal force, whilst the movement of the ring in the other direction regulates and limits the extent to which the tube can be forced outwards by centrifugal force.—A. S.

Separating Non-Gaseous Material from a Mixture with Gaseous Material. A. G. McKee, Cleveland, Ohio. U.S. Pat. 774,851, Nov. 15, 1904.

The apparatus employed, consists of an upright pipe projecting into an outer pipe. The outer pipe is enlarged at its upper portion above the inner pipe, and inside the enlargement is fixed a rotating fan. The mixture to be separated enters at the top, and the non-gaseous materials fall into the annular space between the two pipes, and are removed through a shoot, whilst the gases flow through the inner pipe to a lateral exit.—L. F. G.

Drier. J. E. Turney, Louisville, Ky., Assignor to C. E. Geiger, W. E. Koop, and G. W. Fiske, of Geiger, Koop, and Fiske, Louisville. U.S. Pat. 774,859, Nov. 15, 1904

The apparatus consists of an approximately horizontal cylinder with a double or hollow wall, the annular space formed, being divided into a series of flues by longitudinal partitions. Receiving and discharge heads are fixed at the ends of the cylinder, which is suitably rotated, and the material to be dried is fed into the longitudinal flues from a conveyor, whilst a heating medium is admitted through the central portion of the cylinder.—L. F. G.

Drier. J. E. Turney, Louisville, Ky., Assignor to C. E. Geiger, W. E. Koop, and G. W. Fiske, of Geiger, Koop, and Fiske, Louisville. U.S. Pat. 774,860, Nov. 15, 1904.

The apparatus is similar to that described in the preceding patent, except that the longitudinal flues are formed by attaching a series of troughs of rectangular section to the inner wall of the rotating cylinder.—L. F. G.

Drier. T. Andrews and S. J. Loewenthal, Rockaway, N.J. U.S. Pat. 775,717, Nov. 22, 1904.

A horizontal drying cylinder is mounted concentrically within an outer cylindrical case, a space being left between them for the circulation of the heating agent. A steam turbine, fixed at one end of the inner cylinder, is driven by the steam or other heating fluid, and causes the cylinder to rotate on its axis. Means are provided for introducing and discharging the steam. The claims cover a drying cylinder thus constructed and arranged.—W. H. C.

Kier; Vomiting ——. E. D. Jefferson, Lowell, Mass. U.S. Pat. 775,450, Nov. 22, 1904.

A closed kier is claimed, adapted to contain liquor under pressure, and having a "vomiting pipe" connecting the top and bottom of the kier. The vomiting pipe, by automatic arrangement, is actuated intermittently and independently of the pressure in the kier.—W. H. C.

Vacuum Evaporating Apparatus. C. Ordway, Brooklyn, N.Y. U.S. Pat. 775,577, Nov. 22, 1904.

A vacuum pan is combined with a set of feed and settling tanks. The concentrated liquid flows from the vacuum pan to the settling tanks, and deposits the separated solid matter, which is removed, the liquid being then returned to the vacuum pan. Means are provided for controlling the feed.—W. H. C.

Heating Liquids; Method of ——. A. Waldbaur, Stuttgart, Germany. U.S. Pat. 775,788, Nov. 22, 1904.

See Eng. Pat. 15,875 of 1904; this J., 1904, 928.—T. F. B.

French Patents.

Temperature Regulators; Impts. in ——. N. E. Nash and W. E. Friedman. Fr. Pat. 345,090, Jan. 12, 1904.

A thermostat composed of two thin plates, one of porcelain and the other of nickel, is connected to a bent Bourdon tube. The latter is connected with a supply of compressed air. The Bourdon tube is provided with a valve actuated by the thermostat. When this valve is opened, some of the compressed air escapes from the Bourdon tube, which then alters its shape, and actuates a valve controlling the supply of heating fluid to the radiator or other heating apparatus.—W. H. C.

Pyrometers; Impts. in ——. H. T. Barnes and H. M. Tory. Fr. Pat. 344,718, June 6, 1904.

The apparatus consists of:—a resistance pyrometer of the usual kind, arranged in an electrical circuit in which two resistance coils are placed so as to divide the circuit into two portions; a scale formed of a wire of conducting material mounted in zigzag fashion on a suitable calibrated support; a movable conducting piece which can be brought into contact with the first wire at any position; and an arrangement for emitting sound, such as a telephone. When contact is made between the two conducting wires at a certain point on the scale, which point varies with the emperature to which the pyrometer is subjected, equilibrium s established between the two divisions of the circuit, and consequently no sound is produced in the telephone, whereas, when contact is made at any other point on the scale, ounds are produced. The scale may be calibrated to cover any desired range of temperature.—A. S.

Compound Gas Compressors. M. E. Douane. Fr. Pat. 344,686, July 8, 1904.

The compressor is designed for compressing air or rare gases, and is very compact. In the double-compression ype the cylinders are single-acting, and mounted in tandem on a vertical frame. The compressed air issuing from each cylinder is cooled by circulating in a metal coil placed in a vessel containing water, surrounding the two cylinders. n the triple-compression type, one single-acting cylinder is mounted in tandem with a double-acting cylinder, the hird compression of the gas being effected in an annular cylinder by the return stroke of the piston.—L. F. G.

Measuring Apparatus for Methyl Chloride or other Volatile Liquids. A. Rousseau. Fr. Pat. 344,929, July 12, 1904.

A cylindrical double-walled vacuum vessel, provided with a foot, is graduated in cubic centimetres. Over the top is itted a cover with a straight or curved nozzle, through which the liquid is poured out, a tight joint being made with the vacuum vessel by means of a cork ring.—L. F. G.

Heating Agglomerated Materials under Pressure; Furnace for ——. Galvanische Metall-Papier-Fabrik Act.-Ges. Fr. Pat. 344,791, July 13, 1904.

The furnace is intended for heating under pressure granular and pulverulent agglomerates, such as carbon blocks, carbon dynamo brushes, &c., up to a temperature of 1100° C. The materials are filled into the cylinders of a number of hydraulic presses arranged inside the furnace, and are pressed against the screw covers of the same. The furnace is heated by gas, which is admitted through orifices urrounded by air inlets, to two sides of each press. The products of combustion have to pass downwards before eaching the exit pipes. Means are provided for regulating he gas supply, and spy-holes for observing the temperature attained.—L. F. G.

Retort Furnace. Soc. P. de Lachomette, Williers et Cie. Fr. Pat. 345,010, July 21, 1904.

The Lachomette system of regenerative heating is modified y providing two sets of paths or flues for the waste flames, and for the secondary supply of air. Further, a portion of he secondary supply of air is made to enter the spaces between the outer rows of retorts and the walls of the furnace, whereby the retorts in these rows are heated to a higher temperature, and a more uniform distribution of heat in all parts of the furnace is attained.—A. S.

Siphoning Liquids by Means of Compressed Air. G. Hautke. Fr. Pat. 345,204, July 23, 1904.

An accumulator is interposed between the air-compressor and the vessel containing the liquid. The air in the accumulator is compressed to a high degree, and is then passed through a reducing valve, and used at a lower pressure, whereby a steady flow of liquid is maintained.—W. H. C.

Filter for all Kinds of Liquids. A. F. Capillery. Fr. Pat. 345,113, July 25, 1904.

The filter claimed consists of a number of vertically superposed filter-plates, with suitable base and top pieces. The plates are perforated and separated by filter-paper or cloth, and clamped together by a screw. The inlet and outlet pipes are cast in the border of the plates. A specially constructed core, which can be withdrawn from the casting in parts, is used to form the lateral channels communicating with the interior of the plates. The plates are made of any metal suitable for the liquid to be filtered, and the base and top pieces, which are of cast iron, are protected by a coating of the same metal.—W. H. C.

Pressure Filter, with Rapid Attachment and Concentration of Filtering Surfaces. J. Selves and U. Tocaven. Fr. Pat. 345,516, Aug. 13, 1904.

A cylindrical chamber is supported by trunnions on a suitable carriage. The filter-bags are retained within the cylinder by a special holder, which is attached to the cover-plate of the cylinder by an interrupted screw-joint, which can be rapidly put into or taken out of position. The filter-bags are tied at the lower end with a cord, thus causing them to form into several vertical pleats. They are surrounded by wire netting or open wickerwork shields in order to prevent them from expanding too far.
—W. H. C.

Filter Press (Continuous) composed of Single Elements. P. M. Privat. Fr. Pat. 339,054, Sept. 22, 1903.

The apparatus consists of several filtering elements, joined by means of tubing to several taps fixed to a distributing valve. This distributing valve is spherical, and divided into two compartments by a partition. The one compartment receives the liquid to be filtered, and the other the filtered liquid. By means of the taps the admission of liquid to each element can be controlled, and a defective element isolated.—L. F. G.

Drying Apparatus. Rheinische Webstuhl- et Appretur-Maschinenfabr., G. m. b. H. Fr. Pat. 345,303, Aug. 2, 1904.

See Eng. Pat. 17,957 of 1904; this J., 1904, 1020.—T. F. B.

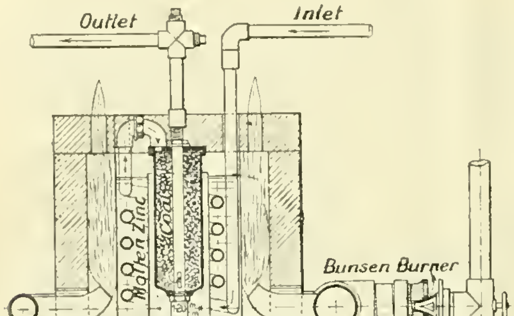
II.—FUEL, GAS, AND LIGHT.

Coal; Spontaneous Ignition of ——. A. O. Doane. Eng. News, 1904, **52**, 141; Science Abstracts, B., 1904, **7**, 940—941.

The amount of moisture present in a bituminous fuel after drying in the air, is stated to be a measure of the risk of spontaneous ignition when the fuel is stored; bituminous coals containing over 4·75 per cent. of water are dangerous. Coal bins should be of iron or steel protected by concrete, and should be roofed over; free air passages should be provided round the walls and beneath the bins to keep them cool; the depth of coal stored in them should never exceed 12 ft. The customary method of providing air passages in the body of fuel is useless, since it only tends to accelerate oxidation, and does not produce a sufficient current of air to keep the temperature down. Cracks or joints in the walls of the fuel bin increase the risk of spontaneous ignition for similar reasons.—T. F. B.

Gas; Distillation of Coal for —— by Highly-Heated [Water] Gas. E. Blass. J. Gasbeleucht., 1904, **47**, 986—987.

The destructive distillation of coal by means of a current of highly-heated water-gas has been investigated with the aid of the apparatus shown in the accompanying figure:—



The inner. iron cylinder was filled with the coal, and was surrounded by molten zinc in which was immersed the heating coil. The water-gas used, traversed first the heating coil and then the coal, and was next led through dilute sulphuric acid for the determination of the ammonia. (It was found that coal-gas suffered no loss of illuminating power when passed through the coil even at the temperature of boiling zinc (about 900° C.).) 300 grms. of coal were distilled in a current of water-gas at 672°—705° C., until the gaseous mixture produced ceased to give a luminous flame and appeared to consist of pure water-gas. The yield of ammonia was found to exceed, by 62 per cent., that obtained on carbonisation of the coal in ordinary retorts; as ammonia is completely expelled only at 900°—1000° C., the yield would have been greater had the apparatus been capable of withstanding that temperature. The quantity of water-gas required was about double that obtainable from the coke (68 per cent.) yielded by the coal. The yield of actual lighting gas was four or five times that given by ordinary distillation, and although the average illuminating power was not equal to that of ordinary coal-gas, it shows that a considerable volume of water-gas can in this way be carburetted by a relatively small quantity of coal. The gas was fully equal to ordinary gas for heating, cooking, and power uses, and for employment with the incandescence burner. A number of theoretical considerations show that the coke produced per kilo. of coal, is not sufficient to yield all the water-gas required for the distillation of the coal (compare following abstract).—H. B.

Gas; Distillation of Coal for —— by Highly-Heated [Water-] Gas. F. R. Besemfelder. J. Gasbeleucht., 1904, **47**, 1083—1084.

The author criticises the remarks of Blass (see preceding abstract), and maintains that the yield of coke is about twice as much as is required for the distillation of the coal. In the author's process, a number of water-gas producers are united to one common distillation retort, which operates uninterruptedly and feeds the incandescent coke continuously to the particular producer in action at the time, through the opening by which the hot water-gas is flowing into the distillation retort from the producer. The number of producers undergoing the air-blast is controlled automatically by the distillation retort, so that a supply of hot waste gases flows continuously round the retort, heating it from the outside. The coal and the gases pass through the retort in opposite directions. Less than half the coke produced, is sufficient for the carbonisation of the coal, and hence the proportion of water-gas contained in the illuminating gas produced is less than in the experiments of Blass, the luminosity of the flame and the calorific value of the gas being correspondingly greater.—H. B.

Naphthalene in Coal Gas; Formation of ——. A. H. White and S. Ball. XXIII., page 1240.

English Patents.

Peat; Process for Converting Raw —— into Solid Peat Fuel. C. Schlickeysen, Steglitz, Germany. Eng. Pat. 4995, Feb. 29, 1904.

The raw peat "as it is taken from the bog," is incorporated, in a mixing and kneading machine, with pulverulent, granular, or fibrous substances, such as peat dust, spent tan, road sweepings, powdered ore and the like, and is then made into blocks. The blocks are, preferably, coated on the surface with pulverulent, granular, or liquid substances, to aid the retention of which the mixture, on issuing from the kneading machine, may be first pressed through a heated mouthpiece, so as to heat the surfaces of the bars to about the boiling-point of water, before applying the coating substance.—H. B.

Gas Producers. L. Mond, London. Eng. Pat. 27,496, Dec. 15, 1903.

In a gas producer of the kind described in Eng. Pat. 12,440 of 1893 (this J., 1894, 938), the blast is supplied through a circular grate having the form of an inverted truncated cone. According to this specification, a blast-pipe passes axially up through the conical grate, the open end being covered with a hood, to prevent any fuel from entering it. The blast of air, steam, or air and steam, is delivered in two portions, one of which passes up through the blast pipe, whilst the other is led down the annular space between the two concentric casings of the producer, to enter through the conical grate.—H. B.

Gas Producers and Steam-Generators for Producing Water-Gas and Generating Steam by the Heat of such Gases; Combined Double ——. F. Neuman, Eschweiler, Germany. Eng. Pat. 21,318, Oct. 4, 1904. Under Internat. Conv., Oct. 20, 1903.

Two alternately operated producers for the generation of water-gas and producer-gas are so connected to a common tubular steam boiler, divided longitudinally by means of a partition, that the producer-gas generated in the one producer and the water-gas simultaneously generated in the other producer are made to traverse the steam boiler simultaneously, but separately from each other, for the purpose of keeping the boiler at the same temperature throughout the alternating water-gas and producer-gas periods, and maintaining a uniform production of steam.
—H. B.

Gas Producers. J. Robson, Shipley, Yorks. Eng. Pat. 22,092, Oct. 14, 1904.

The vertical fire-brick lining of the producer is recessed above the fire-grate, round the region of incandescence, and in the recess there is fitted an annular metal channel through which the supply of air and steam is made to circulate before passing up through the fire-bars. By this means the mixture of steam and air is superheated, and the adhesion of clinker to the walls at the incandescent zone is prevented by the cooling action of the current within the annular channel.—H. B.

Gas and Air Mixing Apparatus. C. C. Dodge, New York. Eng. Pat. 21,776, Oct. 10, 1904.

Inside an outer drum there are arranged, upon a common horizontal shaft, a gas-meter drum and an air-meter drum, constructed with helical compartments adapted to be immersed in water, on the usual principle. The two meter drums are driven by means of the gas pressure within the gas-meter drum, the air and gas which are delivered at the inner ends of the two drums being mixed within the outer drum and passing thence through an outlet pipe. In order to reduce the friction on the shaft-bearing, each meter drum has a central closed chamber, serving as a buoy, attached to the shaft, and the blades forming the helical compartments are attached to the periphery of this chamber. Instead of a stuffing-box at the central point where the gas inlet-pipe enters the gas-meter drum horizontally, a water sealing device is provided, consisting of a concentric sealing chamber on the end of the drum, embracing a concentric disc secured vertically on the gas inlet-pipe.—H. B.

Lighting Purposes ; Bodies Adapted for —— and Rendered Incandescent by Heat or Electricity. J. H. Ladd, Reigate, Surrey. Eng. Pat. 25,698, Nov. 24, 1903.

Flints are heated at 4000°—6000° F. (from 2204° to 3316° C.) to expel "metallic elements," ground to powder, mixed with tar and cement or the like, kneaded into a dough with water, and moulded into the desired shape. If moulded to the shape of an incandescent mantle, the latter is perforated with small holes, dried slowly, impregnated with salts of the rare earths, &c., dried, and baked at a high temperature. The dough can also be made into electric lamp filaments.—H. B.

Mantles of Incandescent Gas Burners. T. K. Johnson and W. McKean, Glasgow. Eng. Pat. 753, Jan. 12, 1904.

To strengthen and increase the lighting power of mantles, they are dipped into a solution of "sulphate of alum," and dried.—H. B.

Electrodes for Arc-Lights. F. J. Gerard and L. Fiedler, London. Eng. Pat. 6972, Mar. 22, 1904.

The electrodes contain a small proportion of lanthanum and of thorium, the ratio of the lanthanum to the thorium lying between 20 : 80 and 70 : 30. They are conveniently prepared by adding to the graphite employed, from 1 to 5 parts per 1000 of the nitrates of the earths in aqueous solution, drying, adding the usual binding ingredients, and proceeding in the ordinary way. The thorium may be replaced partly by zirconium. Two electrodes may be used together, in which the one contains the lanthanum, with or without zirconium, whilst the other contains the thorium, with or without zirconium. Cheaper forms of electrodes are made by adding, instead of rare earths, magnesium and aluminium, or their compounds, in approximately equal proportions.—H. B.

United States Patents.

[*Oil*] *Gas Generator.* F. S. Vincent, Petoskey, Mich., Assignor to R. J. Lyon, Salt Lake City. U.S. Pat. 774,802, Nov. 15, 1904.

A reservoir, containing liquid hydrocarbon, is supplied with compressed air by means of a hand-pump, and is connected to a generator consisting of an upright tubular casing, containing a sheet-metal spiral and heated by a burner placed beneath the generator. A feed-pipe for the generator is connected to the lower part of the reservoir, and is formed with a loop passing round the burner, so that the hydrocarbon is heated on its way to the generator. The feed pipe and upper part of the generator are connected to the top of the reservoir, whereby an even pressure is maintained. The gas produced in the generator is directed through a nozzle into a mixing chamber, wherein it mixes with air, and flows thence into the gas main. A branch pipe from the gas main supplies the gas required by the heating burner.—H. B.

Gas Producer. H. L. Dixon, Assignor to H. L. Dixon Co., Pittsburg. U.S. Pat. 775,265, Nov. 15, 1904.

The producer consists of a number of adjoining, water-sealed chambers, each pair of which has a common intermediate vertical wall. "Grated" air-passages are formed in the inner sides of the vertical walls of the chamber. —A. S.

Gas Generator. A. Weighlé, Töss, Assignor to Schweizerische Locomotiv- und Maschinenfabrik, Winterthur, Switzerland. U.S. Pat. 775,641, Nov. 22, 1904.

See Eng. Pat. 5798 of 1903; this J., 1904, 316.—T. F. B.

Centrifugal Gas Purifier. A. Steinbart, Carlstadt, N.J. U.S. Pat. 775,462, Nov. 22, 1904.

A rotary fan is mounted within a vertical "circular" casing; a concentric annular plate surrounds the fan a short distance from its circumference, and forms an annular chamber with the casing, from which water is injected into the path of the fan tangentially to its circumference. The casing has an outward enlargement at the centre of each side; a tapering gas-inlet tube, having its end curved spirally, being connected to one side, and a flaring outlet-pipe, likewise having its inner end curved spirally, communicating with the other side.—H. B.

Centrifugal Gas-Purifier. F. V. Mattoo, Riverton, Assignor to Camden Iron Works, Camden, N.J. U.S. Pat. 775,738, Nov. 22, 1904.

A rotary fan disc is provided on both sides with blades having recesses, the blades on one side being shorter than those on the other. The fan casing carries inwardly extending lugs, arranged in circular series, against which particles carried by the gas are projected by the action of the blades, the recesses in which register with the lugs when the fan rotates. Water is projected against the fan from one or more nozzles passing through the casing.—H. B.

French Patents.

Briquettes to resist Atmospheric Influences and to bear Transport, &c. ; Process and Apparatus for the Manufacture of Solid ——. G. Höpfner. Fr. Pat. 344,926, June 23, 1904.

The briquettes formed are said to burn without smoke, soot, or sulphurous fumes. The finely-ground fuel is intimately mixed with lime (slaked or unslaked) and the requisite quantity of water, in a long, horizontal cylinder provided with mixing blades. The mixture sets to a pasty mass, which passes into a vertical, cylindrical moulding machine, provided with an endless screw, where it is subjected to a gradually increasing pressure. The moulding machine ends below in an outlet chamber, the walls of which are kept wet by a stream of water, and below this are an automatic cutting blade and a conveyor which carries the briquettes to a drying chamber, where they are dried in an atmosphere containing carbon dioxide.—A. S.

Fuel ; Artificial ——, and Method of Making the same. P. Grayson. Fr. Pat. 345,474, Aug. 10, 1904.

Coal, in a state of fine division, is mixed with water, rosin, or pitch, plaster-of-Paris, lime or cement, and mineral oil, with or without addition of sand and sawdust. The dry materials may be mixed separately, one portion with water and another with mineral oil, and then the two mixtures incorporated; or the dry materials may be mixed with the water, and the mass incorporated with a hot mixture of the mineral oil and rosin or pitch.—A. S.

Gas Generators ; Impts. in ——. J. J. Deschamps. First Addition, dated Oct. 13, 1903, to Fr. Pat. 332,745, June 3, 1903.

See Eng. Pat. 12,221 of 1904 ; this J., 1904, 929.—T. F. B.

Gas Generators. J. J. Lafond, Fr. Pat. 339,097, Oct. 14, 1903.

An annular tuyère or trough is provided round the lower part of the combustion chamber. Hot water, supplied by a small boiler situated at the top of the generator in the path of the hot gases, enters the annular tuyère, and the steam issuing upwards therefrom, prevents the adhesion of clinker to the walls of the generator. In order to prevent the main current of gas from interfering with the cooling action of the steam at the sides, the usual supply of air and steam is admitted by a central blast-pipe at the base of the generator, and the gas produced, is led off by a central conduit (enclosing the small boiler mentioned above) depending into the generator.—H. B.

Generator for Purified Weak Gas. L. Heinen. Fr. Pat. 344,859, Jan. 26, 1904.

The generator comprises a vertical combustion-shaft, the lower part of which is slightly curved, and is provided with a fire-grate and an ash-pit having a slide for letting the ashes drop out; an observation plug at the top of the shaft; a fuel reservoir at the top and to the side of the shaft, having a helical blade for feeding the shaft with the fuel; and a water-regulating device for supplying water and air to a coiled pipe, surrounding the top of the shaft, and immersed in the hot gases produced, which furnishes a mixture of steam and air to be admitted at the foot of the shaft. The hot gases, on leaving the producer, encounter an inwardly directed spray of water, and then pass down a vertical pipe, at the foot of which the heavier solid impurities collect. The lighter particles, becoming wetted by the condensing steam, adhere to the wet surfaces of the fan through which the gases pass on their way to a coke filter and gas-holder.—H. B.

Gas Generators [using Oil and Steam]. Construction Company. Fr. Pat. 345,095, June 27, 1904.

A mixture of vaporised oil and superheated steam is converted, by heating, into a fixed gas consisting of water-gas and gaseous hydrocarbons. The apparatus used is characterised by a combination consisting of a mixing-chamber surrounding a hollow heating-chamber. The inner chamber is heated internally by means of superheated steam, and jets of heated oil and superheated steam are directed upon its surface, the mixture produced, being led off from the mixing chamber and passed through a retort wherein it is converted into fixed gas.—H. B.

Gas, Combustible, from Bituminous Fuel; Production of ——. Soc. Anon. F. Krupp A.-G. Fr. Pat. 345,016, July 22, 1904.

The main combustion chamber of the producer, which is provided with a grate and an inlet for air and steam at the bottom, is surmounted by a cylindrical charging-shaft, opening at its upper end into a covered hopper. Inlets for compressed air are provided in the charging-shaft, at the point where it opens out into the hopper. The gas off-take pipe leaves the producer at the shoulder formed by the junction of the charging shaft with the main combustion chamber, and this shoulder is provided with a series of poke-holes. The object is to maintain two zones of combustion, the one upon the fire grate, and the other at the top of the charging shaft, the latter being easily accessible for loosening the fragments of coal. The fresh coal, placed in the hopper, parts with its tarry matters in the upper zone of combustion, and is converted into coke by the time it reaches the main combustion chamber.—H. B.

Gas Producers. Soc. Menot Père et Fils et Deneuville. Fr. Pat. 345,466, Aug. 10, 1904.

An annular steam generator surrounds the fuel hopper at the top of the producer, and extends downwards some distance into the path of the hot gases. From the upper part of the steam-generator a pipe leads the steam down to the air- and steam-inlet at the base of the fuel chamber. When the water supplied to the steam-generator reaches a certain level, the excess overflows into a second pipe which delivers it into an annular box surrounding the incandescent portion of the fuel, and the steam here generated, mixes with that from the former pipe and enters the fuel chamber.—H. B.

Gases; [Automatic] Apparatus for the Analysis of ——. A. Bayer. Fr. Pat. 345,221, July 29, 1904. XXIII., page 1239.

Gases; Process for Purifying, Absorbing, and Regenerating —— *by Centrifugal Force.* E. Theisen. Fr. Pat. 345,418, Aug. 8, 1904.

See Eng. Pat. 8671 of 1903; this J., 1904, 434.—T. F. B.

Sulphur and Cyanides from Gas-Purifying Materials [Spent Oxide]; Process and Apparatus for Extracting ——. J. J. M. Bécigneul. Fr. Pat. 345,071, July 23, 1904. VII., page 1216.

Filament of High Illuminating Power for Incandescent Electric Lamps. E. L. Frenot. Fr. Pat. 344,759, July 11, 1904.

A metallic or carbon filament is coated by dipping it several times into an alcoholic solution containing the following substances: sugar candy, thorium nitrate, cerium nitrate, cobalt nitrate, aluminium nitrate, and cream of tartar, and then drying it. The alcoholic solution is then placed in a flask and boiled, the vapours, which carry over mechanically a considerable proportion of the above-named substances, being led into a vessel in which is suspended the coated filament, kept incandescent by means of an electric current. The filament is finally carbonised as usual. An alternative process is to prepare a paste of the above-named substances, extrude it into a filament, and carbonise the latter as usual.—H. B.

Filaments for Incandescent Electric Lamps; Manufacture of ——. A. de Madaillan. Fr. Pat. 345,012, July 21, 1904.

Salts or oxides of thorium, cerium, &c., are incorporated with a pasty solution of cellulose and zinc chloride; the mixture is relieved of air-bubbles by subjecting it to reduced pressure, and is then extruded into filaments, which are placed in strong alcohol for two or three hours and then dried. They are next wrapped round blocks of graphite, placed in powdered plumbago, and heated for 30 hours at 2000° C., when they are ready for use.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM AND MINERAL WAXES.

Transformer Oils. D. Holde. Mitt. königl. Materialprüfungsamt, 1904, **22**, 147—150.

According to the author, a transformer oil, *i.e.*, one in which an electrical transformer is immersed to prevent sparks passing from one coil of wire to another, should have the following characters:—(1) It should be a pure, heavy mineral oil, having a flashing-point above 180° C. by the Pensky test or above 190° C. by the open test; (2) It should be completely free from acid, alkali, and water. (3) It should have as low a viscosity as possible, and in any case not higher than 20 by the Engler test, compared with water at 20° C. (4) It should remain liquid when cooled below 0° C.—A. S.

Paraffin; Action of Sulphuric Acid on ——. C. J. Istrati and M. Michailescon. Bull. Soc. Sciences Bucarest, 1904, **13**, 143—145. Chem. Centr., 1904, **2**, 1447—1448.

The authors find that paraffin hydrocarbons of high melting point can be treated with hot sulphuric acid without carbonisation taking place. No sulphonic acids are produced by the reaction. The constitution of the higher members of the paraffin series is discussed, and it is concluded from the results of the present and of previous work that the sulphuric acid has an oxidising action, resulting in the formation of aldehydes and of cyclic compounds.
—A. S.

Paraffin Wax; Admixture of —— *with Substances of Higher Melting Point. [Candle Making.]* E. Graefe. Chem.-Zeit., 1904, **28**, 1144—1149.

In the author's opinion the only reliable methods of determining the melting points of mixtures of paraffin wax with substances of higher melting point, are those based upon measuring the latent heat of melting at the moment of solidification, as in the methods of Finkener, of Dalican, and of Shukoff (this J., 1899, 406). In the experiments described, parallel determinations were made by Shukoff's method, by the capillary tube method, and by a method in which was determined the temperature at which solid material adhering to the bulb of the thermometer melted sufficiently to fall off. Experiments were made with soft paraffin, melting at 42 C. (Shukoff), 42·4° C. (capillary tube) and 42·5° C. (thermometer), mixed with stearine (m.p. 55·2° C.), retene, naphthalene, montan wax (this J., 1901, 1221), acidyl derivatives of aromatic bases, such as the compound, $C_6H_5.NHCOC_{17}H_{35}$, and with hard paraffin wax.

The author explains the well-known fact that the melting point of soft paraffin is really raised by the addition of hard paraffin by Ostwald's theory of solid solution. According to this, solid solutions consist of mixtures of isomorphous crystals or of mixtures of crystalline substances that crystallise in different forms, but yet form homogeneous mixed crystals of the shape of the predominant constituent, *e.g.*, naphthalene and naphthol, or salicylic and benzoic acids. In the case of hard and soft paraffin it is uncertain whether there is isomorphism or formation of mixed crystals, but it is one or the other, since it is possible to isolate different components from the homogeneous mixed crystals, and in the author's opinion the evidence of the microscope points to isomorphism.

This theory also explains why addition of montan wax causes a slight elevation (0·6° C.) in the melting point of the soft paraffin. During the distillation of the wax (this J., *loc. cit.*) slight decomposition occurs, with the formation of small amounts of paraffins which are able to crystallise in homogeneous mixed crystals with the soft paraffin.

The general conclusion arrived at is, that a substance of high melting point can only raise the melting point of paraffin when it is capable of forming with it a solid solution. Otherwise it can only depress the melting point, except in such cases where it crystallises out, when it leaves the melting point unaltered.

Solidity Tests.—The addition of substances such as montan wax confers on soft paraffin a degree of solidity which does not correspond with the melting point, and in the author's opinion a solidity test should also be applied to candles. He regards the test recommended by the (German) Commission on testing technical materials (1902) as the most suitable for the purpose. This consists in keeping the candles for a definite time fixed upright in a room at a definite temperature, and noting the amount of bending. Thus, candles prepared from the mixtures described above were kept for 10 minutes at 25° C. The real melting point (Shukoff's method) is not conclusive in itself, since the solidity of mixtures containing montan wax is greater than that of soft paraffin alone. The older optical methods of determining the melting point may still be of value for comparing different kinds of paraffin, but are useless as a criterion of the solidity of candles.—C. A. M.

Lignite Tar Distilleries; Use of Waste Liquors from —— as Manure. F. Strube. XV., page 1228.

Nitrogenous Refuse and Waste Sulphuric Acid [from Petroleum Refining]; Utilisation of ——. E. Donath. XV., page 1228.

English Patent.

Esparto, Straw, Wood, &c; Utilisation [Distillation] of Residual Matters containing Alkaline and Organic Substances from the Treatment of ——, in the Preparation of Paper-Pulp. E. H. Strange, J. H. Garle and A. A. Longsdon. Eng. Pat. 27,738, Dec. 17, 1903.

The alkaline liquors are concentrated in a multiple-effect evaporator, the uncondensable gases being collected. The concentrated matter is then removed to a retort and subjected to destructive distillation. The products, consisting of combustible gases, tars, oils and soluble organic substances are collected by means of condensers and purifiers. The alkaline residue in the stills is lixiviated and the soluble alkali is causticised.—J. F. B.

United States Patent.

Retort [for Extracting Oil from Shale]. S. L. Hague, Salt Lake City, Utah. U.S. Pat. 775,448, Nov. 22, 1904.

A horizontal cylindrical retort is set in a suitable furnace. A screw conveyor of less diameter than the retort, works in its lower portion and pushes the shale forward. Cross partitions above and partly around the conveyor, divide the retort into a number of compartments, which are connected together by suitable inlet and outlet pipes. A hopper is provided for feeding the shale into one end of the retort.—W. H. C.

French Patent.

Petroleum or Gasoline Soap, and Process for Making the same. L. A. Lebreton-Deshayes. Fr. Pat. 339,061, Sept. 24, 1903. XII., page 1226.

IV.—COLOURING MATTERS AND DYESTUFFS.

Dyestuffs; Theory of ——. J. Schmidlin. Comptes rend., 1904, **139**, 871—873.

Witt's view that certain molecular groupings, "chromophores," were the cause of colour in colouring matters, but that these chromophores were themselves weak and needed development by association with other groupings, "auxochromes," laid the foundation of the theory of dyestuffs. The nature of these two classes of groupings, however, has never been exactly defined. The author's view, based on his researches in the rosaniline series, is that a dyestuff is characterised by a molecule containing a strongly exothermic grouping (auxochrome), which determines the formation at another point in the molecule of an endothermic group (chromophor) containing aliphatic double linkings, which allow one part of the molecule to vibrate under the motive power of luminous waves of the same period. He recalls the fact that Helmholtz, to explain absorption, formulated the hypothesis that a molecule might contain central massive fixed portions, and mobile portions which would usually tend to maintain a position of equilibrium with regard to the fixed portions and to the ether, and that when absorption occurs, the energy of the wave-motion would be transformed into internal molecular energy (heat) by a species of molecular friction between the fixed and the mobile portions. That this dualism of the molecule should be independently arrived at by purely physical and also by chemical and thermochemical considerations renders it probable that the author's exothermic and endothermic groupings correspond to the fixed and the mobile portions of the molecule as imagined by Helmholtz.—J. T. D.

Aromatic Amino- and Hydroxy-Compounds; Action of Sulphites upon ——. H. T. Bucherer. J. prakt. Chem., 1904, **70**, 345—364.

A. *Technical Application of Sulphite Reactions:*—(1) *The reaction* $R.NH_2 \rightarrow R.O.SO_2Na \rightarrow R.OH$.—Certain α-naphtholsulphonic acids are prepared, some exclusively, others most advantageously, from the corresponding α-naphthylamine compounds. These may be obtained as a rule by the sulphite reaction, the exceptions being the *o*- and *m*-sulphonic acids. The following acids may be readily prepared by it:—1.4-, 1.7-, and 1.8-monosulphonic, 1.4.6 , 1.4.7-, 1.4.8-, and 1.6.8-disulphonic acids, and the 1.4.6.8-trisulphonic acid. The reaction is not available for the preparation of β-naphtholsulphonic acids. 1.8.3.6-Diaminonaphthalenedisulphonic acid being a di-*m* compound is not acted upon by sodium bisulphite. It is, therefore, an interesting fact that the corresponding dinitro compound is converted by the action of this salt into 1.8.3.6-aminonaphtholdisulphonic acid ("Acid H"), probably not, however, in the manner indicated in the patent specification (Ger. Pat. 113,944), namely, through the successive stages, dinitro→diamino→aminohydroxy, but by the direct displacement of one of the nitro groups. 1.3.5- (= 1.8.4-)-Diaminonaphthalenesulphonic acid is converted by the sulphite reaction into 1.8.5-aminonaphtholsulphonic acid, the amino group in the *p*-position relatively to the sulphonic acid group, being replaced. If, however, the diamino-compound be first condensed with acetone, and the compound thus produced be submitted to the sulphite reaction, the other amino group is attacked and 1.8.4-aminonaphtholsulphonic acid results. In the case of dihydroxynaphthalene compounds, the sulphite reaction is of value for the preparation of the 1.8.4-(= OH : OH : SO_3H) sulphonic acid. In the benzene series, monamines are scarcely acted upon. With some *m*-diamines which, like *m*-phenylenediamine, react easily, a mixture of products is obtained; with others, the reaction takes place with difficulty.

(2) *The Reaction* $R.OH \rightarrow R.O.SO_2Na$. — Those sulphurous acid esters which contain free amino groups, *e.g.*, $H_2N.R''.O.SO_2Na$, may be diazotised into, *e.g.*, $Cl.N_2.R''.O.SO_2Na$, and the compounds of the latter type may be combined with the usual dyestuff components. By treatment with alkalis, the products are hydrolysed into hydroxyazo dyestuffs. The advantages of this method of preparing the latter are (1) the sulphurous acid esters of aromatic amino compounds well withstand the process of diazotising, their molecules being protected against the action of a slight excess of nitrous acid; (2) the azo dyestuffs formed from the esters are much more soluble than those from the corresponding aminohydroxy compounds. The soluble dyestuffs may be applied to textile fibres and be transformed, *e.g.*, by oxidation, on the fibre, into difficultly soluble hydroxyazo-dyestuffs, faster to soaping and milling than the esters. Sulphurous acid esters with free auxochromous groups (OH, NH_2, &c.) may also be employed as dyestuff components, *e.g.*, in preparing isomerides of dyestuffs already known and in determining the constitution of compounds in regard to which there is doubt; thus, in Cassella's Lanacyl Blue, which is prepared by diazotising "Acid H" and combining with 1.5-aminonaphthol, the diazo residue is represented as occupying the position 6. It is more likely, in the author's opinion, that the attachment is in the position 2. It would be easy to decide the point by making use of the sulphurous ester of the aminonaphthol, with which combination can take place only in the position 2.

(3) *The Reaction* $R.OH \rightarrow R.O.SO_2Na \rightarrow R.NH_2$.—In aminating 2.1-β-naphtholsulphonic acid with ammonia according to the older method, a temperature of above 200° C. is necessary, and, along with the β-naphthylaminesulphonic acid, β-naphthylamine and β-dinaphthyl amine are formed. By the sulphite method, a much lower temperature, below the temperature of decomposition of the sulphonic acid in fact, suffices for the action. The isomeric 1.2-naphtholsulphonic acid cannot be aminated by the sulphite reaction.

B. *Extensions of the Sulphite Reactions.*—Not only primary, but also mono- and di-alkylated amines react, according to the scheme—

$$(1)\ R.N < {}^{R_1}_{R_2} + \text{Bisulphite} \rightarrow R.O.SO_2Na + \text{Alkali} \rightarrow R.OH.$$

$$(2)\ R.OH + \text{Bisulphite} \rightarrow R.O.SO_2Na + NH\,R_1R_2 \rightarrow R.N < {}^{R_1}_{R_2}.$$

R being an aromatic radicle, R_1 and R_2 alkyl groups or hydrogen atoms. The addition of mono- and di-alkylamines to hydroxy compounds by means of the sulphite reaction is, in some instances, effected with greater difficulty than is that of ammonia. Thus, in acting with methylamine upon the sulphurous ester of 1.4-naphtholsulphonic acid, it is convenient to employ a temperature of 125°—150° C., whilst with ammonia the reaction occurs at 90° C. On the other hand, the removal, by the inverse reaction, of mono- and di-alkylamines is accomplished with greater ease than is that of ammonia. The sulphite reaction may be applied to prepare alkylamines. To this end, an aromatic amine may be alkylated, decomposed by an alkali bisulphite into an alkylamine and a hydroxy compound, and the aromatic amine then regenerated by the action of ammonium sulphite upon the latter. To produce pure mono- and di-alkylamines, which in practice is always difficult, advantage may be taken of the differences in behaviour of the alkylamines, $R.NH.R_1$ and $R.N(R_1)_2$, towards sodium bisulphite at specific temperatures. A temperature can be found, for instance, at which the tertiary amine is acted upon whilst the secondary amine is unaffected, or *vice versâ*. Again, a mixture of mono- and di-alkylamines, obtained by decomposing with sodium bisulphite a mixture of secondary and tertiary amines may be brought, after conversion into sulphites, into contact with an aromatic hydroxy compound at such a temperature that only one of the two reacts. The other amine, if sufficiently volatile, may then be removed by distillation after rendering the mixture alkaline, or the alkylated amine may be precipitated, the purified aromatic alkylamine being, in either case, finally decomposed to give the pure mono- or di-alkylamine desired.—E. B.

Hydroxyazo Compounds Obtained by the Combination of Phenols with Diazo Compounds; Influence of Unsaturated Side-Chains on the Formation and Colour of ——. W. Borsche and F. Streitberger. Ber., 1904, **37**, 4116—4136.

The isomeric hydroxycinnamic acids and α-phenylhydroxycinnamic acids were investigated with regard to their behaviour towards diazo compounds. The two stereoisomeric forms of *o*-hydroxycinnamic acid, *i.e.* cumaric and cumarinic acids, each combine with one molecular proportion of diazobenzene fairly smoothly, to form *p*-hydroxyazo compounds. *m*-Hydroxycinnamic acid gives a poor yield of the *p*-hydroxyazo compound in alkaline solution, but the yield is very much improved if combination takes place in alcoholic acetic acid solution. *p*-Hydroxycinnamic acid does not react in alcoholic acetic acid solution. In alkaline solution a very unstable dyestuff is at once formed, which is possibly the compound—

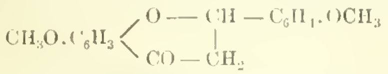
$$O : C_6H_4 : CH.C(: N.NH.C_6H_5).COOH.$$

All hydroxycinnamic acids refuse to combine with two molecular proportions of diazobenzene. On the other hand, *o*- and *m*-hydroxyphenylpropionic acids were found to be capable of combining with two molecular proportions of diazobenzene, whilst *p*-hydroxyphenylpropionic acid, of course, was only capable of combining with one. α-Phenylcumaric acid is unknown. α-Phenylcumarinic acid combines with one molecular proportion of diazobenzene and α-phenyl-*p*-hydroxycinnamic acid behaves in the same manner, in contrast to the non-phenylated compound. On the other hand, α-phenyl *m*-hydroxycinnamic acid only combines to a very slight degree, if at all, with diazobenzene. The α-phenylhydroxydihydrocinnamic acids behaved in all essentials in an analogous manner to the corresponding non-phenylated compounds, the β-hydroxyphenylpropionic acids. It appears that the influence of an α-β unsaturated side-chain on the benzene nucleus is in respect to combining power with diazo compounds, very similar to that of an azo group. Moreover, its disturbing influence is greatest when in the *m*-position to the hydroxy group, weaker in the *p*-, and weakest in the *o*-position. In order to observe the tinctorial effect of the presence of an unsaturated side-chain, the combinations with *p*-diazobenzene sulphonic acid were studied. Cumaric and cumarinic acids combined normally with this reagent, *m*-hydroxycinnamic acid only combined partially, whilst *p*-hydroxycinnamic acid yielded an unstable compound. The three hydroxyphenylpropionic acids reacted normally. It was found that the dyestuffs with unsaturated side-chain dyed wool in redder shades than the corresponding saturated compounds. Here again the influence of the unsaturated side-chain is similar to that of a second azo group. The shades produced on wool are:—Benzenesulphonic acid azocumaric acid, orange-yellow; benzenesulphonic acid azomelilotic acid, canary yellow; benzenesulphonic acid *m*-hydroxycinnamic acid, yellowish-red; benzenesulphonic acid *m*-hydroxycinnamic acid, dark yellow. Benzenesulphonic acid azo-*m*-hydroxydihydrocinnamic acid dyes in redder shades than the corresponding *o*-compound, and α-phenylbenzenesulphonic acid azomelilotic acid in redder shades than the corresponding non-phenylated compound.—E. F.

3.2′-, 3.3′-, *and* 3.4′-*Dihydroxyflavonol.* St. v. Kostanecki, A. v. Szlagier, A. Widmer, and K. Juppen. Ber., 1904, **37**, 4155—4163.

The authors have synthesised 3.2′-, 3.3′-, and 3.4′-dihydroxyflavonol, and find that these isomerides all dye mordanted wool fairly strongly, giving yellow shades on alumina- and brown shades on iron-mordant, showing that in this case the presence of hydroxyl groups in "anchi" position to one another is of no consequence as regards the mordant-dyeing properties of the dyestuff. The experiments on the dyeing properties of 2.2′-, 2.3′-, and 2.4-

dihydroxyflavonol (Kostanecki and others, this J., 1904, 712 and 367) were therefore repeated. The authors now find that the former results were erroneous, owing to the fact that 2.2′-dihydroxyflavonol is much more soluble in hot water and in alcohol than 2.3′- and 2.4′-dihydroxyflavonol. When the latter were employed in the form of fine pastes, it was found that 2·3′-dihydroxyflavonol dyed on alumina mordant almost as strongly as the 2.2′-dihydroxyflavonol, and 2.4′-hydroxyflavonol even more strongly. The presence of hydroxyl groups in "anchi"-position is, therefore, of no importance with regard to the property of dyeing on mordants. To prepare 3.2′-dihydroxyflavonol, salicylic aldehyde methyl-ether was first treated with paeonol to form 2′-hydroxy-4′-2 methoxychalkone $(CH_3O)(OH)C_6H_3.CO.CH:CH.C_6H_4.OCH_3$. This reaction is performed in presence of alcohol and sodium hydroxide. On boiling with alcohol and dilute hydrochloric acid, this is converted into 3.2′ dimethoxyflavanone—

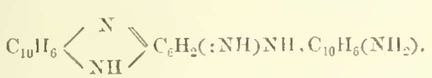


$$CH_3O.C_6H_3\left\langle\begin{array}{l}O - CH - C_6H_4.OCH_3\\ \qquad\;\; |\\ CO - CH_2\end{array}\right.$$

This is converted, by means of amyl nitrite and hydrochloric acid, into an isonitroso compound, which, on boiling with dilute sulphuric acid, forms 3.2′-dimethoxyflavonol. On boiling with strong hydriodic acid, this is converted into 3.2′-dihydroxyflavonol. 3.3′-Dihydroxyflavonol and 3.4′-dihydroxyflavonol are prepared in an analogous manner, the original salicylic aldehdye methyl-ether being replaced by *m*-methoxybenzaldehyde in the first case, and the 2′-hydroxy-4′.2-dimethoxychalkone by 2′-hydroxy-4′.4-dimethoxychalkone in the second.—E. F.

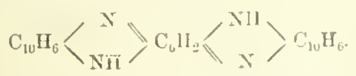
Fluorindines of the Naphthalene Series. R. Nietzki and A. Vollenbruck. Ber., 1904, **37**, 3887—3891.

1.3.4.6 - Dinitrodichlorobenzene is condensed with *o*-naphthylenediamine in presence of sodium acetate, forming aminonaphthyldinitrochloroaniline. This condenses with a further molecular proportion of *o*-naphthylenediamine, in presence of dry sodium carbonate, sodium acetate, and amyl alcohol, to form diaminodinaphthyldinitro-*m*-phenylenediamine, which, on reduction with stannous chloride, tin, and hydrochloric acid, yields diaminodinaphthyltetra-aminobenzene, $C_6H_2(NH_2)_2(NH.C_{10}H_6NH_2)_2$, in the form of a tetrahydrochloride. This substance is oxidised by air in presence of moisture or in aqueous solution, or by ferric chloride, forming aminonaphthyldiaminonaphthophenazine,



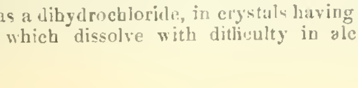
$$C_{10}H_6\left\langle\begin{array}{c}N\\ NH\end{array}\right\rangle C_6H_2(:NH)NH.C_{10}H_6(NH_2).$$

If the oxidation is carried out whilst heating, or if the abovementioned intermediate product is boiled with dilute hydrochloric acid, naphthofluorindene—



$$C_{10}H_6\left\langle\begin{array}{c}N\\ NH\end{array}\right\rangle C_6H_2\left\langle\begin{array}{c}NH\\ N\end{array}\right\rangle C_{10}H_6.$$

is formed. The hydrochloride and other salts form crystalline powders, soluble with difficulty in all solvents. The solutions are pure blue in colour. The solution of the base is red. None of the solutions are fluorescent. If the abovementioned aminonaphthyldinitrochloroaniline is condensed with o-phenylenediamine in presence of sodium carbonate, sodium acetate, and amyl alcohol, aminonaphthylaminophenyldinitro-*m*-phenylenediamine is formed. On reduction this yields aminonaphthylaminophenyltetra-aminobenzene, which readily oxidises to an intermediate product of an "azine" type of which the base is yellow and the hydrochloride, $C_{22}H_{17}N_5(HCl)_2$, brown. On oxidising the boiling, slightly acid solution of the tetra-amino substance by means of a current of air, the mixed fluorindine—



$$C_{10}H_6\left\langle\begin{array}{c}N\\ NH\end{array}\right\rangle C_6H_2\left\langle\begin{array}{c}NH\\ N\end{array}\right\rangle C_6H_4$$

s formed as a dihydrochloride, in crystals having a metallic ustre, and which dissolve with difficulty in alcohol to a blue solution. On considerable dilution the colour of the solution becomes reddish, and shows weak fluorescence. The alcoholic solution of the base is brownish-yellow and shows red fluorescence.—E. F.

Iron-Cyanogen Compounds; Blue ——. K. A. Hofmann, O. Heine, and F. Köchtlen. Annalen, 1904, **337**, 1—36.

The authors find that Soluble Prussian Blue made from potassium ferrocyanide and less than one molecular proportion of a ferric salt is identical with Turnbull's Soluble Blue made from potassium ferricyanide and less than one molecular proportion of a ferrous salt, thus confirming the results of Skraup (Annalen, 1877, **186**, 371). Both represent the ferric-potassium salt of hydroferrocyanic acid, contain water which cannot be removed without decomposition, and correspond to the formula $(FeCy_6.KH_2) - Fe(OH)_2$. Insoluble Prussian Blue, made from potassium ferrocyanide with excess of a ferric salt, or with a mixture of ferric and ferrous salts, is, if thoroughly washed in presence of air, identical with Turnbull's Insoluble Blue, made from potassium ferricyanide and excess of a ferrous salt. Precipitates obtained whilst hot, in presence of free acid, are complicated mixtures, whilst at 15° C., without excess of acid, there is always finally obtained the ferric salt of hydroferrocyanic acid, $Fe_7Cy_{18} + 10H_2O$, in which the water resists all drying agents, and is therefore probably constitutional. The residue from the preparation of hydrocyanic acid is not identical with the precipitate obtained at the ordinary temperature with potassium ferrocyanide and a ferrous salt. The latter can be oxidised, according to the proportion of the constituents, to soluble or insoluble Prussian Blue, whereas the former is only incompletely oxidised by the air, but can be completely oxidised by hydrogen peroxide to Williamson's Violet, which has the same composition as Soluble Prussian Blue, but is probably a polymer of the formula—

$$KH = (FeCy_6) < \begin{array}{c}FeOH\\ FeOH\end{array} > (FeCy_6) = KH$$

The water cannot be removed by drying. The residue from the preparation of hydrocyanic acid is the corresponding ferrous salt—

$$K_2 = (FeCy_6) < \begin{array}{c}Fe\\ Fe\end{array} > (FeCy_6) = K_2$$

Williamson's Blue is much more stable to dilute alkali than Prussian Blue. All the above-mentioned blue and violet compounds can be obtained by the reducing action of hydrogen peroxide on a mixture of potassium ferricyanide and a ferric salt From this fact and their stability towards hydrogen peroxide, it is probable that they all contain the ferrocyanogen group combined with ferric iron, and not the ferricyanogen group combined with ferrous iron. Perfectly dry hydroferrocyanic acid and ferric chloride in solution in absolute alcohol, form intensely blue precipitates, similar in appearance and behaviour to those obtained in aqueous solution, but containing hydrogen, chlorine, and the constituents of alcohol, which cannot be removed by drying in vacuum over phosphorus pentoxide. They represent the hypothetical simple ferric salts of hydroferrocyanic acid, in which the extra radical ferric atoms have united with chlorine, whilst the acid cyano-hydrogen atoms thus set free have given rise to ester formation.—E. F.

English Patent.

Sulphur Dyes [Sulphide Dyestuffs]: Manufacture of Black ——. G. W. Johnson, London. From Kalle and Co., Biebrich-on-Rhine, Germany. Eng. Pat. 26,579, Dec. 2, 1903.

See Fr. Pat. 347,278 of 1903; this J., 1904, 543.—T. F. B.

United States Patents.

Green Dyestuff [Anthracene Dyestuff]. I. Kugel, Cologne, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 775,367, Nov. 22, 1904.

1.4-Diamino-2.3-dibromo-anthraquinone is heated with cupric chloride in a suitable liquid. The dyestuff forms bluish-black needles, insoluble in alcohol. It is reduced by hydrosulphite and caustic soda, and the alkaline solution has the properties of a "vat," which dyes unmordanted cotton a blue shade, turning to a fast green on oxidation in the air.—A. B. S.

Blue Dyestuff [*Anthracene Dyestuff*]. M. Kugel, Cologne, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 775,368, Nov. 22, 1904.

1-Methylamino-2-bromo-anthraquinone is heated with cupric chloride and a suitable liquid. On reduction with hydrosulphite and caustic soda, it is converted into a hydro compound, the alkaline solution of which has the properties of a "vat," dyeing unmordanted cotton in pure blue shades. —A. B. S.

Green-blue Dyestuff [*Anthracene Dyestuff*]. M. Kugel, Cologne, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 775,369, Nov. 22, 1904.

1.3-Dibromo-2-aminoanthraquinone is treated with cupric chloride and a suitable liquid. The dyestuff is reduced by hydrosulphite and caustic soda, the alkaline solution obtained, having the properties of a "vat" which dyes unmordanted cotton in pure greenish-blue shades. —A. B. S.

Sulphur Dye [*Sulphide Dyestuff*]; *Dark Blue* ——. A. L. Laska, Assignor to K. Oehler, Offenbach-on-Maine, Germany. U.S. Pat. 775,570, Nov. 22, 1904.

See Eng. Pat. 12,270 of 1904; this J., 1904, 863.—T. F. B.

French Patents.

Quinonephenolimides and Quinonenaphtholimides; Manufacture and Separation of Stable ——. Farbw. vorm. Meister, Lucius und Brüning. Fr. Pat. 339,044, Sept. 17, 1903.

Quinonechlorimide, obtained by the action of bleaching powder on *p*-aminophenol in hydrochloric acid solution, is allowed to react with an equivalent quantity of phenol, *o*-cresol, *m*-cresol, or α-naphthol in presence of one molecular proportion of sodium hydroxide. From the blue liquids so obtained the phenol derivative is salted out in the form of its sodium salt, the others being precipitated in the form of their colour-acids by addition of acetic acid or sodium bicarbonate. The products are extremely stable, and may be dried without decomposition. They are easily reduced by sodium sulphide or dextrose to the corresponding dihydroxydiphenylamine derivatives.—E. F.

Sulphide Dyestuffs; Process of Making Yellow, Orange-Yellow to Orange ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 339,096, Oct. 12, 1903.

See Eng. Pat. 21,800 of 1903; this J., 1904, 863.—T. F. B.

Sulphide Dyestuffs; Process for Manufacturing Pure Yellow, Orange-Yellow to Yellow-Orange ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 339,103, Oct. 15, 1903.

See Eng. Pat. 21,945 of 1903; this J., 1904, 819.—T. F. B.

Para-acetamino-o-aminophenol, and Monazo Mordant Dyestuffs derived therefrom; Process for the Production of ——. L. Cassella and Co. Fr. Pat. 339,090, Oct. 9, 1903.

See Eng. Pat. 22,289 of 1903; this J., 1904, 898.—T. F. B.

Monoazo Dyestuffs; Process of Manufacturing Mordant ——. K. Oehler. Fr. Pat. 345,128, May 31, 1904.

See U.S. Pat. 767,069 of 1904; this J., 1904, 863.—T. F. B.

Monoazo Dyestuffs; Process for Manufacturing Mordant ——. K. Oehler. First Addition, dated June 13, 1904, to Fr. Pat. 345,128, May 31, 1904.

See U.S. Pat. 767,070 of 1904; this J., 1904, 863.—T. F. B.

Alizarin; Process for Manufacturing ——. Badische Anilin und Soda Fabrik. Fr. Pat. 344,680, July 8, 1904. Under Internat. Conv., Feb. 22, 1904.

Very pure alizarin, which dyes fine bluish-red shades, is produced by heating anthraquinone with very concentrated caustic alkali solution in presence of an oxidising agent. For example, 100 kilos. of anthraquinone are incorporated with a solution of 20—30 kilos. of sodium chlorate and 300 kilos. of a mixture of caustic potash and soda in 100 litres of water, and the whole heated to 200° C. in an open vessel, with agitation. The product is dissolved in water, air is blown through the solution, and the alizarin is precipitated by milk of lime. The precipitate is decomposed by hydrochloric acid, and the residue treated with dilute caustic soda solution, to separate the alizarin from the anthraquinone. The mother liquors of the process contain small quantities of benzoic acid. In place of sodium chlorate, other oxidising agents may be used, *e.g.*, sodium, barium, manganese, or lead peroxides, or mercuric oxide. —T. F. B.

Arylated 1.8-Naphthylaminesulphonic Acids; Preparation of ——. Actienges. f. Anilin-fabrikation. Fr. Pat. 344,810, July 15, 1904.

1-Naphthylamine-4.8-disulphonic acid is heated to about 180—190° C. with aniline or its homologues, with or without the addition of benzoic acid or of hydrochlorides of the same bases. The sulphonic-acid group in the 4-position is thus eliminated, the amino group of the naphthylamine sulphonic acid being simultaneously arylated. After the completion of the reaction, excess of sodium carbonate is added, the excess of aromatic base driven off by a current of steam, the solution cooled and the product precipitated by addition of acid.—E. F.

Azo Dyestuffs; Process for Preparing New Intermediate Compounds and New ——. G. Nuth, H. Hold, and H. Ruegg. Fr. Pat. 344,841, July 16, 1904.

By sulphonating α- and β-naphthylbenzidine at a temperature of 90°—100° C., slightly soluble or easily soluble sulphonic acids are obtained, according to whether ordinary (monohydrate) or fuming sulphuric acid has been used. The sulphonic acids are suitable for the preparation of azo dyestuffs. In diazotising certain of these acids, nitroso-diazonium compounds are produced, but the corresponding nitroso-azo dyestuffs can be converted into the simple azo dyestuffs by boiling with mineral acids. Dyestuffs which give yellow shades on wool are obtained by combining the tetrazo compound of the slightly soluble β-naphthylbenzidine sulphonic acid with salicylic acid; violet, by combining with β-naptholdisulphonic acid R; blue, by combining with aminonaphtholdisulphonic acid S. By combining the diazo derivative of the easily soluble β-acid with "R acid," a bluish-red dyestuff results. A large variety of shades is thus obtained by combining the four sulphonic acids with different phenols and amines. For instance, a black dyestuff results from combining the slightly soluble β-acid, on the one hand, with α-naphthlyamine, and on the other hand, with R salt.—T. F. B.

Monoazo Mordant Dyestuff [*Azo Dyestuff*] *Preparation of a New* ——. (*Case I.*) Kalle and Co. Fr. Pat. 345,083, July 25, 1904.

1-Chloro-4-acetylaminobenzene-6-sulphonic acid is nitrated with an equimolecular quantity of a nitrating agent. The product is either 1-chloro-4-acetylamino-3-nitrobenzene 6-sulphonic acid, or 1-chloro-4-acetylamino-5-nitrobenzene-6-sulphonic acid, or a mixture of the two. It is heated in a brine-bath with dilute sodium hydroxide solution, by which means the acetylamino group is replaced by a hydroxyl group. On subsequent reduction of the sodium salt of the resulting acid, by means of sodium polysulphide by preference, it is converted into a chloroaminophenolsulphonic acid. This is diazotised and combined with one molecular proportion of β-naphthol. The resulting dyestuff yields brownish-orange shades on wool from an acid bath. On subsequent chroming, these change to bluish-black, which are said to be absolutely fast to washing and fulling.—E. F.

Disazomordant Dyestuff [*Azo Dyestuff*]; *Preparation of* ——. (*Case II.*) Kalle and Co. Fr. Pat. 345,984, July 25, 1904.

Chlorobenzene is transformed by sulphonating agents into *p*-chlorobenzenesulphonic acid. This is nitrated, and the mononitro derivative heated for several hours with dilute sodium hydroxide solution to 125°—130° C. By this means the chlorine atom is replaced by a hydroxyl group. The nitro-*p*-phenolsulphonic acid is reduced without isolation, by means of zinc dust, to the corresponding amino derivative. This is precipitated by hydrochloric acid, nitrated and again reduced by means of zinc dust. A diamino-*p*-phenolsulphonic acid is thus obtained, which is tetrazotised and combined with two molecular proportions of β-naphthol. The product dyes wool directly in violet-black shades, which, on development on the fibre by chromium salts, change to bluish-black shades, which are extremely fast.—E. F.

Monoazo Mordant Dyestuffs [*Azo Dyestuffs*]; *Preparation of* —— *from α-Naphthol-o-Sulphonic Acid* (*Case III.*). Kalle and Co. Fr. Pat. 345,985, July 25, 1904.

α-Naphthol-*o*-sulphonic acid is combined with diazo compounds formed from derivatives of *o*-aminophenol. The resulting dyestuffs, when dyed on wool and subsequently chromed on the fibre, give reddish-black to greenish-black shades, which are said to be absolutely fast to washing and fulling. With diazotised *p*-chloro-*o*-aminophenol the resulting chromed dyeing is greenish-black; with the corresponding nitroaminophenol, reddish-black; with picraminic acid, brownish-black; and with *o*-nitro-*o*-aminophenol-*p*-sulphonic acid, violet black.—E. F.

Molasses, Vinasses, Saccharine Juices, and other Vegetable Extracts; Production of Colouring Matter from ——. O. Wichardt. Fr. Pat. 345,410, Aug. 9, 1904.

Molasses, &c. are introduced into solutions of metallic salts containing an excess of acid. In the majority of cases a colouring matter is precipitated in the cold, but especially on heating. In the case of salts of molybdenum and sulphuric acid, a colouring matter resembling indigo is said to be obtained.—J. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Dyeing on Mordants. M. Prud'homme. Rev. Gen. Mat. Col., 1904, **8**, 365—367.

The following general rule can be deduced from the observations of Moehlau and Steimmig, Kostanecki and Liebermann (this J., 1901, 710), on mordant dyestuffs:—When an aromatic compound contains a hydroxy group in a position adjacent to the chromophor, or to a salt-forming group (OH, COOH, SO_3H, &c.) in the *o*-position to the chromophor, this compound will be a mordant dyestuff. By comparing and contrasting the three classes of anthraquinone dyestuffs, as defined by Buntrock (this J., 1901, 983), *viz.*, those which only dye mordanted fabrics (*o*-dihydroxy compounds), those which dye unmordanted animal fibres (amino derivatives), and those which dye mordanted vegetable fibres and unmordanted or mordanted animal fibres (aminohydroxy derivatives), and also the various types of mordant azo dyestuffs, the conclusion is arrived at, that, when a dyestuff dyes unmordanted wool by reason of its containing a certain basic or acid group, it will also dye mordanted wool, if it contain a hydroxy group or an imino-sulphonic group (*e.g.*, $-NH.C_6H_4.SO_3H$) in the position farthest from (*i.e.*, para to) the basic or acid group. —T. F. B.

Formaldehyde-Hydrosulphite of Sodium. L. Baumann, G. Thesmar, and J. Frossard. Rev. Gen. Mat. Col., 1904, **8**, 353—357.

A solution of formaldehyde-hydrosulphite of sodium, obtained by dissolving sodium hydrosulphite in 40 per cent. formaldehyde, furnishes, on cooling, an abundant crop of well-defined crystals, which are found to consist, not of formaldehyde-sodium hydrosulphite, but of a mixture or compound of formaldehyde-sodium bisulphite, $NaHSO_3 + CH_2O + H_2O$, and formaldehyde-sodium bihydrosulphite, $NaHSO_2 + CH_2O + 2H_2O$; these two compounds were isolated by fractional precipitation from aqueous solution by alcohol, in which the bihydrosulphite compound is more soluble. This latter compound is not hygroscopic, is easily soluble in water, melts sharply at 63°—64° C., gives off its water of crystallisation at 120° C., and decomposes at 125° C. with evolution of formaldehyde and hydrogen sulphide. It is very easily decomposed in the cold by acids, but not so easily by alkalis as is the corresponding bisulphite compound. It is suggested that these bihydrosulphite-formaldehyde compounds should be used for reducing nitro to amino compounds. The above results would show that Bernthsen's formula for hydrosulphurous acid ($H_2S_2O_4$) is incorrect, and that Schützenberger's original one (H_2SO_2) represents its constitution, the crude "hydrosulphite" being in reality a mixture of bisulphite and bihydrosulphite, $NaHSO_3 + NaHSO_2 + H_2O$, or $Na_2S_2O_4, 2H_2O$. The formation of the formaldehyde compound is hence shown by the equation—

$$Na_2S_2O_4, 2H_2O + 2CH_2O + 2H_2O =$$
$$NaHSO_3, CH_2O, H_2O + NaHSO_2, CH_2O, 2H_2O.$$

(See also this J., 1904, 657 and 658.)—T. F. B.

Calcium Soaps; Dissolving —— *by Means of Ammonium Citrate.* Justin-Mueller. Chem.-Zeit., 1904, **28**, 1149.

The calcium carbonate precipitated from a water of about 24° of hardness can be dissolved by a solution containing 0·5 grm. of crystalline ammonium citrate per litre, whilst the calcium soap precipitated from the same water requires nearly 100 grms. of the same salt per litre for solution. The industrial application of ammonium citrate solution for dissolving calcium soaps is thus hardly possible, but there are many possible applications of this mode of solution of precipitated calcium carbonate, *e.g.*, in dyeing or printing with diamine dyestuffs. For this purpose the calcium should be precipitated from the water by means of an alkali, of which an excess is avoided, and the precipitate redissolved as described above.—C. A. M.

English Patents.

Drying, Bleaching, Carbonising, &c. of Textile Piece Goods, by Means of Air or other Gases or Vapours; Apparatus for ——. J. D. Tomlinson, Rochdale. From H. and F. Haas, Lennep, Germany. Eng. Pat. 24,666, Nov. 13, 1903.

The apparatus described in Eng. Pat. 15,108 of 1903 (this J., 1904, 659) is modified for use as a continuous machine for piece goods, by the addition of guide rollers.—A. B. S.

Calico Printing; Machine for ——. W. E. Wood, Accrington, J. C. Secombe. Lang Bridge, Ltd., Accrington. Eng. Pat. 25,891, Nov. 27, 1903.

For intermittent printing machines, in which one or more of the printing rollers have to be removed out of contact with the fabric for a definite length of time, the rollers are mounted in sliding bearings, and are pressed against the fabric by means of springs. Rams worked by hydraulic or pneumatic pressure are fitted at each side of the machine, and, when the pressure is on, they come into contact with the shaft of the printing roller and remove it out of contact with the cloth. When the pressure is released, the spring bearings force the rollers back into their printing position. The admission and release of the pressure to the rams is regulated by an arrangement of chain-gearing, which opens and closes the air- or water-valves at the arranged times. The times of contact can be altered by means of interchangeable chain wheels.—A. B. S.

Figured Fabrics; Manufacture of ——. J. Morton, Carlisle. Eng. Pat. 51, Jan. 1, 1904.

The fabrics are woven with two different materials, such as wool and cotton, they are then dyed by a process which only dyes one of the fibres, and the other fibres are either left white, or are dyed, or printed with a colour which does not affect the portions already dyed.—A. B. S.

Yarn Printing in Several Colours; Machine for ——. A. Hofmann, Gothenburg, Sweden. Eng. Pat. 21,793, Oct. 10, 1904.

The yarn-holder is fixed on a travelling carriage, which runs over the tanks containing the different colours to be printed. Each of these tanks is fitted with a printing roller, fixed on an oscillating lever, which can be brought into the position for printing by means of a Jacquard or like mechanism.—A. B. S.

Starching [Sizing] Compositions. E. M. Sharp, Padiham. Eng. Pat. 7560, March 30, 1904.

Ordinary starch is combined with gum tragasol, together with a small proportion of caustic soda, and the mixture is used for textile goods.—J. F. B.

United States Patents.

Retting Vegetable Fibres; Apparatus for ——. B. S. Summers, Chicago, Ill. U.S. Pat. 774,856, Nov. 15, 1904.

A number of digesters are connected by means of upper and lower pipes, with a chamber heated by a heating liquid, the upper pipes being situated below the level of the liquid in the heater. An additional chamber placed above the heater, and not in the circulating system, serves as replenisher, and is connected by piping with the heater and digesters. The digesting liquid is mixed with a precipitant, in an agitating chamber provided with a screw-conveyor and baffle-plates, and then passes through a filter to the heater.
—L. F. G.

Dyeing, &c.; Apparatus for ——. A. Fankhauser and A. Ryser, Baden, and F. J. B. Knibiehler, Lörrach, Assignors to Wegmann and Co., Baden, Switzerland. U.S. Pat. 775,621, Nov. 22, 1904.

See Fr. Pat. 335,696 of 1903; this J., 1904, 251.—T. F. B.

Dyeing; Apparatus for ——. J. Kershaw, Bradford. U.S. Pat. 776,069, Nov. 29, 1904.

See Eng. Pat. 25,108 of 1902; this J., 1903, 1345.—T. F. B.

Dyeing Machine. J. Hussong, Camden, N.J. U.S. Pat. 776,327, Nov. 29, 1904.

See Eng. Pat. 15,207 of 1903; this J., 1903, 1080.—T. F. B.

Centrifugal Machine [for Treating Textiles]. B. Cohnen, Grevenbroich, Germany. U.S. Pat. 776,295, Nov. 29, 1904.

See Eng. Pat. 7716 of 1902; this J., 1902, 1453.—T. F. B.

French Patents.

Artificial Silk; Manufacture of Non inflammable and Non-explosive ——. R. Valette. Fr. Pat. 344,660, July 8, 1904.

As solvents for the nitrocellulose, mixtures of acetone and ethyl alcohol or of acetone and methyl alcohol are used, sometimes with addition of glacial acetic acid. The collodion is denitrated by means of ammonium nitrite.
—A. B. S.

Artificial Silk. H. D. Turgard. Fr. Pat. 344,845, July 16, 1904.

100 grms. of nitrated cotton are dissolved in a mixture of 2400 c.c. of 90 per cent. alcohol, 600 c.c. of glacial acetic acid, 3 grms. of albumin, and 7·5 grms. of castor oil. After well mixing, the solution is filtered and then forced through the "spinning" openings into a 1 per cent. solution of alum. The silk threads thus prepared have no tendency to stick together. The thread is finally denitrated.
—A. B. S.

Artificial Silk; Twisting and Spinning Apparatus for ——. Soc. Franc. de la Viscose. Fr. Pat. 345,274, July 30, 1904.

The cellulose solution [viscose] is fed, under pressure, through a regulating valve into the filtration chamber contained in the bracket supporting the twisting and spinning element. This latter consists of a vertical tube, rotated by a flexible connection at the top end, and supported on two sets of ball bearings carried by the tubular bracket. The viscose flowing from the filtration chamber enters the rotating tube about the middle, and descends to the spinning jet. Right- and left-handed helices are provided on the outside of the rotating hollow spindle, above and below the point where the viscose enters, to prevent any substance, either lubricant or viscose, settling between the spindle and its support. The threads are formed and twisted as they leave the rotating orifices of the jet; the latter is surrounded by a funnel-shaped appendage, which imparts a whirling motion to the coagulating liquid.
—J. F. B.

Artificial Silk; Regulating Valve for Solutions for Spinning ——. Soc. Franc. de la Viscose. Fr. Pat. 345,293, Aug. 1, 1904.

An extremely delicate valve for regulating the speed of th supply of viscose passing to the spinning tubes consists essentially of a plug-cock attached to the viscose mains, and provided with a pointer and index dial. The viscose enters the hollow plug of the cock from below, and passes out through a hole bored perpendicularly to the axis of the plug. This hole communicates with the pipe supplying the spinning jet by way of a tube passing through the plug-seating at right angles to the axis. The hole in the plug does not engage that in the seating directly, but communicates with it through a gradually shallowed groove cut in the periphery of the plug, by which arrangement the delicacy of the adjustment is enormously increased
—J. F. B.

Artificial Silk; Continuous and Automatic Apparatus for Spinning ——. Soc. Franc. de la Viscose. Fr. Pat. 345,320, Aug. 2, 1904.

The viscose is fed by way of the regulating valve, twisting element and spinning jet (see preceding abstracts) into the coagulating bath, where it is formed into a twisted compound thread. After the thread leaves the coagulating and washing baths, it is freed from adherent moisture by a rubber wiper, and passes upwards through a guide-hole, operated with a reciprocal motion by a cam-mechanism This distributes the thread uniformly on to one of a pair of winders, and at a given interval the mechanism of the cam transfers the thread to the other winder; the full one is then removed and replaced by an empty winder.—J. F. B.

Viscose; Jet for Spinning Threads from ——. Soc. Franc. de la Viscose. Fr. Pat. 345,343, Aug. 3, 1904.

The spinning jet consists of a metallic tube, into the mouth of which is fitted a removable disc or truncated cone, the sides of which are grooved parallel to the axis by very fine channels. When the disc is in position these groves constitute capillary orifices through which the viscose, previously strained, is forced. When any of the orifices become clogged, the disc or cone is removed and the grooves are easily cleaned out.—J. F. B.

Mordanting and Weighting of Textile Fibres with Zinc Chloride. C. E. Carstanjen. Fr. Pat. 344,782, July 12, 1904.

To increase the fixation of oxide of zinc on the fibre, sulphates, sulphites or thiosulphates of the alkalis, of the alkaline earths or of aluminium are added to the baths of zinc chloride.—A. B. S.

Dyeing Textile Substances in Bobbins; Process for ——. T. de Naeyer. Fr. Pat. 344,752, July 11, 1904. Under Internat. Conv., Nov. 26, 1903.

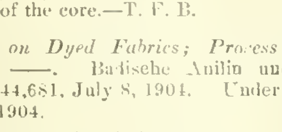
The thread is wound in bobbin form on tubes in the usual manner, and then, before dyeing, is slid on to a tube of smaller diameter than the original one, in order to reduce the tension on the inner threads, thus increasing the uniformity of the subsequent dyeings. The lengths of the tubes to which the bobbins are transferred is equal to, or slightly less than the extreme width of the bobbin, thus ensuring the bobbins being close to one another in the dye vat or other apparatus. Several bobbins, on the tubes as described above, may be held on the same core during dyeing, being kept in position by means of plates screwed on the ends of the core.—T. F. B.

Discharges on Dyed Fabrics; Process for Producing Coloured ——. Badische Anilin und Soda Fabrik. Fr. Pat. 344,681, July 8, 1904. Under Internat. Conv., June 16, 1904.

Although good white discharges are obtained by printing dyed fabrics with formaldehyde-hydrosulphite compounds, coloured discharges produced thus, are not satisfactory, since the discharge colours are imperfectly fixed. By the addition of some aromatic amino-compound to the printing mixture, fine and perfect colour discharges of considerable fastness are produced. For example, 160 grms. of tannin, 60 c.c. of water, 185 c.c. of "dilute" alcohol, and 125 c.c. of aniline are added to 1 litre of the discharge paste, containing 2 kilos. of formaldehyde-hydrosulphite compound dissolved in gum solution. A solution of 40 or 50 grms. of a basic dyestuff of the desired colour in the minimum quantity of gum water is added, and the dyed fabric is printed with the mixture, steamed, and oxidised.—T. F. B.

Lustre; Conferring —— on Materials of all kinds. H. Hall. Fr. Pat. 344,658, July 7, 1904.

The material is passed between rollers the axes of which are oblique to one another (see figure). When the rollers revolve, this arrangement causes a lateral pressure, which increases with the angle between the axes of the rollers.



—A. B. S.

Benzene used for "Dry-Cleaning" Fabrics; Process and Apparatus for Recovering ——. E. Delhotel. Fr. Pat. 344,848, July 16, 1904.

The fabrics saturated with benzene are suspended in a closed chamber or vat, at the bottom of which is a steam coil. Air is introduced through a pipe at the bottom of one side of the vat, and, being heated by the steam coil, removes the benzene from the fabrics. It is then pumped off up a tall column, down which a shower of cold water falls, thus condensing the benzene vapours. The mixture of water and benzene is separated in any convenient apparatus, and the benzene is removed. The cooled dry air is pumped again into the vat containing the fabrics, thus completing a closed circuit and avoiding loss of benzene.

—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

United States Patent.

Hides; Machine for Applying Colouring-Matter to ——. R. W. Churchill, West Peabody, Mass. U.S. Pat. 774,935, Nov. 15, 1904.

A movable perforated cylinder surrounds a stationary cylinder-sector, the skin to be treated, being flattened and held tightly against the cylinder by exhausting the air from the latter. A rotating and "axially-reciprocating" rubber, for applying colour, is arranged adjacent to the cylinder, and opposite to the cylinder-sector, so as to apply colour to the skin at a point where it is held against the cylinder.

—B. N.

VII.—ACIDS, ALKALIS, AND SALTS.

Chamber Process; Theory of the ——. G. Lunge. Z. angew. Chem., 1904, **17**, 1659—1663. (See also page 1178.)

Raschig gives three equations as representing the changes successively occurring in the chamber, and bases the whole process upon the behaviour of a hypothetical substance which has never been actually observed as present, while neglecting altogether another substance known to be always present in large quantity (this J., 1904, 934). He makes no reference to nitrosylsulphuric acid, $NO_2.SO_2.OH$, nor to nitrogen peroxide. Were his theory correct, both of these substances would not merely be accessory by-products, but would exercise a harmful influence from the amount of nitrogen they would abstract from the process, and a chamber would be working so much the better the less nitrogen peroxide it showed and the less "nitrous" the cloud of sulphuric acid was. This is contrary to all experience, which shows that both nitrogen peroxide and nitrosylsulphuric acid are present in large amount in a chamber in good work, and that the latter is formed wherever sulphur dioxide and water in presence of excess of oxygen react on nitric oxide, nitrogen peroxide, or mixtures of the two. Trautz in his paper (this J., 1904, 440) on the physical chemistry of the chamber process, deals chiefly with the reactions of nitrosylsulphuric acid, and though he also treats of Raschig's equations, and admits that nitrososulphonic acid may possibly occur, he has, in the author's view, not laid sufficient stress on the divergence of Raschig's experiments from the actual conditions in the chamber. Raschig has, in fact, in studying the reaction of sulphurous upon nitrous acid, left out of consideration the influence of the enormous excess of atmospheric oxygen, which must at once convert his nitrososulphonic acid, even if it have a momentary existence, into nitrosylsulphuric acid. The existence of nitrososulphonic acid in extremely dilute aqueous solution in a beaker affords no proof of its existence in the chamber cloud, in presence of excess of oxygen. His first equation, then, does not represent a reaction really occurring in the chamber. Regarding his second, he himself admits its uncertainty. The third is as inaccurate as the first: nitrogen dioxide, in presence of water and of oxygen in excess, is quickly and completely converted into nitric acid. Only when sulphuric acid of fair concentration is substituted for water, does this oxidation not proceed to nitric acid, but then the result is nitrosylsulphuric acid, equally far removed from the result in Raschig's equation.—J. T. D.

Chamber Process; Theory of the ——. F. Raschig. Z. angew. Chem. 1904, **17**, 1777—1785. (See preceding abstract; and page 1178.)

The author does admit Lunge's statement (see preceding abstract) that the presence of nitrosylsulphuric acid in the chamber is proved, and considers that the nitrous character of the chamber acid (never higher than 0·03 per cent. of N_2O_3) is due to simple solution of nitrogen trioxide in the acid, which absorbs it in its fall through the nitrous atmosphere. Even admitting, however, the existence of nitrosylsulphuric acid, its occurrence in quantity sufficient to account for its playing any important part in the working of the chamber would still be matter for grave doubt. While the author admits the necessity for an excess of nitrous gases in order that the reaction may be carried to an end, he looks on the nitrous character of the chamber acid not as the index of an unimportant by-reaction, but as a necessary evil. That this evil is only necessary for the completion of the reaction, however, is demonstrated in the fact that the earlier chambers of a set will work with excess of sulphurous acid, where there is absolutely no evidence of the production of nitrosylsulphuric acid, and where indeed there is always evidence of the production of ammonia—a circumstance only explicable on the author's theory. If Lunge postulates in such a chamber the existence of nitrosylsulphuric acid as an intermediate product, the author has much stronger grounds for assuming similarly the existence of nitrososulphonic acid. Moreover, the conditions in the chamber are arranged to secure, for technical ends, the greatest possible speed of reaction ; hence, if we are to look for any of the intermediate products in the chain of successive rapid reactions, the ultimate result of which is the same as that of the slow reaction $SO_2 + O + H_2O = H_2SO_4$, we must modify the conditions so as to retard these reactions, and thus secure for the intermediate products an existence long enough to enable us to identify them. That is why the author has modified the conditions so as to have his "chamber in a beaker," and that is why he doubts, from the very fact of its continued existence under chamber conditions (if that existence be admitted), whether nitrosylsulphuric acid is really an intermediate product in the process, and not rather the final product of a by-reaction. The author, then, holds to his first equation, $ON.OH + SO_2 = ON.SO_3H$: it is a reaction that has been shown to occur, and its occurrence under the chamber conditions may be looked on as certain, though the product so rapidly undergoes change that it may not be detected in the chamber. At least the assumption of this reaction does not, like the assumption of Lunge's reaction, $N_2O_3 + H_2O + O_2 + 2SO_2 = 2(NO_2.SO_3H)$ ascribe to sulphurous acid and nitrous acid, in company, the property which neither separately possesses, of rapidly absorbing oxygen. As to the author's second equation, $ON.SO_3H + ON.OH = 2NO + HO.SO_3H$, the uncertainty expressed by him and seized on by Lunge was not uncertainty as to whether anything of the kind could or did take place, but merely as to whether the equation $ON.SO_3H + 6ON.OH = 6NO + H_2SO_4 + HNO_4 + H_2O$, involving the formation of pernitric acid, might not really represent the reaction occurring. Either reaction involves the reduction of nitrous acid with formation of nitric oxide. The author's third reaction is traversed by Lunge, who maintains that nitric oxide with excess of oxygen forms, not nitrogen trioxide or nitrous acid, but nitrogen peroxide. Though that may be the case with excess of pure oxygen, the author's direct experiments show that with air, even in quantity containing four times or even eight times the quantity of oxygen needed to form nitrogen trioxide, the oxidation of nitric oxide goes no farther than nitrogen trioxide. Only after long standing in contact with the excess of air does the nitrogen trioxide (itself formed almost instantaneously) oxidise farther to peroxide. And further experiments in which mixtures of nitric oxide and air were shaken up with water showed that, though nitric acid was indeed formed when excess of oxygen was present, no excess was sufficient to form more than one molecule of nitric acid to each molecule of nitrous acid, so that the direct oxidation never goes farther than to form nitrogen peroxide, which with water forms nitric and nitrous acids in equimolecular proportions. The author's third equation, then, $2NO + O + H_2O = 2(ON . OH)$, must also stand as experimental fact.—J. T. D.

Sulphates ; Complex Nature of dissolved ——. A. Colson. Comptes rend., 1904, **139**, 857—859.

By comparing the depression of freezing point due to the dissolved sulphate of a divalent metal with that due to the sulphuric acid formed from it by removal of the metal, the author finds that the molecule of the dissolved salt is double that of the solid salt, and ascribes to it the formula $HSO_4.M.O.M.SO_4H$. This formula affords a possible explanation of the acid reaction of sulphates in solution.

—J. T. D.

Calcium Sulphate ; Solubility of —— *in Solutions of Nitrates.* A. Seidell and J. G. Smith. J. of Phys. Chem., 1904, **8**, 493—499, Chem. Centr., 1904, **2**, 1530—1531.

The solubility of calcium sulphate in solutions of sodium, potassium, magnesium, and calcium nitrates at 25° C. was investigated. In all cases the solubility of calcium sulphate in solutions of the nitrates was greater than in those of the corresponding chlorides (this J., 1902, 257, 549). Calcium nitrate diminishes the solubility of the sulphate. In sodium nitrate solution, the solubility of calcium sulphate rises to a maximum and then diminishes. In concentrated solutions of potassium nitrate, the amount of calcium dissolved is greater than that corresponding to the dissolved sulphuric acid, owing to the formation and separation of syngenite, $CaK_2(SO_4)_2.H_2O$ (See also this J., 1904, 865.)—A. S.

Double Chlorides of Iron and Alkali Metals ; Conditions of Formation and of Solubility of ——. F. W. Hinrichsen and E. Sachsel. Z. physik. Chem., 1904, **50**, 81—99.

Solubility determinations of mixtures of sodium and ferric chlorides, and determinations of the expansion of the solutions on heating, showed that between 0° and 60° C. no formation of a double chloride takes place. Potassium chloride and ferric chloride form a double salt, $FeCl_3.2KCl.H_2O$, at 21° C. If potassium chloride is present in excess, mixed crystals of potassium and ferric chlorides separate. The transition temperature for the formation of the double salt is between 22° and 22·5° C. Caesium chloride and ferric chloride form two double salts at 21° C., the compound $FeCl_3.3CsCl.H_2O$, when excess of caesium chloride is present, and the salt, $FeCl_3.2CsCl.H_2O$, in presence of excess of ferric chloride. The authors were unable to isolate the compound, $FeCl_3.CsCl.\frac{1}{2}H_2O$, described by P. T. Walden. The temperature of formation of the red double salt, $FeCl_3.{}_2CsCl_2.H_2O$, is 39.5°—39.8° C. A curve-diagram is given showing the solubility of caesium chloride in water at temperatures from 0° to 40° C. The saturated solution contains at 0·3° C., 61·9 per cent.; at 10° C., 63·5; at 20° C., 64·9; at 30° C., 66·3; and at 40° C., 67·4 per cent. of caesium chloride.—A. S.

Tellurium ; Action of Hydrogen Peroxide on ——. A. Gutbier and F. Resenscheck. Z. anorg. Chem., 1904, **42**, 174—176.

The authors have succeeded in preparing telluric acid from tellurium, by dissolving the metal in potassium hydroxide solution and oxidising it with hydrogen peroxide. To the red solution of potassium telluride obtained by dissolving pure tellurium in a pure 30 per cent. solution of potassium hydroxide, three times the calculated amount of a 10 per cent. solution of hydrogen peroxide was added. A vigorous reaction took place, the solution becoming colourless, and a small quantity of metallic tellurium separating. The oxidation was completed by vigorously boiling the solution for about half-an-hour, the separated tellurium was filtered off, the solution concentrated, and a large excess of concentrated nitric acid added, whereby telluric acid separated gradually in the form of a white crystalline powder.—A. S.

Sodium Vanadate Liquors ; Purification of ——. *Observations on the Industrial Separation of Metals by double Decomposition.* Herrenschmidt. Comptes rend., 1904, **139**, 862—864.

In purifying a liquor containing sodium vanadate and silicate, if an acid be added, there is no precipitation unless the liquor be concentrated ; and if it be so, vanadic acid and silica are precipitated together. By the author's plan (this J., 1904, 1094) of adding vanadic acid, the silica alone is precipitated, and the operation can be carried out in dilute solution. The principle here illustrated, of purifying the solution of a metallic salt by precipitating the impurities by means of the oxide or other compound of the metal in question, is one of wide industrial application, and may even be useful occasionally as a laboratory method.—J. T. D.

"*Flowers of Sulphur*" *and Sublimed Sulphur.* Domergue. J. Pharm. Chim., 1904, **20**, 493—499.

The form assumed by sublimed sulphur is shown to depend upon the temperature of the condensing chamber. When the process of sublimation first commences, the difference of temperature between the vapour of the sulphur and the air of the chamber is great, consequently immediate condensation takes place, and the sulphur is deposited in a spheroidal or vesicular form. As the process proceeds, and the temperature rises, condensation takes place more slowly, and crystalline particles as well as spheroidal sulphur are deposited. Ultimately with further increase of temperature the sublimed sulphur at first formed, is melted, and, on cooling, forms friable blocks or masses which are wholly crystalline in structure. Since the commercial value of sublimed sulphur depends upon the proportion of the spheroidal form it contains, which is the allotropic condition insoluble in carbon bisulphide, it is suggested that that solvent should be employed for determining the value, and that the term "flowers of sulphur" should be reserved for the product which shows not less than 33 per cent. of the insoluble variety at the time of production, and that the value of commercial samples be based upon this standard. Thus a sample containing 30 per cent. of insoluble sulphur should be described for trade purpose as containing 90 per cent. of "flowers of sulphur." The term "sublimed sulphur" should be applied to the whole product of sublimation without regard to its physical condition.

—J. O. B.

Potassium Ferrocyanide; Influence of Anode on Electrolytic Oxidation of ——. A. Brochet and J. Petit. XI. A., page 1222.

Iron Cyanogen Compounds; Blue ——. K. A. Hofmann, O. Heine, and F. Höchtlen. IV., page 1209.

Phosphates; Colorimetric Determination of ——. O. Schreiner and B. E. Brown. XXIII., page 1240.

English Patents.

Oxygen; Preparation of ——. G. F. Jaubert, Paris. Eng. Pat. 26,148, Nov. 30, 1903. Under Internat. Conv., July 3, 1903.

See Addition, of July 3, 1903, to Fr. Pat. 325,627 of 1902; this J., 1903, 1348.—T. F. B.

Nitrogen and Oxygen from Atmospheric Air; Apparatus for the Separation of ——. R. P. Pictet, Steglitz, Germany. Eng. Pat. 14,431, June 27, 1904. Under Internat. Conv., June 27, 1903

See Addition, of June 27, 1903, to Fr. Pat. 322,600 of 1902; this J., 1904, 371.—T. F. B.

United States Patents.

Barium Hydrate; Manufacture of ——. F. Jahn, Assignor to Harrison Bros. and Co. U.S. Pat. 775,752, Nov. 22, 1904. XI. A., page 1223.

Bisulphite Liquor; Apparatus for Preparing ——. P. Drewsen and J. Parent, Assignors to Drewsen-Parent Construction Co., Shawano, Wis. U.S. Pat. 774,869, Nov. 15, 1904.

An elongated closed tank with a substantially flat bottom has its liquid supply at one end, and gas supply and discharge port at the opposite end. There are agitators, each consisting of a shaft provided with blades in and across the tank, and each having a dam in the tank's bottom behind it. There are also removable pipe sections having return bends suspended in the tank, from a bar resting on its edges, and adapted to carry "temperature controlling water" through them.—E. S.

French Patents.

Hydrochloric Acid and Sulphuric Acid; Process for the Production and Simultaneous Separation of ——. Consortium für Elektrochem. Ind. Second Addition, dated June 27, 1904, to Fr. Pat. 335,496 of Aug. 24, 1903. (See this J., 1904, 252 and 606.)

For "acide sulfurique aqueux" in the second sentence of the second paragraph of the specification of the main patent, read "acide muriatique aqueux."—E. S.

Products having great Affinity for Water [Sulphuric Anhydride, &c.]; Process for the Condensation of ——. A. H. Perret. Fr. Pat. 314,964, July 19, 1904.

The products, such as sulphuric and phosphoric anhydrides, are distilled in a retort communicating with receivers, not sealed, but surrounded by materials not readily conducting heat and into which receptacles air, cooled and dried, is passed as it issues from a chamber in which a strong solution of calcium chloride, for instance, is continuously showered down.—E. S.

Arsenious Acid; Apparatus for the Extraction of —— from Ores. E. Biguet. Fr. Pat. 345,063, July 23, 1904.

The apparatus includes a series of muffles, in which the arsenical ore is so heated as to sublime the arsenic, which passes into a chamber to which air is admitted, arsenious anhydride being formed and deposited. Air is aspirated through the entire apparatus in such manner as to lead the vapours through a series of large condensing chambers, and then through complementary chambers of special construction. Lastly, the vapours are led up a coke tower, sprayed at the top with water. The sulphurous acid thus collected, is treated with limestone.—E. S.

Carbonic Acid: Obtaining —— from Solutions of Bicarbonate. Chem. Techn. Fabr. Dr. A. R. Brand and Co. Fr. Pat. 344,744, July 9, 1904.

The alkali bicarbonate solution, mixed, if necessary, with soap or grease, to make a lather, is fed continuously through a tubular apparatus, heated by gases from a furnace passing through a central horizontal pipe. The froth produced passes to a cooler, where it is cooled by the incoming liquid; the froth subsides, the liberated carbon dioxide being collected and the residual solution of monocarbonate used for absorbing carbon dioxide from gases of combustion.

—E. S.

Carbonic Acid; Process for the Storage and Transport of —— in a Solid State and at a Low Temperature. Gebr. Heyl and Co., and A. Wultze. Fr. Pat. 314,957, July 19, 1904.

As the carbon dioxide is stored in the solid state, the recipients need not be of great resisting power. The recipient shown in Fig. 1 is provided with a double enveloping an empty space b, for reception of a refrigerating mixture, such as a mixture of carbon dioxide and ether; the outer layer c is of some non-heat-conducting material. The continual evaporation of the cooling liquid maintains the carbon dioxide within the receptacle in the solid state. g and g^1 are safety valves. A small apparatus for aspiration and compression is set within the space b, the piston to which is actuated from e outside the apparatus, as shown. The vapours arising from the volatile mixture are aspirated at l, through the tube k, and are compressed and liquefied by means of the tuyères m in the evaporating chamber, the process continuing as long as the motive force is applied. A force-pump, o, n, serves to remove the solid dioxide, which may be conveyed into the steel cylinder shown in Fig. 2, fitted with double envelope, &c. like that represented in Fig. 1. Such cylinders are provided with means for charging and discharging similar to those in ordinary use for storing and conveying liquid carbon dioxide. E. S.

Fig. 1.

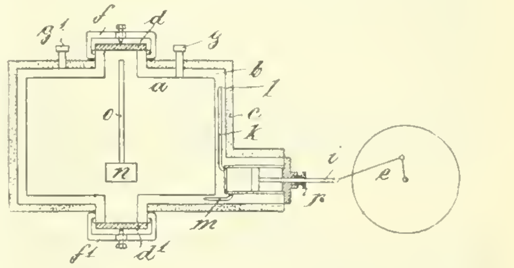
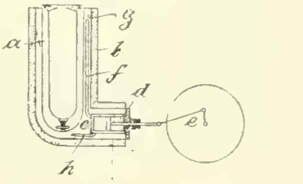


Fig. 2.



Ammonia; Manufacture of ——. H. C. Woltereck. Fr. Pat. 345,399, Aug. 6, 1904.

A mixture of air and steam is caused to act upon peat heated in a retort at a temperature not higher than 550° C., and, preferably, at about 400° C. Other suitable carbonaceous substances, such as coke, lignite, &c., may be substituted for peat in the process. The distilled products may contain, besides ammonia, tar, hydrocarbons, acetic acid, &c. Compare Eng. Pat. 2461 of 1902 and Fr. Pat. 332,591 of 1903; this J., 1903, 695 and 1243.—E. S.

Sulphur and Cyanides from Gas-purifying Materials [*Spent Oxide*]; *Process and Apparatus for Extracting* ——. J. J. M. Béeigneul. Fr. Pat. 345,071, July 23, 1904.

The spent oxide, placed in a closed vessel, is extracted by means of "hot benzene, particularly toluene heated to 100—110° C.;" the hot solution of sulphur is passed through a filter of animal charcoal, to remove the dissolved tarry matters, and is then cooled, to cause the precipitation of the sulphur; and after filtration the toluene is again used for extracting a fresh quantity of spent oxide. The apparatus used is connected together in such a manner as to prevent loss of solvent at any point; the extraction vessel and filters are fitted with steam jackets, so that any solvent present may be distilled off and recovered before the vessel is opened for renewing the contents. The extracted oxide is heated with lime in a closed vessel, in order to obtain the cyanide directly as ferrocyanide of calcium.—H. B.

Air and Gaseous Mixtures; Separating —— into their Elements. Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Procédés G. Claude et R. J. Lévy). First Addition, dated July 29, 1904, to Fr. Pat. 338,812, of June 3, 1903.

Certain corrections are made to the drawing given in the main patent (see this J., 1904, 823) in reference to the overflow tube.—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

Devitrification. W. Guertler. Z. anorg. Chem., 1904, **40**, 268—279.

Certain substances can be obtained in the form of "glasses" by rapid cooling far below the melting point, from the molten state. The time-temperature curves, plotted from the results obtained by slowly heating these glasses in the electric furnace, show a sudden upward bend, almost parallel to the temperature axis, indicating the point of devitrification, *i.e.*, when conversion of the unstable non-crystalline vitreous form into the crystalline form occurs, with evolution of heat. This change is a non-reversible "explosive" action. The following devitrification temperatures were determined:—Sodium silicate, 550° ± 20° C.; cobalt borate, 640° ± 20°; copper borate, 675° ± 15°; manganese borate, 670° ± 20° C.—T. F. B.

Plastic Clay; Is the Shrinkage and Porosity of —— in Firing, of a Mechanical or Chemical Nature? E. Berdel. Sprechsaal, 1904, **37**, 1755—1757; 1792—1795.

From experiments made with Halle clay and Zettlitz kaolin, it appears that the felspar solidifying from the fused mass is of lower specific gravity (by nearly 0·2 per cent.) than the natural product, the change beginning first at a temperature between Seger cones 1 and 2, and decreasing up to the fusing point. The specific gravity of quartz gradually and continually diminishes on heating. The shrinkage and porosity of Zettlitz kaolin undergo modification at about the same temperature as felspar. The effect of felspar on closeness of texture can be detected at Seger cone 1, and justifies the addition of this substance, even to stoneware bodies fired at a low temperature. Its action at low heats undergoes a change coinciding with the change in specific gravity. The influence of felspar varies directly with the fineness of division, so that when very finely ground spar is added in quantity to Zettlitz kaolin the latter is rendered very close in texture, at about Seger cone 2. At low firing heats the expansion of quartz diminishes the shrinkage and close texture of the clay substance, but the action is less pronounced at the "turning point" (Seger cone —2) already mentioned, whilst at higher temperatures the porosity and dimensions of the ware increase. The maximum porosity is attained when quartz and clay substance are in equal proportions, and diminishes with further additions of quartz, which, however, acts less effectually in proportion as it is more finely ground. Halle clay is less influenced by heat than the earthy Zettlitz kaolin, but the influence increases as the sand is removed by levigation. A specific feature of plastic clays is the increased closeness of texture at Seger cones 09 and 1. Halle clay contains considerable quantities of silicate fluxes, which must be classed as "clay substance." The addition of quartz counteracts the influence of firing, the reverse being the case with felspar. A small amount of quartz neutralises the aforesaid decrease in porosity, small amounts of felspar having an entirely opposite effect. This behaviour indicates that the increased closeness in Halle clay is due to finely divided fluxes. The finest non-plastic particles of this clay are particularly rich in these fluxes, and when mixed with Zettlitz kaolin impart to the latter qualities similar to those of Halle clay, thus indicating the important part they play in the last named. From these particulars it is concluded that the behaviour of plastic clays on firing is in part due to the chemical action of the contained fluxes. No difference in principle, however, can be found in the action of fire on plastic and non-plastic clays.—C. S.

United States Patents.

Glass; Apparatus for Manufacturing ——. A. R. Wilson and L. M. Dull, Assignors to A. R. Gordon, F. N. Dull, and W. E. Dittenhaver, all of Toledo, Ohio. U.S. Pat. 775,740, Nov. 22, 1904.

A reservoir extends through a side wall of the tank for the glass, the reservoir being provided with an inlet communicating with the interior of the tank, and with a discharge conduit leading from its lower portion. Means connected with the exposed portion of the reservoir are provided for supplying air under pressure to the interior, so as to operate a check-valve situated within the reservoir and controlling the inlet. A heating chamber, within which is placed a burner, surrounds a portion of the reservoir. The top of this chamber constitutes a mould-receiving platform.
—A. G. L.

Granite [*Glass*]; *Manufacture of Artificial* ——. L. A. Garchey, Paris. U.S. Pat. 776,160, Nov. 29, 1904.

See Fr. Pat. 325,175 of 1902; this J., 1903, 697.—T. F. B.

French Patents.

Gas Furnace for Glass Works; A Highly Regenerative Circular ——. C. Deselles. Fr. Pat. 344,894, July 4, 1904.

The furnace described is for pots, and is heated by a gas-generator. A direct regeneration of the heat produced by the combustion of the gas and air in the arch of the furnace is effected by introducing and circulating air, from without, through chambers or inlets arranged in the whole mass of masonry, which is heated by the process of combustion. The air inlets, and flues for the escape of the products of combustion, are arranged in the pillars forming the openings for the mouths of the pots, and in the pillars of the arches of the furnace.—W. C. H.

Gas Furnace for Glass Works; A Circular Highly Regenerative ——. C. Deselle. First Addition, of July 26, 1904, to Fr. Pat. 344,894, of July 4, 1904.

This addition to the principal patent refers, first, to the arrangement, in the central column of the pot furnace of the air- and gas-channels so that these may be coupled two and two. To allow for the contracted width of the single channel formed by the union of an air- and a gas-channel, an increasing depth is given to the channel towards the centre of the column. In order to catch glass from broken pots, one or more receptacles are arranged outside the furnace, in such a way that the glass can flow from the "siege" down a channel into the receptacle, the bottom of the channel being luted with a vertical tile, to prevent escape of gas from the furnace, which tile is pushed off, when necessary, by the weight of glass behind it. The claims also include details of the arrangement of air- and gas channels in the walls and arch of tank furnaces, in order to attain in them the high degree of recuperation aimed at in the pot furnaces already described.—W. C. H.

Glass; Process and Furnace for the Continuous Manufacture of Finer Kinds of ——, such as Crystal, &c. S. O. Richardson, jun. Fr. Pat. 345,256, April 7, 1904.

See U.S. Pats. 756,409 and 766,771 of 1904; this J., 1904, 489 and 866.—T. F. B.

Glassware; Process for Making ——. J. L., C. V., F. J., F. L., and P. R. Arbogast. Fr. Pat. 345,097, July 16, 1904. Under Internat. Conv., July 16, 1903.

See U.S. Pat. 756,558 of 1904; this J., 1904, 490.—T. F. B.

Continuous Kilns; Arrangement to obviate the Use of Stoves, hitherto employed for the Drying of Ceramic Articles about to be Burnt in ——. Soc. Perrusson fils et Desfontaines. Fr. Pat. 345,318, Aug. 2, 1904.

The heat of the products of combustion in the hotter chambers of a continuous kiln is used for drying articles which are placed in the cooler chambers ready to be burned. The hot gases are conveyed by a system of pipes from a hood, luted with sand on to the roof of a hot chamber, to down-pipes leading into a chamber filled with articles to be dried. When necessary, the heat of the gases can be reduced by the admixture of cold air, admitted to the pipes through a valve.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

English Patents.

Building and Decorating Materials. A. Silbiger, London. Eng. Pat. 24,618, Nov. 12, 1903.

From 90 to 75 per cent. of Portland, Roman, or other hydraulic cement is mixed with 10 to 25 per cent. of asbestos, kieselguhr, or vegetable fibre in a humid state, and the mixture moulded by a pressure of about 1 ton per sq. in. into slabs of the required size. A mixture of 80 per cent. of cement and 20 of asbestos, &c. has been found to give good results; but part of the cement may in some cases be replaced by lime. Wire netting, perforated zinc, &c. may be laid between two thicknesses of the material whilst still in the humid state; or a sheet or board of asbestos, cardboard, &c. may be glued to the finished slabs. The slabs may also be secured to wooden or other frames, or they may be mounted directly on the bricks, if it is desired to cover walls.—A. G. L.

Masonry or Brickwork of Furnaces, Ovens, Pipes, Retorts, and the like; Manufacture of a New Pulverulent Product for Coating and Joining ——. L. E. Muller, Paris. Eng. Pat. 15,057, July 5, 1904. Under Internat. Conv., July 8, 1903.

See Fr. Pat. 338,914 of 1903; this J., 1904, 985.—T. F. B.

United States Patents.

Non-conducting Coverings, Blocks, and Slabs; Manufacture of ——. H. C. Michell, London. U.S. Pats. 774,946 and 774,947, Nov. 15, 1904.

See Eng. Pats. 21,386 and 21,387 of 1902; this J., 1904, 188.

Brick or Stone, Artificial; Process of Making ——. L. F. Kwiatowski, New York. U.S. Pat. 775,222, Nov. 15, 1904.

The bricks, &c. are made from lime and sand by simultaneously incorporating and powdering the whole of the unslaked lime and part of the sand in its natural moist condition, and then adding the remainder of the sand, together with sufficient water to complete the hydration of the lime. The mixture obtained is moulded and subjected to the action of steam under pressure impregnated with salts. —A. G. L.

Building Blocks; Method of Manufacturing —— from Materials including Hydraulic Cement. H. Warden, Fredericksburg, Va. U.S. Pat. 775,588, Nov. 22, 1904.

In order to hydrate the cement in the building blocks without washing out the soluble constituents of the blocks, the latter are placed in intimate contact with (*i.e.*, upon) a substance having the capacity of absorbing water by capillary attraction, and so that the lower portion of the substance is immersed in water of a constant depth. The portion of the substance connecting the part immersed and that in contact with the blocks is arranged so that the flow of water through it will be induced solely by capillarity, and not by gravity, whereby an excessive supply of water to the blocks is avoided.—A. G. L.

Roofing or Flooring; Flexible ——. L. C. Rugen, Boundbrook, N.J., and H. Abraham, N.Y., Assignors to The Standard Paint Co., Boundbrook, N.J. U.S. Pat. 775,635, Nov. 22, 1904.

"A suitable flexible fabric" is impregnated with a heated hydrocarbon mixture to produce a foundation. In the presence of heat and pressure a coloured facing, consisting of a pigment and a carrier or flux containing a resinous body and a fatty body, is then applied to the foundation in a plastic condition, so as to cause the facing and foundation to interlock.—A. G. L.

Weatherproof Covering. L. C. Rugen, Boundbrook, N.J., and H. Abraham, N.Y., Assignors to The Standard Paint Co., Boundbrook, N.J. U.S. Pat. 775,636, Nov. 22, 1904.

To a suitable foundation is applied a permanent facing containing a pitch or bitumen of a brownish colour when examined in a thin layer, and also containing a pigment adapted to become plainly visible, or to be developed by atmospheric influences; to this permanent facing is then applied a temporary facing of about the same colour as the final colour of the permanent facing, the temporary facing being adapted to be removed by exposure to the atmosphere.—A. G. L.

Brick; Refractory ——. W. F. B. Berger, Assignor to The American Bauxite Co., both of Little Rock, Ark. U.S. Pat. 775,887, Nov. 22, 1904.

The brick is made of calcined American bauxite and about 20 per cent. of fire-clay, which acts as a binder. —A. G. L.

Compositions [Plasters] from Calcined Gypsum; Manufacture of ——. L. Mack, Stuttgart, Germany. U.S. Pat. 776,076, Nov. 29, 1904.

See Eng. Pat. 12,584 of 1903; this J., 1903, 952.—T. F. B.

Building Material; Artificial ——. A. Seigle, Lyon-Monplaisir, France. U.S. Pat. 776,430, Nov. 29, 1904.

See Addition, of June 4, 1903, to Fr. Pat. 323,666 of 1902; this J., 1903, 1294.—T. F. B.

Cement; Method of Making White ——. E. Gogler, Podgorze, Austria. U.S. Pat. 794,840, Nov. 15, 1904.

See Eng. Pat. 388 of 1904; this J., 1904, 443.—T. F. B.

Cement Kiln; Rotary ——. T. A. Edison, Llewellyn Park, N.J. U.S. Pat. 775,600, Nov. 22, 1904.

See Eng. Pat. 4735 of 1902; this J., 1903, 367.—T. F. B.

Cement; Method of Burning ——. M. Williams, London. U.S. Pat. 775,693, Nov. 22, 1904.

See Eng. Pat. 10,853 of 1902; this J., 1903, 629.—T. F. B.

French Patents.

Stone, Artificial; Manufacture of a Plastic Material for Making ——. R. Heusch. First Addition, of July 15, 1904, to Fr. Pat. 341,660, of Mar. 25, 1904.

500 grms. of powdered slag or slate are mixed with 150 grms. of magnesite and 100 grms. of pure sand; and to

the mixture 100 c.c. of 96 per cent. sulphuric acid and 140 c.c. of magnesium chloride solution at 30° B. are added, with constant stirring. The mass is then placed in moulds and allowed to harden. A more even product is obtained by mixing 600 grms. of slag or slate powder with 150 grms. of magnesite and adding 180 c.c. of magnesium chloride solution at 30° B.—A. G. L.

Imitations of Marble in Plaster and Cement; Process for the Manufacture of ——. R. Hülsberg. Fr. Pat. 341,912. July 18, 1904.

Imitation marble articles made of plaster or cement, when withdrawn from the mould, are subjected for about 24 hours to the action of an alkaline solution, such as a "trebly concentrated solution of ammonia" (sp. gr. 0·910), and are washed with water immersed for about 24 hours in a solution of magnesium sulphate and sodium phosphate, then dried and, if necessary, impregnated with paraffin.—W. C. H.

Works of Art [*Imitation Marble*] *and the like; Process for Manufacturing* ——. H. J. P. Dumas. Fr. Pat. 345,337, Aug. 3, 1904.

See Eng. Pat. 26,568 of 1903; this J., 1904, 1029.—T. F. B.

Pavements free from Dust; Process for rendering ——. Chem. Werke Mügeln b. Dresden, G. m. b. H. Fr. Pat. 345,067, July 23, 1904.

To prevent the formation of dust, the materials used for the construction of the pavement are moistened and impregnated with lye, preferably that obtained in the manufacture of cellulose. The materials may be moistened and impregnated before, during, or after the laying of the pavement. The resinous substances contained in the lye are said to act as an adhesive between the dust and the materials.—W. C. H.

Plaster; Method of Revivifying Old ——. E. Paupy. Fr. Pat. 345,544, Aug. 12, 1904.

Old plaster, without previous grinding, is stacked up in furnaces similar to those used for burning new plaster, with the larger pieces at the bottom, and the smaller above, and burned until dehydrated. The combustible is placed either in temporary flues built up of lumps of the old plaster, or on the ground (or on bars) under a grating which supports the plaster to be burned.—W. C. H.

Sand and Cement; Setting of Mixtures of ——. B. Chan. Fr. Pat. 345,122, July 26, 1904.

According to this invention, ordinary water used for the setting of mixtures of sand and cement is replaced by lime-water, which is said to react chemically with the silica of the sand and cement, and thus improve the setting of the mortar.—W. C. H.

Cement; Rotary Furnaces for the Manufacture of ——. F. L. Smidth et Cie. Fr. Pat. 345,419, Aug. 8, 1904.

In rotary cement kilns, in the upper part, in which the raw material introduced undergoes drying and preliminary heating by the action of the sensible heat of the products of combustion, partitions are arranged, radially or otherwise, to turn over the material and increase the surface of contact between it and the products of combustion. The partitions may be corrugated &c., to increase the surface.—W. C. H.

X.—METALLURGY.

Blast-Furnace Charging Apparatus: Special Forms of ——. T. F. Witherbee. Amer. Inst. Mining Eng., Sept. 1904.

A description is given of some special forms of charging apparatus for blast-furnaces, the more efficient of which consist in principle of a double bell combined with a hopper. The author suggests, that by means of such devices, the charge could be introduced nearer the centre of the furnace, and that by having a more resistant column of material there to blow against, better results might be obtained, since the tuyère-area could be reduced, and thus the "wandering" of the blast minimised.—A. S.

Dry Air Blast; Influence of —— *on the Working of the Blast-Furnace.* A. Lodin. Comptes rend., 1904, **139**, 922—925.

The work of Gayley (this J., 1904, 1148) is in contradiction to the views hitherto held as to the importance of the moisture in the blast; but the striking results he has obtained are probably due to the special circumstances under which he worked. The total "heat-bills" for the two cases quoted by him show a difference due to the heat of decomposition of the moisture representing 2·8 per cent. of the total heat evolved, and it is not obvious how the saving of this should effect an economy of 19·8 per cent. in the coke used. This heat, however, is absorbed in the immediate neighbourhood of the tuyères, where a very high temperature is necessary, and where the only portion of the heat available is that given out between the temperature of the burning fuel and that of the burning slag or pig; this difference is never very considerable, because the carbon is here burnt only to monoxide. Hence small subtractions or additions of heat here will have a very important influence on the coke consumption. In the Isabella furnaces, with which Gayley worked, this influence is exaggerated by the low temperature of the blast, and the rise of 100° C. in the blast-temperature resulting from the drying, is largely responsible for the improved results. Had the blast been heated to 500° C., instead of being dried, probably the same improvement would have resulted. In Europe, where the blast is heated to 700°—800° C., the effect produced by previous drying will almost certainly be much less than that obtained by Gayley.—J. T. D.

Dry Air Blast; Employment of ——, *in Blast Furnaces.* H. Le Chatelier, Comptes rend., 1904, **139**, 925—927.

The economy in fuel—20 per cent.—stated by Gayley (this J., 1904, 1148) to result from the removal of the moisture from the air of the blast is four times as great as the amount due to the saving of heat which, with moist air, is spent in dissociating the water vapour and reacting with it on the coke; so that if the economy be real, its cause must be other than that to which Gayley attributes it. It is to be borne in mind that the consumption of fuel varies greatly with the temperature at which the furnace is worked; and if the dry blast, for example, gives a pig containing less sulphur than the moist blast at the same temperature, it will be possible with the dry blast to work at a lower temperature than with the moist, thus saving fuel, and yet produce an equally pure pig. If this be the true cause of economy, then it does not follow that the same economy will result, as the author concludes, from the use of dry air in other operations, such as the Bessemer process. It seems highly probable that the use of dry air will produce a less sulphurous pig; for the sulphur exists chiefly in the coke, and with dry air will burn to sulphur dioxide, which will be oxidised and absorbed by the lime in the flux and will go into the slag, never reaching the spongy iron in the layers above, whilst in presence of hydrogen derived from the moisture, phenomena of equilibrium will be produced, and the gases will contain a certain proportion of hydrogen sulphide, which will in part at least reach and be absorbed by the spongy reduced iron. The author has found that calcium sulphide, heated to 600° C. in a stream of dry carbon monoxide, gives off no gas that will blacken a strip of heated silver or a solution of silver nitrate; but when the carbon monoxide is mixed with water vapour or hydrogen, both the metal and the solution are rapidly blackened.—J. T. D.

Cast Iron; Manganese Ore as a Desulphurising Agent in the Smelting of ——. Wedemeyer. Stahl u. Eisen, 1904, **24**, 1377—1380.

Trials in reverberatory and crucible furnaces gave results confirming those obtained in the cupola (see this J., 1904, 1149), and show that the use of expensive manganese ore as a desulphurising agent for cast iron is irrational.

—A. S.

Rusting of Iron; Stimulating and Paralysing Effects of certain Substances on the ——. L. Lindet, Comptes rend., 1904, **139**, 859—862.

Certain metals, especially copper, when placed in water kept constantly aerated, in presence of iron, accelerate greatly the process of rusting; whilst others, such as tin, lead, zinc, manganese, aluminium, and magnesium, retard it. These effects are not due to the metal, but to minute quantities of oxide or hydroxide in solution; for water which has been for some time in contact with the metal, produces the same effect as that which contains it. Ferric oxide itself exerts an accelerating influence on rusting. Prominent among those which exert a paralysing influence is arsenious oxide; in presence of this oxide, the rusting is either stopped or greatly retarded. In the latter case, ferric arsenite is formed in a colloidal state. Arsenic pentoxide and orpiment, if present to the extent of 1 per cent., also act as retarders. Most dissolved salts, in consequence of their electrolytic dissociation, greatly increase the rapidity of rusting. Organic substances vary greatly in their action; sugar, phenol and resorcinol accelerate it, whilst alcohol, methyl salicylate, &c., retard it. The tinned or galvanised cans in which denatured alcohol is delivered often rust badly; this forms an obstacle to the use of such spirit for motor cars. Denatured alcohol is almost always made from the first runnings of the distillation, and hence contains aldehyde, ethyl acetate, and traces of acetic acid. To it is added impure methyl alcohol, containing acetone and methyl acetate, together with (if it is to be used for motor cars) an equal volume of light coal-tar spirit. This last is the substance which is most active in causing rusting. The aldehyde and esters do not provoke oxidation, but they attack the zinc or the tin, and then the iron; and the metallic acetates formed then start the oxidation. Arsenic compounds suggest themselves as a remedy for this; alcohol dissolves only traces of arsenic itself, it dissolves much more considerable quantities of its oxidised compounds.

—J. T. D.

Cyanide Practice at the Maitland Properties, South Dakota. J. Gross. Amer. Inst. Mining Eng., Sept., 1904.

The ores worked are the so-called "Potsdam silicious ores," containing pyrrhotite and iron pyrites in about equal proportions, together with arsenic, copper, and traces of antimony and tellurium; also, considerable quantities of bismuth have been found in the zinc-box precipitates. Only the oxidised ores are subjected to cyanide treatment. The ore is crushed in a solution containing 1·2—1·3 lb. of potassium cyanide and 0·8 to 1 lb. of caustic soda per ton. For every ton of ore fed to the stamp-battery, 4—5 tons of cyanide solution are used. The crushed product obtained contains about 60 per cent. of sand and 40 per cent. of slime, and is passed to the cone classifiers, consisting of two upper conical vessels, the discharges from which unite and pass into a lower conical vessel, where they meet an upward current of cyanide solution. The aim is to make a clean sand rather than a clean slime. The sand discharged from the bottom of the lower cone is leached with a solution containing 1·5—1·6 lb. of potassium cyanide and 1·0—1·2 lb. of caustic soda per ton. The slime overflowing from the cones is treated by a system of combined agitation and decantation. The extraction averaged 62·22 per cent. of the gold, and 26·1 per cent. of the silver in the first half of 1903, and 75·52 per cent. of the gold and 44·3 per cent. of the silver in the second half. These figures, though low, exceed those yielded by test extractions by from 5—10 per cent. Of the total extraction, 47·9 per cent. is obtained in the battery, 27 per cent. from the sand-leaching, and 25·1 per cent. from the slime treatment.—A. S.

Crushing in Cyanide Solution, as practised in the Black Hills, South Dakota. C. H. Fulton, Amer. Inst. Mining Eng., Sept. 1904. (See preceding abstract.)

The most economical extraction is obtained if the ore is crushed so that most of it is between 30-mesh (0·0195 inch) and 60-mesh (0·0075 inch) size. The separation of the sand from the slime is effected in the outer sheet-iron cones of an ordinary hydraulic classifier, from which the inner cones have been removed. The high content of lime (added during the crushing of the ore in the cyanide solution) in the pulp is a source of trouble, both by its coagulating effect on the slime, causing the latter to settle with the sand, and by giving rise to the formation of an excessive quantity of froth or foam. In charging the sand-vats, the system of "dry-filling" is adopted, the pulp being fed into the empty vat, and the solution continually drained off until the vat is full of sand. The advantages of this method are that—(1) The slime in the pulp is uniformly distributed with the sand, whereby the percolation of the solution through the charge is favoured. (2) During the filling a large quantity of solution passes through the sand, thus increasing the extraction. Two methods of slime treatment are in use. In the first the treatment is completed in the vat into which the pulp is first charged, the agitation being effected by means of compressed air. In the second method, the slime is repeatedly transferred from one vat to another (generally 3 or 4 times), and the charge is agitated by means of centrifugal pumps.—A. S.

Platinum; Volatilisation of ——. G. A. Hulett and H. W. Berger. J. Amer. Chem. Soc., 1904, **26**, 1512—1515.

Platinum begins to volatilise in air at about 800° C., and the action increases markedly as the temperature rises. In a vacuum or an atmosphere free from oxygen, there is no volatilisation. The phenomenon is consequently due to the presence of oxygen, and it seems probable that there exist volatile compounds of the platinum metals which are stable at high temperatures, but decompose at lower temperatures, and such compounds would probably be endothermic. The existence of a volatile oxide of platinum which decomposes at 800° C. and below, but is stable above that temperature, would account for all the observed facts. The "sprouting" of molten platinum when cooling may be due to the decomposition of such a compound.—T. H. P.

Copper, Tin, and Oxygen. E. Heyn and O. Bauer. Mitt. königl. Materialprüfungsamt, 1904, **22**, 137—147.

A previous investigation dealt with the relations between copper and oxygen (this J., 1901, 723, 956). In the present series of experiments, the authors investigated the action of oxygen or compounds containing oxygen on fused copper-tin alloys, and the changes produced thereby during and after solidification. The results have a bearing on the technical question of the alteration of bronzes when these are fused with access of air. It was found that any oxygen contained in copper-tin alloys is in the form of crystals of stannic oxide, which are insoluble in the fused alloy (and also in fused tin). The crystals are frequently stunted, forming pellicles, which are always found in that constituent of the alloy which solidifies last, *i.e.*, that which is rich in tin. The presence of stannic oxide causes a thickening of the fused alloy. If cuprous oxide be used in preparing the alloys, this reacts with the tin at the melting temperature, forming copper and stannic oxide. Phosphorus is an effective de-oxidising agent for copper-tin alloys containing stannic oxide. If copper tin alloys be fused with access of air, there are formed at first an upper layer of an alloy of copper and cuprous oxide, and a lower layer of a copper-tin alloy, both containing crystals or pellicles of stannic oxide. If the heating be continued for a sufficiently long period, the lower layer entirely disappears, the whole of the tin being converted into stannic oxide. The authors also state that the grey and yellow patches frequently observed on a fracture of a commercial tin bronze are not due to segregation (liquation), but to the formation of large grains owing to slow cooling. The different coloured patches of metal contain the same percentage of tin, and with more rapid cooling they become smaller, and so intimately mixed, that the fracture exhibits a uniform "mixed-colour."—A. S.

Stannic Oxide in Copper-Tin Alloys; Electrolytic Separation and Determination of ——. E. Heyn. XXIII., page 1239.

Arsenical Poisoning; Danger of ——, to Workmen engaged in Autogenous Soldering. G. Lunge. Chem.-Zeit., 1904, **28**, 1169—1170.

THE author has already drawn attention to the danger arising from arsenical hydrogen to workers with autogenous soldering apparatus, especially in close workshops or in the inside of small vessels. He now gives some figures communicated by Major Nathan, of the Government Powder Works at Waltham Abbey, contained in a report (not yet printed) by Mr. Robertson, the chemist there. Tested by the Marsh-Berzelius process, samples of zinc from Ash and Lacey showed from 0·00008 to 0·00015 per cent. of arsenic (0·0074 to 0·0140 grains of arsenious oxide per lb.); one marked G. v. Giesches Erben, 0·0008 per cent. (0·074 grains per lb.); one of Brunner, Mond & Co.'s electrolytic zinc 0·00008 per cent. (0·0074 grains per lb.). Hence, a maximum limit of 0·0005 per cent. of arsenic (0·047 grain of arsenious oxide per lb.) may fairly be demanded of dealers. Three samples of sulphuric acid yielded:—*a*, Denitrated, not concentrated, acid, 0·00022 per cent. (0·02 grain per lb.); *b*, Concentrated acid from the Kessler evaporator, the same amount; *c*, Chapman and Messel's acid, half the amount. Taking 0·0005 per cent. in the zinc, and 0·00022 per cent. in the acid, a week's work in the soldering shop at Edmondsey would produce 180 c.c. of arsine, forming 0·845 grm. of arsenic trioxide, or 0·141 grm. per day. The danger of direct poisoning by this amount of arsenic trioxide is small; but it is not to be disregarded, nor is that due to accumulations of arsenical dust. Arsine itself is, of course, much more poisonous than the product of its combustion, and the escape of the gas by faulty tubing or connections, or leaks in the apparatus, should be carefully guarded against. Copper sulphate solution, with which the author recommended that the gas should be washed to remove the arsenic, has not been found effectual by Robertson, who recommends for the purpose 5 per cent. permanganate solution, or chromic acid in sulphuric acid solution. The author suggests the use of electrolytic hydrogen, which prepared from alkaline solutions is probably free from arsenic, and could be sold, compressed in cylinders, at little more cost than that made from acid and zinc.—J. T. D.

ENGLISH PATENTS.

Iron; Manufacture of ——, in the Blast Furnace. W. J. Foster, Walsall. Eng. Pat. 755, Jan. 12, 1904.

THE present invention is an enlargement of Eng. Pat. 4147, of 1901 (this J., 1902, 349), according to which highly-heated solid carbon and fluxes were injected into the furnace by and with the hot blast through the tuyères. Under the present extension, metal pieces, such as "swarf" (iron or steel turnings, or shavings), or metallic iron of any form, with or without solid carbon and fluxes, and previously heated to a temperature at least as high as that of the hot blast, are injected with the blast into the furnace, as described in the cited patent.—E. S.

Regenerative Furnaces [for Steel Manufacture]: Impts. in ——. B. Talbot, Leeds. Eng. Pat. 1365, Jan. 19, 1904.

IN regenerative gas furnaces, and especially in such as are used in the manufacture of steel, in order to cool the masses of brickwork at the two ends of the furnace, through which the uptakes bring the gas and air from the regenerators into the furnace, a chamber is built into such brickwork, preferably semi-circular in cross section, having its bottom open, or partly open to the air on the side facing the furnace, whilst the top is closed, and provided with air-channels passing completely through the brickwork to allow of air circulation.—E. S.

Steel; Manufacture of ——, and Treatment of Copper Nickel, and like Mattes. Cie. du Réacteur Métallurgique, Paris. Eng. Pat. 14,985, July 4, 1904. Under Internat. Conv., Aug. 6, 1903.

SEE Fr. Pat. 334,151 of 1903; this J., 1904, 66.—T. F. B.

Zinc; Extraction and Purification of ——. A. V. Cunnington, Winnington, Cheshire. Eng. Pat. 4706, Feb. 25, 1904.

THE preferably roasted, and finely-divided zinc ore, is stirred in a strong solution of zinc chloride, and the basic zinc salts formed are converted into the chloride by the addition of hydrochloric acid, introduced below the surface of the liquid. The process may be made continuous by making successive additions of ore and of acid, and withdrawing the exhausted portion of the ore. To free the liquor from arsenic, either freshly-precipitated ferric hydroxide is stirred into the neutral or slightly alkaline liquid, or, to the slightly acid liquor containing ferric iron in solution, zinc oxide, lime, or the like is added to precipitate ferric hydroxide, which carries the arsenic down with it, and the precipitate is removed. The arsenic-free liquor may be treated electrolytically or otherwise, to recover the zinc and other metals present.—E. S.

Alloy. Soc. Anon. La Néo-Métallurgie, Paris. Eng. Pat. 23,361, Nov. 3, 1903. Under Internat. Conv., Nov. 6, 1902.

SEE Fr. Pat. 326,140 of 1902; this J., 1903, 805.—T. F. B.

Alloy or Compound; Metallic ——. Soc. Anon. La Néo-Métallurgie, Paris. Eng. Pat. 24,924, Nov. 16, 1903. Under Internat. Conv., April 17, 1903.

SEE Fr. Pat. 331,276 of 1903; this J., 1903, 1136.—T. F. B.

Alloys; Manufacture of ——. A. Jacobsen, Hamburg, Germany. Eng. Pat. 6945, March 22, 1904.

SEE Fr. Pat. 342,054 of 1904; this J., 1904, 903.—T. F. B.

Metals and Alloys; Hardening of ——. S. Cowper-Coles and Co., Ltd., and S. O. Cowper-Coles, London. Eng. Pat. 27,172, Dec. 11, 1903.

ALUMINIUM, or an alloy of aluminium, is covered with zinc dust (containing some zinc oxide) within a receptacle, which is closed, and heated to a temperature below the melting point of zinc, say to about 400° F., for a suitable period. It is stated that the articles on removal will be found to be "coated with zinc," which penetrates to a certain depth, forming a very hard skin. The process is also applicable to articles made of copper or alloys of copper.—E. S.

UNITED STATES PATENTS.

Steel; Manufacture of ——. T. J. Tresidder, Sheffield. U.S. Pat. 774,958, Nov. 15, 1904.

SEE Fr. Pat. 333,582 of 1903; this J., 1903, 1353.—T. F. B.

Steel Armour Plate, &c., with a Hardened Face; Manufacture of ——. T. J. Tresidder, Sheffield. U.S. Pat. 774,959, Nov. 15, 1904.

SEE Eng. Pat. 8299 of 1903; this J., 1904, 325.—T. F. B.

Steel; Treating Scrap —— and Recarburising the same. H. B. Atha, East Orange, N.J. U.S. Pat. 774,973, Nov. 15, 1904.

SEE Eng. Pat. 2187 of 1904; this J., 1904, 609.—T. F. B.

Puddling Furnace: Mechanical ——. W. B. Burrow, Norfolk, Va. U.S. Pat. 775,026, Nov. 15, 1904.

THE furnace is of the stationary reverberatory type, having a hearth or metal bed supported by machinery, with means for imparting to it combined rocking and horizontal movements. There is a concave lining within and around the hearth, and refractory linings project on either side over the concave lining and the bed, whereby the flames are deflected downwards upon the hearth. The inclined planes or wedge-shaped run-ways for the bed have a water-cooled track. A fireplace at each end of the furnace supplies the hearth with the products of combustion, and a pendant angular roof has its lowest point immediately above the hearth at the centre of the furnace, and from which flues pass for exit of waste gases. A stationary, detachable toothed rabble extends into and across the hearth in the direction of its width, for stirring and raking the metal as the hearth oscillates. The furnace is specially adapted for the manufacture of wrought or malleable iron. (Compare U.S. Pat. 755,215 of 1904, this J., 1904, 444.)—E. S.

Gold and Oxide of Iron; Process of Recovering —— from Sand. T. J. Lovett, Chicago. U.S. Pat. 775,043, Nov. 15, 1904.

Sand containing magnetic iron oxide with gold is mixed with water and treated magnetically, to concentrate the iron oxide with the gold which it carries, which concentrate, together with that obtained from the tailings of the first process, is subjected to the action of a suitable chemical solution "capable of dissolving the gold without material injury to the iron." The undissolved iron oxide is left in an available condition, and the gold contained in the solution is recovered.—E. S.

Gold-saving Apparatus. L. Sachse, Oroville, Cal. U.S. Pat. 774,786, Nov. 15, 1904.

This is a float-gold saving apparatus, in which a tank is separated by an intermediate floor into an upper and lower compartment, communicating through an opening in the floor. A trough is formed within the upper compartment into which the body of silica-carrying water flows. Wells are formed between the outer walls of the trough and of the compartment. There are adjustable means vertically over the opening in the floor, whereby the inflowing liquid is intercepted, and the precipitates from it are directed through the opening into the lower compartment, and in the path of the flow it is arranged to project water into the inflowing current of gold-carrying water, in opposition to the downward current from the feed sluice. The general arrangements are such that a body of the water carrying black sand is held for a time approximately still, an eddy being caused when desired by a suitably placed water-pipe; there are also adjustable deflectors whereby the flow is deflected as desired.—E. S.

Metals; Extracting [Cyanide Process] —— from their Ores. F. H. Long, Chicago, Ill. U.S. Pat. 775,405, Nov. 22, 1904.

The mixed ore and cyanide solution are contained in a closed vessel having a funnel-shaped bottom terminating in a pipe so connected, branched and valved, that when the mixture is caused to flow into the pipe by pressure of an air-blast, it may be caused to return to the reservoir by a branch leading to the top of the latter, or may be otherwise diverted. In any case the effect is to pass the charge "through a contracted channel" with the air-blast, so as to revivify the cyanide and "clear" the ore.—E. S.

Precious Metal from Ores; Process of Extracting ——. J. J. Berrigan, East Orange, N.J., Assignor to F. J. Arend, New York, and J. Bernstrom, Stockholm. U.S. Pat. 775,509, Nov. 22, 1904.

The process is continuous, and consists in causing the comminuted ore to meet a stream of an aqueous solvent of the precious metal, whereby an aerated mixture of ore and solution is produced. This mixture is then centrifugally agitated and projected through successive quantities of solvent contained in a number of vessels arranged at different levels and communicating with one another, the mixture descending by gravity from one vessel to the next lower one. The enriched solution is finally separated centrifugally from the ore. (See the two following abstracts.)—A. S.

Precious Metal from Ores; Apparatus for Extracting ——. J. J. Berrigan, East Orange, N.J., Assignor to F. J. Arend, New York, and J. Bernstrom, Stockholm. U.S. Pat. 775,414, Nov. 22, 1904.

The comminuted ore and an aqueous solvent of the precious metal are fed into a horizontal mixing vessel through separate inlets at the top. A conveyor is arranged inside the vessel to move the ore towards the outlet, which is at the bottom, below the inlet for the solvent. The mixed ore and solvent pass by gravity to the highest of a number of centrifugal agitators, arranged at different levels, each of which consists of a vessel rotating on an eccentric axis, and having an outlet in its circumferential wall, and means for discharging the ore and solution through the outlet. From the lowest agitator the pulp passes to a centrifugal separator, in which the enriched solution is separated from the ore. (See following abstract.)—A. S.

Centrifugal Separator. J. J. Berrigan, East Orange, N.J., Assignor to F. J. Arend, New York, and J. Bernstrom, Stockholm. U.S. Pat. 775,415, Nov. 22, 1904.

The separator consists of a frusto conical vessel supported eccentrically within a horizontal rotary cylinder mounted on axial trunnions, the larger end of the separator and one end of the cylinder being in one piece. One of the trunnions is hollow, and the mixture of solid and liquid materials is fed continuously through it into the large end of the separator. Inside the separator is a spiral conveyor for moving the solid material from the inlet to the outlet, the latter being at the small end of the separator. By means of suitable gearing the conveyor is rotated at a speed different from that of the separator. The liquid is discharged through an outlet in the large end of the separator between its circumferential wall and the axis of rotation, the outlet extending through the hollow trunnion.—A. S.

Metals: Apparatus for Treating Finely-divided Material for the Recovery of ——. D. C. Boley, Deadwood. U.S. Pat. 774,736, Nov. 15, 1904.

The apparatus belongs to the type in which ores are treated with a solution, and are washed by upward filtration. There are two elevated supply tanks, one for the solvent liquid and one for water, and there is a compressed air or gas supply, all connected by valved pipes to the bottom of the filtering tank, so that solution, water, or compressed air may be admitted, separately or otherwise, with a float-regulator valve operating for cutting off or turning on the liquid supply. A lining of textile fabric is secured to the upper surface of a perforated (double) tank bottom, by folds of the fabric inserted as grooves, the folds being filled "with the packing material as a rope, and held to the tank bottom by battens overlying the groove, but placed beneath the textile fabric," the edges of the latter being secured to the sides of the tank.—E. S.

Ores; Process of Reducing ——. H. F. Brown, Oakland, Cal. U.S. Pat. 774,930, Nov. 15, 1904.

The powdered ore is passed through highly heated vertical tubular apparatus, in which the air is not whirled, and is then continuously passed in its hot state through a whirling heated atmosphere moving in the same direction as the descending body of ore.—E. S.

Ore-roasting Furnace. A. P. O'Brien, Richmond, Va. U.S. Pat. 775,147, Nov. 15, 1904.

The furnace is of the vertical type with a number of superposed hearths fed from above, and a central hollow vertical rotating shaft divided into as many vertical compartments as there are hearths. A hollow arm carrying rabbles extends into the shaft at each compartment, through its walls. The rabble arms have internal passages for leading air from one compartment in the shaft to the adjoining one. The disc secured to the shaft, whereby it is rotated by means of suitable gearing, is thin and somewhat flexible, that it may accommodate itself to the expansion or contraction of the shaft by changes of temperature. The blades of the rabbles are progressively set at different angles from one end of the arm to the other whereby the action of the blades on the ore is varied. There is a gas collector at the top of the furnace, including a segmental casing in connection with a series of pipes leading to it from different parts, an elongated slot being formed in the casing for reaching every portion of the gas collector. Provision is made for the passage of water through the shaft and rabble arms.—E. S.

Zinc; Apparatus for the Extraction of ——. C. S. Brand, Knowle, England. U.S. Pats. 775,359 and 775,360, Nov. 22, 1904.

See Fr. Pats. 341,345 and 341,346 of 1904; this J., 1904, 827.—T. F. B.

Copper or like Metals; Process of Separating —— *from their Ores.* P. Weiller, Vienna, and A. Weiller, Trieste, Austria. U.S. Pat. 775,548, Nov. 22, 1904.

See Addition, of April 7, 1904, to Fr. Pat. 336,989 of 1903; this J., 1904, 903.—T. F. B.

Metals; Process of Separating —— *from Sulphide Ores.* C. V. Potter, Balaclava, Vic. U.S. Pat. 776,145, Nov. 29, 1904.

See Eng. Pat. 1146 of 1902; this J., 1902, 410.—T. F. B.

French Patents.

Steel; Process for Incorporating Crystalline or Amorphous Silicon Carbide with ——. W. Kaufmann and A. Bouvier. Fr. Pat. 344,906, July 13, 1904.

The silicon carbide is introduced in equal quantities, at regular intervals, into the molten metal as it runs into the ladle or mould, the carbide being introduced at a point close to where the stream of metal enters the ladle, so as to obtain a homogeneous product. The molten metal should be as hot as possible, and should contain no slag, otherwise the carbide will be decomposed. The following proportions of carbide are used: for steel for tyres, 0·11 to 0·12 per cent.; for moulded steel, 0·37 to 0·39 per cent.; for mild basic steel (resistance, 46—50 kilos.), 0·075 to 0·08 per cent.—T. F. B.

Metals and Oxides; Means for Recovering —— *from Solutions containing them.* A. Gutensohn. Fr. Pat. 344,630, July 6, 1904.

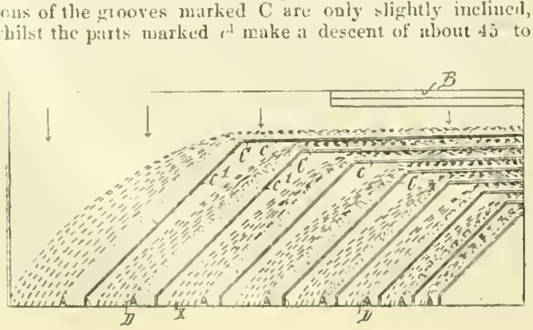
Metals, or their oxides, are recovered from their acid solutions by treatment with a precipitant prepared by heating together melted rosin and slaked lime, and then adding a solution of sodium carbonate and caustic soda. The precipitant is brought into contact with the, preferably hot, solution to be precipitated, and more alkali is subsequently added. The oxide or metal is carried down in combination with the rosin. The resulting compound is collected and distilled in order to recover the rosin, the metal being obtained as such or in the form of its oxide.—E. S.

Melting Furnace. Osnabrücker Maschinenfabrik, R. Lindemann. Fr. Pat. 344,935, July 18, 1904.

The furnace is formed with double walls, within which is a serpentine channel for the heating of the air to be admitted to the grate.—E. S.

Ores; Concentrators for ——. J. F. C. Abelspies. Fr. Pat. 345,198, July 20, 1904.

The table represented in plan in the drawing is slightly inclined, so that the mud or pulp flowing upon it from the reservoir B is received by the groove C, and overflows to the next, and so on, whilst the stream of washing water drives the ore downwards, and, aided by a see-saw motion continuously imparted to the table, forms whirls on the way. The flow is also towards the edge of the table. The portions of the grooves marked C are only slightly inclined, whilst the parts marked c^1 make a descent of about 45° to the horizontal. At the lower edge of the table, the currents from the several grooves are kept apart by the guides D, the waste and the concentrate being directed into separate channels. The grooves are successively farther apart from the lowest to the highest part of the table.—E. S.



XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Electrolysis with Alternating Current. A. Brochet and J. Petit. Z. Elektrochem., 1904, **10**, 909—912.

The solubility of platinum under the action of alternating currents is ascribed to secondary chemical reaction between the finely divided metal thrown off from the cathode and the cyanide solution. Iron is dissolved under the influence of alternating current, but shows an anomalous behaviour. Increase of current density favours the reactions up to a limit when the solubility reaches its maximum value. Although higher frequency of the current generally decreases the chemical effect, this is not always the case. —R. S. H.

Barium Platinocyanide; Preparation of ——. A. Brochet and J. Petit. Z. Elektrochem., 1904, **10**, 922—924.

The authors find that the usual somewhat tedious chemical preparation of this salt can be greatly simplified by making use of the fact that platinum is soluble in barium cyanide under the influence of alternating current. With a current of 0·4 ampère per sq. cm., a P.D. of 5 volts, and an electrolyte containing 270 grms. barium cyanide per litre, they obtained a satisfactory product. About 8·0 K.W. hours are required per kilo. of the double salt. The product which is obtained by crystallisation does not at first possess the fluorescence necessary for its use for X-ray screens; but by recrystallisation from a solution containing cyanide, *e.g.*, barium cyanide, the small fluorescent crystals are readily obtained. (See also this J., 1904, 548.)—R. S. H.

Potassium Ferrocyanide; Influence of Anode on Electrolytic Oxidation of ——. A. Brochet and J. Petit. Comptes rend., 1904, **139**, 855—857.

In the electrolysis of potassium ferrocyanide there may appear at the anode not only potassium ferricyanide, but also hydroferrocyanic acid, the production of the latter involving escape of free oxygen, which is thus lost as far as the production of ferricyanide is concerned. If the ferrocyanogen ions can attack the anode, the metallic ferrocyanide is formed, and if this be insoluble, it forms a resisting coating and lessens the current or raises the potential difference in the cell. The authors have employed anodes of various materials, and divide them into five groups:—1. Those not forming metallic ferrocyanide (platinum, carbon); 2. Those slightly attacked, and giving fair yields (iron, cobalt, nickel); 3. Slightly attacked, but poor yields (lead, antimonial lead, tin); 4. Strongly attacked, but variable yields (copper, zinc, cadmium, mercury); 5. Those behaving as soluble anodes (magnesium, aluminium, silver). The yields vary from 75 per cent. of the theoretical (platinum), or 50 per cent. (iron), to none; and the physical condition of the anode is important, platinised platinum only yielding 45 per cent., for instance, against 75 per cent. for the polished metal. —J. T. D.

Transformer Oils. D. Holde. III., page 1206.

Copper; Electrolytic Determination of ——. A. Kufferath. XXIII., page 1239.

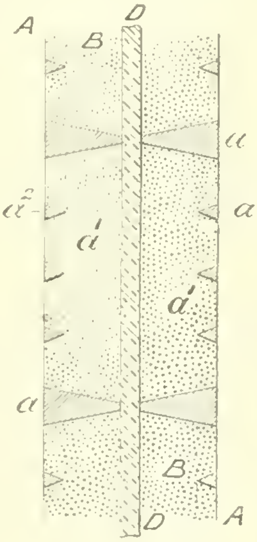
Stannic Oxide in Copper-Tin Alloys; Electrolytic Separation and Determination of ——. E. Heyn. XXIII., page 1239.

English Patents.

Batteries; Electric ——. P. J. Kamperdyk, New York. Eng. Pat. 214, Jan. 4, 1904.

Each cell has a central porous vessel of carbon, open at its upper and lower ends, and two similar lateral porous vessels, one side wall of each of the latter being formed by the corresponding wall of the outer receptacle. The porous vessels may be provided internally with a supporting metallic frame of wire. The bottoms of the vessels are closed by being embedded in a layer of suitable material on the base of the outer cell, and the porous vessels thus form the positive compartments, the positive electrodes consisting of carbon rods or balls in contact with non-oxidisable metal, or conductors coated with such a metal, or the balls may be threaded on the conductors. The negative electrodes of zinc may have an internal supporting framework of non-oxidisable metal, or wire covered with such a metal. Pipes are also embedded in the material closing the bottoms of the porous vessels, so as to make connection between the positive or between the negative compartments. A number of cells are in communication with feed reservoirs in such a way that the exciting and depolarising liquids may be fed into the cells, or withdrawn through waste pipes. For this purpose there is a system of communication between the cell compartments and the reservoirs, the system comprising two conduits, which may be rotated, and each is provided with three apertures, the latter being adapted so that two of them simultaneously coincide with ducts in connecting boxes. Tubes lead from the boxes to the cell compartments. Three-way cocks are inserted in the conduits, so that in one position of the latter the liquids are delivered from the reservoirs into the cell compartments, and in the second position the liquids are withdrawn through the waste pipes.—B. N.

Accumulators or Secondary Batteries. T. Peseatore. Manchester. Eng. Pat. 1036, Jan. 15, 1904.



Two plates, A, made of hard lead, are placed back to back, the space a^1 between the ribs a being filled with a composition B, composed of a mixture of active spongy material and an inert powder, he material being held in position by means of a network of cross ribs a^2. If necessary, a lead plate D may be placed between the plates A so as to increase he surface contact, and he plates are then bolted ogether. The material is maintained constantly in compression, and is prevented from expanding or welling, thus avoiding loss of conductivity from disintegration and separation of he particles of the material. —B. N.

Activity in Electrode Masses of Badly Conductive Metallic Oxides or Hydrates; A Method for Increasing the ——, in Accumulators with Invariable Electrolyte. E. W. Jungner, Norrköping, Sweden. Eng. Pat. 21,403, Oct. 5, 1904, under Internat. Conv., Oct. 31, 1903.

The method claimed consists in intimately mixing powdered lectrode masses of badly conducting oxides or hydrates hydroxides] with well pulverised "chemically pure black ead," and then mixing with pure crystalline graphite in the orm of flakes or scales, in order to increase the conductivity f the masses.—B. N.

Cells; Galvanic ——. R. Ziegenberg, Berlin. Eng. Pat. 21,913, Oct. 11, 1904.

Plates of peroxide of lead are first dried in a moderately eated atmosphere, and finally in a suitable vacuum apparatus. While the vessel is still exhausted, concentrated lphuric acid is admitted from below so as to cover the ates, and air is then allowed to enter from above in order drive the acid into the pores of the peroxide. The plates, charged with acid, are then placed in a suitable vessel with zinc plates, and water is added to form a galvanic cell. —B. N.

United States Patents.

Electrical Energy; Converting the Energy of Fuel into ——. H. Jone, Chicago, Ill. U.S. Pat. 775,472, Nov. 22, 1904.

A galvanic cell is constructed with a positive pole of metal, a negative pole consisting of a porous carbon vessel, which contains a metallic oxide as depolariser, and an alkali as electrolyte. The cell is maintained at an elevated temperature by means of the waste heat produced at other stages of the process; and electrical energy is generated by oxidation of the metal, the depolariser being simultaneously deoxidised. The oxidation product of the metal is then reduced to metal by introducing into the cell hot fuel gases from carbonaceous materials, or a reducing gas obtained from the fuel gases. Tin is mentioned as a suitable metal. and also those metals which generate hydrogen with alkali, which are capable of "acting as an acid towards alkali;" which form oxides that yield chiefly carbon dioxide in addition to metal when reduced by carbon, and which form lower and higher oxides. In the last-mentioned case, the oxidation is carried only to the formation of the lower oxide.—A. S.

Storage Battery Plates; Protective Coating or Covering for ——. A. Meygret, Paris. U.S. Pats. 776,192 and 776,480, Nov. 29, 1904.

See Eng. Pat. 1673 of 1903; this J., 1904, 119. The plates may also be coated with a mixture of cellulose tetracetate and tetrabutyrate, or with the latter alone.—T. F. B.

Furnace; Electric ——. R. Raddatz, Milwaukee, Wis. Assignor to Allis-Chalmers Co., N.J. U.S. Pat., 775,282, Nov. 15, 1904.

A travelling bed, adapted to support and carry forward the substance to be treated, is provided with a feeding device for delivering the material to the bed, and electrodes, with their ends brought within "arcing" distance, are arranged in proximity to the point at which the material is delivered. The negative electrode is relatively nearer, and the positive electrode farther from the feeding-inlet. Suitable mechanism imparts motion to the bed and feeding devices, and means are provided for varying the relative movements of these, in order that the feed and delivery may be accurately proportioned to the rate at which the material is reduced. The material is fed over an incline, and a hood extends from the bed over the proximate ends of the electrodes and upward over the inclined feed surfaces, whereby the waste heat from the arc and from the fused material is caused to act upon the incoming material. —B. N.

Electric Furnace. A. C. Higgins, Worcester, Mass. U.S. Pat. 775,654, Nov. 22, 1904.

The furnace consists of a base upon which is supported a removable, conical, unlined shell, forming the side walls of the furnace. Means are provided for lifting the shell, the furnace-charge being left entirely supported on the base. A stream of water is supplied at the top of the shell, and flows down the outer surface of the latter into a trough formed in the base, the cooling effect of the water causing the fused material within the furnace to form a lining on the inside of the shell.—A. S.

Gases; Apparatus for Electrically Treating ——. K. Birkeland, Christiania. U.S. Pat. 775,123, Nov. 15, 1904.

See Fr. Pat. 335,692 of 1903; this J., 1904, [illegible] —T. F. B.

Barium Hydrate; [Electrolytic] Manufacture of ——. F. Jahn, Ridley Park, Assignor to Harrison Bros. & Co. Philadelphia, Pa. U.S. Pat. 775,752, Nov. 22, 1904.

Barium sulphide solution is electrolysed "between electrodes of which the anode is larger than the cathode, with interposition of a porous partition, whereby some of the barium hydroxide is formed in the cathode compartment while the remainder and greater part is formed along with polysulphides in the solution in the anode compartment." The barium hydroxide is then recovered from the solution in the latter compartment.—E. S.

Paper Pulp; [Electrolytic] Production of ——. J. Kitsee. U.S. Pat. 775,829, Nov. 22, 1904. XIX., page 1233.

French Patents.

Heating Agglomerated Materials under Pressure; Furnace for ——. Galvanische-Metall-Papier-Fabrik Act.-Ges. Fr. Pat., 341,791, July 13, 1904. I., page 1203.

Foods, Flour, Milk, &c.; Process and Apparatus for Producing a Bleaching, Improving or Sterilising Agent for ——. The Ozonised Oxygen Co., Ltd. Fr. Pat. 341,914, July 18, 1904.

Air is passed through an ozoniser, and then quickly through a sparking apparatus, or *vice versâ.* The mixed gases produced are employed for treating the articles to be bleached or preserved. In the case of flour, the treatment may be carried out in the apparatus described in Eng. Pat. 21,971, 1898 (this J., 1899, 1045).—W. P. S.

(*B.*)—ELECTRO-METALLURGY.

Electric Furnaces; Bibliography of ——. First Period. Ad. Minet. Faraday Soc., June 2, 1904.

Laboratory Furnaces (1808—1886).

Original Furnaces.

Davy. Voltaic Arc. Phil. Trans., 1813. Cathode Furnace. Phil. Trans., 1807—1810.

Pepys. Resistance Furnace of the Sixth Class. Cementation of Iron. Phil. Trans., 1815, **105**, 370.

Napier. Cathode Furnace. Treatment of Copper Ores. Eng. Pat. 10,362 of 1844; 684 of 1845. Houston, J. Franklin Inst., 1889, **125**, 376.

Electro-metallurgy of Aluminium.

Davy. Electrolysis of Alumina. Phil. Trans., 1808.

Monckton. Mixed Furnace, solid resistance at first, then liquid in course of operation. Eng. Pat. 264 of 1862.

Bunsen. Electrolysis of Fused Salts. Current Density. Conditions of the mass relatively to the elements constituting the electrolyte. Pogg. Annalen, 1854, **92**, and **94**, 612.

Deville (Henry Ste. Claire). Carbon and Aluminium Electrodes. Ann. de Chim., 1854, **43**, 27. Aluminium, Paris, 1859, 95.

Le Chatelier. Carbon and Aluminium Electrodes. Eng. Pat. 1214 of 1861.

Gaudin. Cryolite and Sodium Chloride. Monit. Scient., **12**, 62, according to Richards (Aluminium, 2nd Ed., London, 1890).

Kagenbuch. Clay with Flux and Zinc. Eng. Pat. 4811 of 1872.

Berthaut. Same process as Deville. Eng. Pat. 48,011 of 1879.

Graetzel. Fused Chlorides and Fluorides. Crucible as Cathode. Reducing Gas. Ger. Pat. 26,962 of 1883.

Boguski-Zdziarski. Followed Graetzel's process (1884).

Farmer. Cathode Crucible without Cover (1885).

Grousilliers. Closed Vessel under Pressure. Ger. Pat. 3[illegible],407 of 1885.

Grabau. Special Furnace Ger. Pat. 45,012 of 1886.

Electro-metallurgy of Magnesium.

Bunsen. Fused Magnesium Chloride. Liebig's Annalen, 1852, **82**, 137.

Matthiessen. Double Salt of Magnesium and Potassium. J. Chem. Soc., **8**, 107.

Liebig. Application of Bunsen's Process (1852—1854). Borchers, Electro-metallurgy, Fr. Ed., 1896, 19.

Berthaut. Magnesium Chloride, Electrodes of Carbon and Magnesium. Eng. Pat. 4087 of 1879.

Gorup-Besanez. Double Chloride of Magnesium and Potassium. Lehrb. der anorg. Chem., 4th Ed., 517. Brunswick (1871).

F. Fischer. First Apparatus: Dingler's Polyt. J., 1882, **246**, 28. Second Apparatus: Wagner-Fischer's Jahresb. der Chem. Techn., 1884, 1337. Handb. der Chem. Techn., 14th Ed., 344. Leipzig (1893).

Graetzel. Double Fluorides and Chlorides, Cathode Crucible, Reducing Gas. Ger. Pat. 26,962 of 1883.

Electro-metallurgy of Lithium.

Bunsen and Matthiessen. Fused Chlorides. Liebig's Annalen, 1855, **94**, 107.

Troost. Cast Crucible. Comptes rend., 1856, **43**, 921. Ann. de Chim. Phys., 1856, **41**, 112.

Hiller. Reducing Gas. Lehrb. der Chem., Leipzig (1863)

Grabau. Special Furnace. Ger. Pat. 41,494 of 1887.

Electro-metallurgy of Sodium.

Davy. Electrolysis of Alkaline Hydrates. Phil. Trans 1807—1810.

Watt. Sodium Chloride. Eng. Pat. 13,755 of 1851.

Jobloehkoff. Sodium Chloride. Dingler's Polyt. J., 1884 **251**, 422.

Hoepfner. Apparatus. Ger. Pat. 30,414 of 1881.

Rogers. Preparation on a large scale. U.S. Pat. 296,357 of 1884.

Omolt. Preparation on a large scale. Ger. Pat, 34,727 of 1885.

F. Fischer. Wagner-Fischer's Jahresb., 1886, 222.

Electro-metallurgy of Potassium.

Davy. Electrolysis of Alkaline Hydrates. Phil. Trans., 1807—1810.

Matthiessen. Potassium and Calcium Chlorides. Liebig's Annalen, 1855, **93**, 277.

Linnemann. Fused Cyanide of Potassium. J. prakt. Chem., 1848, **73**, 425.

Calcium, Strontium, and Barium.

Davy. Electrolysis of Earthy-Alkaline Hydrates. Phil. Trans., 1807—1810.

Bunsen and Matthiessen. Electrolysis of Earthy-Alkaline Chlorides. Matthiessen, Liebig's Annalen, 1855, **93**. 277; Bunsen, Current Density, Pogg. Annalen, 1854, **91**, 619.

Matthiessen. Strontium. Liebig-Kopp's Jahresb., 1855. 323; J. Chem. Soc., **8**, 107; Chemie de Gmelin-Kraut. Handb. der anorg. Chem., **2**, 255, Heidelberg, 1886.

Feldmann, A. Strontium. Ger. Pat. 50,370. Borchers, Electro-metallurgy, 90.

Miscellaneous Furnaces.

Despretz. Arc and Resistance Furnaces. Comptes rend. 1849, **29**.

Pichon. Arc Furnace, Fusion of Minerals in 1853, according to Andreoli (Industries, 1893).

Johnson. Arc Furnaces, Fusion of Minerals, 1853. Eng Pat. 700 of 1859; Cowles, Eng. Pat. 4004 of 1887.

Berthelot. Synthesis of Acetylene and Hydrocarbons 1851—1901. Berthelot, Experimental Researches Gauthier Villars, Paris, 1901.

Siemens. Arc and Cathode Furnaces, Fusion of Metals Eng. Pats. 1878 and 2110 of 1879.

Huntington. Co-worker with Siemens in the researches or the Fusion of Metals. Minet, Traité d'Electrométallurgie, 275.

Clerc, Louis. Arc Furnace, Sun Lamp, Fusion of Lime Fr. Pat. 1880; Bel. Pat. 144,397 of 1881.

Borchers. Resistance Furnace, Third Class. Reduction o Refractory Oxides, 1880. Production of Calcium Carbide. Borchers, Electro-metallurgy. 1st Fr. Ed. 1896; 2nd Ger. Ed., 1894.

Menges. Arc Furnace. Ger. Pat. 40,354 of 1886.
Kleiner-Tiertz. Arc Furnace. Ger. Pat. 12,022 of 1886.
Gerard-Lecuyer. Arc Furnace. Ger. Pat. 14,511 of 1886.
Rogerson, Statter, and Stevenson. Arc directed by Magnetism. Fr. Pat. 183,987 of 1886.
Farmer, G. Arc Furnace. Minet, Traité d'Electrométallurgie, 336.

Electrolytic Winning of Metals from Ores with Insoluble Anodes. St. Laszczynski. Elektrochem.-Zeit., 1904, **11**, 54—56.

In order to do away with the necessity of an ordinary diaphragm and at the same time overcome the difficulties due to oxidation at the anode, the author recommends a special cell for such electrolytic work. The essential peculiarity lies in closely surrounding the anode with a thick texture which hinders the diffusion of the ferrous and other oxidisable salts to the anode.—R. S. H.

Lead-Tin Alloys; Separation of Tin from Lead in ——. L. Peetz. Metallurgie, 1904, **1**, 281—297, and 336—345. Science Abstr., A. 1904, **7**, 931.

Attempts were made to remove the lead from lead-tin lloys by means of molten stannous chloride, or its double salts with alkali chlorides Stannous chloride and its louble salts are completely decomposed by lead, the rate of lecomposition increasing with rise of temperature, but the lecomposition is not complete in the case of lead-tin alloys, a state of equilibrium being reached. The losses of tin by volatilisation render the process useless practically. Tin an be separated from tin-lead alloys electrolytically by means of lead oxide in alkaline solution, alkali stannate being formed; the separation is possible in three days, using a temperature of 35° C. The alloy is best used in plates 1 mm. thick, in which case no loss of tin occurs.
—T. F. B.

English Patent.

Water-jackets, Casings and the like; Manufacture of —— by Electrolytic means. A. F. Bosquet, Paris. Eng. Pat. 20,896, Sept. 28, 1904.

HIS invention relates to the manufacture of jackets, asings, &c., for the cylinders of explosion motors. The ylinder is provided with grooves for the reception of the acket edges, the grooves being produced during the casting f the cylinder and afterwards treated with a sand jet. The acket is formed of copper deposited from an ordinary lectrolytic bath, after a preliminary coating from a bath of opper cyanide, the metal being deposited in the grooves nd on a material, cast on the cylinder, which is fusible at a omparatively low temperature. The cylinder is afterwards laced in hot water or steam to melt the fusible metal, and hus leave a cavity for the circulation of water.—B. N.

antalum Metal; Purification of ——. Siemens und Halske Akt., Berlin. Eng. Pat. 21,766, Oct. 10, 1904. Under Internat. Conv., Oct. 15, 1903.

MPURE metallic tantalum powder is compressed into a r or mass, which is heated electrically in a crucible of agnesia or thoria, lined with tantalum metal, a bar of he same being used as cathode. The apparatus is enclosed n a glass chamber in which a vacuum is maintained.
—E. S.

United States Patents.

old; Extracting —— from Ores [Cyanide Process]. H. R. Cassel, London. U.S. Pat. 775,597, Nov. 22, 1904.

HE powdered ore is agitated with a solution containing a anide and a haloid salt (a bromide or chloride of a itable base) and the gold present is gradually and connuously transformed into a soluble cyanide by passage of n electric current at a stated high density. From the lution separated from the ore, the gold is precipitated d the haloid salt recovered, and to the residual solution a anide is added to fit it for re-use. Compare U.S. Pats. 2,708 and 732,709 of 1903; and 769,938 and 774,349 of 04; this J., 1903, 915, and 1904, 939, 1151.—E. S.

Electrically Treating Materials; Method of ——. W. S. Franklin. Assignor to F. Conlin, both of Bethlehem, Pa. U.S. Pat. 775,031, Nov. 15, 1904.

The electric current is passed between electrodes, arranged within a chamber, and through molten slag which partially fills the chamber. The distance between the electrodes is caused to vary continuously so that an arc is formed at intervals between the upper electrode and the slag. The material is fed into the top of the chamber, first passing through the arc and then through the slag.—B. N.

Aluminium or other Metals; Process of Reducing ——. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 775,060, Nov. 15, 1904.

An oxygen compound or oxide of a metal, or metals, such as lithium and calcium, is maintained in a state of fusion, and an oxygen compound or oxide of a metal, such as aluminium, and having a less affinity for oxygen, is added to the fused mass. On passing an electric current, the metal with the lesser affinity for oxygen is liberated, an anode being used which will combine with the disengaged oxygen. The bath is replenished from time to time with the oxygen compound of the metal which is being liberated. The fusion of the mass may be maintained by an alternating current which does not yield metal, and by the simultaneous action of a direct current, the metal may be liberated at a temperature below the normal melting point of the oxide of the metal.—B. N.

French Patents.

Electric Furnace. P. Girod. Addition, dated July 4, 1904, to Fr. Pat. 329,822 of Feb. 28, 1903 (this J., 1903, 1054).

The modification claimed in the present addition has for its object the circulation of the current through the largest possible portion of the available space of the furnace, and consists in separating the heating resistance into a number of circuits, arranged in any desired manner.—A. S.

Electric Furnace intended for the Transformation of Cast Iron into Steel. G. H. Gin. First Addition, dated Aug. 3, 1904, to Fr. Pat. 342,101 of March 30, 1904 (this J., 1904, 904).

The main patent, relating to the refining of molten iron by running it into a gutter repeatedly curved upon itself, constituting the resistance in an electric circuit, is now supplemented in certain respects. The electrothermic heating of the metals and alloys is kept separate from the purifying reactions, in effecting the former mainly whilst the metal is in channels of small section, and the latter, whilst it is in basins successively reunited by the passing of the current along the heated channels. Thus, the current in traversing the metal flowing in narrow sections heats it more highly than the metal which is traversing broad sections, or in re-united sections, such as may be made by merging some of the intervening section walls.

The narrow heating channels for the flow of the metal, are caused to start immediately from the steel masses which serve as poles to the current. These masses are cooled by a "peripheral" current of water. The bases of these blocks are guarded by cylindrical envelopes of bronze or of copper containing phosphorus, cooled by interior water circulation, to ensure electrical contact with the conductors, and reduce to a minimum the self-induction of the current.—E. S.

Zinc; Process for extracting —— Electrolytically from Sulphate Solutions. Siemens und Halske Akt.-Ges. Fr. Pat. 345,154, July 27, 1904. Under Internat. Conv., Nov. 20, 1903.

See Eng. Pat. 16,396 of 1904; this J., 1904, 1098.
—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

Paraffin Wax; Admixture of —— with Substances of Higher Melting Point. [*Candle Making.*] E. Graefe. III., page 1206.

English Patents.

Waste Oil Filter. S. H. H. Barratt and the United Asbestos Co., Ltd., London. Eng. Pat., 21,452, Oct. 6, 1904.

This apparatus consists of a vessel divided into two or more compartments by means of vertical or nearly vertical partitions. A filtering medium of woven fabric, asbestos, &c., is stretched, across a grid placed over a hollow frame, in the partition, whilst a porous filtering mass within the frame is kept in position by means of a second grid (which may also be covered with a woven fabric), the pressure of which can be regulated by means of a screw or other device. The waste oil introduced through a strainer into one compartment, passes horizontally through the filtering media into the other compartment or compartments, so that there is but little accumulation of impurities on the filter.
—C. A. M.

Oil and the like; Apparatus for Purifying——. C. A. Koellner, Neumühlen, Germany. Eng. Pat. 22,238, Oct. 15, 1904.

This apparatus, intended for the filtration of viscous oil, engine grease, etc., consists of two superposed chambers each of which contains filtering sheets kept apart by means of bars, frames, etc., and kept in position by means of a screw or other device. The oil enters at the bottom of the upper chamber, rises through the filter, and is then conducted to the top of the lower chamber through the filter, in which it passes downwards. The passage connecting the two chambers may be provided with a cover and observation window, and may end in a shoot to conduct the oil towards the middle of the top of the lower filter.—C. A. M.

Soap Preparations for use in Preventing Poisoning by Compounds of Lead, Copper, Arsenic, Mercury and other Metals; Process for making——. F Nusch, London. From Chem. Werke G. m. b. H., vorm. C. Zerbe, Freiburg in Baden. Eng. Pat. 18,152, Aug. 22. 1904.

The ready decomposition on contact with air of soaps containing "sulphuretted alkali and hydrothionic acid," is prevented by coating the preparation with paraffin, soluble glass (alkali silicate), or the like, whilst the stability of the soap is increased by the addition to its ingredients of a substance such as vaseline, to counteract the influence of the air. (Compare Fr. Pat. 341,159 of 1904; this J., 1904, 829.)—C. A. M.

French Patents.

Petroleum or Gasoline Soap, and Process for Manufacturing the same. L. A. Lebreton-Deshayes. Fr. Pat. 339,061, Sept. 29, 1903.

Thirty-two kilos. of petroleum or gasoline, previously agitated with 16 kilos. of caustic soda lye, are stirred into 20 kilos. of melted animal or vegetable fat, and then 24 kilos. of caustic soda lye are added, with stirring. The soap is run into a suitable mould, which is transferred to a room heated to about 30° C. for about 24 hours, to complete the saponification.—T. F. B.

Soap; Manufacture of Neutral——, *Keeping its Neutrality during Hydrolysis.* P. Horn. Fr. Pat. 345,185, Aug. 11, 1904.

Products of the artificial digestion of albuminoids with acids or alkalis ("albuminoses") are introduced into the soap, with the object of combining with free alkali already present or liberated during the hydrolysis of the soap by water.—C. A. M.

Soap Preparation for use as Protection against Lead Poisoning; Process for making a——. Chem. Werke Ges. m. b. H., vorm. Dr. C. Zerbe. First Addition, dated Aug. 13, 1904, to Fr. Pat. 341,159, Feb. 25, 1904.

See Eng. Pat. 18,152 of 1904; preceding these.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

United States Patents.

Paint Composition. W. A. Hall, Bellows Falls, Vermont. U.S. Pat. 775,919, Nov. 29, 1904.

See Eng. Pat. 26,903 of 1903; this J., 1904, 328. T. F. B.

Oil Colour. M. Hérisson. Addition, dated July 28, 1904, to Fr. Pat. 337,440, Dec. 5, 1903. (See this J., 1904, 495.)

The oil colour claimed in the main patent (*loc. cit.*) can be advantageously used in place of red lead, for a first coating on iron. The pigment is improved by decreasing the amount of barium chloride, and increasing that of zinc white, and it should be coloured by adding a little red ochre.
—M. J. S.

(*B.*)—RESINS, VARNISHES.

United States Patents.

Citrus Fruits; Process of Extracting Oleo-resin from the Peel of——. E. J. Sheenan, Assignor to San Gabriel Valley Essential Oil Co. U.S. Pat. 775,502, Nov. 22, 1904. XX., page 1237.

Citrus Fruits; Oleo-resinous Product from——. E. J. Sheenan, Assignor to San Gabriel Valley Essential Oil Co. U.S. Pat. 775,546, Nov. 22, 1904. XX., page 1237.

French Patents.

Amber; Process for Utilising Waste Yellow——. H. Thiemann. Fr. Pat. 345,196, July 15, 1904.

Amber powder, turnings, and other waste are treated with chloroform, so as to obtain the soft α- and β-resins free from impurities. The addition of these resins to copal or amber of low quality produces a mixture suitable for the manfacture of ambroïde. Addition of a small quanity of succinic acid causes a cloudiness, by which the resemblance of the product to natural yellow amber is enhanced.—M. J. S.

(*C.*)—INDIA-RUBBER, &c.

Latex of Castilloa Elastica. A. W. K. de Jong. Ber., 1904, **37**, 4398—4399.

The substance which retards the coagulation of the latex of *Castilloa elastica* (this J., 1904, 990) has been found to be of an albuminoid character. It is precipitated by alcohol and acetone, but not by acetic acid, and its action is probably due to the adherence of the precipitate to the particles of caoutchouc, thus reducing the cohesive power of the latter. The author has also succeeded in detecting in the latex the presence of a tannic acid (calcium salt, $C_{31}H_{58}O_{20}Ca$), an acid, $(C_{17}H_{30}O_{10})_x$, potassium chloride, a sugar (m. pt. of osazone, about 200° C.), and a compound the neutral solution of which is coloured green.—A. S.

French Patents.

[Rubber] Latex; Process and Apparatus for the Treatment of——. P. F. E. Christiaens. Fr. Pat. 345,020, July 22, 1904.

The latex is mixed with water and passed first through gauze tissue of fairly wide mesh to remove leaves, dirt, &c.; and then through one or two stretched cloths previously coated or sprinkled with a coagulating agent. The apparatus consists of three frames fitted one within the other, between the ends of which the cloths are stretched. The outer and inner frames are without bottoms, but the middle one has an openwork bottom of laths or bamboo.—A. S.

Vulcanised Rubber Waste; Regenerating——. A. Kittel. Fr. Pat. 344,734, July 9, 1904.

The rubber waste is cut up into small pieces and incorporated with a dry powdered alkali capable of uniting with the sulphur. The mixture is pressed, heated for 2—3 hours at 220°—280° C., and then treated in the usual manner. In the case of waste containing a large proportion of loading material, powdered rosin may be added with the alkali. —A. S.

XIV.—TANNING; LEATHER, GLUE, SIZE.

Tannin Extracts; Note on the Behaviour of Sulphites in ——. R. Lepetit and C. C. Satta. Collegium, 1904, 311—313, 317—324.

The results of a series of experiments on tannin extracts containing sulphites, lead the authors to confirm Parker and Gansser's view (this J., 1901, 1085), that such extracts have no injurious action on leather. It was found that in an extract of quebracho treated with bisulphite, a fairly large proportion of sulphate was always formed by oxidation, but only very little free sulphuric acid.—F. D. T.

Tannin Matters; Note on the Analysis of ——. R. Lepetit. Collegium, 1904, 305—311.

The author criticises the present official method of analysis, in that it does not take sufficient account of the values of "non tannins," and takes no account of "insolubles," notwithstanding the fact that the latter include the phlobaphenes which enter largely into the composition of leather. The figures of analysis would be more exact if, instead of bringing the result to a hundred by obtaining one of the percentages by subtraction, the various determinations were all made direct.

A comparison of analyses of similar extracts made by several chemists last year showed considerable differences, although the same hide powder was used. The variations were evidently due not only to differences of manipulation, but also to the fact that insufficient care was taken when the samples were drawn. The author recently drew samples with great care from about two kilos of liquid extract, and also from dry extracts, which latter he pounded up finely and then passed through two sieves. Comparative analyses by several members of the I.A.L.T.C. showed then considerably less variation than in the case above cited. The author does not think it advisable to adopt, without restriction, the rule that all tannin solutions must be filtered before analysis, as many tanners rightly demand that there should be a certain quantity of insoluble matter present. In view of the increasing importance of extracts known as "soluble in the cold," the author proposes that the Congress should settle what the maximum amount of insoluble matter in these extracts should be.—F. D. T.

Gelatin; Setting and Swelling of ——. P. v. Schroeder. Z. Phys. Chem., 1903, **45**, 75—117. Science Abstr. A., 1904, **7**, 914.

By heating a solution of gelatin at 100° C., its viscosity, measured at 25° C., gradually decreases to a constant minimum; this change is attributed to hydrolysis, and is accelerated by both hydrogen and hydroxyl ions (*i.e.*, by addition both of acid and alkali), the final viscosities thus reached being lower than that obtained with a pure gelatin solution. The sulphates and chlorides of potassium, sodium, and ammonium, sodium nitrate, and the chlorides and sulphates of lithium and magnesium all increase the viscosity of gelatin solutions, the greatest increase being produced by magnesium salts. The vapour pressure of gelatin, after soaking in water, is found to be greater than that of water at the same temperature.—T. F. B.

Colloids [Gelatin, &c.]; Solution and Swelling of ——. K. Spiro. Beitr. Chem. Physiol. Path., 1904, **5**, 276—296. Science Abstr., 1904, A, **7**, 922—923.

The swelling of gelatin is considerably accelerated by hydrogen and hydroxyl ions (see von Schroeder, preceding abstract), and also by colloidal ferric hydroxide, even in presence of a substance such as dextrose. With a 3 per cent. solution of dextrose, the maximum swelling of gelatin is produced; with a 25 per cent. solution, no water is absorbed, whilst with more concentrated solutions, the gelatin loses water and shrinks. Other substances, such as plates of agar, are not affected in the same way as gelatin. In a colloidal ferric hydroxide solution, obtained by prolonged dialysis (which contains an appreciable amount of chlorine), part of the substance is undoubtedly present in true solution, but the greater part is merely in suspension. Gelatin is affected less by dialysed than by "commercial" solutions of colloidal ferric hydroxide. The formation of a colloidal solution appears to require the presence of a small amount of an electrolyte.—T. F. B.

Nitrogenous Refuse [Leather Waste, &c.] and Waste Sulphuric Acid; Simultaneous Utilisation of ——. E. Donath. XV., page 1228.

English Patent.

Tanning Leather; Process of and Apparatus for ——. H. de Marneffe, Liège, Belgium. Eng. Pat. 22,395, Oct. 18, 1904.

See Fr. Pat. 339,428 of 1904; this J., 1904, 720.—T. F. B.

United States Patents.

Hides; Machine for Applying Colouring Matter to ——. R. W. Churchill. U.S. Pat. 774,935, Nov. 15, 1904. VI., page 1213.

Leather; Process of Treating [Waterproofing] ——. P. Magnus, Collingwood, Victoria. U.S. Pat. 775,839, Nov. 22, 1904.

See Fr. Pat. 331,239 of 1903; this J., 1903, 1140.—T. F. B.

French Patents.

Tannin Extracts; Process for the Clarifying of ——. Soc. des Extraits de Chêne en Russe. Fr. Pat. 339,064. Sept. 25, 1903.

The tannin liquors are treated with finely-pulverised neutral bodies such as sand, clay, kaolin or barium sulphate. The latter carry down insoluble matters in suspension, thereby rendering the extracts clear.—F. D. T.

Skins; Process for the Tanning of ——. E. L. Alilaire. Fr. Pat. 345,002, July 21, 1904.

The skins are tanned with liquors extracted from peat. It is claimed that skins so treated are especially supple and strong.—F. D. T.

Leather; Artificial ——, *and Method of Making the same.* J. B. Granjon and J. F. J. Berchet. Addition, dated Aug. 5, 1904, to Fr. Pat. 343,704, June 4, 1904 (this J., 1904, 1036).

The artificial leather prepared according to the process described in the main patent, is coated (before the tar is quite dry) on one or both sides with a sheet of paper, cardboard, textile fabric, or metal.—A. S.

Size Glue; Manufacture of a Special ——. C. Vierue and F. Kowachiche. Fr. Pat. 339,098, Oct. 14, 1903.

From 1—20 per cent. of zinc oxide is added to the hot solution of glue, and after well agitating, the liquor is passed through a sieve and cooled in moulds. It is claimed that the resulting glue, which is white and opaque, has a tensile breaking strength 20 per cent. greater than that of ordinary glue, whilst size prepared from it has a resistance to moisture, 30 per cent greater than ordinary glue size.—A. S.

XV.—MANURES, Etc.

Calcium Phosphates; Action of Water on the ——. F. K. Cameron and A. Seidell. J. Amer. Chem. Soc., 1904, **26**, 1454—1463.

Both tricalcium phosphate and monocalcium phosphate are considerably hydrolysed and decomposed by the action of water. In both cases, the amount of decomposition and the concentration of the resulting solution at the temperature employed in the authors' experiments (25° C.), is dependent on the ratio between the amounts of solid phosphate and water. Dicalcium phosphate, however, is only slightly decomposed by water and appears to dissolve mainly as such, so that it is the only phosphate of calcium stable in water under ordinary conditions.

The presence of calcium sulphate slightly increases the phosphoric acid dissolved from tricalcium phosphate, produces probably a slight increase with the monocalcium salt, but a marked decrease with dicalcium phosphate; calcium carbonate diminishes the phosphoric acid dissolved from all three phosphates. Carbon dioxide increases the phosphoric acid dissolved from tri- or di-calcium phosphate, but is without apparent effect on the action of water on the monocalcium salt.—T. H. P.

Lignite-tar Distilleries; Use of Waste Liquors from —— as Manure. F. Strube. Z. angew. Chem., 1904, **17**, 1787.

In spite of repeated trials, no method of treatment for these waste liquors has yet been found which will render them inoffensive at a practicable cost; usually they are diluted by being run into neighbouring streams. The author has, however, successfully applied them for manurial purposes. Two portions of land were treated similarly in all respects save that one was regularly sprinkled, by means of spray-diffusers, with these waste liquors, and the other not. The yield of oats on the sprinkled portion was represented by the figures 44·5 grain, 79·0 straw, 11·0 chaff, while the corresponding figures for the other portion were 38·0, 61·5, 8·0; the grain from the sprinkled portion contained 2·13 per cent. of nitrogen, that from the other 1·67 per cent., so that the total yields of nitrogen from the two portions were very nearly in the ratio of 3 to 2. -J. T. D.

Nitrogenous Refuse [Leather Waste, &c.] and Waste Sulphuric Acid [from Petroleum Refining]; Simultaneous Utilisation of ——. E. Donath. Chem.-Zeit., 1904, **28**, 1153—1154.

When nitrogenous substances such as leather, wool, hair, horn, &c., are heated at about 300° C. with 30—50 per cent. of sulphuric acid and afterwards extracted with water, considerable amounts of ammonium sulphate are obtained, whilst the carbonised residues, according to the nature of the substance employed, may be utilised as a decolorising agent, or, if unsuitable for this purpose, may be utilised for the production of potassium ferrocyanide. For the first operation it is proposed to employ waste sulphuric acid from the purification of petroleum. In an experiment in which leather meal (220 grms.) was treated with sulphuric acid, 3·36 grms. of ammonia were obtained; and of the total nitrogen only 2·5 per cent. was lost. In another experiment, however, the loss was much greater. The carbonised residues contained from 4 to 10 per cent. of nitrogen.—N. H. J. M.

English Patent.

Fertiliser or Manure; Manufacture of ——. H. Myers, Burton-on-Trent. Eng. Pat. 494, Jan. 8, 1904.

Claim is made for a mixture consisting of pressed brewers' yeast (20 to 30 parts), oak sawdust (15 to 20 parts), powdered lime (25 parts), bone dust (10 to 20 parts), basic slag (10 parts), and sodium sulphate (10 parts). After blending, the mixture is passed through a revolving cylindrical wire riddle.—C. A. M.

XVI.—SUGAR, STARCH, GUM, Etc.

[Sugar]; Carbonating and Systematic Washing of Filter-press Scums. A. Aulard. Bull. Assoc. Chim. Sucr. et Dist., 1904, **22**, 299—312.

In order to secure perfect washing of filter-press scums, the juice must have been well treated with lime, and the first carbonating carried out at about 70° C. The pressure at the filter-presses should not exceed two atmospheres. The water used, is the ammoniacal water from the third and fourth bodies of the multiple effect, cooled to 45°—50° C. It should be put into the press at from 1 to 1·5 atmospheres pressure. When the presses are not arranged for absolute displacement of the juice as in those of the Fives-Lille Co., and there is consequent mixing of water and juice, it is of advantage to return part to serve as water of displacement for the succeeding operation. For liming, sufficient water only should be used to bring the slaked lime to from 32° to 34° B. There is no reason against the use of a dense milk of lime when the mixing of the diffusion juice in the cold with lime lasts at least an hour.—L. J. de W.

Sugar Solutions; Boiling Points of Pure and Impure ——. H. Claassen. Zeits. Ver. Deutsch. Zuckerind., 1904, **54**. 1159. (See this J., 1904, 1105.)

Sugar or Dry Solids.	Boiling Points of Pure Sugar Solutions.			Rise in the Boiling Point in ° C. for a Purity of— (Claassen and Hermann.)				
	Gerlach.	Flourens.	Claassen and Frentzel.	100.	93.	83.	73.	62.
Per Cent.								
5	..	..	..	0·05	0·05	0·05	0·05	0·05
10	100·4	100·1	100·1	0·1	0·1	0·1	0·15	0·2
15	..	..	..	0·2	0·2	0·25	0·25	0·35
20	100·6	100·3	100·3	0·3	0·3	9·35	0·40	0·5
25	..	..	..	9·45	0·45	0·5	0·6	0·75
30	101·0	100·6	100·6	0·6	0·65	0·7	0·85	1·1
35	..	..	..	0·8	0·85	1·0	1·2	1·5
40	101·5	101·1	191·1	1·05	1·15	1·35	1·6	1·95
45	..	..	..	1·4	1·55	1·75	2·1	2·5
50	102·0	101·9	101·9	1·8	2·0	2·25	2·7	3·15
55	..	..	..	2·3	2·6	3·0	3·5	4·0
60	103·0	103·1	103·0	3·0	3·3	3·8	4·5	5·0
65	..	..	..	3·8	4·25	4·8	5·6	6·2
70	106·5	105·3	105·3	5·1	5·4	6·2	7·0	8·0
75	109·0	107·4	107·3	7·0	7·3	8·5	9·2	10·3
80	112·2	110·4	..	9·4	10·0	11·4	12·2	13·6
85	117·5	114·9	..	13·0	13·4	15·9	16·9	18·2
90	127·0	122·6	..	19·6	(20·0)	(22·0)	24·7	26·9
92	..	127·9	..	24·0	..	..	..	..
94	..	..	..	30·5	..	..	..	..

—L. J. de W.

Sugar in Solutions of Tannin; Presence of ——. H. Nové. Bull. Assoc. Chim. Sucr. et Dist., 1904, **22**, 325—326.

The author finds that alcoholic solutions of tannin, frequently used along with lead acetate to clarify and decolorise sugar solutions for polariscope readings, especially after being kept some time, may contain dextrose and consequently affect the accuracy of the results. The natural glucosides present in some tannins are decomposed into dextrose and gallic acid. The use of concentrated solutions of tannin is therefore condemned.—L. J. de W.

Starch-Glucose Syrups prepared by Hydrochloric Acid; Suitability of —— for Confectionery. E. Preuss. Z. Spiritusind., 1904, **27**, 478.

Glucose which has been prepared with hydrochloric acid, as the American confectioners' glucose is, must never be neutralised with chalk, but always with sodium carbonate. The author has ascertained experimentally that the resulting sodium chloride is without any inverting action upon the cane sugar in the process of boiling confectionery. The proper use of sodium carbonate also decomposes any calcium chloride which may be produced by the action of the acid upon the ash of the starch; well neutralised syrups never contain calcium chloride. Further, the author shows that it is not necessary to use higher temperatures when converting with hydrochloric acid, than when sulphuric acid is employed. In practical work a temperature of 120°—130° C. or a pressure of one atmosphere is never exceeded, on account of the danger of reversion. Syrups properly prepared with hydrochloric acid are no less suitable for confectionery than those made with sulphuric acid, and any defects observed are really attributable to the presence of abnormal products due to conversion at excessively high temperatures or to incorrect neutralisation, filtration, or decolorisation.—J. F. B.

Aldoses; Separation of —— by Secondary Hydrazines. R. Ofner. Ber., 1904, **37**, 4399—4402. (See also this J., 1904, 993.)

The author has succeeded in preparing in acetic acid solution the methylphenylhydrazones of dextrose and xylose, and the benzylphenylhydrazone of xylose, although hitherto it has only been possible to produce these derivatives from neutral solutions. The following is the method adopted for the preparation of the methylphenylhydrazone of dextrose. Two grms. of dextrose are well mixed with 5 c.c. of 50 per cent. acetic acid, 1·8 grms. of methylphenylhydrazine are added, and the mixture is allowed to stand at the ordinary temperature in a closed flask with occasional shaking. The whole of the sugar gradually passes into solution, and from the deep red liquid, the hydrazone separates after about two hours in the form of colourless needles. After a further hour, the crystalline mass is repeatedly digested with ether, pressed on an earthenware plate and re-crystallised from alcohol. The yield of pure hydrazone is 50 per cent of the theoretical amount.—A. S.

Beetroots; Direct Determination of Sugar in ——. Non-Influence of Air on the Results. H. and L. Pellet. XXIII., page 1241.

Beetroot Juice; Determination of the Purity of ——. H. Schulz. XXIII., page 1241.

Maple Syrup and Maple Sugar; Composition, Analysis and Adulteration of ——. J. Hortvet. XXIII., page 1241.

Denaturing Sugar for Use in the Brewery; Directions for ——. XVII., page 1230.

Sugars; Reaction of Aldehydic ——. A. Berg. XXIII., page 1240.

Starch-containing Materials; Method of Distinguishing between Different —— by means of Iodine Vapour. A. Dubosc. XXIII., page 1240.

English Patents.

Achroo-Dextrin; Manufacture of —— [from Peat]. G. Reynaud, Paris. Eng. Pat. 4792, Feb. 26, 1904.

See U.S. Pat. 761,542 of 1904; this J., 1904, 721.—T. F. B.

French Patents.

Beet Sugar; Process for Manufacturing ——. M. Roeseler, A. Schaer, and H. W. Hinze. Fr. Pat. 345,299, Aug. 1, 1904.

See U.S. Pat. 770,700 of 1904; this J., 1904, 994.—T. F. B.

Sugar or Diffusion Juices; Purification of Crude ——. Vve. H. Breyer (*née* Mitterbacher) and A. J. von Wehrstedt. Fr. Pat. 345,463, Aug. 8, 1904.

An intimate mixture, consisting of two parts of calcium hydroxide with one part of powdered brick, is added to the crude sugar juice at a temperature of 80° C. in the proportion of 2·5 to 3·0 per cent. on the weight of the beetroots. The mixture is agitated mechanically, whilst it is saturated with carbon dioxide.—J. F. B.

Sugar; Rapid and Economical Process of Refining ——. J. B. L. Aurientis and R. Fontenilles Fr. Pat. 345,261, July 26, 1904.

Sugar of the quality known as No. 3 or "extra," is melted with water in such proportions and at such a temperature that the syrup, after cooling to about 30° C., contains at least 60 per cent. of refined crystals produced by suitable "malaxage." The syrup drained off from this mass is utilised for melting a second batch of sugar, with the addition of the necessary quantity of water. When the drained syrups become too highly coloured, they are decolourised and returned for re-melting. Any concentration of the syrups is avoided. The crystallised refined mass is drained in the centrifugal machines, mixed with hot, saturated, "clairce" syrup, and moulded in any suitable manner. The refuse from the moulded sugar is remelted.—J. F. B.

Viscous Materials [Molasses]: Apparatus for Drawing off ——, the Draw-off Cock being Automatically regulated by a Float. B. Gäde. Fr. Pat. 344,724, June 21, 1904.

The viscous material is drawn off from a tun into a vessel, and as this fills, it raises a float connected by means of a lever to a weight. When the vessel is full, the weight is released and closes the draw-off cock.—L. F. G.

Molasses, Vinasses, Saccharine Juices, and other Vegetable Extracts; Production of Dyestuffs from ——. O. Wichardt. Fr. Pat. 345,440, Aug. 9, 1904. IV., page 1211.

Betaïne or its Salts from Molasses; Process for Extracting ——. C. Stiepel. Fr. Pat. 344,954, July 19, 1904.

Concentrated molasses is intimately mixed with twice its volume of 95 per cent. alcohol. The mixture is allowed to settle, and the alcoholic layer is decanted off, filtered, and decolorised by animal charcoal. It is then concentrated to a syrupy consistency, treated with strong hydrochloric acid, and cooled; the crystals of betaine hydrochloride which separate out, are subsequently purified by recrystallisation from alcohol.—J. F. B.

Starch [Amyloid]; Manufacture of —— from Cellulose, Wood, &c. A. Börner. Fr. Pat. 345,370, Aug. 4, 1904.

Sawdust or other waste vegetable material is digested for 18—60 hours with a suitable acid or alkaline solution. The most suitable solvent consists of a 1—2 per cent. solution of caustic soda, with which the sawdust is systematically extracted in a diffusion battery at a temperature of about 24° C. The extract is freed from resins, &c. by acidulation, and the "starch" is precipitated from the clarified solution by saturating the latter with common salt. The separated "starch" may then be saccharified by acid, and converted into alcohol by fermentation and distillation.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Culture Yeasts; Researches on —— in the Moist and Pressed Condition. W. Henneberg. Woch. f. Brau., 1904, **21**, 625—629, 654—660, 668—675, 683—686, 711—716, 731—740, 747—751, 759—763.

Conclusions are summarised setting forth the results of a long series of investigations on the behaviour and longevity of quiescent yeast cells and the influence of foreign organisms on yeast, including a study of spontaneous infection, decomposition, and putrefaction of preserved yeast. The experiments were carried out (1) with absolutely pure cultures, and (2) with pressed industrial yeast. A comparison of these two series showed that, in the bulk, the pure cultivated yeast lived for a shorter time than the industrial cultures, but that frequently a few cells of the pure cultures survived after the whole of those of the industrial cultures were dead. Variations in the relative longevity of the two kinds of cultures were observed, according to the temperature of storage and the race and type of the yeast. In pure cultures the bottom yeasts lived longer than the top yeasts, but in industrial cultures the reverse was the case; the two types of yeast are, however, not really comparable. In pure cultures there was frequently a slight reproduction, but scarcely any in the industrial cultures. In pure cultures of Races II. and XII. the presence of excess of moisture was very injurious, but in industrial cultures much less so. Exclusion of air by means of a layer of paraffin was found to be unfavourable in pure cultures of Race XII., but favourable in industrial cultures. Industrial cultures of Race XII. often contained spores, whereas the pure cultures of this variety were always devoid of them. Infection by *Oidium lactis* is very destructive in pure cultures, but in industrial cultures of the distillery yeasts, this fungus forms a protective film with distinctly favourable effects. Sulphuretted hydrogen (due to infection) was produced only in the industrial cultures; the latter also were proof against putrefactive bacteria and hay bacilli. Generally, it may be said that the life of moist yeast cells in the quiescent state is comparatively short, especially at high temperatures. The life of the cell is cut short by the accumulation in the restricted space of the pressed mass, of poisonous products of metabolism, or by foreign organisms. In order to obtain a culture which will remain alive for a considerable time, it is necessary to select a suitable race of yeast and to cultivate it under conditions which will induce a vigorous growth, as free as possible from infecting organisms.—J. F. B.

Denaturing Sugar for Use in the Brewery; Directions for ——. Z. Ver. Deutsch. Zucker Ind., 1904, **54**, [Gen. Part], 408. (See this J., 1904, 1053.)

In accordance with the law of July 5, allowing the use of duty-free sugar for brewing purposes in France, the following two methods of denaturing the sugar were sanctioned on October 1:—(1) A mixture is made in the following order of 1000 kilos. of drinking water, 2 kilos. of syrupy, purified commercial phosphoric acid of sp. gr. 1·45, 1000 kilos. of sugar or syrup, and 20 kilos. of hops. The mixture is brought to the boil. After boiling for 15 minutes, the density of the boiling liquid is taken with a hydrometer, and boiling continued until it has reached 1·26. The syrup poured off, must have a density of 1·32. (2) A mixture is made in the following order, 1000 kilos. of drinking water, 4 kilos. of crystallised tartaric acid, 1000 kilos. of sugar or syrup, and 20 kilos. of hops. The rest of the procedure is as under (1).—L. J. de W.

[*Brewing.*] *Action of Disinfectants on Beer Incrustation.* V. Törnell and E. Morell. Z. ges. Brauw., 1904, **27**, 841—846.

Experiments were made on the incrustation found in the main leading from the hop-back to the cooler. The substance which contained 9·4 per cent. of moisture and was soluble to the extent of 14½ per cent. in water, was crushed and exposed to the action of the reagents (20 c.c. per 0·4 grm. of substance) for an hour, then stirred and left for a similar period, the insoluble residue being finally collected on a tared filter, washed with 300 c.c. of water and dried at 100° C. "*Antiformin*" (in which the active substance is hypochlorous acid, and which contains 5·2 per cent. of sodium hydroxide) dissolved 97 per cent. of the incrustation with brisk effervescence, the chlorine decolorising the solution. On the other hand, a 5 per cent. solution of *caustic soda*, dissolved only 23 per cent., so that the more vigorous action of the first-named reagent must be ascribed to the active chlorine, though in the case of *sodium hypochlorite* and *bleaching powder*, this activity was less pronounced (64·4 per cent. and 39·7 per cent. respectively). *Sodium* and *potassium carbonates* act more by loosening the incrustation than as solvents, only 20 per cent. being dissolved by solutions of 2½—10 per cent. strength. *Potassium bisulphite* increases the insolubility of the incrustation in water by nearly 2 per cent., and also hardens the crust—a behaviour explaining the known fact that vats treated with this reagent incrust sooner and more firmly than otherwise. The same result, but in still higher degree, is furnished by "*montanin*," which actually increases the insolubility by 25 per cent., and is therefore entirely unsuitable as an anti-incrustant. *Ammonium bifluoride* (0·5—1 per cent. solution) dissolves only about 1 per cent. more than water. It is therefore concluded that oxidising agents alone, do not exert any powerful solvent action on the incrustation.—C. S.

Distillery Yeast Mash; Heating the —— to 75°—81° C. after Acidification. Schirmann. Z. Spiritusind., 1904, **27**, 478—479.

The heating of the preliminary yeast mash to a temperature of 75—81° C., after acidification by lactic acid bacteria and before sowing the yeast, is always recommended as a safeguard for destroying any undesirable bacteria which may have developed along with the lactic bacteria. The author, however, questions the utility of this partial sterilisation, because its good effects may be outweighed by its ill effect on the nutrition of the yeast. He contends that if the lactic fermentation has taken place under favourable conditions of purity, the heating is unnecessary, and that it is quite likely, by its action upon the albuminoids and enzyme-constituents of the mash, to modify the composition of the liquid in a direction unfavourable to the yeast. He claims that it is possible to judge whether an acidified yeast mash is in such a condition as to require heating for sterilisation purposes, or whether this heating may be omitted with advantage to the yeast. Henneberg, commenting on the above, points out that there are some kinds of "wild" lactic bacteria which develop well under the same conditions as the "cultivated" species, and that these are capable, in sufficient quantities, of exerting a disastrous effect upon the yield of spirit. It is very doubtful whether it is possible in practice to distinguish the presence to a dangerous extent of these harmful bacteria, and the pasteurisation of the mash must be regarded as a necessary safeguard.—J. F. B.

Distillery Fermentation Tuns; Attemperators for ——. G. Heinzelmann. Z. Spiritusind., 1904, **27**, 477.

Attemperators are of two kinds, the stationary and the movable. The copper pipes of the stationary coils should be flattened or oval in section, since their sole function is to cool the mash. The pipes of the moving coils should on the other hand be round in section, since flattened pipes in their spiral path cut through the mash without making a sufficient path for the escape of the carbon dioxide, which is the chief object of their motion. The speed of rotation should be 18 to 20 revolutions per minute, and the up and down stroke should be about 3 ft. in length. The coils should never be so adjusted that they break through the surface of the mash as they rise, as thereby a loss of alcohol would occur. The attemperators must be kept perfectly clean, and there should be no projections or corners to which particles of stale mash may adhere and so cause infection; any leakage of water from the inside of the coils may also introduce infecting bacteria. Mere spraying is not sufficient to remove the slimy deposit of yeast which collects on the coils; these should be scrubbed as frequently as possible with milk of lime.—J. F. B.

Rum distilled in British Guiana; Proportion of Esters normally Present in ——. J. B. Harrison. British Guiana Official Gazette, Oct. 19, 1904.

From the results of analysis of a number of "estate" rums and of "bush" rums (the products of illicit distilleries), it is concluded that rum as at present manufactured in British Guiana is subject to a wide range of variation in its contents of esters (calculated as ethyl acetate), the numbers obtained varying from 12 to 80 parts for estate rums and for bush rums from 24 to 115 parts per 100,000 of alcohol by volume. The mean contents of esters in the rum exported from the colony during the past three years have varied from 64·7 to 104 parts, the mean for the total export being 83·5 parts. Rum distilled by means of continuous and of Coffey stills contains a mean of 41·9 parts of esters with 18·4 parts of acids; that from vat stills, 69·9 parts of esters with 33·1 parts of acids. The results here given offer no support to the theory that rum can be judged as to its freedom from admixture with silent spirit by the amount of esters present.—T. H. P.

Trehalase; Presence of —— in Mushrooms.
E. Bourquelot and H. Hérissey. XXIV., page 1243.

Rusting of Iron [by Denatured Spirit]; Stimulating and Paralysing Effects of certain Substances on ——. L. Lindet. X., page 1219.

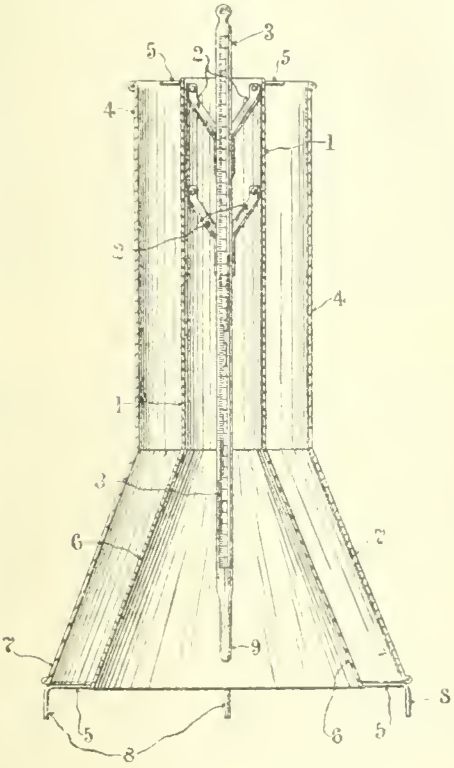
English Patents.

English Beers or Malt Liquors; Manufacture of ——, and Production of Pure Yeast Cultures for use therein. N. H. Claussen, Copenhagen. Eng. Pat. 28,184, Dec. 22, 1903.

Claim is made for the employment in the manufacture of English beers, such as ale, stout, and porter, of cultures of a new species of micro-organisms, which are termed brettanomyces and which do not form endospores, in order to produce the flavour and condition peculiar to such beers. The brettanomyces may be added after the primary fermentation or after pasteurisation, or may be mixed with the pitching yeast.—T. H. P.

Temperature of Kilns or other Hot-Air Chambers used in Drying Grain and like Materials; Apparatus for Indicating the ——. A. J. Murphy, Leeds. Eng. Pat. 967, Jan. 14, 1904.

This apparatus consists of a casing 1, provided with inturned spring clips 2, for holding a thermometer 3 centrally within the casing, 4 being an external shield or jacket which is held concentrically outside the casing 1 by distance pieces, 5. The bases of the casing 1 and shield 4 are opened out into trumpet bases 6 and 7, and feet 8, are provided, which are placed in perforations in the floor of the kiln. When the apparatus is placed on the floor of the kiln, the gases are free to ascend and pass in close contact with the bulb 9, of the thermometer, without being altered in temperature by contact with the walls of the apparatus in contact with the grain.—T. H. P.



Fertilizer or Manure [from Brewers' Yeast]; Manufacture of ——. H. Myers. Eng. Pat. 494, Jan. 8, 1904. XV., page 1228.

United States Patents.

Malt Kiln. C. E. Glafke, San Francisco. U.S. Pat. 774,915, Nov. 15, 1904.

A kiln-furnace provided with grate-bars for burning coke, is combined with a supplemental horizontal flue, U-shaped in vertical cross-section, opening into the furnace. A jacket surrounds the top and sides of the horizontal flue at such a distance that an air chamber is thus formed, which opens into the furnace; there is also an air chamber below the floor of the horizontal flue. Liquid fuel is supplied at the end of the horizontal flue furthest removed from the furnace.
—J. F. B.

Brewing; Art of ——. J. Schneible, Weehawken, N.J. U.S. Pat. 775,730, Nov. 22, 1904.

See Eng. Pat. 14,028 of 1904; this J., 1904, 996.—T. F. B.

French Patents.

Phlegms, Wines, and Alcoholic Liquors generally; Continuous Rectification of ——. A. Baudry. Fr. Pat. 339,079, Oct. 2, 1903. (See also this J., 1904, 1107.)

Two distillation columns are provided, the first serving for the separation of the volatile impurities, gases, &c., from the phlegms or wine as far as possible, and the second serving for the separation of volatile impurities from the liquor returned from the rectifying column. The second distillation column may be heated by the latent heat of the alcoholic vapours of the separating column. The volatile impurities from the two distillation columns concentrate themselves on certain plates of a "double" column, leaving a distinct "neutral zone" practically free from impurities. The alcoholic liquid from the "neutral zone" is divided into two parts, one descending into the lower portion of the double column and concentrating the fusel oil products on certain plates, whilst the other is mixed with the phlegms or wine in the first distillation column.—J. F. B.

Spirits; Manufacture of Naturally Perfumed and Aromatic ——. H. Pape and G. Defourneaux. Fr. Pat. 339,085, Oct. 6, 1903.

A selected species of yeast, isolated from sugar canes and cultivated in the pure state, and rendered more active by special treatment, is utilised for the production of fine rum from sugar-cane molasses. The same yeast can be utilised for the fermentation of mashes prepared from beetroot products or saccharified grains, with the addition, if desired, of vinasses derived from sugar-cane products. The fermented mashes are distilled in rectifying columns, and the various distillates are selected or blended.—J. F. B.

Alcoholic Vapours; Recovery of —— from other Volatile Products. J. Jean et Cie and G. Raverat. Fr. Pat. 345,138, July 25, 1904.

The alcoholic vapours, mixed with air or other gases, are passed through columns containing concentrated sulphuric acid. The acid absorbs the alcohol, which is subsequently recovered by diluting with water.—J. F. B.

Wines, Musts, Ciders, &c.; Apparatus for Determining the Dry Extract and the Alcohol in ——. A. B. Darbois. Fr. Pat. 345,455, July 28, 1904. XXIII., page 1239.

Marcs and Grapes [Alcohol and Cream of Tartar]; Process and Apparatus for Treatment of ——. Egrot, Grangé et Cie. Fr. Pat. 344,737, July 9, 1904.

The fermented marcs are charged into a battery of closed diffusion vessels elongated in form and of small diameter, and capable of withstanding a high pressure. The marcs are extracted in these vessels, first by cold or warm water under pressure, and subsequently by hot water heated under pressure to a temperature above 100° C. The cold water extracts the alcohol, whilst the hot water dissolves the cream of tartar. The same apparatus may be used for extracting the must from the vintage before fermentation, or for the extraction of the wine from the fermented lees.—J. F. B.

Marcs of Wine or Fermented Products: Recovery of Alcohol from ——. G. Ciapetti. Fr. Pat. 314,880, June 18, 1904.

Referring to a previous patent (this J., 1903, 1099), the batteries in which the marcs are treated with sulphurous acid and hydrosulphurous acid for the extraction of cream of tartar, are connected with a distilling and rectifying apparatus in which the alcoholic vapours, expelled from the marcs before their extraction, are separated into refined spirits and common spirits, both, at a high concentration. (See also this J., 1904, 1039.)—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Flour; Bleaching of ——. E. Fleurent. Comptes rend., 1904, **139**, 945—946.

Three processes are in use for bleaching flour, depending on the use respectively of ozonised air, of air charged with chemically prepared nitrogen peroxide, and of air charged with nitrogen oxides obtained by the spark discharge through it. If these processes merely changed the colour of the flour they would not be worth using; but experiment has shown, it is stated, that by their influence on the transformations of the fatty matters, on the acidity, on the diastatic power, and on harmful micro-organisms, they allow an increased amount of superior flour to be extracted, and improve its keeping qualities.—J. T. D.

Cows' Milk; Nutritive Value of —— *Sterilised at* 108° *C.* G. Variot. Comptes rend., 1904, **139**, 1002—1003.

During the last twelve years about 400,000 litres of cows' milk, sterilised at 108° C. in hermetically sealed bottles, have been sent out in France. The results show that such milk maintains the whole of its nutritive value, whilst its assimilability is not appreciably changed.—T. H. P.

Straw Pulp and Cattle Fodder. Lehmann. XIX., page 1233.

English Patent.

Milk Powder; Manufacture of ——. G. H. Rayner, London. From J. Maemecke, Berlin. Eng. Pat. 6720, March 19, 1904.

Milk is first pasteurised, then filtered, and rendered homogeneous. During this time the quantity of calcium separated as an insoluble compound is determined, and a corresponding amount of a calcium compound (calcium combined with a higher alcohol, or sugar) is added to the milk, which is evaporated under reduced pressure to about one-fifth of its volume. The thick liquid obtained, is then completely dried in layers of about 5 mm. thickness in flat-bottomed pans. The dry product is powdered. The latter is soluble, and it is claimed that it does not become rancid on keeping.—W. P. S.

United States Patent.

Preserving and Disinfecting; Method of ——. A. Müller Jacobs, Brooklyn. U.S. Pat. 775,066, Nov. 15, 1904.

Decomposable matter is preserved and disinfected by subjecting it to the action of zirconium compounds (which possess radio-active functions) by immersing the matter in a suitable solution of the salts of zirconium.—J. F. B.

French Patents.

Gluten; Process and Apparatus for Drying and Bleaching ——. L. A. Morel. Fr. Pat. 344,631, July 6, 1904.

The gluten, in the form of cakes, is placed upon electrically heated plates under the receiver of an air-pump. Pasty gluten is filled into tubes which stand on the plates. The temperature of the latter is controlled by means of a special thermostat. Absorbing materials contained in vessels surrounded by cold water are placed under the receiver and a stirring apparatus for the absorbent is actuated by connections with the handle of the air pump.—W. P. S.

Foods—Flour, Milk, &c; Process and Apparatus for Producing a Bleaching, Improving or Sterilising Agent for ——. The Ozonised Oxygen Co., Ltd. Fr. Pat. 344,914, July 18, 1904. XI. A, page 1224.

Lac Derivative [*Lining Preserved Food Tins*], *and Process for Manufacturing the same.* W. S. Bucklin. Fr. Pat. 345,174, July 28, 1904.

See Eng. Pat. 16,800 of 1904; this J., 1904, 1154.—T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

Arsenical Poisoning; Danger of —— *to Workmen Engaged in Autogenous Soldering.* G. Lunge. X., page 1220.

Calcium Soaps; Dissolving —— *by Means of Ammonium Citrate.* Justin Mueller. V., page 1211.

English Patents.

Sterilising Liquids, particularly Water; Process for ——. R. Cambier, A. Tixier, and C. E. Adnet, Paris. Eng. Pat. 28,586, Dec. 29, 1903.

See Fr. Pat. 337,630 of 1903; this J., 1904, 500.—T. F. B.

Water Purifying Apparatus. P. Schou, Copenhagen. Eng. Pat. 21,777, Oct. 10, 1904.

The water enters a conical vessel from pipes attached to a central rotating pipe, the rotation being caused by the pressure of water issuing from the pipes. The central rotating column extends upwards into a chamber placed above the conical vessel. This second chamber contains the chemicals to be added to the water, and stirrers attached to the central column serve to keep these well mixed. A cam is placed on the shaft, and, as it rotates, it opens and closes a spring valve in a pipe leading from the chemical chamber to the water tank. The distance which the valve opens is partially regulated by an adjustable disc on the valve-rod, and also by a piston on the main shaft, which rises with an increase of the pressure of the water supply and causes a wider part of the cam to operate on the valve rod.—W. P. S.

United States Patents.

Garbage or Offal; Apparatus for Cooking ——, *and Removing the Oil or Grease therefrom.* C. S. Wheelwright, Bristol, R.I. U.S. Pat. 774,804, Nov. 15, 1904.

See Eng. Pat. 14,482 of 1904; this J., 1904, 879.—T. F. B.

Garbage, &c.; Process of Cooking ——, *and Removing the Oil, &c., therefrom.* C. S. Wheelwright, Bristol, R.I. U.S. Pat. 774,805, Nov. 15, 1904.

See Eng. Pat. 14,709 of 1904; this J., 1904, 879.—T. F. B.

Garbage or Offal; Apparatus for Cooking ——, *and Removing the Oil therefrom.* C. S. Wheelwright, Bristol, R.I. U.S. Pat. 774,806, Nov. 15. 1904.

See Eng. Pat. 14,483 of 1904; this J., 1904, 879.—T. F. B.

Garbage &c.; Process of Cooking ——, *and Removing the Oil, &c., therefrom.* C. S. Wheelwright, Bristol, R.I. U.S. Pat. 774,807, Nov. 15, 1904.

See Eng. Pat. 15,235 of 1904; this J., 1904, 909.—T. F. B.

Garbage or Offal; Apparatus for Removing Oil or Grease from ——. C. S. Wheelwright, Bristol, R.I. U.S. Pat. 774,808, Nov. 15, 1904.

See Eng. Pat. 14,483 of 1904; this J., 1904, 879.—T. F. B.

Water, Purifying Apparatus ——. J. C. W. Greth, Assignor to W. B. Scaife and Sons Co., Pittsburg, Pa., U.S. Pat. 775,901, Nov. 22, 1904.

A lime-saturating and lime-treatment tank, a "soda"-treatment tank, an upward flow settling tank and a filter are contained in a single outer tank. The water to be treated, passes through the system in the above order. Means are provided for controlling the supply of water and chemicals automatically, and for causing an inverse vertical flow in the lime and "soda" tanks.—W. H. C.

French Patent.

Liquids [*Water*]; *Process of Sterlising* ——. L. Freyssinge and R. Roche. Fr. Pat. 345,148, July 26, 1904.

The process consists in adding to the liquid, especially water, compounds capable of generating a small quantity of hydrogen peroxide (about 50 mgrms. per litre of water), and then separating the water by decantation or filtration from the residual reaction products. The compounds added, must be of such a nature that the residual products are insoluble and perfectly innocuous.—A. S.

(C.)—DISINFECTANTS.

Bactericidal and Antiseptic Action of Eucalyptus Oil and its Constituents. C. Hall. Schimmel's Report, Oct. 1904, 37—39.

Eucalyptol [cineol] is the least active in bactericidal power of all the constituents of eucalyptus oils. Aromadendral, piperitone and phellandrene are the most active bodies. *B. coli communis* is only destroyed after eight hours' exposure to the action of cineol; the same effect is obtained under similar conditions, in 10 minutes with aromadendral, in 40 minutes with piperitone, and in 90 minutes with phellandrene. Dextro- and lævo-pinene and aromadendrene are somewhat less powerful as antiseptics than phellandrene, but are more active than cineol. Eudesmol has a powerful bactericidal action, and also increases the activity of cineol and piperitone. When eucalyptus oil contains ozone, due to the oxidation of the terpenes, the antiseptic power of the contained cineol is enormously increased. Such oils destroy the vitality of *B. coli communis* in 15 minutes, and the activity of the cineol is then only exceeded by that of aromadendral. For this reason only ozonised eucalyptus oils should be employed as the source of cineol intended for medicinal use. It is stated that the ozone is not removed from cineol by the process of extraction by freezing and rectification.—J. O. B.

French Patent.

Phenol and Formaldehyde; Process for Preparing a Condensation Product of —— [Disinfectant]. A. Stephan. Fr. Pat. 345,398, Aug. 6, 1904.

200 grms. of phenol are heated with 400 grms. of a 40 per cent. solution of formaldehyde, in presence of alkali, to about 100° C., using a pressure of $1\frac{1}{2}$ to 2 atmospheres. The resulting liquid is heated on a water-bath under reflux condenser till the odour of phenol has disappeared, and precipitation is then effected by the addition of acid. The precipitate is filtered off and dried, and is suitable for use as a disinfectant. (See also Lingner, this J., 1903, 1014; and Raetz, this J., 1904, 500.)—T. F. B.

XIX.—PAPER, PASTEBOARD, Etc.

Straw Pulp [for Paper-Making] and Cattle Fodder. Lehmann. Papier-Zeit., 1904, **29**, 3562.

A proposal is made for increasing the fodder value of cereal straw by combining the manufacture of straw pulp for paper mills with that of "soda-straw" for cattle fodder. It is suggested that the manufacture might be undertaken by the beet-sugar factories during the season when sugar manufacture is at a standstill. The straw is boiled in spherical boilers of at least 10 cubic metres capacity; in one operation straw cellulose for papermaking is prepared by boiling the straw with caustic soda and separating the fibre in the form of "half-stuff." In the next operation the alkaline liquors, drained off from the pulp and containing at least half of the nutrient matters of the straw, are utilised for boiling a second batch of straw which is to be used as cattle fodder.—J. F. B.

English Patent.

Esparto Grass, Straw, Wood, and the like, Utilisation [Distillation] of Residual Matters containing Alkaline and Organic Substances, such as the Residual Matters resulting from the Treatment of ——, in the Preparation of Paper Pulp. E. H. Strange, J. H. Gaele, and A. A. Longsdon. Eng. Pat. 27,732, Dec. 17, 1903. III., page 1207.

United States Patents.

Fibre for Paper-Making: Apparatus for Preparing ——. F. H. Cloudman, Rumford Falls, Me. U.S. Pat. 775,027, Nov. 15, 1904.

A condenser is arranged above, and connected with the upper part of a digester, and an air separating and gas-absorbing arrangement is placed between the condenser and the lower part of the digester. After leaving the condenser, the condensed liquid and absorbed gas return to the digester by the action of gravity through the air-separating means, the latter being provided with an outlet for the discharge of the air.—B. N.

Fibre for Paper-Making; Apparatus for Preparing ——. F. H. Cloudman, Westbrook, Me. U.S. Pat. 775,028, Nov. 15, 1904.

A digester is connected by means of a pipe, provided with a valve, with a gas absorber placed at a higher level. Above the gas absorber, and connected with it, is a condenser provided at the top with an air-relief pipe; the liquid and gas return by the action of gravity through a pipe connecting the lower parts of the absorber and digester, the pipe being provided with a check-valve.—B. N.

Paper Pulp. J. Ferrand, Asnières, France. U.S. Pat. 774,982, Nov. 15, 1904.

See Fr. Pat. 327,046 of 1902; this J., 1903, 879.—T. F. B.

Paper Pulp; Production of ——. J. Kitsee, Philadelphia. U.S. Pat. 775,829, Nov. 22, 1904.

Crude wood or other fibre is immersed in a saline solution containing an alkali base, *e.g.*, sodium chloride. The fibre and solution are placed in the negative compartment of an electrolytic apparatus, and the mixture is subjected to the action of an electric current which produces sufficient caustic alkali to dissolve the non-cellulose matters of the wood.—J. F. B.

Wood-Pulp Mill Effluents; Process of Neutralising ——. C. W. Doughty, Augusta, Ga. U.S. Pat. 775,525, Nov. 22, 1904.

The waste sulphite liquors are passed through a tank fitted with partitions, to give an up-and-down motion, and with agitators. The liquors are there treated with calcium carbonate introduced as a continuous current; after suitable agitation the heavy matters are removed by settling, and the decanted liquid is treated with ammonia.—J. F. B.

Paper-Making Apparatus. R. Binns, South Windham, Conn. U.S. Pat. 775,511, Nov. 22, 1904.

A cylinder with a "screened" periphery and closed ends is supported entirely upon a hollow shaft within a tank. Outlet passages are provided, through which the water inside the cylinder passes into the hollow shaft. At one end of the hollow shaft is a tilting discharge outlet, the size of which may be altered, and by means of which the level of water inside the cylinder may be varied relatively to that of the water in the tank surrounding the cylinder.—A. S.

Filter [for Waste from Paper and Cellulose Factories]. O. Mehnert and P. Pape, Assignors to Maschinenfabrik Akt.-Ges., vorm. Wagner and Co., Kothen, Germany. U.S. Pat. 775,475, Nov. 22, 1904.

See Eng. Pat. 8061 of 1903; this J., 1904, 557.—T. F. B.

French Patents.

Paper from Maize Stalks, Sugar Cane, and Similar Pithy Stems; Manufacture of ——. V. Dreesen. Fr. Pat. 344,692, July 9, 1904.

The stems are split and chopped into suitable pieces, which are then boiled with caustic soda under pressure. The boiled material is then washed and broken in a "potcher" of special construction, provided with washing surfaces which allow the pith cells to pass through their meshes along with the washing water, leaving the true fibres of the stems in the engine. The good fibres are converted into paper pulp, whilst the washing waters containing the pith cells are collected in large tanks in which the cellular matter is separated by sedimentation—J. F. B.

Pavements free from Dust; Process for Rendering ——. Chem. Werke Mügeln, b. Dresden, G. m. b. H. Fr. Pat. 345,067, July 23, 1904. IX., page 1218.

Celluloid Substitute [*Casein Basis*]; *Transparent and Non-inflammable*——. H. M. Provenx. Fr. Pat. 339,081, Oct. 5, 1903.

"Caselith" may be prepared in two ways—(1) Casein, nitrocellulose, and camphor are mixed with 1 part of glycerin, and a boric acid solution, consisting of 1 part of alcohol, heated to 120° C. and containing 50 per cent. of boric acid; (2) the same mixture with the omission of the nitrocellulose and camphor. The proportion of glycerin may be varied according to the degree of plasticity desired. When nitrocellulose and camphor are employed, these constituents are added immediately before rolling. The milled products are finally hardened by immersion in a bath of formaldehyde.—J. F. B.

Artificial Silk; Twisting and Spinning Apparatus for ——. Soc. Franç. de la Viscose. Fr. Pat. 245,274, July 30, 1904. V., page 1212.

Artificial Silk; Regulating Valve for Solutions for Spinning ——. Soc. Franç. de la Viscose. Fr. Pat. 345,293, Aug. 1, 1904. V., page 1212.

Artificial Silk; Continuous and Automatic Apparatus for Spinning ——. Soc. Franç. de la Viscose. Fr. Pat. 345,320, Aug. 2, 1901. V., page 1212.

Viscose; Jet for Spinning Threads from ——. Soc. Franç. de la Viscose. Fr. Pat. 345,342, Aug. 3, 1904. V., page 1212.

Celluloid Objects and Similar Substances; Process for Imparting a Lustre to ——. W. Homberger. Fr. Pat. 345,405, Aug. 6, 1904.

See Eng. Pat. 17,232 of 1904; this J., 1904, 997.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Adrenaline (Suprarenine). E. Friedmann. Beitr. chem. Physiol. u. Pathol. **6**, 92—93, Chem. Centr., 1904, **2**, 1512.

The optically active tribenzenesulpho-adrenaline can be oxidised to a compound containing the same number of carbon atoms as adrenaline, but which is optically inactive, and is of a ketonic character. The author has identified this compound as methylaminoacetopyrocatechol, and names it *adrenalone.* On further oxidation it yields a substituted acid amide, $C_6H_3(OH)_2 . CO.CO.NH(CH_3)$, *peradrenalone.* It is concluded that adrenaline has the constitution:

$$(OH)C\left\langle\begin{matrix}C(OH){:}CH\\ CH\ .\ CH\end{matrix}\right\rangle C.CH(OH).CH_2.NH(CH_3).$$

—A. S.

Ephedrines, Synthetic ——. E. Fourneau. J. Pharm. Chim., 1904, **20**, 481—492.

In addition to ephedrine $C_{10}H_{15}NO$, m. pt. 30° C., isolated by Nagai from *Ephedra vulgaris*, pseudoephedrine $C_{10}H_{15}NO$ m. pt. 114—115° C., discovered by Ladenburg and by Miller in the same plant; and isoephedrine, obtained by Nagai by heating ephedrine with hydrochloric acid, which was subsequently shown by Schmidt to be identical with pseudoephedrine, the following synthetic amino-alcohols, isomerides and homologues of ephedrine, are described.

Methylaminodimethylphenylcarbinol, $(C_6H_5)(CH_3)C[CH_2.NH(CH_3)]OH$, obtained by heating methoethenylphenyl chlorhydrin or iodhydrin with monomethylamine, under pressure at 130° C. After separating the crystals of methylamine hydrochloride, the mother liquor is concentrated, treated with 20 per cent. hydrochloric acid, and shaken out with benzene to remove neutral bodies and uncombined chlorhydrin; the base is next liberated by sodium carbonate and shaken out with ether. The ethereal residue is then fractionally distilled *in vacuo.* Methylaminodimethylphenyl-carbinol is thus obtained as a syrupy noncrystalline base, b. pt. 137° C. under 33 mm. pressure. It affords crystalline salts; hydrochloride, m. pt. 153° C.; aurichloride, m. pt. 148° C.; oxalate, m. pt., 158° C.; the dibenzoyl derivative melts at 122° C.

Dimethylaminodimethylphenylcarbinol, $(C_6H_5)(CH_3)C[CH_2.N(CH_3)_2]OH$, also a liquid: b. pt. 135° C. under 22 mm. The hydrochloride melts at 160°, the iodomethylate at 157° C.

Methylaminophenylethylcarbinol, $(C_6H_5).CH(OH).CH(CH_3).NHCH_3$, is obtained by treating phenylpropylene with iodine and mercuric oxide in the presence of aqueous ether; by this means an impure iodhydrin is obtained in which the iodine is attached to the carbon of the ethylene chain furthest removed from the benzene nucleus. This crude iodhydrin is allowed to stand in contact for some days with an alcoholic solution of monomethylamine, at normal temperature. The base formed is isolated by fractional distillation *in vacuo.* It boils at 155°—156° C. under 31 mm.; it is a syrupy liquid which separates in large prisms from solution in light petroleum spirit; m. pt., 60° C.; the hydrochloride melts at 178° C., the dibenzoyl derivative at 92° C.

Dimethylaminophenylethylcarbinol, $(C_6H_5)C\ CH(CH_3).N(CH_3)_2]HOH$, like the preceding base, is an oily liquid crystallising from light petroleum spirit: m. pt., 47° C.; b. pt., 151°—152° C. under 31 mm. The hydrochloride melts at 180° C., the picrate at 80° C., the dibenzoyl derivative at 108° C. The last-named is said to have an intense anæsthetic action.

Methylaminomethylbenzylcarbinol, $(C_6H_5.CH_2)C[CH_2.NH(CH_3)]HOH$, is obtained from the iodhydrin resulting from the action of nascent hypoiodous acid on phenylallylene. It boils at 148° C. under 22 mm. and at 169° under 40 mm. It is very syrupy, remains amorphous at low temperatures, and gives crystalline salts with difficulty. The iodomethylate, precipitated from alcoholic solution by means of ether, and crystallized from acetic ester and ether, melts at 148° C. The dibenzoyl derivative melts at 42°—43° C.

Dimethylaminomethylbenzylcarbinol, $(C_6H_5.CH_2)C[CH_2.N(CH_3)_2]HOH$, is obtained by substituting dimethylamine for monomethylamine in the preceding experiment. The base boils at 143° C. under 22 mm. The hydrochloride is syrupy; aurichloride, m. pt., 122° C.; the monobenzoyl derivative is liquid; its hydrochloride, which is said to have a powerful anæsthetic action, melts at 165° C.

Primary methylaminomethylbenzylcarbinol, $C_6H_5.CH(CH_2OH)[CH_2.NH(CH_3)]$, is obtained from the chlorhydrin, $(C_6H_5)CH(CH_2Cl)(CH_2OH)$, which is produced by the action of epichlorhydrin on phenylmagnesium bromide. It boils at 145° C. under 22 mm. It is heated at 130° C. under pressure, with benzene solution of methylamine. The base thus obtained boils at 145° C. under 24 mm. It is a reducing agent; all its salts are oily.

Dimethylaminomethylbenzylcarbinol.—The base obtained with dimethylamine boils at 136° C. under 24 mm. Its hydrochloride is obtained crystalline by precipitating the solution in acetone with anhydrous ether; m. pt. about 288° C. The aurichloride melts at 126°—127° C., the iodomethylate at 148° C. The hydrochloride of the dibenzoyl derivative forms fine crystals; m. pt., 141° C.—J. O. B.

Skimmianine, an Alkaloid from Skimmia japonica Thunb. J. Honda. Arch. exp. Pathol. u. Pharmak, 1904, **52**, 83—94. Chem. Centr., 1904, **2**, 1511—1512.

The alkaloid *skimmianine,* $C_{32}H_{29}N_3O_9$, is present in all parts of the *Skimmia japonica Thunb.*, but most abundantly in the leaves. It was isolated by extracting the air-dried leaves with 96 per cent. alcohol at the ordinary temperature. The alcohol was distilled off from the extract, the green residue shaken with warm water, and filtered. The brown filtrate was shaken with chloroform, and after removal of the chloroform, the base was crystallised from alcohol and obtained in the form of yellowish prisms melting at 175·5° C. The free alkaloid is almost tasteless, but its salts are intensely bitter. The base is easily soluble in chloroform and alcohol, moderately soluble in methyl alcohol, slightly soluble in ether, amyl alcohol, and carbon bisulphide, insoluble in water and light petroleum spirit. Dilute mineral acids dissolve skimmianine only when added in excess; the salts crystallise in needles when the solutions are evaporated. The alkaloid gives voluminous precipitates with the ordinary reagents, such as potassium-mercuric iodide, iodine dissolved in potassium iodide, picric, tannic, and phosphotungstic acids. With Fröhde's reagent it gives a green colour, which changes to blue, and with a solution of potassium permanganate in concentrated sulphuric acid a violet coloration, which changes to yellowish-brown.—A. S.

Essential Oil of Basil. P. van Romburgh and C. J. Enklaar. Report of Konink. Acadm. van Wetenschappen ti Amsterdam, 1904; Schimmel's Report, Oct. 1904, 14.

The essential oil of *Ocimum basilicum* contains a new terpene, ocimene $C_{10}H_{16}$, closely resembling myrcene; like that terpene, it readily absorbs oxygen, being converted into a colourless viscid substance. Ocimene differs from myrcene, however, in physical characters, and on reduction with sodium in alcohol, yields a dihydro-ocimene, which gives a crystalline bromine addition compound differing in sp. gr. from that obtained by Semmler from dihydromyrcene. Incidentally it is noted that basil oil finds useful application for blending with mignonette bouquets.

—J. O. B.

Citronella Oil; Reliability of Bamber's Test for the Presence of Impurity in ——. Schimmel's Report, Oct. 1904, 21.

A sample of citronella oil, considered to be quite pure, which contained 60 per cent. of total geraniol, and gave a turbid solution which separated no oily drops on cooling, by the "improved Schimmel's test" (this J., 1904, 686) was found when examined by Bamber's method (this J., 1904, 77) to give results indicating the presence of 5 per cent. of impurity. Doubt is therefore expressed as to the reliability for quantitative determinations of Bamber's method, which it is proposed to make the official test for controlling the quality of citronella oil (see Trade Report, p. 1247).

—J. O. B.

Essential Oil of Cypress. Schimmel's Report, Oct. 1904, 23—26.

Furfural, *d*-pinene, *d*-camphene, *d*-sylvestrene, cymene; a ketone possibly sabinol; a terpene alcohol (?); *d* terpineol, as ester, probably acetate; valeric acid, *l*-cadinene, a sesquiterpene alcohol; cypress camphor, identical with the sesquiterpene alcohol of cedar oil; and a body with the odour of gum labdanum, are recorded as constituents of cypress oil.—J. O. B.

Essential Oil of Fennel [and Anethol]; Cause of the Increase of Density of ——. Schimmel's Report, Oct. 1904, 42.

The observed increase in the sp. gr. of fennel oil on keeping under certain conditions is due, in part, to the oxidation of anethol into anisic aldehyde and anisic acid, and, in part, to the polymerisation of the anethol. Fennel oil [and anethol] should therefore be stored in vessels from which light and air are excluded. A specimen of anethol which originally had the following characters: sp. gr. at 25° C., 0·9846; $\alpha^{25°}_{D} = \pm 0°$; $n^{25}_{D} = 1·56079$; solidifying point + 21·3° C.; solubility in 90 per cent. alcohol 1:2, after being kept for two years exposed to air and light, acquired the sp. gr. at 25° C. of 1·1245; α_D, $= \pm 0°$; $n^{25}_{D} = 1·54906$; not solidifying at − 20° C.; solubility in 70 per cent. alcohol, 1:1·5. Not only was the sp. gr. greatly increased, but the oil had become much more soluble; it was less mobile than normal anethol, and the taste had entirely changed, becoming disagreeable. It contained some anisic aldehyde but only traces of anisic acid. The greater part of the original anethol had become polymerised.

—J. O. B.

Essential Oil of Ginger-Grass; Constituents of ——. Schimmel's Report, Oct. 1904, 44—48.

Dextro-limonene and dipentene have been isolated from ginger-grass oil, also an aldehyde $C_{10}H_{16}O$, isomeric with citral, having an odour resembling that of œnanthic aldehyde and of citronellal, b. pt. at 5 mm. 76°—78° C., at 754 mm. 221° 224° C., sp. gr. at 15° C. 0·9551 optically inactive; this aldehyde only occurs to the extent of 0·2 per cent. in the original oil. The alcohol $C_{10}H_{18}O$, resulting from its reduction, was a thick oil, b. pt. at 4 mm. 89°—91° C.; at 755 mm. 236°—238° C.; sp. gr. at 15° C. 0·9419, optically inactive; m. pt. of phenylurethane, 100°—101° C. On exposure to air the aldehyde readily oxidises, forming a crystalline acid, $C_{10}H_{16}O_2$, m. pt. 106°—107° C. It is identical with the acid obtained by saponifying the esters of the oil. In addition to the above, an alcohol, $C_{10}H_{16}O$ is found to accompany the geraniol present.—J. O. B.

Essential Oil of Juniper; Russian, Dextrorotatory ——. Schimmel's Report, Oct. 1904, 50.

Two specimens of Russian juniper oil have been met with, which were normal in all physical characters except optical rotation, the α^D being + 7° and + 8° instead of showing the usual lævogyrate rotation. The aroma of the oils was good, and the solubility normal.—J. O. B.

Lemon-Grass [Essential] Oil from the Cameroons. Schimmel's Report, Oct. 1904, 52.

A specimen of *Andropogon* grass oil, distilled from plants cultivated in the Botanical Gardens at Victoria, Cameroons, which were believed to be authentic citronella grass, has been found to have all the characters of lemon-grass oil, sp. gr. 0·8929; $\alpha_D = - 0° 8'$; citral content 84 per cent.; imperfectly soluble in 70, 80, 90 per cent., and absolute alcohol. In its insolubility in alcohol the oil resembles West Indian lemon grass oil. Great confusion exists in the botanical nomenclature of the species *Andropogon*; in addition to this, it is possible that conditions of climate, soil, and culture, profoundly modify the character of the oil of the same species grown in different localities. West Indian grass oil, supposed to be derived from *Andropogon schoenanthus*, which should yield palmarosa oil, gave a product more nearly approaching lemon-grass oil. In another instance, the same plant has been found, in one locality, to yield an oil rich in geraniol; in another, a distillate in which citral was the predominant constituent. A further difficulty lies in the fact that distinct species of the genus *Andropogon* are susceptible of great variation, this being especially the case with *Andropogon schoenanthus*. Another source of error is the vernacular names given to the oils. Thus in Java, lemon-grass oil is known as "sireh," but the same name is applied to the oil of *Tetranthera citrata*, belonging to a different natural order, but closely resembling lemon-grass oil in odour.—J. O. B.

Essential Oil of Limes. Schimmel's Report, Oct. 1894, 54.

Two specimens of Dominica lime oil from Barbados have been examined.

Hand-pressed Lime Oil.—Sp. gr. at 15° C., 0·9008; α_D − + 36° 17′; α_D of first 10 per cent. on fractionating = + 39° 30′; acid value 6·05; ester value 29·55; residue on evaporation 17·8 per cent.; solubility in 90 per cent. alcohol somewhat over 1:4, with slight turbidity due to a paraffin. The dilute alcoholic solution shows a blue fluorescence, probably due to the presence of methyl anthranilate. The oil is yellow, and has a pleasant lemon-like aroma.

Distilled Lime Oil.—The oil was bright yellow in colour, and had an unpleasant empyreumatic odour: sp. gr. 0·8656; α_D = + 46° 36′; α_D of first 10 per cent. on fractionating = + 53° 8′; acid value 1·8; ester value 4·05; residue on evaporation 3·16 per cent.; solubility in 90 per cent. alcohol, about 1 in 5, with slight cloudiness.—J. O. B.

Essential Oil of Nutmeg. Sp. Gr. of —— in the British Pharmacopaia. Schimmel's Report, Oct. 1904, 66.

THE limits of sp. gr. 0·870 to 0·910 at 15·5° C. officially required by the Pharmacopœia are considered to be too low, and instead of ensuring the supply of oil distilled from rich nutmegs, have an opposite tendency. The normal range of sp. gr. is from 0·870 to 0·920; oil distilled from specially fine nutmegs attaining the sp. gr. 0·922.—J. O. B.

Essential Oil of Opopanax. Schimmel's Report, Oct. 1904, 67.

STEAM distillation of the so-called opopanax gum, derived from a *Balsamodendron*, probably *B. kafal*, yields the fragrant oil used in perfumery. A recently prepared specimen had the sp. gr. 0·895, $\alpha_D = -12° 55'$, saponification value 14·5, which was increased on acetylating. The bulk of the oil distilled under 3 mm. pressure at 45°—130° C. From the residue a small quantity of a sesquiterpene alcohol was separated; b. pt. *in vacuo* 135°—137° C. This had the characteristic odour of the oil. The portion which distilled *in vacuo* consisted chiefly of a sesquiterpene, boiling at ordinary pressure at 260°—270° C. It gave a crystalline hydrochloride, m. pt. 80° C.—J. O. B.

Essential Oil of Phellandrium Aquaticum [*Water Fennel*]; *New Constituents of ——.* Schimmel's Report, Oct. 1904, 88—92.

A NEW aldehyde, phellandral, $C_{10}H_{16}O$, isomeric with citral, has been isolated from the essential oil of *Phellandrium aquaticum*, after removing phellandrene. Phellandral has the following characters:—B. pt., 89° C. under 5 mm. pressure; sp. gr. at 15° C., 0·9445; $\alpha_D = -36° 30'$; the semicarbazone, sparingly soluble in alcohol, has the m. pt. 204° C.; the oxime, in large brilliant tablets, melts at 87°—88° C.; the phenylhydrazone, which readily resinifies, melts at 122°—123° C. On exposure to the air, phellandral oxidises, forming a crystalline acid, having the formula $C_{10}H_{16}O_2$. When oxidised with permanganate, a dibasic acid, $C_9H_{16}O_4$, soluble in water and crystallising in needles, is obtained. In the non-aldehydic portion of the oil a new alcohol, androl, $C_{10}H_{20}O$, was isolated by fractionating the lower boiling portions of the oil. This had the b. pt. 197°—188° C.; sp. gr. 0·858; $\alpha_D = -7° 10'$; $n_D^{15°} = 1·44991$. It had, in a high degree, the characteristic odour of the oil, and is probably the chief odorous principle. Another alcohol, with a rose-like odour, was isolated from the fractions boiling above 230° C. by means of phthalic anhydride, but the amount was too small for identification.—J. O. B.

Essential Oil of Cinnamomum Loureirii; Nekkei Oil. Schimmel's Report, Oct. 1904, 96.

THE essential oil of the leaves and young shoots of the Japanese cinnamon, *Cinnamomum loureirii*, distilled in Japan, is bright yellow in colour, and has a pleasant odour resembling that of citral and Ceylon cinnamon oil. The yield is 0·2 per cent. It has the following characters:—Sp. gr. at 15° C. 0·9005; $\alpha_D = -8° 45'$, acid value, 3·01; ester value, 18·6; solubility in 70 per cent. alcohol 1 : 2 to 2·5 and more, with opalescence; 1 : 1 with 80 per cent. alcohol. It contains 27 per cent. of aldehydes, chiefly citral; the non-aldehydic constituents contain cineol and linalool, the latter constituting about 40 per cent. of the original oil.—J. O. B.

Essential Oil of Tanacetum Boreale. Schimmel's Report. Oct. 1901, 97.

THE half-dried herb yielded 0·12 per cent. of a yellowish oil with a powerful thujone odour; sp. gr. at 15° C. 0·9218; $\alpha_D = +48° 25'$; soluble with turbidity in about 8 volumes of 70 per cent. alcohol, and separating paraffin.—J. O. B.

Thuja Articulata; Essential Oil of the Wood of ——. E. Grimal. Comptes rend., 1904, **139**, 928-928.

THE wood of this Algerian tree (which furnishes Sandarac resin) when submitted to distillation with steam, yields about 2 per cent. of a dark reddish-brown essential oil, which smells of phenols. It contains carvacrol, thymoquinol, and thymoquinone.—J. T. D.

Essential Oil in Annuals; Formation and Distribution of ——. E. Charabot and G. Laloue. Comptes rend., 1904, **139**, 928-929.

BEFORE the period of flowering, the essential oil is formed in the green parts of the plants. As the development of the flowers proceeds, the quantity of essential oil in the whole portion of the plant borne by each stalk, increases; but that in the green parts shows a diminution, whilst that in the flowers shows a great increase. The essence thus appears to be transported from the leaves to the flowers, along with the carbohydrates which are destined for the nutrition of the flowers and fruit. After fruiting, when the reserve storage of carbohydrates is accomplished, and the transport of nutritive substances to the flower ceases, the essential oil seems to return to the leaves; for these show an increase, whilst the amount in the flowers, and the total amount in the plant, have decreased. The essential oil thus seems not to be independent of the mechanism which provides for the accumulation of reserve nutriment in the fruit. Comparing different organs of the plant, the leaves and flowers are found to be richest in essential oil; the stalks contain but little, and the roots none.—J. T. D.

Lupeol from the Bark of Roucheria Griffithiana, Planch. J. Sack and B. Tollens. Ber., 1904, **37**, 4105-4109.

THE authors have studied the above bark which is employed by the natives of Malacca for mixing with their arrow-poison. They have obtained from it dextrose and a crystalline substance belonging to the cholesterol group, which is identical with the *lupeol* previously observed in lupin-pods and in certain species of gutta-percha. The lupeol was extracted from the bark by means of alcohol and was prepared, after repeated purification, in the form of fine colourless needles, melting at 210° C. It is insoluble in water and aqueous acids and alkalis, but soluble in most organic media. Lupeol has the formula $C_{26}H_{42}O$ and a rotatory power, in 6·5 per cent solution in chloroform, of $[\alpha]_D = 27·3°$. When treated with acetic anhydride and strong sulphuric acid, its chloroform solution yields a violet coloration after half an hour. Lupeol combines with 2 atoms of bromine by addition; the dibromide melts at 154° C., the benzoate at 262° C., and the phenylcarbamate at 226° C.—J. F. B.

Barium Platinocyanide; Preparation of ——. A. Brochet and J. Petit. XI. A., page 1222.

Osmosis, Solubility and Narcosis; Theories of ——. I. Traube. XXIV., page 1242.

Chlorine in Essential Oil of Bitter Almonds; Manipulation of the Test for ——. Schimmel's Report, XXIII., page 1240.

ENGLISH PATENTS.

Amino-Alcohols and their Derivatives [*for Perfumery*]; *Preparation of ——.* E. F. A. Fourneau, Paris. Eng. Pat. 24,631, Nov. 12, 1903.

SEE Fr. Pat. 338,889 of 1903: this J., 1904, 910.—T. F. B.

Pyrocatechnicmonoalkylethers and especially of Guaiacol and Guaethol with Protein Substances; Process for the Production of Compounds of ——. H. C. Fehrlin, Schaffhausen, Switzerland. Eng. Pat. 449, Jan. 7, 1904.

COMPOUNDS of "pyrocatechuic monoalkyl ethers" with protein substances (*e.g.*, albumin) are prepared either by mixing together aqueous solutions of the substances, with or without heating, until the mixture coagulates, or by adding an aqueous solution of the proteid to an alkaline solution of the "pyrocatechuic ether" and precipitating the solution with dilute acid. The product is filtered, washed, dried, heated to 115°—120° C., washed with some indifferent solvent (*e.g.*, toluene), and finally dried. For example, 650 grms. of guaiacol or guaethol, dissolved in alcohol, are added, with constant stirring, to a solution of 1 kilo. of egg albumin in 10 litres of water; or a mixture of 1 kilo. of casein, 150 grms. of guaiacol, and 2 kilos. of alcohol is heated for several hours on the water-bath. The compounds thus produced, are insoluble in water, alcohol, and acids, but are decomposed by alkalis; they are also completely insoluble in the gastric juice, and are said to possess therapeutic value.—T. F. B.

UNITED STATES PATENTS.

Ionone; Process of making Homologues of ——. R. Schmidt, Assignor to Haarmann and Reimer, Chem. Fab zu Holzminden G. m. b. H., Germany. U.S. Pat. 775,251, Nov. 15, 1904.

Cyclic homologues of ionone are prepared by treating aliphatic homo-ionones with dilute acid, and treating the "α-cyclic" homo-ionones thus formed with a concentrated acid at a temperature not above 40° C.; the cyclic homo-ionones may also be prepared by treating the aliphatic ketones directly with concentrated acid below 40° C. Different isomers of the ionone derivative are obtained according to the nature of the concentrated acid employed. See also Ger. Pats. 116,637, 122,466, and 134,672, and U.S. Pat. 762,765; this J., 1901, 151 and 1018; 1902, 1348; and 1904, 798.—T. F. B.

Citrus Fruits; Process of Extracting Oleo-Resin from the Peel of ——. E. J. Sheenan, Assignor to San Gabriel Valley Essential Oil Co., Pasadena, Cal. U.S. Pat. 775,502, Nov. 22, 1901.

The peel of citrus fruits is coarsely ground, wrapped in filter cloth, and the water removed by pressing between plates. The mass is finely pulverised, extracted with a suitable volatile solvent (ether, chloroform, or carbon bisulphide), the extract evaporated, and the oleo-resin dried in a current of hot air.—T. F. B.

Citrus Fruits; Oleo-resinous Product from ——. E. J. Sheenan, Utica, N.Y., Assignor to San Gabriel Valley Essential Oil Co., Pasadena, Cal. U.S. Pat. 775,546, Nov. 22, 1904.

Claim is made for the oleo-resinous product extracted from the peel of citrus fruits by the method described in U.S. Pat. 775,502 (see preceding abstract). This consists, in addition to the essential oil of the fruit, of a series of flavouring resins composed of acid and neutral resins in about equal proportions and together constituting from 6—10 per cent. of the total product. Its specific gravity is slightly higher and its optical rotation slightly lower than those of the commercial essential oils. The neutral resins are not volatile in steam, but are deposited from hot alcohol in the form of crystals of m. pt. 120°—130° C. The acid resins are insoluble in alcohol, but soluble in alcoholic sodium hydroxide solution. These resins are all completely soluble in ether, chloroform, or carbon bisulphide.—T. F. B.

Dialkylbarbituric Acid; Process for Preparing ——. M. Engelmann, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 775,809, Nov. 22, 1904.

The process is similar to that described in Eng. Pat. 22,967 of 1903 (this J., 1904, 76) with the exception that the thiocarbonyl group of the dialkyl-di-imino-thiopyrimidine is first oxidised to a carbonyl group, the two imino groups being subsequently eliminated.—T. F. B.

Dialkylbarbituric Acid: Process of Preparing ——. M. Engelmann, Elberfeld, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 775,810, Nov. 22, 1904.

See Eng. Pat. 22,967 of 1903; this J., 1904, 76.—T. F. B.

Phenol Compound. C. Gentsch, Vohwinkel, Germany, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 775,814, Nov. 22, 1904.

The addition compounds, formed by uniting 1 mol. of an alkali salt of a phenol with several molecules of a free phenol, are claimed. Special claim is made for that derived from 1 mol. of the potassium salt of *m*-cresol and 3 mols. of *m*-cresol, which is a crystalline solid having an alkaline reaction; it melts at 88° C., above which temperature *m*-cresol is split off.—T. F. B.

Alcohols and Aldehydes; Process of Making ——. H. S. Blackmore, Assignor to R. C. Mitchell, Mount Vernon, N.Y. U.S. Pat. 774,824, Nov. 15, 1904.

A mixture of an alcohol and aldehyde is produced by passing the corresponding hydrocarbon over a mass of a suitable metallic oxide (*e.g.*, ferric oxide) heated to a temperature sufficient to oxidise the hydrocarbon, but insufficient to decompose the desired products. Thus, a mixture of methyl alcohol and formaldehyde is obtained by passing a current of methane under pressure over heated ferric oxide. When the process is complete, the reduced iron is reoxidised by heating it and passing a current of air over it.
—T. F. B.

FRENCH PATENTS.

Aldehydes; General Process of Preparing ——. L. Bouveault. Fr. Pat. 339,121, Oct. 26, 1903.

Aldehydes are produced by decomposing with water the product of the reaction of di-substituted aminoformaldehydes on alkyl-, aryl-, or hydroaryl magnesium halides. The stages of the process are represented by the equations—

$$R.Mg.X. + H.CO.NR'R'' = R.CH(O.Mg.X)NR'R.''$$

$$2.R.CH(OMg.X)NR'R'' + H_2O =$$
$$2R.CHO + MgO + MgX_2 + 2NHR'R''$$

where R, R', and R'' represent alkyl-, aryl-, or hydroaryl radicles and X a halogen atom.—T. F. B.

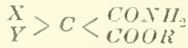
Marcs of Wine or Fermented Products; Recovery of Alcohol [and Cream of Tartar] from ——. G. Ciapetti. Fr. Pat. 344,880, June 18, 1904. XVII., page 1231.

Marcs and Grapes, [Alcohol and Cream of Tartar]; Process and Apparatus for Treatment of ——. Egrot Grangé et Cie. Fr. Pat. 344,737, July 9, 1904. XVII., page 1231.

Alkylaminoacetopyrocatechols; Process for Preparing ——. Farbwerke vorm. Meister, Lucius und Brüning. First addition, dated July 18, 1904, to Fr. Pat. 344,930, July 18, 1904. Under Internat. Conv., Sept. 26, 1903.

See Eng. Pat. 26,430 of 1903; this J., 1904, 1043.—T. F. B.

Dialkylbarbituric Acids from Dialkylaminomalonic Esters



$$\begin{matrix}X\\Y\end{matrix}>C<\begin{matrix}CONH_2\\COOR\end{matrix};$$

Process for Producing ——. Maison E. Merck. Fr. Pat. 344,980, July 20, 1901. Under Internat. Conv., March 16, 1904.

Dialkylbarbituric acids, as well as dialkylbarbituric esters and dialkylmalonic acid amides, are produced by the action of urea, thiourea or guanidine on dialkylaminomalonic esters, of the formula $(X)(Y)C(CONH_2)COOR$, in presence of suitable condensing agents. Diethylbarbituric acid is produced by heating diethylaminomalonic acid with urea and sodium ethylate. Diethylmalonylguanidine is produced similarly from guanidine hydrochloride and diethylaminomalonic ester.—T. F. B.

C.C.-Dialkylbarbituric Acids; Process for the Production of ——. E. Merck. Fr. Pat. 345,196, July 20, 1904. Under Internat. Conv., Oct. 20, 1903.

Dialkylmalonylguanidines, $R_2C:(CO.NH)_2:C:NH$, are converted into dialkylbarbituric acids by heating (*e.g.* in a sealed tube at 120° C., for an hour), with reagents which will split off the imino group, such as dilute hydrochloric or sulphuric acid (1 : 3). Compare Fr. Pat. 343,673 of 1904; this J., 1904, 1043.—T. F. B.

Barbituric Acids; Process for Converting Di-imino or Tri-iminobarbituric Acids (Di-iminomalonylguanidines) into ——. E. Merck. Fr. Pat. 345,497, July 20, 1904. Under Internat. Conv., Feb. 10, 1904.

Di-imino and tri-iminobarbituric acids, obtained by condensing malonyl-nitrile or its alkyl derivatives with urea or guanidine, are converted into barbituric acids by heating with mineral acids. (Compare preceding abstract.)
—T. F. B.

Bromodialkylacetamides : Process for Preparing ——. Kalle et Cie. Fr. Pat. 345,231, July 29, 1904. Under Internat. Conv., Dec. 9, 1903.

Bromodialkylacetamides of the constitution R.R′.CBr.CONH$_2$, are obtained from the corresponding dialkylacetic acid by converting the latter, by the action of phosphorus chloride or phosphorus and bromine into dialkylacetyl chloride or bromide, brominating with one mol. of bromine, and converting the resulting bromodialkylacetyl chloride or bromide into bromodialkyl acetamide by treating with ammonia or ammonium carbonate in ethereal solution. The diethyl, ethylpropyl, and dipropyl compounds are described.—T. F. B.

Picric Acid ; Process for Preparing —— in the Cold. O. Wichardt. Fr. Pat. 345,441, Aug. 9, 1904.

Picric acid may be prepared without the aid of heat, by adding 20 parts of phenol, with constant stirring, to a mixture of 100 parts of nitric acid (sp. gr., 1·4) and 30 parts of alcohol. The crystalline mass thus produced is dissolved in hot water, and the crude picric acid, which separates on cooling, is purified in the usual way. The yields are stated to average 95 per cent of the phenol used.
—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Development with an Acid Developer. Maes. Brit. J. Phot., 1904. **51,** 1031—1032.

Balagny (Fr. Pat. 338,650 of 1903 ; this J., 1904, 680) has shown that amidol can be used successfully in acid solution for developing plates and papers : the author finds that other developers, notably pyrogallol, ortol, and adurol, give equally good results in acid solutions. The time necessary for development is greater than when alkaline solutions are employed, but there is less tendency to fog and halation, and better gradation is obtainable.—T. F. B.

Photographs prepared by Lippmann's Process ; The Dark Stripes [Zenker's Stripes] which appear on Spectra Covering ——. L. Pfaundler. Ann. der Physik, 1904 [3], **15,** 371—384. Chem. Centr., 1904, **2,** 1146. (See this J., 1891, 483 ; 1893, 464 ; 1895, 65 ; 1896, 400 ; 1900, 273.)

The chief result of the author's work, which is mainly mathematical, is that if two light waves of unequal wavelengths penetrate the silver bromide film, the two systems of silver separations are optically influenced. The appearance of the dark stripes predicted by Zenker shows that in the Lippmann process, quite a number of colour-pairs do not unite to a correct colour-mixture, but are neutralised to black.—A. S.

Gelatin ; Setting and Swelling of ——. P. v. Schroeder. XIV., page 1227.

Colloids [Gelatin, &c.] Solution and Swelling of ——. K. Spiro. XIV., page 1227.

English Patents.

Photographs ; Process for Producing Coloured ——. W. Riebensahm, Berlin, and G. Koppmann, Hamburg. Eng. Pat. 808, Jan. 12, 1904.

See Fr. Pat. 338,170 of 1903 ; this J., 1904, 622.—T. F. B.

Photography ; Films for Use in —— [Pigment Process]. C. D. Abel, London, From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 925, Jan. 13, 1904.

See Fr. Pat. 339,654 of 1904 ; this J., 1904, 727.—T. F. B.

French Patents.

Colouring Silver [Photographic] Pictures ; Process for ——. O. Gros. Fr Pat. 345,033, May 31, 1904. Under Internat. Conv., April 9, 1904.

"Silver prints" are first converted into "manganic prints," (see Fr. Pat. 343,583 of 1904 ; this J., 1904, 1044) and then coloured by means of suitable dyestuffs or solutions. For example, a silver bromide print is decolorised in the following solution : 10 per cent. potassium bromide solution, 3 c.c. ; 10 per cent. citric acid solution, 2 c.c. ; and 3 c.c. of a solution obtained by mixing 6 grms. of sodium tartrate, 1 grm. of crystallised manganous sulphate, 5 grms. of N/1 sodium carbonate solution, and 5 grms. of a 4 per cent. potassium permanganate solution. To this solution is added 100 c.c. of a 0·4 per cent. solution of potassium ferricyanide. The decolorised print is washed and introduced into a solution composed of 90 c.c. of 2 per cent. potassium ferricyanide solution, and 10 c.c. of sodium carbonate solution. The brown "manganic" print thus obtained can be coloured by any known process, *e.g.*, by means of aniline hydrochloride. By this process it is stated that a much greater variety of tones may be obtained than by working directly on the ordinary silver print.
—T. F. B.

Photographic Paper ; Sensitive Coating for ——, and Process for Manufacturing same. G. Hauser. Fr. Pat. 345,206, July 25, 1904.

Certain insoluble zinc salts, particularly the oxide, possess the property of accelerating considerably the reduction of soluble silver salts by daylight. The emulsion may be prepared by immersing the paper or other support, previously coated with gelatin with which zinc oxide has been incorporated, in a solution of silver nitrate or citrate. Prints of a pleasing black tone are said to be obtained on such a paper. They require no further toning, and are finished by simply fixing in sodium thiosulphate solution, which in no way alters the tone. Under-exposed prints may be developed in the usual way, thus permitting the working of these papers by artificial light.—T. F. B.

Photographic Films ; Self-Detaching ——. M. Bry et Cie. Fr. Pat. 345,535, Aug. 12, 1904.

The self-detaching films at present in use, consisting of a gelatin film attached to a paper support by means of wax, rubber, glucose, &c., possess the disadvantage of frequently becoming detached during the manipulations, and also of being easily distorted and of curling up, even when dry. These defects are found to be remedied by backing a gelatin film (0·8—1·0 mm. thick) with a film of collodion, applying the sensitive emulsion to the gelatin, and fastening the temporary paper support to the collodion side by means of an albuminoid adhesive, soluble in water. Such a film is stated to retain its shape during the operations, and to be easily detached when finished.—T. F. B.

Pigment [Photographic] Pictures on Transparent Supports : Process for Producing Detachable ——. H. Schmidt. Fr. Pat. 345,594, Aug. 13, 1904.

See Eng. Pat. 17,610 of 1904 ; this J., 1904, 998.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, Etc.

English Patents.

Explosives [Perchlorate]. F. E. W. Bowen, London. Eng. Pat. 21,481, Oct. 6, 1903.

The composition of these explosives is as follows :—Shell powder : ammonium perchlorate (75 per cent.), aluminium (12 per cent.), and paraffin (13 per cent.). Blasting powder : ammonium perchlorate (72 per cent.), aluminium (11 per cent.), and nitronaphthalene (17 per cent.).
—G. W. McD.

Explosives. F. E. W. Bowen, London. Eng. Pat. 21,482, Oct. 6, 1903.

Nitrocellulose (66—75 parts) is dissolved in acetone or ether alcohol and finely powdered ammonium perchlorate (25—33 parts) incorporated with it. The mixture can then be rolled or pressed as usual.—G. W. McD.

Explosives for Blasting or like Purposes. J. Russell, Hamilton, Scotland. Eng. Pat. 28,710, Dec. 31, 1903.

Mono-, di-, or trinitrotoluene (2—10 cent.) is added to nitroglycerin blasting explosives to prevent them from freezing at low temperatures.—G. W. McD.

Explosives; Impts. in ——. N. Evangelidi, Charcow. Russia. Eng. Pat. 20.106, Sept. 17, 1904.

The explosive consists of potassium chlorate (78 parts), yellow prussiate of potash (37·5 parts), wood charcoal (6 parts), and glycerin (6·5 parts). The addition of glycerin is said to give safety and to allow of the intimate mixing of the ingredients. For a granulated powder one-half of the charcoal is replaced by tannin.—G. W. McD.

Gunpowder; Manufacture of ——. Soc. de la Poudre Peigne et des Brevets. J. Luciani, Geneva, Switzerland. Eng. Pat. 21,204, Oct. 3, 1904. Under Internat. Conv., Feb. 17, 1904.

The charge of powder for ordnance or small fire-arms consists of a sheet of explosive of suitable thickness coiled on itself and provided, either over the whole of its surface, or only a part, with cuts or notches of straight, waved or other shape, which extend wholly or partly through the thickness of the sheet. The object of the invention is to produce a sheet containing a certain number of points at which combustion may commence and from which it may spread in a regular and uniform manner.—G. W. McD.

United States Patent.

Pyrotechnical Compound. K. Hufnagel, Germany, Assignor to E. H. Wagner, New York. U.S. Pat. 775,822, Nov. 22, 1904.

The compound consists of a mixture of white and red phosphorus, potassium chlorate, red clay, and gum arabic. —A. S.

French Patent.

Picric Acid: Process for Preparing —— in the Cold. O. Wickardt. Fr. Pat. 345,411, Aug. 9, 1904. XX., page 1238.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Continuous Extraction of Solutions with Chloroform; Apparatus for ——. E. Baum. Chem.-Zeit., 1904. **28**, 1172.

The apparatus is easily understood from the drawing. Some chloroform is first placed in the inner vessel, followed by the solution to be extracted. Connection is then made to the vessel below containing the chloroform, and to the reflux condenser above, the end of which is so arranged, as seen in the figure, that the drops of condensed chloroform fall through the solution to be extracted.—J. T. D.

French Patents.

Gases; Apparatus [Automatic] for Analysis of ——. A. Bayer. Fr. Pat. 345,221, July 29, 1904.

The apparatus is designed for determining and registering graphically the composition of a gaseous mixture, *e.g.*, boiler-furnace gases. It comprises two or more gas meters, communicating with one another, but having interposed between them vessels containing liquid or solid absorbents and tubular cooling devices. The rate of flow of the gas is thus measured before and after the removal of the component to be determined, the gas being brought to the same temperature in each case before passing through the meter. The dials of the meters are connected to a differential registering mechanism, by means of which the rates of flow are traced with a stylus upon a diagram carried by a drum. The gas to be analysed is drawn through the apparatus by means of a water-pump.—H. B.

Wines, Musts, Ciders, &c.; Apparatus for Determining the Dry Extract and the Alcohol in ——. A. B. Darbois. Fr. Pat. 345,455, July 28, 1904.

The apparatus consists of an ebullition alcoholometer and a densimeter with immersion tube in a portable case. The ebullition apparatus is heated by a spirit lamp, the flame of which impinges on a metal bulb through which the wine is caused to circulate, whereby rapid heating is ensured. The upper part of the ebullition cylinder is connected with a condenser. The densimeter floats in a cylinder which fits on the same stand as the alcoholometer: it is provided with an index fixed on the top of the cylinder which can be read at a point above the liquid. The stem of the float is graduated in two scales, one showing the dry extract and the other the amount of alcohol obtainable from any fermentable must.—J. F. B.

INORGANIC—QUANTITATIVE.

Iron; Separation of —— from Nickel and Cobalt by Formic Acid. L. H. Borgström. Bull. Comm. Geol. de Finlande, 1903, **14**, 73; Chem.-Zeit., 1904, **28**, Rep. 353.

The difficulties in the way of the ordinary methods of separation are obviated by using ammonium formate as the precipitant of the iron, the latter alone being thrown down from a neutral solution. A second precipitation suffices to entirely free the iron from nickel and cobalt. The precipitates are easily filtered, but the decomposition, filtration, and washing must be effected in the warm.—C. S.

Copper; Electrolytic Determination of ——. A. Kufferath. Z. angew. Chem., 1904, **17**, 1785—1786.

For technical purposes, where the highest degree of accuracy is not required, copper can be determined electrolytically with great rapidity if formaldehyde (in the shape of commercial formalin) be added to the solution. The deposition of nickel, cobalt, and iron is hindered or entirely prevented by the presence of formaldehyde. The solution for electrolysis, about 130 c.c., is placed in a platinum basin of about 9 cm. diameter and 4.5 cm. depth, the inner surface of which has been slightly matted by careful rubbing with finely-powdered glass. To the solution are added 1·5—2·0 c.c. of formalin, the temperature raised to and kept at 60°—65° C., and a current of 2·5—3·0 ampères at 2 volts passed till a sample shows no copper reaction. Without interrupting the current, the deposit is washed clean with water, then twice with 95 per cent. alcohol and lastly with ether; it is then dried *in vacuo* over sulphuric acid. The whole analysis takes 2—2½ hours. The anode is a flat platinum spiral kept as deep as possible in the solution, and passes through an inverted funnel which just touches the liquid: all loss of spray is thus avoided. Results with pure copper sulphate solution were accurate; with mixtures in approximately equal proportions of copper and nickel, copper and cobalt, copper and iron sulphates, 99·71 to 99·92 per cent. of the actual copper was yielded. Ammonium nitrate, chlorides, or free nitric acid, prevent concordant results from being obtained; very small amounts of the last-named, however, may be present without interfering seriously with the process.—J. T. D.

Stannic Oxide in Copper Tin Alloys; Electrolytic Separation and Determination of ——. E. Heyn and O. Bauer. Mitt. königl. Materialprüfungsamt, 1904, **22**, 144—145. (See page 1219.)

The alloy in the form of turnings is placed on the bottom of a platinum dish and serves as anode, the cathode is of platinum gauze, and the electrolyte sulphuric acid of sp. gr. 1·18. A current strength of 0·5—0·7 ampère is employed. The metallic constituents of the alloy dissolve rapidly, whilst stannic oxide separates at the anode. The copper deposited on the cathode must be frequently removed, to prevent it falling to the bottom and to avoid short-circuiting. Towards the end of the electrolysis the solution of the alloy proceeds very slowly, the separated stannic oxide preventing good electrical contact with the anode. The dish should now be continuously shaken, in order to expose fresh surfaces of the alloy. The residual stannic oxide is washed with sulphuric acid, treated for a short time with nitric acid, dried, and ignited. It contains a trace of copper, a sample analysed giving the following results:—Stannic oxide, 99·16; copper, 0·99 per cent. —A. S.

Phosphates; Colorimetric Determination of ——. O. Schreiner and B. E. Brown. J. Amer. Chem. Soc., 1904, **26**, 1463—1468. (See also this J., 1904, 911.)

BESIDES the solutions (1), (2), (3), and (4), given in the paper of Schreiner and Ferris on the determination of magnesium, the following are required: (6) 1 part of strong ammonia solution (sp. gr. 0·9) free from silica, and 9 parts of water; silica may be removed by distillation; (7) saturated ammonium oxalate solution; (8) magnesia reagent, prepared by dissolving 13 grms. of magnesium chloride, $MgCl_2, 6H_2O$, and 20 grms. of ammonium chloride in about 900 c.c. of water, adding 50 c.c. of strong ammonia solution (sp. gr. 0·9) and diluting to a litre; 1 c.c. of this solution will precipitate 0·0035 grm. of phosphoric anhydride. To a convenient quantity of the liquid, usually 50 c.c., 1 drop of ammonia solution and two or three drops of saturated ammonium oxalate solution are added and the liquid evaporated to dryness on a water-bath. 1 c.c. of the magnesia reagent (7) is well mixed with the cooled residue, and the whole allowed to stand about two hours. The precipitated magnesium ammonium phosphate is then washed on a filter free from silica several times with the ammonia solution (6) until the filtrate measures approximately 50 c.c. The precipitate is then washed with about 5 c.c. of cold water, dissolved on the filter in about 5 c.c. of nitric acid (2) and the filter is washed with hot water until about 45 c.c. of filtrate are obtained. 4 c.c. of ammonium molybdate solution (1) are added to the cooled liquid and, after 20 minutes, the solution is compared with the standard colorimetric phosphate solution (4). This method gives good results with quantities of phosphates as small as 1 part of phosphoric anhydride per million of solution, and it is not influenced by the presence of other salts, including silicates. —T. H. P.

ORGANIC—QUALITATIVE.

Sugars; Reaction of Aldehydic ——. A. Berg. Bull. Soc. Chim., 1904, **31**, 1216—1217.

THIS method is based on the fact that the aldoses are oxidised by bromine in presence of water, the aldehydic group being converted into a carboxylic group. These alcohol acids all give a deep yellow coloration with an acidified solution of ferric chloride. Under similar conditions, ketoses are not converted into carboxylic acids, and the resulting solutions give no coloration with ferric chloride. 0·02—0·03 grm. of the sugar is heated with 10 c.c. of saturated bromine water to 60°—70° C. for 10 minutes, and the excess of bromine removed by boiling. On adding to this solution 10 c.c. of a solution made by the addition of 4 drops of ferric chloride solution (sp. gr. 1·44) and 2 drops of concentrated hydrochloric acid to 100 c.c. of water, the yellow coloration is produced if an aldehydic sugar has been used. This method gives a simple means for establishing the purity of the ketoses. In testing the poly-oses, it is necessary to use freshly prepared bromine water, since hydrobromic acid would tend to cause inversion of the sugar.—T. F. B.

Starch-containing Materials; Method of Distinguishing between Different —— *by Means of Iodine Vapour.* A. Dubosc. Chem.-Zeit., 1904, **28**, 1149.

THIS method, first described by Bleicher, consists in placing the substance on a glass plate, on which is also placed a watch glass containing a little iodine, and covering the whole with a bell-jar. After 24 hours, marked differences can be observed in the colorations of different substances. Thus, maize starch turns blackish-violet, wheat starch bluish-grey, sago starch brownish-grey, and potato-starch yellowish-grey, the yellow shade increasing with the proportion of foreign matters present.—C. A. M.

Essential Oil of Bitter Almonds; Manipulation of the Test for Chlorine in ——. Schimmel's Report, Oct. 1904, 7—8.

A PIECE of filter paper about 2 × 2½ ins. is folded into a spill, saturated with the oil, placed in a small porcelain dish, ignited, and covered over while burning with a capacious beaker, the inside of which has been previously moistened with distilled water. This beaker is allowed to remain for a minute after the flame has burnt out; it is then rinsed with 10 c.c. of distilled water, and the rinsings tested for chlorine in the usual manner, with silver nitrate. Precaution should be taken to ensure that any reaction obtained is not due to hydrocyanic acid.—J. O. B.

ORGANIC—QUANTITATIVE.

Nitrogen in Organic Compounds; Determination of ——. H. C. Sherman and M. J. Falk. J. Amer. Chem. Soc., 1904, **26**, 1469—1474.

DYER'S modification (this J., 1895, 604) of the Gunning-Kjeldahl method of nitrogen determination, in which the substance is heated with sulphuric acid and mercury until frothing subsides, after which 10 grms. of potassium sulphate are added, and the solution boiled until colourless, combines all the advantages of the other modifications of this method. It is, however, not sufficient in all cases to boil the liquid until it becomes colourless. With very resistant substances, such as alkaloids, coal, &c., the boiling with sulphuric acid, mercury, and potassium sulphate should be continued for at least two hours after the solution becomes colourless, and for not less than three hours in all. No advantage is found in the use of copper in addition to the reagents mentioned, but with the coals tested, slightly higher results were obtained by the careful use of permanganate at the end of three hours' boiling. With all samples in which the nitrogen exists essentially as proteids or albuminoids and related compounds, including the so-called "nitrogenous extractives," and other amides and amino-compounds, it is only necessary to use mercury and potassium sulphate and to boil for at least one hour from the time the potassium sulphate is added.—T. H. P.

Ammonia and Amines; Determination of ——. J. Effront. Ber., 1904, **37**, 4290—4295.

WHILE the measurement of the nitrogen evolved by the reaction of hypochlorites upon ammonia and amino-compounds does not afford a generally applicable and accurate method for the determination of these substances, much better results are obtained by measurement of the available chlorine destroyed in the reaction. Amino-, imino-, and nitrile bases, amides and amino-acids can be thus determined, but ammonium-bases are without action on hypochlorites. To carry out the process, 20 c.c. of a solution of bleaching-powder (1·5—2 per cent. of available chlorine) are placed in a 50 c.c. flask, 20 c.c. of *N*/sodium carbonate solution are added, and 1—5 c.c. of a 1 per cent. solution of the substance under examination; the flask is filled up with distilled water, corked, and allowed to stand in the dark for 12—15 hours. The liquid is then rinsed into a beaker, arsenious oxide solution exactly equivalent to the original bleaching powder solution used, is added, then 20 c.c. of N-sulphuric acid, followed by 10 c.c. of saturated solution of sodium bicarbonate; the excess of arsenious oxide is now titrated by means of iodine solution. The method is available for the determination of ammonia in waters. (See this J., 1904, 912.)—J. T. D.

Naphthalene in Coal Gas and Tar; Determination of ——. A. H. White and S. Ball. J. Gas Lighting, 1904, **88**, 262—263, 323—326.

THE authors determined the amount of naphthalene in the gas as it leaves the retort, and followed step by step the progress of its elimination in the subsequent manufacturing plant. For the determination of naphthalene in the purified gas, Küster's method (Ber., 1894, **27**, 1101), as modified by Colman and Smith (this J., 1900, 128), was found to give good results. To determine naphthalene in tar, the following method was finally adopted:—About 1 grm. of tar is weighed into an Erlenmeyer flask of 50 c.c. capacity, closed by a doubly bored stopper containing two tubes, one of which forms an air inlet, whilst the other is attached to a U-tube, the first two thirds of which is filled with fragments of quicklime, and the remainder with glass-wool and phosphorus pentoxide. The flask and drying-tube are placed in an air-bath heated to 70°—80° C., the outlet of the latter being coupled by a short connection to a second U-tube outside the air-bath and immersed in ice-cold water. A current of air is drawn through the apparatus at the rate of 2 litres per hour, the naphthalene being volatilised and retained in the cold U-tube. The operation is continued until the latter no longer gains in weight, and the final increase of weight is taken as the quantity of the naphthalene in the tar; although the naphthalene formed is not quite pure, the results are sufficiently accurate for the purpose in view. To determine the amount of naphthalene in the crude gas, in which it is present partly in solution in the suspended tar, and partly in the form of vapour, a half-inch glass tube packed with glass wool is inserted some six inches into the gas main at the point where the test is to be made, the filtering material being thus kept at the same temperature as the gas. One cubic foot is aspirated through the filter, and thence, through as short a connection as possible, into a bottle containing picric acid solution, which retains the naphthalene present as vapour. The naphthalene in the tar filter is estimated in the manner above described, and the picric acid solution is washed into a 50 c.c. Erlenmeyer flask, solid caustic soda added to neutralise the acid, and the naphthalene volatilised and determined as before. The combined result gives a sufficiently accurate representation of the total quantity of naphthalene, both in the suspended tar and as vapour in the crude gas, but does not permit of the estimation of the proportions present in each state, inasmuch as the tar filter, although maintained at the same temperature as the gas, largely absorbs the naphthalene vapour before it reaches the picric acid. It has frequently been stated that the vapour pressure of naphthalene is affected by the presence of moisture, ammonia, and acetylene in the gas, but the authors find, on experimental investigation of this point, that these gases exert no such influence. Experiments made with benzene vapour seemed to indicate that this hydrocarbon increased the vapour pressure of naphthalene, but the authors do not regard the results as conclusive.

—H. G. C.

Beetroots; Direct Determination of Sugar in ——. Non-influence of Air on the Results. H. and L. Pellet. Bull. Assoc. Chim. Sucr. et Dist., 1904, **22**, 312—317.

In reply to Loga, who found that in the hot aqueous digestion method of Pellet it was necessary for accuracy to remove the air by subjecting the liquids examined to a vacuum for 30 to 40 minutes, the author attributes his failures to improperly formed pulp. The coarse pulp obtained with rasps having saw teeth give very little emulsion, and the froth is readily removed with a little ether or alcohol. The Keil disc should not revolve at a greater rate than 250 turns per minute, and the normal weight of pulp should be made to 200 c.c. and read in a 400 mm. tube. There is then no difficulty in removing the air.—L. J. de W.

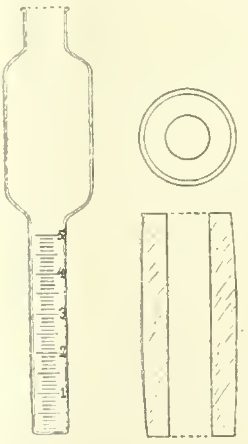
Beetroot Juice; Determination of the Purity of ——. H. Schulz. Z. Ver. Deutsch. Zucker Ind., 1904, **54** [Techn. Part], 1248—1250.

Recent researches have shown that the usual method of determining the quotient of purity of raw beetroot juice is very unsatisfactory. In the first place it is desirable to be able to prepare readily in the laboratory a juice which shall represent in composition the factory juice in its various conditions, for it is of far greater importance to know the purity of such juice than that of raw juice which, as is well known, is purified in very different degrees during separation, owing to the varying precipitability of its non-sugars.

The author treated the normal weight of fine rasped pulp in a 200 c.c. flask, half filled with water, with 2 or 3 c.c. of a 1:10 milk of lime, and heated on the water bath to 85°—90° C. In two minutes the separation was complete. Precipitation of the excess of lime by the ordinary reagents was found to be unsatisfactory. "Active" magnesium carbonate (magnesium bicarbonate) precipitates the lime quantitatively, but the reagent quickly loses its power, when a mixture of magnesium hydroxide and carbonate remains in solution. The active reagent is prepared by completely saturating magnesium hydroxide held in suspension in water with carbon dioxide. The filtrate is cooled at the temperature of melting ice and the magnesium salt crystallised out. It may also be prepared by gradual evaporation at 20° C., but the yield is less and the product not so active.—L. J. de W.

Maple-Syrup and Maple Sugar; Composition, Analysis, and Adulteration of ——. J. Hortvet. J. Amer. Chem. Soc., 1904, **26**, 1523—1545.

The author describes the methods he has employed in the analysis of a number of samples of maple-syrup and maple-sugar, both pure and adulterated. One of the determinations which gives a clue to the purity or otherwise of the product is that of the volume of the precipitate formed with lead sub-acetate; the method of measuring this is as follows: Into the tube shown in the figure, which has a total length of 15·2 cm., a diameter at the wide part of 3·0 cm., and at the stem of 2·0 cm., are placed 5 c.c. of the syrup or 5 grms. of the sugar and 10 c.c. of water. After complete solution, 0·5 c.c. (10 drops) of alumina-cream and 1·5 c.c. of lead sub-acetate solution are added, and the tube well shaken. The tube is then allowed to stand for from 45 to 60 minutes, with occasional twisting to facilitate the settling of the precipitate. It is then fitted into the holder, which is 7·7 cm. long, 3·2—3·5 cm. in diameter, and has a central aperture 1·3 cm. in diameter, and placed in a centrifugal machine and run for six minutes; any material adherent to the wider portion is then loosened with a piece of wire and the centrifugalising continued for a further period of six minutes at the same speed as before. The volume occupied by the precipitate is then noted, reading to 0·01 c.c. as nearly as possible. A similar blank experiment is made with water, alumina-cream, and lead sub-acetate, the volume of the precipitate obtained being subtracted from those given by the sugars.



The analytical results obtained with sugars and syrups of known purity are summarised in the following table:—

	Syrups.			Sugars.		
	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.
Volume of lead sub-acetate precipitate in c.c.	2·89	1·38	1·87	3·37	1·31	1·99
Ash, per cent.	1·53	0·76	1·02	1·45	0·72	0·99
Phenolphthalein alkalinity	0·62	0·30	0·40	0·57	0·25	0·41
Total alkalinity	2·18	1·09	1·69	2·39	1·12	1·69

These numbers all refer to the amount of dry matter present in the samples.—T. H. P.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Helium: Presence of —— in Radio-Active Gaseous Mixtures evolved from Thermal Springs. C. Moureu. Comptes rend., 1904, **139**, 852—855.

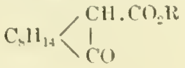
In view of the production of helium from the radium emanation, discovered by Ramsay and Soddy, and since observed by other investigators, it seemed desirable to ascertain whether this element accompanied the radioactive constituents of the gases from mineral springs. Curie and Laborde have already recognised it in three instances, and the author has found the helium line in the spectrum of the gases from 12 other springs which he has examined. In nearly all of them the helium line ($\lambda = 587 \cdot 6$) was at least as brilliant as the strongest argon lines in the same spectrum. The amounts of helium present vary greatly, that in the strongest springs being estimated at 50 times that in the weakest.—J. T. D.

Colloidal State: The ——. G. E. Malfitano. Comptes rend., 1904, **139**, 920—922.

The author considers that matter in the colloidal state consists of an electrolyte dissociated into ions, with insoluble molecules grouped around these ions.—J. T. D.

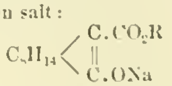
Salt Formation in Solutions, especially of Tautomerisable Compounds (Pseudo Acids, Pseudo Bases). J. W. Brühl and H. Schröder. Z. physik. Chem., 1904, **50**, 1—42.

The authors have determined by physico chemical methods the chemical constitution of esters and ester-salts of the type of aceto-acetic ester and sodium aceto-acetic ester. The experiments were carried out with the methyl, ethyl-, and amyl esters of camphocarboxylic acid, these compounds being converted into their sodium salts by treatment with the corresponding sodium alcoholates. Three spectro-chemical methods were employed, each giving results controlling and confirming those obtained by the other two. Details are given showing how it can be ascertained by determinations of the refraction and dispersion of the different components and of the mixtures (or solutions of the ester salts):—(1) Whether, in the process of salt formation, the optical properties of the acid radical alter, and, consequently, whether a chemical transformation (enolisation, ketonisation) takes place; (2) whether the optical properties of the basic radical (metal or ammonium) alter; or (3) whether the difference between the optical functions of the salt and of the acid (or base) is a constant, as in the case when the salt formation takes place without chemical transformation, or is smaller or greater than this constant. These methods are applicable to all compounds capable of undergoing tautomerisation (pseudo acids, pseudo bases, and amphoteric compounds). In the case of camphocarboxylic acid esters (which behave as weak acids), it was found that in methyl, ethyl, and amyl alcoholic solutions the formation of ester salts is always associated with a transformation of the ketonic ester:



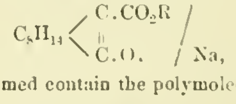
$$C_8H_{14}\left\langle\begin{array}{l}CH.CO_2R\\ |\\ CO\end{array}\right.$$

into the enolic oxygen salt:



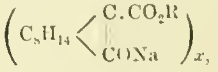
$$C_8H_{14}\left\langle\begin{array}{l}C.CO_2R\\ \|\\ C.ONa\end{array}\right.$$

In dilute methyl- and ethyl-alcoholic solutions of the ester salts, the optical function (atomic refraction) of the sodium is practically the same, but is quite different from (about 20 per cent. smaller) than that of the metal in amyl alcoholic solutions of equal dilution. The optical function of the sodium is greater in concentrated than in dilute solutions, and is then the same for all three solvents. These differences are due to the facts that in dilute methyl- and ethyl-alcoholic solutions, the ester salts are ionised, whereas in concentrated methyl- and ethyl alcohols, and in amyl alcoholic solutions, they are not. Determinations of the osmotic pressure and electric conductivity of the solutions confirmed this view. It was found, in fact, that the sodium salt of camphocarboxylic acid methyl ester is almost completely ionised in dilute methyl alcoholic solution. Solutions of sodium alcoholates in the corresponding alcohols also exhibited a similar behaviour, and it is concluded that the degree of ionisation corresponds to the optical function of the sodium. The optical function can thus be used as an exact expression and measure of the condition of ionisation. Determinations of the optical function of sodium in dilute (ionised) and in concentrated (non-ionised) aqueous solutions of sodium hydroxide showed that this is about 12—15 per cent. smaller in the case of the sodium ion than in that of the non-ionised metal. It would, therefore, be possible to determine spectrochemically the degree of ionisation of a dissolved compound. The difference in behaviour of solutions of sodium salts of camphocarboxylic acid esters in methyl- or ethyl-alcohol on the one hand, and in benzene or ether on the other hand, is due to the fact that the first-named solutions contain the monomolecular and ionised salt—



$$C_8H_{14}\left\langle\begin{array}{l}C.CO_2R\\ \|\\ C.O.\end{array}\right. \Big/ \; / \; Na,$$

whilst the last-named contain the polymolecular salt—



$$\left(C_8H_{14}\left\langle\begin{array}{l}C.CO_2R\\ \|\\ CONa\end{array}\right.\right)_x,$$

x being equal to from 3 to 4.—A. S.

Osmosis, Solubility, and Narcosis: Theories of ——. I. Traube. Phil. Mag., 1904, **8**, 704—715.

As the result of experiments on a large number of substances, it is found that the greater the osmotic velocity of a substance soluble in water, the more that substance reduces the capillary constant of water. Substances that cannot penetrate membranes increase that constant. It has also been shown that, in every substance examined by Overton and the author, osmotic and capillary phenomena correspond. Whence it is deduced that the difference of surface tensions determines the direction and velocity of osmosis, in fact it is the motive force in osmotic pressure. From this conclusion it would appear that the generally accepted theory of diffusion is incorrect, and that in reality it is the pure solvent which, by virtue of its low surface tension, migrates into the salt solution. Further, if two mutually soluble liquids, or a solid and a solvent be brought into contact, the "solution tension" will depend chiefly on the difference between the surface tensions. This explains why a much greater quantity of ethyl or amyl alcohol dissolves in water than of water in ethyl or amyl alcohol, and why a coarse and a fine powder behave differently towards solvents (Hulet, Z. Phys. Chem., 1901, 385). Also the surface tension of a solution will never fall below that of the dissolving substance, for, with increasing concentration of the solution, a point will finally be reached when the surface tensions of solution and dissolving substance are equal; at this point the solution will be saturated. This theory is verified by several experiments, *e.g.*, with solutions of ethyl and amyl alcohol in water. It has also been experimentally established that equal equivalents of substances belonging to homologous series (*e.g.*, alcohols, fatty acids, esters), which exercise a strong influence on capillarity, lower the capillary height of water in the proportion $1 : 3 : 3^2 : \ldots$ The solution tensions of these substances would therefore show a similarly proportional increase with increasing molecular weight. It is then deduced that distribution coefficients and solution tensions —hence also surface tensions and osmotic velocity—are proportional magnitudes of the first approximation; this is also independently established from experimental data. Overton and H. Meyer have found that efficacious narcotics, anæsthetics, and antipyretics all penetrate thin membranes rapidly; but since a near relation exists between osmotic velocity and surface tension, it was to be expected that surface tension and narcotic power would run parallel. This is actually the case, even in substances differing materially in constitution. In narcotics belonging to homologous series the analogy is complete, since it is found that the narcotic action of homologous substances increases with increasing molecular weight in the ratio $1 : 3 : 3^2$. . . . Since narcotics exercise their chief action in cells containing much lipoid substance, it follows that, after penetration into the cell, not only will some narcotic be dissolved in the lipoid substance, but some of the lipoid will dissolve in the narcotic, which is probably the cause of the disagreeable secondary effects exerted more or less by all narcotics. If this be the case, there would seem little probability of ever finding a perfectly innocuous narcotic.—T. F. B.

Aromatic Ketones; Hydrogenation of —— by Reduced Nickel. New Synthesis of Aromatic Hydrocarbons. G. Darzens. Comptes rend., 1904, **139**, 868—870.

When aromatic ketones are hydrogenated at 190°—195 C. with the catalytic aid of nickel reduced from nickelous oxide at (not below) 300° C., the reaction $C_6H_5.CO.R + 2H_2 = C_6H_5.CH_2.R + H_2O$ occurs sharply. In this way acetophenone yields (95 per cent.) pure ethylbenzene; *p*-cresyl ketone gives with ease a similar yield of *p*-methylethylbenzene; and *p*-butylacetophenone (easily prepared by treating tertiary butylbenzene with acetyl chloride and aluminium chloride) gives *p*-tertiary butylethylbenzene, a new hydrocarbon, faintly smelling of carrots, b. pt. 209°—213° C. The same method applied to benzene-substituted fatty ketones is equally fertile, benzoylacetone, for example, yielding normal butylbenzene. While Friedel and Crafts' reaction yields chiefly *m*-derivatives, this method is most applicable to *p*-derivatives. The author finds that the temperature at which the nickel is reduced not only affects the energy of the reaction, but in some cases also its nature; thus nickel reduced at a much lower temperature than 300° C. yields from the ketone not the aromatic hydrocarbon, but its hexahydro derivative.—J. T. D.

Trehalase; Presence of —— in Mushrooms. E. Bourquelot and H. Hérissey. Comptes rend., 1904, **139**, 874—876.

In most species of mushrooms trehalase exists. The period of its presence and that of its disappearance seem to be in relation respectively with that during which trehalose is utilised by the plant, and that during which it is being stored as a reserve substance.—J. T. D.

Tyrosine in Elder Berries; Occurrence of ——. J. Sack and B. Tollens. Ber., 1904, **37**, 4115.

Fresh elder berries were boiled with water, and the extracted juice was clarified by means of lead acetate. The filtrate was then freed from lead, and concentrated. After cooling, crystals separated out, and were fully identified as those of *tyrosine*.—J. F. B.

Technical Chemistry; The Relations of —— to the other Sciences. Address by Prof. C. E. Munroe, of the George Washington University, before the Int. Congress of Arts and Sciences, St. Louis, Sept. 23, 1904. Applied Chemistry Section.

Numerous instances are detailed in this paper of the bearings which technical chemistry has upon other sciences and on the arts, and also of the many ways in which it depends upon other sciences for its progress. Thus, physical processes form an important part of most chemical manufactures; further, technical chemists utilise many physical methods in their analytical work—*e.g.*, spectrum analysis, photometry, polarimetry, &c. It is shown how necessary are research laboratories, both for introducing and examining new products and processes, and for devising and improving analytical methods. The bearing of atomic weight determinations on the purely commercial side of technical chemistry is pointed out. In many instances technical chemistry has benefited greatly by the practical application of theories, such as those of dissociation, mass action, and osmotic pressure. In the course of the paper the following statistics are given of the growth of chemical industry in the United States from 1890—1900:—

Year.	Number of Establishments.	Number of Employés.	Total Wages.	Cost of Materials used.	Value of Products.
			Dols.	Dols.	Dols.
1890	58,195	710,485	311,369,495	2,177,443,777	3,165,768,188
1900	84,172	1,038,543	469,848,022	3,392,211,974	4,962,715,787

The United States is the only country which takes a census of manufactures, so no comparisons could be obtained.—T. F. B.

Technical Chemistry; Some Present Problems in ——. Address by Prof. W. H. Walker, of the Mass. Inst. of Technology, before The Internat. Congress of Arts and Sciences, St. Louis, Sept. 1904.

In the author's opinion the point upon which most stress should be laid is that there is no dividing line between pure science and the utilitarian side of chemistry. The explanation of Germany's success in solving the problems confronting chemical industries rests mainly on the fact that in that country it is recognised that the questions have first to be regarded as problems in pure chemistry, to be studied by men fully trained in pure science. If these men are also chemical engineers, then obviously the ultimate solution of the technical problem is hastened, but in the first place the main desideratum is that the men have been trained in the spirit and methods of scientific research. The author reviews some of the important problems in technical chemistry: (1) The production of fertilisers in the United States has increased from 1,900,000 tons to 2,900,000 tons in the past 10 years. It is estimated that the total value of the potash, phosphoric acid, and nitrogen consumed by agricultural products in one year amounts to 3,200,000,000 dols. Of these three ingredients of fertilisers, the supply of phosphoric acid in the form of native phosphate deposits, and of slags from metallurgical processes, seems practically inexhaustible. The supply of potash, on the other hand, will not be on a perfectly satisfactory basis until sources independent of the Stassfurt deposits are discovered. In this direction Clark's method of converting the potassium of felspar into potassium chloride by fusing the mineral with ammonium chloride is of interest; and if the reaction could be applied to orthoclase, and the ammonia recovered economically, an important new source of potash would be available. Most importance, however, attaches to the supply of available nitrogen, and, after a survey of the progress made, the author predicts that it will not be a great while before the synthetic preparation of cyanides, ammonia, and nitric acid from atmospheric nitrogen will be on a commercial basis. At the present time the fixation of atmospheric nitrogen as nitrate through the agency of bacteria rather than by an electrical process appears to be more promising; in fact, cultures for the artificial inoculation of the soil may now be obtained in considerable quantity, and field experiments have shown that with their aid, good crops may be grown upon what would otherwise be almost sterile soil. Another problem connected with technical chemistry, and which is rendered more acute by the possible use of cellulose as a raw material for the production of foodstuffs, is (2) the conservation of forests. The solution of the problem will consist in the substitution of other raw materials in chemical industries where wood is now used for the purpose. As raw materials for the production of cellulose, there are the waste straw of flax-, wheat-, oat- and other crops, cornstalks, and bagasse from sugar manufacture. (3) In countries where the tax on fermented mash is not high, there would seem to be an opening for a process for the manufacture from alcohol of acetic acid in a more concentrated form than can be produced with the aid of *Mycoderma aceti*, the crude molasses which is wasted in large quantities in semi-tropical countries being used as raw material for the production of the alcohol. Formic acid, also, which can be synthesised from carbon and water, might be substituted for acetic acid for many purposes. Other problems calling for solution are:—(4) methods of tanning with materials other than vegetable tannins; (5) the synthesis of india-rubber, or substances with similar properties; the utilisation of trade wastes, such as (6) soda and sulphite cellulose lyes, *e.g.*, as foodstuffs for cattle, &c.; (7) waste yeast; (8) arsenic sulphide from the purification of crude acids; (9) grease from wool washing, city garbage, &c.; (10) the hygienic preservation of food; (11) the fireproofing and preservation of wood; and (12) the prevention of the corrosion of structural iron and steel. The author also discusses the applications of electrical energy and of catalysis or contact action, forces the usefulness of which technical chemists are only beginning to appreciate.—A. S.

New Books.

CHEMIKER-KALENDER, 1905. Ein Hülfsbuch für Chemiker, Physiker, Mineralogen, Industrielle, Pharmazeuten, Hüttenmänner u.s.w. Von Dr. RUDOLF BIEDERMANN. Sechsundzwanzigster Jahrgang. In zwei Theilen. *Erster Theil.* Julius Springer's Verlag, Monbijouplatz 3, Berlin. 1905. Price 4*s.*

ARRANGED as a pocket book and containing almanack for 1905, with also a table of the more frequently used atomic weights and their multiples. In the Thermochemical Tables those numbers are repeated which Berthelot used. Dr. H. Bernthsen and Dr. P. Julius have contributed material improvements in the chapter on Colour Chemistry. The Tables on the Naphthalene derivatives and the Coal-Tar Colours have been thoroughly revised, and Dr. L. Spiegel has revised the Alkaloid Tables. There is a Chronological Table of the principal events in the History of Physical Sciences. A Note-book Calendar with blank pages is further arranged for the different days of the year, in which observations, facts, &c., may be recorded. Then follows tabulated matter, useful in the Laboratory: of Specific Gravities, of Gases and Liquids, Salts, Alcohols, Tables of Solubility and Properties of Chemical Substances, Analysis, Volumetric Analysis, Gas Analysis, and Spectrum Analysis. The subject-matter, exclusive of the Calendar and the blank pages for Notes, fills 362 pages.

Zweiter Theil.—This supplementary work is of similar size to the pocket-book, but is unbound, and is more directly of Technological interest. It contains Tables relating to I. Physics and Physical Chemistry, II. Mineralogy, and III. Technical Chemical Analysis and Investigations. But, besides the tabulated matter, there are concise descriptive paragraphs of introductory character, with descriptions of Analytical Methods. The subdivisions under III. are as follows:—1. Water. 2. Assaying. 3. Fuels. 4. Sulphuric Acid. 5. Alkali. 6. Bleaching Powder. 7. Saltpetre and Explosives. 8. Ceramics. 9. Glass. 10. Mortar and Cement. 11. Illuminants. 12. Starch and Sugar. 13. Fermentation Industry. 14. Fats and Oils. 15. Tanning. 16. Textile Fibres and Paper. 17. Photography. 18. Dyeing. 19. Physiological Chemical Analysis. Appendix with various Recipes, &c. The subject-matter fills 511 pages.

THE CENTURY IN PHOSPHATES AND FERTILIZERS. A Sketch of the South Carolina Phosphate Industry. By PHILIP E. CHAZAL. Lucas-Richardson Lithograph and Printing Co., 130, East Bay Street, Charleston, S.C. 1904.

8vo pamphlet containing 71 pages of subject-matter.

NOTES ON ASSAYING AND METALLURGICAL LABORATORY EXPERIMENTS. By RICHARD W. LODGE, Assistant Professor of Mining and Metallurgy, Massachusetts Institute of Technology. First Edition. John Wiley and Sons, New York. U.S.A. Messrs. Chapman and Hall, Ltd., London. 1904. Price 12*s.* 6*d.*

8vo volume containing 279 pages of subject-matter, with 47 illustrations, and the alphabetical index. The subjects treated of are as follows:—I. Apparatus, Reagents, and Materials. II. Sampling. III. Assay of Ores for Silver. IV. For Gold. V. For Lead. VI. Bullion. VII. Assay of Ores for Copper and Tin. VIII. Platinum and the Platinum Group. IX. Metallurgical Laboratory Experiments and Notes. These notes, it is stated, are chiefly those used by the third-year and partly those used by the fourth-year Students in Assaying, in the Metallurgical Laboratory of the Massachusetts Institute of Technology.

Trade Report.

I.—GENERAL.

GERMAN CHEMICAL INDUSTRY; PROFITS IN THE ——.

Eng. and Mining J., Dec. 1, 1904.

In the fiscal year 1903-4, comparatively few companies have shown increased profits, in fact, the more important among them have, by reason of keen competition, realized smaller earnings. Still, shareholders' dividends have been from 5 to 10 per cent. for the 12 months. The net profits of the Hönningen Chemical Company in 1903-4, amounted to 22,171*l.*, permitting the payment of a 10 per cent. dividend. The Stassfurt Company, with a share capital of 150,000*l.*, showed net profits of 15,439*l.*, and a dividend of 8 per cent., while the United Company, of Leopoldshall, from net profits of 15,602*l.*, declared 5 per cent. on its preferred stock, and 2 per cent. on the common. Although it gained 314*l.* in net profits to 10,705*l.*, the Byk Chemical Works, of Berlin, paid a dividend of 6 per cent., against 7 per cent. a year ago. The Wilhelmsburg Chemical Company, of Hamburg, cut its dividend rate from 8 to 6 per cent.; the Paul Gulden Colour and Tar Products Company, of Leipzig, from 6·5 to 5·5 per cent., while the North German Chemical Company, of Harburg, paid only 6 per cent. on the preferred, nothing on the common, and the Union Company, of Stettin, increased its rate from 8 to 9 per cent. The Dusseldorf Color Works, reports net profits of 1,400*l.*, as against a heavy loss in 1902-3. A forecast for the year 1904-5 suggests that the increased activity and better prices ruling will result in a substantial improvement.

JAPANESE CHEMICAL INDUSTRY.

Chem. and Druggist, Dec. 10, 1904.

Although chemical industry is in a flourishing condition in Japan, no prospects are offered to European chemists, in consequence of the number of Japanese who have studied in Europe, or at the high schools in Tokio or Kioto. There are at present 840 factories in Japan employing chemists. Two of these undertakings employ over 500 workmen, 86 over 100, 207 over 50, and 348 have 30 men employed. Altogether there are 38,591 men and women at work in various chemical works. The Japanese Government contributes largely towards promoting this branch of industry, and last year there were 79 Government laboratories, whose duty it is to ascertain and impart the methods of utilising the numerous varieties of seaweed and other fishery products, which are so plentiful in Japanese waters.

II.—FUEL, GAS, AND LIGHT.

COAL BRIQUETTES IN INDIA.

Eng. and Mining J., Dec. 1, 1904.

During the year 1902, 13,400 tons of patent fuel were made in India. Khost (Baluchistan) produced nearly 7,000 tons, and Dandot (Punjab) over 6,000 tons. During the official year 1903-1904, 14,513 tons were manufactured at Khost with an outlay of 190,000 Rs. The fuel is used on the railways. There is a small plant also at Giridih (Bengal), but since the installation of modern coke-ovens it has been little used.

RUSSIA; COAL INDUSTRY OF ——.

Bd. of Trade J., Dec. 1, 1904.

The coal production of Russia for the past three years is shown in the subjoined table.—

——	1901.	1902.	1903.
	Thousands of Pouds.	Thousands of Pouds.	Thousands of Pouds.
South Russia	694,420	642,140	728,090
Poland	258,915	263,320	295,160
Ural.........	30,255	33,202	30,080
Moscow district.......	16,007	12,814	13,919
Caucasus	3,342	2,036	2,210
Total { 1,000 of pouds	1,002,939	953,512	1,069,450
Total { Tons........	27,859,000	26,486,000	29,707,000

The destination of the coal produced in the Donetz basin during the past two years was as follows :—

——	1902.	1903.
	Thousands of Pouds.	Thousands of Pouds.
Railways	141,287	166,937
Salt mines............................	3,600	5,167
Shipping	11,262	11,596
Gas works............................	2,770	1,282
Sugar refineries	38,154	41,924
Foundries*............................	110,358	119,787
Manufactories of machinery	19,122	22,058
Other manufactories	25,188	33,531
Towns of Kharkov, Ekaterinoslaw, Rostov, and Taganrog	15,726	13,329
Exported through Taganrog	31,607	57,462
Other consumers	52,729	61,878

During 1903, the Russian railways consumed 166,937,000 pouds of coal from the Donetz basin, 44,218,449 pouds from Poland, 6,500,000 pouds from the Moscow district, and 34,000,000 pouds of imported coal.

The distribution during the past two years of the coal produced in Poland, which is not suitable for gasworks, is shown below :—

——	1902.	1903.
	Thousands of Pouds.	Thousands of Pouds.
Railways	34,781	43,218
Foundries.	29,628	34,103
Denaturating works...................	18,227	17,779
Sugar refineries......................	24,924	16,752
Other manufactories..................	76,314	92,840
Domestic consumption.......	50,683	54,854

Poud = 36 lbs.

III.—TAR PRODUCTS, PETROLEUM, Etc.

PETROLEUM; CALIFORNIA ——.

P. W. Prutzmann. J. of Elect., 1904, 306—317. *Science Abstracts, B.*, 1904, 7, 939—940.

Out of twenty-seven counties in California, only seven are producing oil profitably, the remainder having either yielded nothing, or only very small quantities of oil. In the seven producing counties, there are 14 centres of production, and on Dec. 31, 1903, the state of the industry was as follows :—Producing wells, 2998 ; abandoned wells, 1271 ; wells drilling, 159 ; uncertain, 322 ; total, 4750. Oil lighter than 20° B. is suitable for refining, the remainder being utilised for fuel purposes, or in the manufacture of asphalt. The total production of oil according to this classification is as follows :—Refining, 3,540,000 barrels ; fuel, 21,070,000 barrels ; thus averaging 27·7 barrels per well. The author devotes the remainder of the paper to describing the methods of refining employed, and the characteristic properties of Californian petroleum.—T. F. B.

VII.—ACIDS, ALKALIS, Etc.

ROCK PHOSPHATE ; NEW SOURCE OF ——.

Bd. of Trade J., Dec. 1904.

A large deposit of rock phosphate, testing 63 to 68 per cent. of tribasic calcium phosphate, has been discovered about 35 kilometres from the deposit at Metlaoui. In 1906 when this new mine—"Redeyef"—will be connected with the Sfax-Metlaoui railroad, the export of this new phosphate will be commenced.

VIII.—GLASS, POTTERY, AND ENAMELS.

GARNET ; A NEW SOURCE OF ——.

Eng. and Mining J., Dec. 1, 1904.

The use of garnet as an abrasive is firmly established in certain manufacturing industries, and there is little doubt that this material will continue to find favour, notwithstanding the great expansion in the utilisation of other abrasives, particularly corundum and carborundum. In the United States the production of garnet now amounts to over 4,000 tons yearly, and the value of the yearly product approximates 150,000 dols. The principal supplies hitherto have been derived from the Adirondack region of New York, smaller quantities being obtained from Pennsylvania, Connecticut, and North Carolina. With the opening of some new quarries in the last-named State a larger output may be expected in the future from that section of the country. The properties are situated near Marshall, in Madison county. The garnet is of the almandine variety, and occurs in a band of chloritic schists, about 20 ft. wide, that can be traced on the outcrop for nearly a mile. The crystals are of large size, averaging 2 in. in diameter, and often exceeding this limit. While somewhat altered to chlorite near the surface, the garnet in the deeper workings is perfectly fresh, and breaks into clean, sharp particles, so that a very pure abrasive material can be obtained. Its hardness, according to the usual scale, is about 7·5.

The property is well situated for railroad transportation, being on the main line of the Southern Railway running from Salisbury, N.C., to Chattanooga, Tenn. Active quarrying was begun in January of the present year, since which time a large quantity of garnet has been taken out and shipped to market.

IX.—BUILDING MATERIALS, Etc.

CEMENT PRODUCTION OF THE UNITED STATES.

Bd. of Trade J., Dec. 8, 1904.

A report issued by the Department of the Interior, at Washington, states that the total production of hydraulic cement in 1903 was 29,899,140 barrels, valued at 31,931,341 dols., as compared with 25,753,504 barrels, valued at 25,366,380 dols., produced in 1902. Of the total production in 1903, 22,342,973 barrels, having a value of 27,713,319 dols., were Portland cement. The production of natural-rock cement was 7,030,271 barrels, valued at 3,675,520 dols. The production of Pozzuolana or slag cement was 525,896 barrels, valued at 542,502 dols.

The increased production of Portland cement in 1903 resulted in a glutted market, which made the artificial product so low in price in the eastern part of the country as to seriously interfere with the production of natural-rock cement. Many of the plants whose output is exclusively the natural cement were for this reason shut down during a large part of the year.

X.—METALLURGY.

MINERAL PRODUCTION OF NEW ZEALAND IN 1903.

Bd. of Trade J., Dec. 8, 1904.

The annual report of the Minister for Mines contains the following particulars of the quantities and values of the chief mineral products exported from and coal used in New Zealand during the years 1902 and 1903:—

	1902.		1903.	
	Quantity.	Value.	Quantity.	Value.
	Ozs.	£	Ozs.	£
Gold	508,045	1,951,433	583,314	2,037,831
Silver	674,196	71,975	911,914	91,497
	Tons.		Tons.	
Copper ore	..	..	6	123
Manganese ore	..	..	70	210
Chrome ore	175	525	..	..
Mixed minerals	415	4,422	625	7,014
Hæmatite	17	116	..	1
Coal exported	188,677	154,747	152,332	128,927
Coal used in New Zealand	1,174,025	587,012	1,267,861	633,931
Kauri gum	7,430	450,223	9,357	631,102
Shale (treated in New Zealand)	2,338	1,169	36	18
Total value	..	3,221,622	..	3,530,654

IRON AND STEEL IN RUSSIA.

Eng. and Mining J., Dec. 1, 1904.

Official figures recently published show that the production of pig iron in Russia in 1903 was 2,453,953 tons, a decrease of 106,191 tons from the previous year. The output by districts was as follows:—North Russia, 22,462 tons; Moscow, 95,591; South Russia, 1,366,437; Poland, 308,914; Ural, 660,546 tons. In Poland there was an increase of 26,612 tons over 1902; all the other districts showed decreases, the most important being in the Ural, where it was 69,797 tons. The production of iron castings, or foundry work, was 209,000 tons, an increase of 19,000 tons. The wrought, or puddled, iron reported, in finished forms, was 194,000 tons, a decrease of 83,000 tons. In steel production, however, there was an increase of 315,000 tons, or 15 per cent., the total being 4,325,510 tons.

—	1902.	1903.
Pig iron produced	2,560,000	2,454,000
Imported as pig	18,000	13,000
Imported in finished forms	327,000	336,000
Total consumption	2,905,000	2,803,000

The proportion of steel made by the various methods was: Bessemer, or converter, 24·3; open-hearth, 75·6; crucible, 0·1 per cent.

The approximate consumption of iron is given in the foregoing table, finished material and machinery being reduced to terms of equivalent pig-iron.

The consumption of iron per head in Russia is much less than that of any other European country. There is practically no iron nor steel exported from the country.

XIII. C.—INDIA-RUBBER, Etc.

RUBBER PRODUCTION OF PARÁ, 1899-1904.

Bd. of Trade J., Dec. 1, 1904.

The following particulars of the rubber production of Pará for the year, July 1903 to June 1904, as compared with the four previous years, are taken from the *Brazilian Review* of 25th October:—

Crop Years.	Quantity.	Value.
	Met. Tons.	£
1899—1900	9,957	2,862,400
1900—1901	9,247	2,647,185
1901—1902	10,333	2,799,720
1902—1903	11,327	3,059,000
1903—1904	11,362	2,807,641

Of the exports through Iquitos, Manaos, and Pará, during the year 1903-04, 12,160 metric tons of rubber and 3,338 metric tons of caucho were sent to Europe, and 13,873 metric tons of rubber and 1,210 tons of caucho to the United States of America.

XVI.—SUGAR, STARCH, Etc.

BEET-SUGAR PRODUCTION OF EUROPE FOR THE 1904-5 SEASON.

U.S. Cons. Rep., No. 2119, *Nov.* 29, 1904.

The *Wochenschrift des Centralvereines für Rüben-Zucker-Industrie* gives the following results of the latest inquiry made by the Internationale Vereinigung für Zuckerstatistik regarding the probable sugar output for the current sugar season of 1904-5. These are preliminary estimates, subject to correction when the results of the second inquiry become known, which inquiry is undertaken later in the season:—

Country.	Factories in Operation.		Beets.		Sugar (in terms of Raw).	
	1903-4.	1904-5.	1903-4.	1904-5.	1903-4.	1904-5.
			Met. Tons.	Met. Tons.	Met. Tons.	Met. Tons.
Austria-Hungary	215	206	7,775,500	6,165,000	1,158,800	914,800
Germany	384	375	12,706,500	9,933,000	1,929,400	1,518,000
France	296	275	6,441,500	4,686,000	794,400	614,300
Belgium	100	90	1,550,000	1,267,000	202,800	179,100
Holland	29	26	880,000	908,000	123,500	133,900
Russia	275	276	7,705,300	6,580,000	1,160,700	945,400
Sweden	17	18	748,400	591,000	107,200	88,200
Denmark	7	7	380,000	340,000	48,000	48,000
Italy	32	32	1,000,000	700,000	135,000	80,000
Total	1,355	1,305	39,187,200	31,170,000	5,659,800	4,521,700

The authoritative publication from which the above data are taken calculates the quantities available for export from the beet-sugar countries during the current sugar year (1904-5) as shown in next column.

In the year 1903-4 Great Britain alone took 1,400,000 tons of sugar (in terms of raw), and the sugar stocks of the world are now over 400,000 tons less than a year ago, hence there is some reason to anticipate a scarcity of supply in the European sugar markets during the current sugar season. These facts have already resulted in higher prices. But an increase of price is bound to benefit cane sugar as well, and thus strengthen the competition on the part of the tropical product by causing its entrance into markets which until lately were held securely and exclusively by European beet sugar.

Country.	Production.	Consumption.	Available for Export.
	Met. Tons.	Met. Tons.	Met. Tons.
Austria-Hungary	915,000	450,000	465,000
Germany	1,518,000	930,000	588,000
France	614,000	580,000	34,000
Belgium	179,000	80,000	99,000
Holland	134,000	80,000	54,000
Total	3,360,000	2,120,000	1,240,000

XVII.—BREWING, WINES, SPIRITS, Etc.

Alcohol in France; Production, Imports, and Exports of —— in the Season 1903–4.

Z. Spiritusind., 1904, **27**, 471.

The total production of alcohol in France in the season 1903–4 has been very much higher than in the previous year, as is shown by the following figures for the last five years:—1899–1900, 2,641,505 hl.; 1900–1, 2,799,543 hl.; 1901–2, 2,026,212 hl.; 1902–3, 1,729,652 hl.; 1903–4, 2,200,725 hl. The whole of the increased production is from industrial distilleries, that of the private distilleries showing a decrease from 77,748 hl. to 37,437 hl.

The following statistics show the sources from which the industrial distilleries produced their alcohol in 1903–4, the figures in brackets being those for 1902–3: Wine, 36,663 hl. (27,342 hl.); marcs, 34,220 hl. (18,730 hl.); grain, 368,562 hl. (322,007 hl.); beetroots, 1,084,163 hl. (499,965 hl.); molasses, 639,527 hl. (773,625 hl.); other materials, 153 hl. (235 hl.).

Imports in 1903–4 amounted to 122,911 hl., and exports to 287,699 hl., while home consumption was 2,172,550 hl., and the stock at the end of the official year, 538,947 hl. The figures for the previous year were 87,715 hl., 279,091 hl., 1,774,341 hl., and 685,530 hl. respectively.—J. F. B.

Spirit-Industry; German ——.

Chemist and Druggist, *Dec.* 3, 1904.

The German Chambers of Commerce of Nordhausen and Hanau, whose districts are especially interested in the spirit-industry, have appealed to the Federal Council requesting that regulations may be issued permitting the distillation of spirit from maize, in order to prevent the threatened scarcity and further increase in the prices of spirit and potatoes. In urging this petition the Chambers state that even though the spirit-production since October 1, 1903, is normal, the stocks of spirit on October 1, 1904, were lower by 40,000 hectolitres than the stocks at the same period of 1903. The petition also states that as the position is at present, it will require the best efforts of all distilleries to produce sufficient spirit for the demand in 1904–5. This will only be possible by exercising the greatest economy with potatoes. They are convinced that difficult times are ahead, and that a period of scarcity may be expected in the spring. In order to realise the consequences of this development, it is only necessary to point out the increase in price of methylated spirit, which has advanced by 10 M. per hectolitre since last year. The use of spirit for lighting, heating, and technical purposes, which for several years has increased in consumption by 100,000 hectolitres per annum, will also be greatly hampered, says the petition. As regards consumption for drinking purposes, this takes up almost two-thirds of the entire yearly production of those who are engaged in the brandy trade. The larger and richer distilleries will probably be able to weather the periods of unfavourable prices, but the smaller works will be placed in a most difficult position if the prices of brandy advance further. At present they are higher than they have ever been.

The present Secretary of the Treasury, Count Posadowsky, issued regulations in 1902 which were entirely in accordance with the wishes of the Spirit Ring. In these regulations it is not the taxation but the regulation of the production which requires remedying. When the last regulations in 1902 were issued, the spirit industry suffered from over-production, and naturally the Spirit Ring fitted the law to the immediate position. The Spirit Ring was founded in 1899. The production, which 10 years previously amounted to an average of 306·9 million litres, rose to 382·3 million litres in 1898–99, to 365·5 million in 1899–1900, to 406 millions in 1900–1, and 424·4 millions in 1901–2. On the basis of these regulations, the Spirit Ring ordained an artificial control of the production, and this has eventually brought about the present scarcity.

The *Berliner Tageblatt* reports that movements are on foot to amalgamate the Bank für Spirit- und Produktenhandel, Berlin, and the Posen Spirit Co., who own works in Posen and Magdeburg. It is intended to bring about greater economies in the management of the business. The contracts of the Centrale with the spirit manufacturers and the agricultural distillers expire in 1908, and the Spirit Ring evidently hopes, by means of closer union, to be able to oppose more effectually any immoderate demands on the part of the distillers. The two companies in question have already stood in close relations with each other, and the director of the Centrale, Mr. Stern, and the rentier, Mr. Gutman, belong to the directorate of both companies.

Spirit Market; Position of the German —— at the End of October 1904.

Z. Spiritusind., 1904, **27**, 470.

The production of spirits in October was considerably greater than in the corresponding month of 1903 and 1902, but there is likely to be a shortness in the supply later on, There has been a marked falling off of the consumption in all branches. The decrease in duty-paid spirit for drinking is partly accounted for by the clearing of excessive supplies in September. The total issue of duty-free spirits shows a slight decrease as compared with October 1903. The decrease in the consumption of spirit for industrial purposes is due to the rise in the price of alcohol; these conditions are likely to continue for the present and to be attended by a decreased production. The whole of the decrease in the consumption of industrial spirits is due to fully denatured spirits. In the consumption of pure and partially denatured spirits, issued free of duty for industrial purposes, there has been a slight rise as compared with October 1903. The export of spirit in October this year has been merely nominal, and is likely to remain so: this trade has for the last few years been conducted at a loss. The position of the market at the end of October 1904 is shown in the following statement:—Stock at end of September, 260,668 hl.; production in October, 217,955 hl.; total available supply, 478,623 hl.; Consumption: for drinking, 180,938 hl.; duty-free industrial spirit, denatured, 64,480 hl.; pure or partially denatured, 36,542 hl.; exported, 223 hl.; total, 282,183 hl.—J. F. B.

XX.—FINE CHEMICALS, Etc.

Camphor Monopoly; The Japanese ——.

Schimmel's Report, *Oct.* 1904, 15.

The restrictions imposed on the camphor industry by the regulations of the Japanese Government monopoly, have induced experiments on the cultivation of *Cinnamomum camphora* in German colonies. Camphor trees are best grown from seed, which is gathered in the autumn and stored during the winter in sand. Before sowing in the spring, the dry seed is soaked in water for 24 to 48 hours, then sown $\frac{1}{2}$ to $\frac{3}{4}$ inch deep; the seedlings are transplanted when from 10 to 16 inches high. If the camphor is to be obtained from the leaves, the plants are arranged in hedges; but if distillation of the wood is to be performed, a space of 15 to 16 feet between each tree is allowed. The tree may also be propagated by layers or from cuttings. Experiments in this direction are being conducted at the German Biologico-agricultural Institute at Amanti, and also with the cultivation of *Dryobalanops aromatica*, which yields Borneo camphor.—J. O. B.

Essential Oil of Cedar Wood.

Schimmel's Report, *Oct.* 1904, 18.

As lead pencils are now made from Florida cedar wood which is imported ready sawn, and not in logs as formerly, waste sawdust and turnings are becoming scarcer, causing an increase in the price of cedar-wood oil. In view of the growing demand, it may be necessary to import the wood in logs for the purpose of distillation, in which case a still further increase in price will follow.—J. O. B.

Citronella Oil.

Schimmel's Report, *Oct.* 1904, 19.

Export.—After showing a decline of more than 200,000 lb. in 1903, compared with 1902, the shipments of citronella oil from Ceylon again show an increase, 710,071 lb. being recorded as shipped to the end of July 1904 against 569,875 lb. for the corresponding period last year. The United States is the largest consumer, taking, this year, 325,419 lb.; 300,847 lb. have been shipped to the United Kingdom, and 37,459 lb. to Germany; France has only taken, direct, 235 lb. The above figures do not represent the consumption of the oil in the countries named since a large bulk is re-shipped to the Continent *via* London.

Control of Quality.—It is proposed to subject citronella oil for export to official supervision; oil which is found by Bamber's test (this J., 1904, 77) to contain not more than 1 per cent. of admixture being marked with the Government brand "Pure Oil," and sealed with a red official seal. Oils which contain admixture up to 10 per cent., by the same test, are to be marked "90 per cent. purity," and sealed with green seals. The export of all oils containing more than 10 per cent. of admixture is forbidden. Stations for examining the oil under this system are to be established at Galle and Colombo.—J. O. B.

Bergamot Oil.

Schimmel's Report, Oct. 1904, 27.

Higher prices may be expected to rule for Bergamot oil. The product of harvest, provided the fruits yield the normal amount of oil, is not expected to exceed 40,000 or 50,000 kilos., compared with 100,000 kilos. of the previous harvest. The bergamot orange trees were much affected by the hot dry weather which occurred at the end of the flowering, and prevented the proper setting of the fruit, causing enormous quantities of immature fruits to fall from the trees.—J. O. B.

Lemon Oil Market.

Schimmel's Report, Oct. 1904, 28.

Great fluctuations have taken place in the price of lemon oil. After reaching, in March last, the lowest figure recorded, 4 marks per kilo., a sharp upward movement to 5·25 marks, caused by large American purchases, took place in May. This was followed by a decline to 4·5 marks per kilo., at which price the oil has remained, until the reduction of stock to 25,000 kilos. caused a slight upward tendency. This small stock will probably be exhausted by the time the product of the new crop arrives on the market.

No exact estimates of the amount of the new crop are yet possible; it is expected that the total yield of oil will be about one-fifth below that of last year.—J. O. B.

Essential Oil of Geranium.

Schimmel's Report, Oct. 1904, 43.

In Algeria, the cultivation of geranium has been considerably increased, with the result that large quantities of oil have been put on the market, causing a fall in prices to 5 francs a kilo. The product of the recent harvest is of exceptionally good quality.

In Réunion, although great damage was done to the geranium plantations early in the year by a cyclone, after a temporary rise immediately following this disaster, prices have fallen to a lower figure than before, since the new plantations, requiring only four months to produce material for distillation, were in a position to supply oil in a relatively short period. Large stocks of oil had also accumulated which also tended to depress the market rate. The present stock at Marseilles is estimated at about 4,000 kilos. No change in price is anticipated.—J. O. B.

Lavender Oil.

Schimmel's Report, Oct. 1904, 50.

The dry weather of the past summer has had a general adverse effect on the French lavender crop, rendering the harvest yield only about one fourth of the normal quantity. No stocks appear to be held in France, so that very high prices will probably rule.—J. O. B.

Neroli Oil Industry; French ——.

Schimmel's Report, Oct. 1904, 60.

Although the blossom harvest in the Alpes Maritimes has been normal, with an estimated amount of 1,800,000 kilos., and the oil yield from these was favourable, a tendency to increased price is evident. This is due to dispute between the growers and the distillers. The former, driven by the unremunerative prices offered for the blossoms, have formed a syndicate for controlling the price, which is fixed at 65 francs per 100 kilos. If this be not conceded they intend to commence distilling themselves. It is stated that the growers' syndicate have actually distilled about 300 kilos. of oil this year, and have destroyed 40,000 kilos. of blooms, which they could not deal with owing to lack of distilling plant. Arrangements are in progress which will enable the growers to distil the whole of next year's blossom crop should the distillers refuse to accept their terms.—J. O. B.

Peppermint Oil Industry; American ——.

Schimmel's Report, Oct. 1904, 70.

Michigan and Indiana.—The severe winter of last year destroyed a large proportion of the plants, and rendered new roots for planting difficult to obtain. The total yield of oil from this district is estimated this year at between 137,000 to 140,000 lb.

Wayne County.—There are indications that the cultivation of peppermint on marshy land, which has been to a great extent abandoned during the past six years on account of the low market price of the oil, is being actively resumed. Black mint is the only plant cultivated, which under proper cultivation yields from 30 to 50 lb. of oil per acre. Much of the mint planted this year has not been distilled, but has been reserved for still further extending the crop for next season. The yield of black mint oil for 1904 is estimated at about 14,000 lb.—J. O. B.

Peppermint Oil Industry; English ——.

Schimmel's Report, Oct. 1904, 74.

The yield of oil from this year's crop is the lowest recorded for 20 years, not amounting to more than half the average product. The bulk of the distillation has already been sold at prices 20 per cent. higher than those obtained in 1903. A further advance in price is therefore inevitable. The quality of the oil produced this year is good.—J. O. B.

Peppermint Oil Industry; Japanese ——.

Schimmel's Report, Oct. 1904, 75.

The high prices obtained last year have led to an important extension of the cultivation of peppermint in Japan, the product of the first crop in one district alone being estimated at about 200,000 kilos. A later crop from another district is anticipated to yield 72,000 kilos.; the total production of the whole of Japan will probably not fall below 300,000 kilos. In consequence of this large production, a heavy fall in prices has occurred both in menthol and in de-mentholised oil; the former declining from 18*s.* to 9*s.*, and the latter from 5*s.* 9*d.* to 4*s.* In view of the upward tendency of the American peppermint-oil market, a further decline is not anticipated.—J. O. B.

Peppermint Oil in Saxony.

Schimmel's Report, Oct. 1904, 76.

Despite the exceptional drought of the past summer the crop of peppermint oil in the neighbourhood of Miltitz has been good, yielding a high-grade oil. The dry weather, however, prevented the growth of a second crop.—J. O. B.

Rose Oil [Otto of Rose]; Turkish ——.

Schimmel's Report, Oct. 1904, 77.

The rose harvest this year has been favourable, and has given a yield of about 5000 kilos. of rose oil. This is not quite equal to the product of the 1903 harvest, when 6200 kilos. were obtained, but is in excess of an average yield. Up to the present about 2200 kilos. have changed hands, at prices near 500 marks, below which the so-called first quality oil has not yet fallen. The total export of otto of rose from April 1st, 1903, to April 1st, 1904, amounted to 6002 kilos., against 3624 kilos. for the same period in 1902—1903. Of this amount, France took 1834 kilos.;

America, 1403 kilos.; Germany, 1039 kilos.; and the United Kingdom, 913 kilos. An increase of price in rose oil is not expected.—J. O. B.

Patent List.

N.B.—In these lists, [A.] means "Application for Patent," and [C.S.] "Complete Specification Accepted."

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

[A.] 24,832. Eldred. Heating process and reverberatory furnace. Nov. 28.

,, 24,836. Bruns. Process of and apparatus for making extracts, washing precipitates, purifying liquids, and like processes. Nov. 28.

,, 24,858. De Bavay. *See under* X.

,, 24,879. Wilton. *See under* III.

,, 25,892. Hesketh. Apparatus for depriving air of moisture previous to supplying it to blast furnaces, converters, &c. Nov. 28.

,, 25,966. Davis. Apparatus for heating or vaporising water or other fluid. Nov. 29.

,, 26,102. Lloyd and Sutcliffe. Drying appliance for hydro-extractors. Nov. 30.

,, 26,255. Neumann and Stade. Vacuum pans. Dec. 2.

,, 26,270. Richards. Hot air driers. [U.S. Appl., June 20, 1904.]* Dec. 2.

,, 26,578. Barham. Apparatus for cooling or heating liquids. Dec. 6.

,, 26,602. Johnson (Badische Anilin und Soda Fabr.). *See under* XI.

,, 26,623. Mélotte. Centrifugal liquid separators. Dec. 7.

,, 26,669. Hudson and Crooke. *See under* X.

,, 26,670. Hudson and Crooke. *See under* X.

,, 26,978. E. Allen and Co., Ltd., Leach and Leach. Apparatus and appliances for drying slurry in the manufacture of cement, paints, colours, and the like. Dec. 10.

[C.S.] 26,778 (1903). Blount and Middleton. Kilns or furnaces, especially applicable to kilns for burning lime, cement, &c. Dec. 7.

,, 26,822 (1903). Bolton. Apparatus for superheating steam. Dec. 14.

,, 28,087 (1903). Oxford and Buxton. Means of drying semi-liquids. Dec. 14.

,, 28,594 (1903). Lake (Trump). Process of drying and otherwise treating materials by air or other currents. Dec. 14.

,, 28,595 (1903). Lake (Trump). Apparatus for drying and otherwise treating materials by air or other currents. Dec. 14.

,, 28,617 (1903). Harvey. *See under* XVI.

,, 28,711 (1903). Harvey. *See under* XVI.

,, 2211 (1904). Lawrence. Trays for filter-presses. Dec. 14.

,, 2860 (1904). Dempster. Lutes for the covers of gas-purifiers and other receptacles for gaseous or vaporous substances. Dec. 7.

[C.S.] 3050 (1904). Reeves and Bramwell. Apparatus for filtering liquids. Dec. 14.

,, 23,066 (1904). Lake (Caspar). Apparatus for drying granular and other like materials. Dec. 14.

,, 23,081 (1904). Kent. Furnaces. Dec. 7.

,, 23,942 (1904). Allison (Niles-Bement-Pond Co.). Filter-press plate. Dec. 14.

II.—FUEL, GAS, AND LIGHT.

[A.] 25,844. Thorn. Incandescent gas mantle. Nov. 28.

,, 25,877. Neuman and Becker. Generators for the manufacture of generator-gas, water-gas, &c. Nov. 28.

,, 25,879. Wilton. *See under* III.

,, 25,997. Neuman. Manufacture of a mixture of coal-gas and water-gas. Nov. 29.

,, 26,057. Owensmith. Mantles for incandescent gas or oil burners. Nov. 30.

,, 26,074. Galley. Apparatus for the production of gas for illuminating, heating, or other purposes. Nov. 30.

,, 26,178. Vogt. Apparatus for producing combustion gases under pressure, for use as motive power, and means in combination therewith for producing a liquid jet. Dec. 1.

,, 26,246. Busse. Process and apparatus for the manufacture of illuminating gas. Dec. 2.

,, 26,300. Noll and Trainer. Manufacture of fuel briquettes.* Dec. 2.

,, 26,442. Herrick. Gas-producers. Dec. 5.

,, 26,493. Chalk Power Gas Syndicate, Ltd., and Pearson. Process for the continuous and concurrent production of fuel-gas and lime. Dec. 5.

,, 26,770. Fleischer. Process and apparatus for the manufacture of power-gas. [Ger. Appl., Dec. 11, 1903.]* Dec. 8.

,, 26,879. Williams. Purification of coal and other gases. Dec. 9.

,, 26,915. Dempster. Electrodes for arc lamps. [U.S. Appl., Dec. 10, 1903.]* Dec. 9.

,, 26,916. Steinmetz. Arc lamp electrodes. [U.S. Appl., Dec. 10, 1903.]* Dec. 9.

,, 26,917. Whitney. Electrodes for arc lamps. [U.S. Appl., Dec. 10, 1903.]* Dec. 9.

,, 26,918. Härden. Arc lamps, and electrodes therefor. [U.S. Appl., Dec. 10, 1903.]* Dec. 9.

,, 26,919. Härden. Arc light electrodes. [U.S. Appl., Dec. 10, 1903.]* Dec. 9.

,, 26,920. Lindsay. Arc light electrodes, and methods of making same. [U.S. Appl., Dec. 10, 1903.]* Dec. 9.

,, 26,921. Weedon. Electrodes for arc lamps, and methods of making same. [U.S. Appl., Dec. 10, 1903.]* Dec. 9.

,, 26,922. Weedon. Arc light electrodes. [U.S. Appl., Dec. 10, 1903.]* Dec. 9.

[C.S.] 26,596 (1903) Schweich. Manufacture of producer gas and producers therefor. Dec. 7.

,, 26,974 (1903). Hartridge. Manufacture of artificial fuel. Dec. 14.

,, 27,361 (1903). Davies and Davies. Burning of liquid hydrocarbons. Dec. 14.

,, 27,362 (1903). Davies and Davies. Apparatus for burning liquid fuel. Dec. 14.

,, 576 (1904). Key. System for the manufacture of coke and gas, the construction of coke ovens and gas retorts, and the recovery of bye-products from same. Dec. 7.

,, 1393 (1904). Johnson (Deuts. Continental Gas-Ges., and Bueb). Manufacture of coal gas. Dec. 14.

,, 3794 (1904). Abel (Act.-Ges. f. Anilinfabr.). *See under* XXI.

[C.S.] 11,105 (1904). Guenot. Manufacture of water-gas. Dec. 14.

„ 14,389 (1904). Gerdes. Manufacture of fuel blocks or briquettes. Dec. 14.

„ 23,444 (1904). Hill. Manufacture of incandescent gas mantles. Dec. 7.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

[A.] 25,879. Wilton. Distillation, especially of tars or tarry products, and for use in the manufacture of carburetted water-gas and like processes. Nov. 28.

„ 26,192. Salasco and Rovere. Process for reducing the density of mineral and vegetable oils.* Dec. 1.

„ 26,198. Wynne. Process for purifying petroleum oils. Dec. 2.

„ 26,643. Macknight. *See under* VII.

„ 26,747. Bamlett. *See under* IX.

[C.S.] 23,379 (1904). Zimpell. Sulphate of ammonia saturators. Dec. 14.

IV.—COLOURING MATTERS AND DYESTUFFS.

[A.] 25,889. Johnson (Badische Anilin und Soda Fabrik). Reduction of indigo and similar colouring matters. Nov. 28.

„ 25,901. Imray (Soc. Chem. Ind. in Basle). Manufacture of brown monoazo dyestuffs developed by chroming. Nov. 28.

„ 25,998. Ransford (Cassella and Co.). Manufacture of nitroso compounds, and blue dyestuffs therefrom. Nov. 29.

„ 26,345. Read Holliday and Sons, Ltd., Turner and Dean. Black colouring matters containing sulphur. Dec. 3.

„ 26,361. Ransford (Cassella and Co.). Manufacture of benzene derivatives, and dyestuffs therefrom. Dec. 3.

„ 26,457. Newton (Bayer and Co). *See under* XIII. A.

„ 26,477. Abel (Act.-Ges. f. Anilinfabr.). Manufacture of a new yellow sulphurised dyestuff. Dec. 5.

„ 26,643. Macknight. *See under* VII.

„ 26,908. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matter suited for use in the form of its lakes. Dec. 9.

„ 26,909. Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matters especially suitable for use in the form of their lakes. Dec. 9.

[C.S.] 25,738 (1903). Iljinskij, and R. Wedekind and Co. Manufacture of o-oxyanthraquinones and of o-oxyanthraquinone oxysulpho acids. Dec. 7.

„ 2468 (1904). Johnson (Badische Anilin und Soda Fabrik). Production of colouring matters of the naphthalene series. Dec. 7.

„ 2469 (1904). Johnson (Badische Anilin und Soda Fabrik). Manufacture of azo colouring matter especially suitable for the preparation of lakes, and of intermediate products. Dec. 14.

„ 2608 (1904). Johnson (Boehringer und Soehne). Manufacture of azo compounds. Dec. 7.

„ 3096 (1904). Ransford (Cassella and Co.). Manufacture of azo dyestuffs. Dec. 14.

„ 7725 (1904). Abel (Act.-Ges. f. Anilinfabr.). Manufacture of new sulphurised dyestuffs. Dec. 7.

„ 14,566 (1904). Lorrain (Bell). Dye-compound. Dec. 14.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

[A.] 26,084. Fries. Machines for treating yarn.* Nov. 30.

„ 26,287. Bernhardt. Washing and rinsing machine for fibrous materials. Dec. 2.

„ 26,563. Thestrup. Composition for washing and bleaching. Dec. 6.

[C.S.] 26,984 (1903). Kellner. Manufacture of thin threads from short fibres, particularly wood cellulose. Dec. 7.

„ 2167 (1904). Castle. Manufacture and waterproofing of leather, leather cloths, and all kinds of animal and vegetable fabrics. Dec. 7.

„ 2357 (1904). Howorth (Soc. Franç. de la Viscose). *See under* XIX.

„ 2573 (1904). Ransford (Cassella and Co.). Means for discharging dyeings. Dec. 14.

„ 2758 (1904). Hübner and Pope. Manufacture of calender bowls or rollers applicable for finishing textile goods, paper, and other fabrics, and for other purposes. Dec. 14.

„ 17,454 (1904). Mowbray, Black, and Warriner. Apparatus for multi-colour printing. Dec. 7.

„ 21,634 (1904). Könitzer. Production of oxidation black on animal fibres, mixtures of animal and vegetable fibres, and fabrics made from the same. Dec. 14.

VII.—ACIDS, ALKALIS, AND SALTS.

[A.] 26,081. Woakes. *See under* IX.

„ 26,188. White. Process for the expulsion of water of crystallisation from metallic salts. Dec. 1.

„ 26,278. Mackenzie. Concentration of sulphuric acid, and apparatus therefor.* Dec. 2.

„ 26,493. The Chalk Power Gas Syndicate, Ltd., and Pearson. *See under* II.

„ 26,557. Boult (Ashcroft). *See under* XI.

„ 26,643. Macknight. Process for treating soot for recovery of ammonia, pyridine, and aniline dye, and the production of a black pigment. Dec. 7.

„ 26,659. Stead. Carbonic acid gas producing apparatus. Dec. 7.

„ 26,790. Johnson (Deuts. Gold- und Silber-Scheide Anstalt, vorm. Rössler). Manufacture of metallic perborates.* Dec. 8.

[C.S.] 25,867 (1903). Schütz. Production of carbonic acid. Dec. 7.

„ 27,249 (1903). Garuti and Pompili. *See under* XI.

„ 456 (1904). Leetham and Bousfield. *See under* XI.

„ 4217 (1904). Abel (Gebr. Siemens und Co.). Manufacture of barium oxide. Dec. 7.

„ 4796 (1904). Stanley. Preparation of nitrates and similar salts. Dec. 7.

„ 22,030 (1904). Posternak. *See under* XVIII. A.

„ 23,379 (1904). Zimpell. *See under* III.

VIII.—GLASS, POTTERY, AND ENAMELS.

[C.S.] 2470 (1904). Gobbe. Apparatus for use in the manufacture of sheets and other articles of glass. Dec. 7.

„ 15,180 (1904). Fleming. Manufacture of earthenware. Dec. 14.

„ 17,073 (1904). Schütz. Apparatus for manufacturing hollow glassware. Dec. 7.

„ 23,492 (1904). Gacon. Manufacture of artificial emery. Dec. 7.]

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

[A.] 25,829. Wohle and Hart. Composite material for architectural and other analogous purposes and for electrical insulation. Nov. 28.

,, 25,837. Eldred. Process of burning cement. Nov. 28.

,, 25,884. De la Roche. Silico-calcareous composition. Nov. 28.

,, 26,059. Lichtenstein. Impregnation of wood. Nov. 30.

,, 26,081. Woakes. Separating silica from earths and minerals. Nov. 30.

,, 26,465. Illeman. Manufacture of insulating coverings for steam pipes, boilers, and the like.* Dec. 5.

,, 26,516. Staudt. Manufacture of artificial stone compositions. Dec. 6.

,, 26,747. Bamlett. Manufacture of asphalt and tar macadam. Dec. 8.

,, 26,978. E. Allen and Co., Ltd., Leach and Leach. *See under* I.

[C.S.] 26,778 (1903). Blount and Middleton. *See under* I.

,, 26,899 (1903). Electric Timber Seasoning and Preserving Co., Ltd., and West. Treatment by impregnation of porous, cellular, and fibrous substances, and apparatus for the purpose. Dec. 14.

X.—METALLURGY.

[A.] 25,858. De Bavay. Apparatus for separating by flotation parts of the constituents of ores and other solid bodies from the remainder thereof. Nov. 28.

,, 25,882. Jacobsen. Manufacture of bronze. Nov. 28.

,, 25,948. Soc. Electro - métallurgique Française. Manufacture of steel. [Ger. Appl., July 8, 1904.]* Nov. 29.

,, 26,093. Lindemann. Crucible steel smelting furnaces, &c. Nov. 30.

,, 26,610. Savigny and Douxami. Process for utilising the scoriæ derived from the reduction of antimony by means of iron. Dec. 6.

,, 26,669. Hudson and Crooke. Method of extracting moisture from air and gases used in metallurgical and other operations. Dec. 7.

,, 26,670. Hudson and Crooke. Method of removing moisture from air and gases used in metallurgical and other operations. Dec. 7.

,, 26,849. Bailey. *See under* XI.

,, 26,881. Perret. Process of treating ores of vanadium. Dec. 9.

,, 26,947. Mills (Edison). Method and apparatus for cleaning metallic surfaces.* Dec. 10.

,, 26,949. Mills (Edison). *See under* XI.

[C.S.] 26,570 (1903). Winter. Process for manufacturing plated wire. Dec. 7.

,, 27,298 (1903). Dawes. Magnetic separators for ores, &c. Dec. 14.

,, 28,590 (1903). Cowper-Coles and Co., Ltd., and Cowper-Coles. Coating metals with copper. Dec. 7.

,, 3087 (1904). Johnson. *See under* XI.

,, 20,160 (1904). Gillies. Apparatus for recovering zinc and other sulphides from their ores by the wet or chemical process. Dec. 7.

,, 23,331 (1904). De Dion and Bouton. Manufacture of case-hardened articles of chrome-nickel steel. Dec. 14.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

[A.] 25,829. Wohle and Hart. *See under* IX.

,, 25,839. Thorp. Electrolysing apparatus. Nov. 28.

[A.] 25,902. Ekstromer Accumulator Co., Ltd., and Oppermann. Secondary batteries. Nov. 28.

,, 26,557. Boult (Ashcroft). Process and apparatus for producing metals of the alkali group by electrolysis. Dec. 6.

,, 26,602. Johnson (Badische Anilin und Soda Fabrik). Production of reactions in gases by means of electric arcs. Dec. 6.

,, 26,786. Hardingham (Felten und Guilleaume Carlswerk Act.-Ges.). Means for rendering the insulation of electric conductors fireproof. Dec. 8.

,, 26,849. Bailey. Apparatus for electro-deposition of metals. Dec. 9.

,, 26,948. Mills (Edison). Storage batteries.* Dec. 10.

,, 26,949. Mills (Edison). Continuous apparatus for nickel plating. Dec. 10.

[C.S.] 27,249 (1903). Garuti and Pompili. Apparatus for collecting, separating, drying, or similarly treating oxygen and hydrogen generated by electrolysis of water. Dec. 7.

,, 456 (1904). Leetham and Bousfield. Manufacture of chlorine by electrolysing sodium chloride solution, and apparatus therefor. Dec. 14.

,, 3087 (1904). Johnson. Apparatus for amalgamating and coating metals or alloys with metals or alloys by aid of electricity. Dec. 14.

,, 18,403 (1904). Townsend. Electrolytic process and apparatus therefor. Dec. 14.

,, 21,402 (1904). Jungner. Electrodes for electric accumulators with variable electrolyte. Dec. 14.

,, 23,622 (1904). Möllmann. Galvanic batteries. Dec. 7.

XII.—FATTY OILS, FATS, WAXES, AND SOAP.

[A.] 26,192. Salasco and Rovere. *See under* III.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

[A.] 25,830. Wohle and Hart. Compound for use, in combination with pigments, for the preparation of paints. Nov. 28.

,, 28,937. Hickman. Composition to be used as a coating for metallic surfaces for the prevention of corrosion. Nov. 29.

,, 26,263. Samples. Oil paints. Dec. 2.

,, 26,457. Newton (Bayer and Co.). Production of new colour lakes. Dec. 5.

,, 26,643. Macknight. *See under* VII.

,, 26,908. Johnson (Badische Anilin und Soda Fabrik). *See under* IV.

,, 26,909. Johnson (Badische Anilin und Soda Fabrik). *See under* IV.

,, 26,978. E. Allen and Co., Ltd., Leach and Leach. *See under* I.

[C.S.] 2376 (1904). Hérisson. Manufacture of paints or pigments. Dec. 7.

,, 2469 (1904). Johnson (Badische Anilin und Soda Fabrik). *See under* IV.

XIV.—TANNING; LEATHER, GLUE, SIZE, Etc.

[A.] 25,916. Head. Process of preserving skins. Nov. 29.

,, 25,984. The Sunbury Leather Co., Ltd., and Miller. Manufacture of leather. Nov. 29.

,, 26,778. Payne. Improvements in tanning, and in the treatment of waste tanning materials and liquids. Dec. 8.

[C.S.] 26,049 (1903). Dolat. Process for the preparation of skins. Dec. 7.

,, 2167 (1904). Castle. *See under* V.

,, 22,952 (1904). Wetter (Thüringer Gelatine-Fabrik, E. Jetter und Krause). Gelatine or gelatinous foodstuffs. Dec. 7.

[C.S.] 23,016 (1904). Dougherty. Machines for mechanically seasoning, oiling, or otherwise treating skins. Dec. 14.

XVI.—SUGAR, STARCH, GUM, Etc.

[C.S.] 27,666 (1903). Harvey (Naudet and Hinton). Treatment of sugar cane, beetroot, and the like. Dec. 7.

,, 28,617 (1903). Harvey. Evaporators for the treatment and concentration of cane juice, beet juice, and other juices and liquids. Dec. 7.

,, 28,711 (1903). Harvey. Evaporators for concentrating sugar cane, beet, and like juices or liquids. Dec. 7.

XVII.—BREWING, WINES, SPIRITS, Etc.

[A.] 26,698. Board and Board. The process of fermentation. Dec. 7.

,, 26,751. Hart. Method of and apparatus for use in the fining of beer and other like liquors.* Dec. 8.

[C.S.] 2398 (1904). Ward. Device for agitating and aerating wort. Dec. 7.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; & DISINFECTANTS.

(*A.*)—Foods.

[A.] 26,623. Mélotte. *See under* I.

,, 26,654. Mitchell. Process for the production of proteid. Dec. 7.

,, 26,905. Weitzmann. Process for refining and purifying coffee. [Appl. in Denmark, Sept. 27, 1904.]* Dec. 9.

[C.S.] 26,495 (1903). Nesfield. Sterilisation of water and other liquids and of alimentary substances to render same potable or edible. Dec. 7.

,, 20,885 (1904). Combret. Alimentary products constituting a phosphated vinegar. Dec. 7.

,, 22,030 (1904). Posternak. Process for the production of soluble earthy alkaline and metallic salts of the organic phosphorus compound contained in vegetable foodstuffs. Dec. 7.

,, 22,952 (1904). Wetter (Thüringer Gelatine-Fabrik). *See under* XIV.

,, 23,177 (1904). Müller. Food preparations. Dec. 7.

(*B.*)—Sanitation; Water Purification.

[C.S.] 5467 (1904). Wehner. Apparatus for purifying water. Dec. 14.

(*C.*)—Disinfectants.

[C.S.] 4540 (1904). Kitching and Shirley. Disinfectants. Dec. 7.

XIX.—PAPER, PASTEBOARD, Etc.

[A.] 26,434. Woods and Morgan. Manufacture of celluloid compounds. Dec. 5.

[C.S.] 1857 (1904). Hawke. *See under* XXI.

,, 2357 (1904). Howorth (Soc. Franç. de la Viscose). Apparatus for treating viscose. Dec. 7.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

[A.] 26,383. Loebell. Process for purifying crude viscine obtained from plants of the ilex class.* Dec. 3.

,, 26,649. Livingstone (Stein). Compound for use in medicine, and process of manufacturing the same. Dec. 7.

,, 26,713. Oberlander and The Alliance Chemical Co., Ltd. Manufacture of saccharine. Dec. 8.

,, 26,779. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of camphor. Dec. 8.

[C.S.] 22,030 (1904). Posternak. *See under* XVIII. A.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

[A.] 25,897. Harris, Gillard, and Molyneux. Coating or preparation of paper or other material for photographic purposes. Nov. 28.

,, 26,066. Kelly and Bentham. Self-developing dry plate. Nov. 30.

,, 26,247. Morgan. Manufacture of sensitive photographic self-toning printing-out paper.* Dec. 2.

,, 26,456. Newton (Bayer and Co.). The pigment process, and new copying materials for use therein. Dec. 5.

,, 26,573. Clarke. Colour photography. Dec. 6.

[C.S.] 1857 (1904). Hawke. Manufacture of sensitised copying papers. Dec. 7.

,, 2693 (1904). Hewitt and Miles. Photographic printing. Dec. 14.

,, 3794 (1904). Abel (Act.-Ges. für Anilinfabr.). Manufacture of flash-lights for photography. Dec. 7.

,, 22,988 (1904). Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses Fils. Sensitised plates for a process of colour photography. Dec. 14.

XXII.—EXPLOSIVES, MATCHES, Etc.

[A.] 26,146. Curtis's and Harvey, Ltd., and Hargreaves. Explosive compounds. Dec. 1.

,, 26,974. Luck. Manufacture of explosives. Dec. 10.

,, 27,005. Wetter (Westfälisch-Anhaltische Sprengstoff-Act.-Ges.). Priming or detonating compositions suitable for percussion caps. Dec. 10.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

[C.S.] 28,262 (1903). Schlatter and Deutsch. Method of and apparatus for ascertaining the quantity of carbonic acid in furnace gases. Dec. 7.

Printed and Published by Eyre and Spottiswoode, East Harding Street, London, E.C., for the Society of Chemical Industry.—P 856.

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Total Membership on February 29th, 1904 = 3996.

A

1897. Ablett, A. W., P.O. Box 91, Germiston, near Johannesburg, Transvaal, S. Africa, Cyanide Works Manager.
1903. Abraham, Herbert, 13, West 89th Street, New York City, U.S.A., Chemist.
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1900. Ackroyd, Wm., Borough Laboratory, and (communications) Crossley Street, Halifax, Yorks, Analytical Chemist.
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1892. Adams, Arthur, Kelvin House, Edgbaston Road, Smethwick, near Birmingham, Science Lecturer.
1884. Adams, M. A., Ashford Road, Maidstone, Kent, Public Analyst.
1902. Adams, O. Gore, School of Mines, Thames, Auckland, New Zealand, Director.
1897. Adams, Thos. H., 107, Crewe Street, Derby, Analyst.
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1886. Aitken, J. B., Gerard's Fold Chemical Works, Widnes, Chemical Manufacturer.
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1891. Alcock, Jno. W., Central Brewery, Mott Street, Birmingham, Maltster and Brewer.
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1890. Aldrick, Edwin John, 53, Alpha Road, West Ferry Road, Millwall, E., Chemical Works Clerk.
1899. Alexander, D. Basil W., Denver Testing Laboratory, P.O. Box 1341, Denver, Colo., U.S.A., Chemist.
1900. Alexander, Jerome, c/o National Gum and Mica Co., 502—510, West 45th Street, New York City, U.S.A., Chemist.
1883. Alexander, W. T., Crumnock, Eccles, Manchester, Drysalter.
1901. Allan, Dr. F. B., Chemical Laboratory, University of Toronto, Canada, Lecturer on Chemistry.
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1898. Allan, John, 55, Northern Grove, West Didsbury, near Manchester, Chemist.
1902. Allbright, Wm. B., 5139, Lexington Avenue, Chicago, Ill., U.S.A., Chemical Engineer.
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1892. Allen, Walter W., Room 1709, 170, Broadway, New York City, U.S.A., Metallurgical Manager.
1900. Allen, Wilfrid T., c/o Hugh Wallace and Co., Ltd., 5, Fenchurch Street, London, E.C., Director.
1884. Allen, Wm., Evenley Hall, Brackley, North Hants.
1893. Allerton, Rt. Hon. Lord, F.R.S. (Journals), Allerton Hall, near Leeds; and c/o W. L. Jackson and Sons, Ltd., Buslingthorpe, Leeds, Tanner.
O.M. Allhusen, A., Gateshead-on-Tyne, Chemical Manufacturer.
1886. Allibon, G. H., 35, Eglantine Avenue, Belfast, Ireland, Chemical Works Manager.
1900. Allingham, Jno., 76, Gayville Road, Wandsworth Common, London, S.W., Assayer.
1887. Alliott, J. B., Messrs. Manlove, Alliott, and Co., Ltd., Nottingham, Mechanical Engineer.

1900. Allison, Thos. McGregor, Sargent Street, Bedminster, Bristol, Tanner.

1895. Allison, Wm. O., 100, William Street, New York City, U.S.A., Publisher of "Oil Paint and Drug Reporter."

1889. Alpiar, Agop, Smyrna, Asia Minor, Morphia Manufacturer.

1899. Alsop, Wm. K., 30, Ferry Street, New York City, U.S.A., Chemist.

1901. Alston, Robt. A., New Rietfontein Estates Gold Mines, Ltd., P.O. Knights, Rietfontein, Transvaal, Mining Engineer.

1904. Alton, W. Lester, "Dangarvan," Putney Heath, S.W., Chemist.

1898. Ambler, Chas. Taaffe, Dharhara Station, E.I. Ry., Bengal, India, Mine Owner and Contractor.

1897. Amend, Otto P., 205—211, Third Avenue, New York City, U.S.A., Chemist.

1900. Anderson, Jas. W., 1, Preston Villas, Halling, near Rochester, Kent, Analytical Chemist.

1889. Anderson, Robt. T. R., 80, Seedhill Road, Paisley, Technical Chemist.

1894. Anderson, Dr. W. Carrick, 2, Florentine Gardens, Hillhead, Glasgow, University Lecturer.

1895. Anderson, Wm., 19—21, Blackfriars Street, Edinburgh, Drysalter.

O.M. Anderton, G. H., Howendyke, Howden, Yorks, Chemical Manufacturer.

1896. Andreoli, Gabriel, P.O. Box 3725, Johannesburg, Transvaal Colony, South Africa, Electro-chemist.

1889. Andrews, C. W., c/o The John Crerar Library, Wabash Avenue and Washington Street, Chicago, Ill., U.S.A., Librarian.

1904. Andrews, Geo. D., 7, Old Ford Road, London, N.E., Chemist.

1903. Andrews, Wm. H., c/o Pratt and Lambert, Buffalo, N.Y., U.S.A., Manager (Varnish Works).

1903. Anfilogoff, N. A., c/o The Roumanian Oil Trust, Ltd., Thames Haven, Stanford-le-Hope, Essex, Chemist.

O.M. Angell, J., 6, Beaconsfield, Derby Road, Withington, Manchester, Chemical Lecturer.

1892. Annandale, C. J. R., The Briary, Shotley Bridge, Co. Durham, Paper Maker.

1883. Annandale, Jas. H., Polton Paper Works, Midlothian, N.B., Paper Maker.

1897. Annis, Dr. E. G., Public Health Dept., Town Hall, Greenwich, S.E., Medical Officer of Health.

1887. Annison, R. H., 16, Water Lane, Tower Street, London, E.C., Master Lighterman.

1894. Ansbacher, L. A., P.O. Box 1934, New York City, U.S.A., Colour Manufacturer.

1903. Anspach, Dr. R., Markt 2, Siegburg, bei Köln, Germany, Chemist.

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1899. Appleby, C. W., Farnworth, near Widnes, Lancashire, Pith and Size Manufacturer.

1895. Appleby, Prof. W. R., 911, 5th Street, S.E., Minneapolis, Minn., U.S.A., Professor of Mining and Metallurgy.

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1901. Archbold, Dr. Geo., P.O. Box 283, Prescott, Ont., Canada, Consulting Chemist and Manager.

O.M. Archbutt, Leonard, The Yews, Madeley Street, Derby, Analytical Chemist.

1899. Archdale, T. Henry, 77, Queen's Road, Blackburn, Manager of Tar and Ammonia Works.

1904. Archdale, Wm., 21, Oldham Road, Miles Platting, Manchester, Manager of Chemical Works.

1901. Ardagh, Edw. G. R., 28, Leopold Street, Parkdale, Toronto, Canada, Chemist.

1900. Ardern, Edw., 2, Atkinson Road, Urmston, near Manchester, Chemist.

1901. Argall, Philip, 728–732, Majestic Buildings, Denver, Colo., U.S.A., Manager (Gold Extraction Works).

1903. Armstrong, E. D., c/o Empire and American Glycerin Co., Hartford City, Ind., U.S.A., Chemist.

1902. Armstrong, Edward E., Pennsylvania Salt Manufacturing Co., Natrona, Pa., U.S.A., Manufacturing Chemist.

1899. Armstrong, Richard, Saul Street Soap Works, Preston, Lancashire, Soap Manufacturer.

1901. Arnold, G. Edmund, 6, Kingsfield Terrace, Faversham, Kent, Manager (Cotton Powder Co., Ltd.).

1899. Arnott, G. W. Campbell, 188, King Street East, Toronto, Canada, Chemical Agent.

1903. Arnott, J. S., Cifnentes, No. 5, Gijon, Spain, Chemist and Metallurgist.

1901. Arundel, Arthur S. D., Penn Street Works, Hoxton, N., Paper Box Manufacturer.

1901. Asano, K. 25, Kitachonyachō, Kyobashi, Tokyo, Japan, Mining Chemist.

1903. Ashley, Frank R., Western Chemical Manufacturing Co., Denver, Colo., U.S.A., Manufacturing Chemist.

1900 Ashley, Harrison Everett, 1089, Acushnet Avenue, New Bedford, Mass., U.S.A., Metallurgical Chemist.

1900. Ashton, Jas., Rhodes Farm, Whitefield, Manchester, Chemist and Manager.

1890. Ashton-Bost, W. D. *See* Bost, W. D. Ashton.

1885. Ashwell, H., 117, Waterloo Crescent, The Forest, Nottingham, Bleacher and Dyer.

1885. Ashwell, J. H., 117, Waterloo Crescent, The Forest, Nottingham, Bleacher and Dyer.

1894. Ashworth, Arthur, Fernhill Chemical Works, Bury, Lancs., Chemical Manufacturer.

1903. Ashworth, Jno. B., The Creamery, Broad Green, Liverpool, Manager.

1898. Aspinall, Thos., 42, Gilnow Road, Bolton, Analytical and Manufacturing Chemist.

1897. Aspinwall, Capt. H. C., Haskell, N.J., U.S.A., Explosives Manufacturer.

1900. Aston, Bernard C., Agricultural Department, Wellington, New Zealand, Chemist.

1891. Atkins, C. E., Teigngrace, Byculla Park, Enfield, N., Chronometer Maker.

1885. Atkinson, A. J., 41, Stewart Street, Cardiff, Analytical Chemist.

1902. Atkinson, Edwin B., Furze Glen, Lambert Road, Great Grimsby, Lecturer in Chemistry.

1900. Atkinson, Jno. W., Betteravia, Cal., U.S.A., Chemist.

O.M. Attfield, Dr. J., F.R.S., Ashlands, Watford, Herts.

1900. Atwood, Frank W., 216, Milk Street, Boston, Mass., U.S.A., Chemist.

1895. Auchterlonie, Wm., jun., c/o Clark Thread Co., Newark, N.J., U.S.A., Dyeworks Manager.

1901. Auden, Dr. H. A., c/o United Alkali Co., Ltd., Central Laboratory, Widnes, Chemist.

1897. Auger, Chas. L., 425, Park Avenue, Paterson, N.J., U.S.A., Silk Dyer.

1887. Austen, Prof. Peter T., 218, St. John's Place, Brooklyn, N.Y., U.S.A., Professor of Chemistry.

1901. Austin, Herbert, c/o George Scott and Son, Ltd., 67, Lord Street, Liverpool, Engineer.

1902. Austin, J. H., Allscott, Wellington, Shropshire, Analytical Chemist.

1901. Auty, Albert M., c/o John Smith and Sons, Field Head Mills, Bradford, Chemist.

1902. Avery, D., 23, Belmont Avenue, Kew, Melbourne, Vic., Australia, Teacher of Chemistry.

1901. Ayer, Harold O., 503, Whitaker Street, Savannah, Ga., U.S.A., Chemist.

1890. Aykroyd, H. E., Oakwood Dye Works, Bradford, Yorks, Dyer.

1899. Aylsworth, Jonas W., 223, M'lland Avenue, East Orange, N.J., U.S.A., Chemist.

1903. Ayres, W. J., P.O. Box 187, Pernambuco, Brazil, Sugar Expert.

B

1895. Bacon, Nathaniel T., Peace Dale, Rhode Island, U.S.A., Chemical Engineer.
1903. Bacon, R. A., 31, West 17th Street, New York City, U.S.A., Manufacturing Chemist.
1897. Bacon, Wm., 4, New Court, Lincoln's Inn, W.C., Chemist.
1897. Badock, Stanley H., 41, Downleaze Road, Stoke Bishop, near Bristol, Smelter.
1898. Baekeland, Dr. Leo, Snug Rock, North Broadway, Yonkers, N.Y., U.S.A., Manufacturing Chemist.
1902. Baer, Dr. Samuel H., 158, Chambers Street, New York City, U.S.A., Consulting Chemist.
1903. Bailey, Prof. E. H. S., The Library, Kansas State University, Lawrence, Kas., U.S.A., Professor of Chemistry.
1885. Bailey, Edwin M., The Elms, East Calder, N.B., Technical Chemist.
1883. Bailey, Dr. G. H., Marple Cottage, Marple, Cheshire, Chemical Lecturer.
1903. Bailey, Harold J., c/o Great Western Colliery Co., Pontypridd, S. Wales, Chemist.
1898. Bailey, Henry, 18, Lavender Sweep, Lavender Hill, S.W., Analytical Chemist.
1888. Bailey, Dr. T. Lewis, Gas Street, Runcorn, Chemist.
1888. Bailey, Sir W. H., Albion Works, Salford, Manchester, Chemical Engineer.
1888. Bailey, Walter P., Fabrica de Productos Amoniacales, 2A, Aguada, Cadiz, Spain, Manufacturing Chemist.
1902. Bain, Jas. Watson, 90, Charles Street, Toronto, Ont., Canada, Chemist.
1890. Baird, H. Harper, 14, Cross Street, Hatton Garden, London, E.C., Laboratory Furnisher.
1902. Baird, Dr. Julian W., Massachusetts College of Pharmacy, Boston, Mass., U.S.A., Professor of Chemistry.
1891. Baird, Wm., c/o Lewis Berger and Sons, Ld., Homerton, N.E., Technical Chemist.
1895. Baird, W. Raymond, 271, Broadway, New York City, U.S.A., Patent Lawyer.
1890. Bairstow, John, Burley, Queen's Park, Chester, Chemical Works Manager.
1903. Baker, Arthur, 93, Blackburn Road, Darwen, Lancs., Chemist.
1902. Baker, Chas. F., Technical College, Sunderland, Lecturer in Chemistry.
1901. Baker, F. Guy Stirling, Marryatt's Lodge, The Forest, Snaresbrook, Essex, Student.
1883. Baker, Harry, Epworth House, Moughland Lane, Runcorn, Analytical Chemist.
1899. Baker, H. Fenimore, c/o Thomsen Chemical Co., Baltimore, Md., U.S.A., President.
1892. Baker, Julian L., 7, Addison Road, Bedford Park, W., Sugar Chemist.
1886. Baker, Theodore, c/o G. Henry, Pompton Lakes, N.J., U.S.A., Analytical Chemist.
1898. Baldwin, Abram T., Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Manufacturer.
1903. Baldwin, F. H., Bergenport Chemical Works, Bayonne, N.J., U.S.A., Superintendent.
1903. Baldwin, Dr. H. B., 9–11, Franklin Street, Newark, N.J., U.S.A., Chemist (Dept. of Public Health).
1901. Ball, Edward, c/o B. Young and Co., Spa Road, Bermondsey, S.E., Glue and Size Manufacturer.
1903. Ball, S. F., Hull Avenue and 209th Street, Bronx Borough, New York City, U.S.A., Analytical Chemist.
1389. Ballantyne, H., 75, Chancery Lane, London, W.C., Analytical Chemist.
1903. Ballantyne, W. H., 111, Hatton Garden, London, E.C., Patent Agent's Assistant.
1892. Ballard, Ernest, Colwall, Great Malvern, Malt Vinegar Brewer.
O.M. Ballard, E. G., Greenfield Cottage, Hoole Road, Chester, Alkali Works Inspector.
1891. Ballinger, Jno., Free Library, Cardiff, Librarian.
1903. Baltzly, E. B., c/o Semet Solvay Co., Syracuse, N.Y., U.S.A., Chemist and Superintendent.
1890. Baly, E. C. C., University College, Gower Street, London, W.C., Analytical Chemist.
O.M. Bamber, H. K., 9, Victoria Street, London, S.W., Consulting Chemist.
1894. Bamber, H. K. G., Ingress House, Greenhithe, Kent, Cement Works Chemist and Manager.
1898. Bamford, Harry, 70, Duckworth Terrace, Bradford, Yorks, Dyer.
O.M. Banister, H. C., Elmhurst, Blundellsands, near Liverpool, Chemical Works Manager.
1890. Banks, Jno. H., c/o Ricketts and Banks, 104, John Street, New York City, U.S.A., Mining Engineer.
1895. Bannan, John F., 59, Court Street, North Andover, Mass., U.S.A., Chemist (Woollen Mill).
1385. Banner, Samuel, 4, Ivanhoe Road, Liverpool, Petroleum Merchant.
O.M. Bannister, R., 59, Tregunter Road, South Kensington, S.W., Analytical Chemist.
O.M. Bannister, W., Victoria Lodge, Cork, Ireland, Manufacturing Chemist.
1901. Barber, René R., Georgetown, Ont., Canada, Analytical Chemist.
1892. Barden, Alf., Far Bank, Shelley, near Huddersfield, Glue and Size Maker.
1886. Bardsley, Robt., Messrs. Jewsbury and Brown, Ardwick Green, Manchester, Mineral Water Manufacturer.
1895. Bardwell, Fred. L., Massachusetts Institute of Technology, Boston, Mass., U.S.A., Assistant Professor of Chemistry.
1903. Baringer, Fred. J., Eagle White Lead Works, 1020, Broadway, Cincinnati, Ohio, U.S.A., Chemist.
1902. Barker, Hugh S., 32, Cumberland Avenue, Sefton Park, Liverpool, Laboratory Furnisher.
1895. Barlow, Clinton W., 103—105, Greene Street, New York City, U.S.A., Merchant.
1901. Barlow, John J., 177, Manchester Road, Accrington, Calico Printer's Chemist.
1899. Barlow, Wm., 311, Market Street, Droylsden, near Manchester, Analytical Chemist.
1891. Barnes, Edward A., Dynamite Works, Modderfontein, Transvaal, Technical Chemist.
1901. Barnes, Fred., 46, Park Road, Sittingbourne, Kent, Paper Mill Chemist.
1884. Barnes, H. J., Phœnix Chemical Works, Hackney Wick, E., Manufacturing Chemist.
O.M. Barnes, Jos., Green Vale, Westhoughton, near Bolton, Lancashire, Analytical Chemist.
1881. Barnes, Jonathan, 301, Great Clowes Street, Manchester, Analytical Chemist.
1902. Barnett, Marcus S., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Sugar Works Chemist.
1897. Barnett, Robt. E., 9, Virginia Road, Leeds, Headmaster (Leeds Technical School).
1898. Barnicott, Jas. A., Messrs. May and Baker, Ltd., Garden Wharf, Church Road, Battersea, S.W., Chemical Manufacturer.
1901. Baron, Wm. Briscoe, Manchester Steam Users' Association, 9, Mount Street, Manchester, Chemist.
1901. Barr, Geo., Manchester Mills, Manchester, N.H., U.S.A., Calico Printer.
O.M. Barr, J., Dinting Vale, Dinting, near Manchester, Chemical Manager.
1890. Barraclough, Wm. H., Mortomley, near Sheffield, Analytical Chemist.
1900. Barralet, Edgar S., 4, Kenyon Mansions, Queen's Club Gardens, W. Kensington, W. Chemist.
1896. Barratt, J. Treeby, Bronheulog, Mostyn, North Wales, Chemist and Manager.
1903. Barreto, Ignacio de Barros, Engenho do Meis Vergea, Pernambuco, Brazil, Manager (Sugar Factory).
1890. Barrett, Arthur A., 5, Strada del Pozzo Leone, Messina, Sicily, Manufacturer of Essential Oils.
1890. Barrie, D. McLaurin, Analytical Chemist.
1900. Barrow, Jos., 13, The Grove, Bebington, Cheshire, Chemist.
1893. Barton, G. E., c/o Whitall, Tatum, and Co., Flint Glass Works, Millville, N.J., U.S.A., Technical Chemist.

1900. Barton, L. Edward, 283—285, Broadway, Albany, N.Y., U.S.A., Chemist.
1903. Bartripp, Geo. F., 51, Pulteney Road, South Woodford, Essex, Analytical Chemist.
1895. Baskerville, Dr. Chas., University of North Carolina, Chapel Hill, N.C., U.S.A., Professor of Chemistry.
1884. Bassett, H., 26, Belitha Villas, Barnsbury, N.
1899. Bassett, Wm. H., Torrington, Conn., U.S.A., Chemist.
1890. Bate, William, c/o National Explosives Co., Ltd., Hayle, Cornwall, Technical Chemist.
1903. Bateman, A. H., 34, Bridge Avenue, Hammersmith, W., Chemist.
1903. Bates, C. O., Coe College, Cedar Rapids, Iowa, U.S.A., Teacher of Chemistry.
1884. Bateson, Percy, Cuckoo Lane, Gateacre, near Liverpool, Technical Chemist.
1903. Battle, A. E., The B. S. A. Asphalt Manufacturing Co., Ltd., Woodstock, Capetown, S. Africa, Works Manager.
1885. Batty, R. B., Wharncliffe, Erdington, near Birmingham, Nickel Works Manager.
1903. Baty, E. J., 76, Prenton Road East, Birkenhead, Chemical Student.
1903. Bauer, Geo. W., 632, Sacramento Street, San Francisco, Cal., U.S.A., Vice-President and Chemist (Hop and Malt Co).
1900. Baur, Jacob, 67, Wells Street, Chicago, Ill., U.S.A., Liquid Carbonic Acid Manufacturer.
1898. Baxter, John G., c/o Mrs. Kitchell, Cemetery Lodge, Heckmondwike, Yorks, Chemist.
O.M. Baxter, W. H., Nuthurst, Streatham, S.W., Brewery Director.
1899. Bayly, Francis W., Royal Mint, Sydney, N.S.W., Australia, Assayer.
O.M. Baynes, J., Royal Chambers, Scale Lane, Hull, County and Borough Analyst.
1897. Beadle, Alec A., Greenheys, Granville Road, High Barnet, Herts., Electro-Chemist.
1886. Beadle, Clayton, Melrose, Hatherley Crescent, Sidcup, Kent, Consulting Chemist.
1890. Bealey, Adam C., c/o A. C. Bealey and Sons, Radcliffe, Lancashire, Bleacher and Alkali Manufacturer.
O.M. Beanes, E., Moatlands, Paddock Wood, Kent, Manufacturing Chemist.
1883. Beaven, E. S., 5, Boreham Terrace, Warminster, Wilts, Maltster.
1897. Beaver, Chas. J., Stanmore, Cecil Road, Hale, Cheshire, Chemist.
1895. Bechi, G. de, c/o Messrs. W. Blythe and Co., Church, Lancs., Chemical Engineer.
1898. Beck, Herbert H., 105, South Queen Street, Lancaster, Pa., U.S.A., Chemist.
O.M. Beckett, G. H., Glendye Cottage, Stevenston, Ayrshire, Analytical Chemist.
1898. Beckett, Jos. H., 20, Albert Road, Parkgate, near Rotherham, Analytical Chemist.
1903. Beckwith, Edw. Pierrepont, Garrison on the Hudson, N.Y., U.S.A., Chemist.
1899. Bedford, Alf. C., 26, Broadway, New York City, U.S.A., Chemical Merchant.
1891. Bedford, Chas. S., Rocela, Weetwood, Headingley, Leeds, Manufacturing Chemist.
1891. Bedford, Jas. E., Messrs. Wood and Bedford, Airedale Chemical Works, Leeds, Manufacturing Chemist.
O.M. Bedson, Prof. P. Phillips, Durham College of Science, Newcastle-on-Tyne, Professor of Chemistry.
1901. Beebe, Murray C., Nernst Lamp Co., Pittsburg, Pa., U.S.A., Engineer.
1901. Beevers, Clifford J., c/o Brotherton and Co., Holmes Street, Dewsbury Road, Leeds, Analyst.
1899. Behr, Dr. Arno, Pasadena, Cal., U.S.A., Chemist.
1903. Behrend, F., 54, Front Street, New York City, U.S.A., Importer of Chemical Stoneware.
1902. Behrend, Dr. Otto F., Hammermill Paper Co., Erie, Pa., U.S.A., Vice-President.
O.M. Beilby, G., 11, University Gardens, Glasgow, Chemical Engineer.
1902. Bek, Lars P., Colonial Sugar Refining Co., Ltd., Pyrmont Refinery, Sydney, N.S.W., Australia, Analytical Chemist.
1884. Bell, C. Lowthian, Free Library, Middlesbrough-on-Tees, Soda and Iron Manufacturer.
1902. Bell, Edwin L., Vidal Dyes Syndicate, Ltd., West Ferry Road, Millwall, E., Manager.
1900. Bell, Hugh P., 30, Egerton Crescent, London, S.W., Chemist.
O.M. Bell, J. Carter, Bank House, The Cliff, Higher Broughton, Manchester, Public Analyst.
1886. Bell, J. Ferguson, Derby Gas Light and Coke Co., Derby, Gas Engineer.
O.M. Bell, Sir Lowthian, Bart., F.R.S., (Journals) Rounton Grange, Northallerton ; and (subs.) c/o Bell Bros., Middlesbrough, Iron and Chemical Manufacturer.
1903. Bell, P. Carter, Milburn, N.J., U.S.A., Chemical Manufacturer.
1884. Bell, T. Hugh, Middlesbrough-on-Tees, Soda and Iron Manufacturer.
1902. Bement, Alburto, 218, La Salle Street, Chicago, Ill., U.S.A., Chemical Engineer.
O.M. Bendix, D., The British Alizarin Co., Limited, Silvertown, Victoria Docks, E. ; Journals to 371, Romford Road, Forest Gate, E., Managing Chemist.
1898. Bendixen, Julius C.,
Leather Manufacturer.
1897. Benfey, Dr. Hans, 2, Sunnyside Terrace, Clayton, Manchester, Manufacturing Chemist.
1903. Benham, Keith, Deans Hill, Stafford, Analytical and Consulting Chemist.
1902. Benjamin, Albert, c/o Thos. Hardcastle and Sons, Ltd., Firwood Works, Bolton, Colorist and Dyer.
O.M. Benjamin, Dr. M., Smithsonian Institution, Washington, D.C., U.S.A., Consulting Chemist, A.M.
1904. Benn, R. H. D., 16, Springfield Avenue, Westmount, Montreal, Canada, Analytical Chemist.
1899. Bennett, Alex. H., Chemical Laboratory, 39, Lime Street, E.C., Works Chemist.
1901. Bennett, Arnold, c/o Saml. Osborn and Co., Clyde Steelworks, Sheffield, Chemist.
1884. Bennett, Thos., Birch Vale, near Stockport, Calico Printer.
1902. Bennie, P. McN., P.O. Box 118, Niagara Falls, N.Y., U.S.A., Foreign Representative.
1901. Bentley, Wm. H., 6, Woodbine Terrace, Irlam, near Manchester, Technical Chemist.
1890. Bentz, Ernest, 107, Shaw Lane, Dinting, near Manchester, Lecturer on Dyeing.
1897. Berg, Julius, Elsässischer Petroleum Geselischaft, Waburg, Elsass, Germany, Oil Refinery Manager.
1884. Beringer, J. J., Basset Road, Camborne, Cornwall, Metallurgist.
1893. Berk, Fred. W., 1, Fenchurch Avenue, London, E.C., Chemical Manufacturer.
1903. Berkeley, Dr. Wm. N., Box 466, San Juan, Puerto Rico, U.S. West Indies, Chemist.
1900. Bermingham, Jno., jun., c/o California Powder Works, Pinole, Contra Costa Co., Cal., U.S.A., Powder Works Superintendent.
1889. Bernard, Jas., jun., Casal das Rolas, Olivaes, near Lisbon, Chemical Works Manager.
O.M. Bernays, J., 96, Newgate Street, London, E.C., Civil Engineer.
1900. Berolzheimer, D. D., 317, South 18th Street, Philadelphia, Pa., U.S.A., Chemist.
1897. Berry, Albert E., 62, Claremont Road, Forest Gate Essex, Works Manager.
1883. Berry, E. E., Bordighera, Italy, Technical Chemist.
1889. Berry, G. F., Atlas Chemical Works, West Ferry Road, Millwall, E., Chemical Works Manager.
1903. Berry, W. G., 329, West 83rd Street, Manhattan Borough, New York City, U.S.A., Chemist.
1898. Berwick, D. C., 62, Trinity Road, West Bromwich, and (Journals) c/o Chance Bros. & Co., Ltd., Glass Works, near Birmingham, Electro-Metallurgist.
1886. Best, Dr. T. T., Hardshaw Brook Chemical Works, St. Helens, Lancashire, Technical Chemist.

1901. Betts, Anson G., Troy, N.Y., U.S.A., Chemist.

O.M. Bevan, E. J., 4, New Court, Lincoln's Inn, London, W.C., Public Analyst and Consulting Chemist.

1900. Bevan, Jno. W., Risedale, St. James' Crescent, Swansea, Manager of Metallurgical Works.

O.M. Beveridge, Jas., "The Gables," Alderley Edge, Cheshire; and (Journals) c/o The Cushing Sulphite Fibre Co., Ltd., St. John, N.B., Canada, Pulp and Paper Manufacturer.

1900. Bevington, Col. S. B., 42, St. Thomas Street, Southwark, S.E., Leather Dresser.

1893. Bhaduri, Prof. K., Canning College, Lucknow, India, Professor of Chemistry.

1898. Bhattacharyya, Haripada, Foundry and Shell Factory, Cossipore, Calcutta, India, Chemist.

1896. Bibby, John, c/o J. Bibby & Sons, Formby Street, Liverpool, Student.

O.M. Bickerdike, W. E., Bryer's Croft, Wilpshire, near Blackburn, Manufacturing Chemist.

1895. Bicknell, G. Arthur, 839, East Madison Avenue, Cleveland, Ohio, U.S.A., Analytical Chemist.

1901. Bielecki, Dr. Jan, "Chemik Polski," 118, Marszalskowska Street, Warsaw, Russian Poland, Chemist.

1903. Bierwirth, L. W., Dover, N.J., U.S.A., Civil Engineer (Laflin and Rand Powder Co.)

1884. Biggart, J. Wm., 29, Cathcart Street, Greenock, N.B., Analytical Chemist.

1891. Biggart, Wm. L., Woodbine, Bridge of Weir, N.B., Public Analyst.

O.M. Biggs, B., 110, Cannon Street, London, E.C., Chemical Merchant.

O.M. Billing, H. S., 11, Devon Terrace, Ford Park, Plymouth, Analytical and Managing Chemist.

1896. Billings. Edgar F., 64, Federal Street, Boston, Mass., U.S.A., Manufacturing Chemist.

1896. Billington, Chas., jun.. Studleigh, Longport, Staffordshire, Metallurgist.

1898. Binney, Harold, Washington Life Building, 141, Broadway, New York City, U.S.A., Patent Lawyer.

1902. Binning, Stevenson, 101, Shooter's Hill Road, Blackheath, S.E., Technical Chemist.

1903. Binns, John H., Thornfield, Mystic Pond, Methuen, Mass., U.S.A., Dyer and Finisher.

1896. Bird, Arthur W., 10, Norfolk Square, London, W., Works Engineer.

1896. Bird, Jno. B., Minver House, 61, Bateman Street, Cambridge, Manure Manufacturer.

1903. Bird, Thos., 59A, Brook Street, Grosvenor Square, London, W., Surgeon.

1902. Bird, W. Robt., 217, Newport Road, Cardiff, Oil Merchant.

1895. Bird, Wm. R., (communications) 125, Goddard Avenue; (Journals) Laboratory, G.W.R. Works, Swindon, Wilts, Analytical Chemist.

1885. Birley, R. K., c/o Chas. Macintosh and Co., Ltd., Cambridge Street, Manchester, India-rubber Manufacturer.

1895. Bischoff, Dr. Ernst, 87-89, Park Place, New York City, U.S.A., Chemist.

1883. Bishop, A. Conway, Three Mills Lane, Bromley-by-Bow, E., Manufacturing Chemist.

1884. Bishop, Fred, c/o Burmah Oil Co., Rangoon, Burmah, Technical Chemist.

O.M. Bishop, G. A., 38, Sherbrooke Avenue, Maxwell Park, Glasgow, Mining Engineer.

1903. Bishop, Howard B., 609, Greene Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1903. Bishop, J. T. F., Chemical Club, Manchester, Secretary.

1902. Black, Walter G., 9, Routh Road, Wandsworth Common, S.W., Chemist.

1894. Blackmore, H. S., 206, South Ninth Avenue, Mount Vernon, N.Y., U.S.A., Chemist (Pure Aluminium and Chemical Company).

1899. Blackwell, G. G., 44-47, The Albany, Liverpool, Mineral and Metal Merchant.

1896. Blagden, Victor, 50-51, Lime Street, London, E.C., Chemical Merchant.

1883. Blagden, W. G., 4, Fenchurch Avenue, London, E.C., Chemical Merchant.

1897. Blair, Andrew A., 406, Locust Street, Philadelphia, Pa., U.S.A., Analytical Chemist.

1884. Blake, Jas., Thames Sugar Refinery, Silvertown, London, E., Sugar Refinery Manager.

1902. Blakemore, Geo. H., Great Cobar Copper Mine, Cobar, N.S.W., Australia, Metallurgist.

1890. Blakey, A. J., Dudbridge Mills, Stroud, Gloucestershire, Dyer.

1891. Blass, Edw., Essen (Ruhr), Germany, Civil Engineer.

1893. Blears, John, c/o Langworthy Bros. and Co., Lim., Greengate Mills, Salford, Dyer and Calico Printer.

O.M. Bles, A. J. S., 32, Chorlton Street, Manchester, Chemical Merchant.

1889. Bloede, Victor G., Station D., Baltimore, Md., U.S.A., Manufacturing Chemist.

1891. Bloomer, Fred. J., Penpont, Clydach, R.S.O., Glamorgan, Technical Chemist and Nickel Works Manager.

1886. Blount, Bertram, Chemical Laboratory, 76 and 78, York Street, Westminster, S.W., Analytical Chemist.

1588. Bloxam, A. G., Birkbeck Bank Chambers, Chancery Lane, W.C., Analytical Chemist.

1890. Bloxam, W. Popplewell, c/o Indigo Improvements Syndicate, Dalsingh Serai, Tirhoot, Bengal, India, Research Chemist.

1902. Bluman, Nicholas J., 10, Amersham Road, New Cross, S.E., Student of Chemistry.

1903. Blumenthal, Lionel, 25, Lever Street, Piccadilly, Manchester, Chemist.

1886. Blundstone, E. R., 14, Great Smith Street, Westminster, S.W., and (Journals) Heathfield, Park Road, Hampton Hill, Middlesex, Consulting and Analytical Chemist.

O.M. Boake, A., Warton Road, Stratford, E., Manufacturing Chemist.

1888. Boake, Edmund J., Aberffraw, Nursery Road, Loughton, Essex, Manufacturing Chemist.

1885. Board, J. T., Distillery, Cheese Lane, Bristol, and (Journals) Roseneath, Willsbridge, near Bristol, Distiller.

1899. Boehm, Fred., 16, Jewry Street, London, E.C., Chemical Agent and Merchant.

1898. Bogert, Prof. Marston T., Department of Organic Chemistry, Columbia University, New York City, U.S.A., Instructor in Organic Chemistry.

1903. Boissevain, Chas. E. H., 92, van Eeghenstraat, Amsterdam, Holland, Chemical Manufacturer.

1903. Bolam, Dr. H. W., Leith Technical College, Leith, N.B., Lecturer on Chemistry.

1901. Bolton, E. Richards, 54, Digby Mansions, Hammersmith, W., Manufacturing Chemist.

1892. Bookman, Dr. S., 9, East 62nd Street, New York City, U.S.A., Chemist.

1888. Boor, Leonard G., 39, Mincing Lane, London, E.C., Chemical Merchant.

1896. Boot, John C., Klatten, Java, Netherlands Indies, Chemist.

1904. Booth, N. Parr, Analytical Laboratory, Cadbury Bros., Ltd., Bournville, near Birmingham, Analytical Chemist.

1894. Booth, Robt., 110, Cannon Street, London, E.C., Engineer.

1891. Boothby, Chas., 31, Dryburgh Road, Putney, London, S.W., Analytical Chemist.

1903. Boral, Robin, Rhodes Mount, Rhodes, near Manchester, Works Manager.

1897. Borland, C. R., P.O. Box 24, Concord Junction, Mass., U.S.A., Smokeless Powder Manufacturer.

O.M. Borland, W. D., Beacon Lodge, Bean, *viâ* Dartford, Kent, Explosives Chemist.

1903. B roschek, Dr. L., 149, East 56th Street, New York City, U.S.A., Chemist.

1903. Bossi, Dr. Arnold, L., c/o Arnold Print Works, North Adams, Mass., U.S.A., Chemist.

1890. Bost, W. D. Ashton, Cartvale Chemical Works, Paisley, N.B., Chemical Manufacturer.

O.M. Bothamley, C. H., Hurst Knoll, Weston-super-Mare, Somerset, County Director of Technical Instruction.

1890. Bott, Dr. W. Norman, The Vicarage, Sleaford, Lincolnshire, Science Lecturer.

1884. Böttinger, Dr. H. T., Elberfeld, Germany; and (subs.) c/o The Bayer Co., Ltd., 19, St. Dunstan's Hill, E.C., Colour Manufacturer.

O.M. Bottle, Alex., 4, Godwyne Road, Dover, Pharmaceutical Chemist.

1901. Bottomley, Dr. J. Frank, 21, Wentworth Place, Newcastle-on-Tyne, Consulting Chemist.

O.M. Boulton, H. E., 64, Cannon Street, London, E.C., Chemical Manufacturer.

1890. Boulton, James, Crayford Mills, Stratford, E., Manufacturing Chemist.

O.M. Boulton, S. B., 64, Cannon Street, London, E.C., Chemical Manufacturer.

1883. Boulton, T. S., 14, Freegrove Road, Caledonian Road, N., Manager.

1900. Bourcoud, Augustin E., Comp. General de Productos Quimicos del Aboño, Gijón, Spain, Civil Engineer.

1884. Bow, R. H., 7, South Gray Street, Edinburgh, Civil Engineer.

1904. Bowden, Thos., 201, Heights Lane, Rochdale, Dyer and Chemist.

1885. Bowen, S. B., Brickfield Chemical Works, Llanelly, South Wales, Chemical Manufacturer.

1899. Bowen, Wm., 43, Woodend Road, Erdington, Birmingham, Chemist.

1888. Bower, Frank, Truman's Brewery, Spitalfields, E., Analytical Chemist.

1897. Bower, Wm. H., 29th Street and Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemical Manufacturer.

1892. Bowes, Harry, 53, Moss Bank, Higher Crumpsall, Manchester, Analytical Chemist.

1903. Bowey, John, jun., Box 227, Coraopolis, Pa., U.S.A., Chemist.

1889. Bowing, Jno., Fuel Works, Tilbury, Essex, Consulting Chemist.

1883. Bowley, Jos. John, Wellington Works, Battersea Bridge, London, S.W., Chemical Manufacturer.

1899. Bowley, J. Plunkett, 1, Wellington Road, Battersea, S.W., Varnish Manufacturer.

1883. Bowman, Dr. F. H., Spinningfield, Deansgate, Manchester, Chemical Manufacturer.

1894. Bowman, Jas. H., Canada Chemical Manufacturing Co., London, Ont., Canada, Professor of Chemistry.

1884. Bowman, R., Cynwyd, near Corwen, N. Wales, Chemical Manufacturer.

1896. Bowman, Walker, 39, Cortlandt Street, New York City, U.S.A., Chemist.

1899. Bowtell, Norman E., Hazeldene, Heath Road, Runcorn, Cheshire, Works Chemist.

1893. Boyce, Frank, c/o Goodall, Backhouse, and Co., White Horse Street, Leeds, Technical Chemist.

1884. Boyd, Pythagoras, 17, Union Street, North Adams, Mass., U.S.A., Print Works Superintendent.

O.M. Boyd, W., P.O. Box 1829, Johannesburg, South Africa, Technical Chemist.

1899. Boyes, Herb. J., Rio de Janeiro Flour Mills, Ltd., Caixa do Correio 574, São Paulo, Brazil, Chemist.

1902. Brach, Dr. Ludwig K., c/o U.S. Finishing Co., Norwich, Conn., U.S.A., Chemist and Colourist.

1885. Bradburn, J. A., Dade City, Fla., U.S.A., Chemical Engineer.

1883. Bradbury, A., Queen Buildings, 11, Dale Street, Liverpool, Chemical Broker.

1902. Bradbury, S., Thornham New Road, Castleton, Manchester, Chemist.

1898. Bradford, Ernest, Ohio State University, Columbus, Ohio, U.S.A., Metallurgical Chemist.

1895. Bradford, Henry, c/o W. H. Gorringe, Southampton House, Southwick, near Brighton, Analytical Chemist.

1904. Brading, R. W., Casella, Sandal Road, New Malden, Surrey, Builder.

1894. Bradley, Edw. F., The Star Brush Co., Ltd., Eden Grove, Holloway, N., Engineer.

1896. Bragg, Everett B., 1745, Chicago Avenue, Evanston, Ill., U.S.A., Manufacturing Chemist.

1891. Braithwaite, Isaac, Kendal, Westmoreland, Drysalter.

1897. Braithwaite, Jno. O., Hilika, Warren Road, Chingford, Essex, Pharmaceutical Research Chemist.

1901. Braman, Winfred W., State College, Pennsylvania, U.S.A., Assistant Instructor.

1903. Brame, J. S. S., 5, Coleraine Road, Blackheath, S.E., Demonstrator in Chemistry.

O.M. Bramham, W., 86, Bow Road, London, E., and (communications) 115, Broadhurst Gardens, West Hampstead, London, N.W., Chemical Engineer.

O.M. Bramwell, Major E., Chemical Works, St. Helens, Lancashire, Chemical Manufacturer.

O.M. Bramwell, G. H., Cowley Hill, St. Helens, Lancashire, Alkali Manufacturer.

1902. Branegan, Jas. Aug., 4,523, North Uber Street, Philadelphia, Pa., U.S.A., Chemical Salesman.

O.M. Branson, F. W., Wynneholme, Far Headingley, Leeds, Pharmaceutical Chemist.

1903. Brassard, Fred. à. c/o Messrs. Bever and Wolf, 46, Vicar Lane, Bradford, Yorks, Aniline Colour Importers.

1901. Brearley, Harry, Salamander Stahlwerke, Jaegel, Riga, Russia, Analytical Chemist.

1888. Breffitt, Wm., Glasshoughton, Castleford, Yorks, Glass Manufacturer.

1888. Bressey, Edw., 209, Romford Road, Stratford, E., Gold and Silver Refiner.

1901. Brewer, Dr. C. E., Wake Forest, N.C., U.S.A., Professor of Chemistry.

1903. Brewer, Leonard A., Prior Well Brewery, Worksop, Notts, Brewer and Chemist.

1900. Brewis, E. Theodore, 7, Cowper Street, Finsbury, E.C., Chemist.

1894. Breyer, Theodor, c/o Warner Sugar Refining Co., Waukegan, Ill., U.S.A., Chemist (American Glucose Co.).

1885. Briant, L., 24, Holborn Viaduct, London, E.C., Analytical Chemist.

1890. Brierley, J. T., Highfield, Golden Hill, Leyland, near Preston, Lancs., Analytical Chemist.

1894. Briggs, J. Burnett, Vauxhall Soap Works, 6, Blackstock Street, Liverpool, Soap Manufacturer.

1893. Briggs, J. F., 12, Salisbury Road, Maidstone, Sugar Works Chemist.

1885. Briggs, T. Lynton, 188, Central Avenue, Flushing, Long Island, N.Y., U.S.A., Technical Chemist.

1886. Briggs, Wm., 13, Panmure Street, Dundee, Manufacturing Chemist.

1890. Brindley, G. F., c/o Niagara Electro-Chemical Co., Niagara Falls, N.Y., U.S.A., Chemical Engineer.

1886. Bristow, G. W., 10, Philpot Lane, London, E.C., Chemical Manager.

1887. Broadbent, H., c/o Goodall, Backhouse, & Co., Sovereign Street, Leeds, Chemist.

1896. Broadhurst, W. Homer, 294, Lafayette Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1889. Brock, Arthur, Firework Factory, Sutton, Surrey, Firework Manufacturer.

O.M. Brock, J., Gwern-Tyno, Colwyn Bay, North Wales, Chairman of United Alkali Co., Ld.

1896. Brooke, C. B., jun., Colne House, Brantham, near Manningtree, Xylonite Manufacturer

1900. Brooke, Jno. R., 36–37, Mincing Lane, London, E.C., Chemist.

1884. Brookes, E. A., c/o The Chilian Mills Co., Ltd., Chiguayante, Concepcion, Chile, Analytical Chemist.

1895. Brookman, Fred. W., 6, West Street, Rochdale Manure Works Manager.

1903. Brooks, H. Kibbe, c/o Casein Co. of America, Bellows Falls, Vermont, U.S.A., Chemist.

1893. Broome, F. S. J., Leaholme, Holloway, near Matlock Bath, Derbyshire, Assayer.

1901. Broome, Jos., 40, East 39th Street, Bayonne, N.J., U.S.A., Chemical Engineer.

O.M. Brotherton, E. A., M.P., Commercial Buildings, Leeds, Ammonia Distiller.
1884. Brown, Prof. A. Crum, F.R.S., 8, Belgrave Crescent, Edinburgh, Professor of Chemistry.
1902. Brown, A. H., c/o Daly Reduction Co., Hedley, B.C., Canada, Metallurgist.
1891. Brown, Cæsar R., 23, Gower Road, Forest Gate, E., Works Foreman.
O.M. Brown, D., 93, Abbey Hill, Edinburgh, Chemical Manufacturer.
O.M. Brown, D., Donaghmore, Tyrone, Ireland, Soap Manufacturer.
1890. Brown, Edw. Hilton, c/o W. Ropes and Co., St. Petersburg, Russia, Analytical Chemist.
1903. Brown, Frank C., P.O. Box 211, Framingham, Mass., U.S.A., Foreman.
1894. Brown, Geo. E., c/o The Photogram, Ltd., Effingham House, Arundel Street, Strand, London, W.C., Chemist.
O.M. Brown, Henry, Benskin's Brewery, Watford, Herts, Brewing Chemist.
1899. Brown, Dr. Henry C., The Chemical Works, King's Lynn, Chemical Manufacturer.
O.M. Brown, Dr. Horace T., F.R.S., 52, Nevern Square, Kensington, S.W., Brewing Chemist.
O.M. Brown, Dr. J. Campbell, 8, Abercromby Square, Liverpool, Professor of Chemistry.
1891. Brown, J. Henry, Minas d'Aljustrel Alemtejo, Portugal, Technical Chemist.
1901. Brown, Jos., Ashleigh House, Savile Town, Dewsbury, Manufacturing Chemist.
1892. Brown, Reginald B., 11, Circular Road, Withington, Manchester, Technical Chemist.
1889. Brown, Robt., The Firs, Hartford, Northwich, Engineer.
1901. Brown, Samuel B., Loveclough, Rawtenstall, Lancashire, Calico Printer's Manager.
O.M. Brown, T., Skopelos, Hunstanton, Chemical Manufacturer.
O.M. Brown, Walter, c/o Jas. H. Dennis and Co., Ltd., Widnes, Technical Chemist.
1900. Brown, Walter B., Victor Chemical Works, Chicago Heights, Ill., U.S.A., Chemist.
1897. Brown, Wm., 293, Great Clowes Street, Higher Broughton, Manchester, Engineer.
1901. Browne, Dr. Arthur L., 13-15, North Street, Baltimore, Md., U.S.A., Analytical Chemist.
1903. Browne, Dr. Chas. A., jun., Audubon Park, New Orleans, La., U.S.A., Sugar Chemist.
O.M. Browning, W., Broad Oak, Accrington, Calico Printer.
1901. Brownlie, David, 11, Langford Road, Heaton Chapel, near Manchester, Chemist.
1902. Brownrigg, Marcus P., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1902. Brownsdon, Dr. H. W., King's Norton Metal Co., Ltd., Abbey Wood, Kent, Works Chemist.
1902. Bruce, Alex., Laboratory, Hyde Park Corner, Colombo, Ceylon, Chemist.
1890. Bruce, Jas., Vauxhall Distillery, Liverpool, Distiller.
1900. Bruce, Wm. T., c/o Hugh Wallace and Co., Ltd., 5, Fenchurch Street, London, E.C., Director.
1892. Bruckmann, G. T., 192, 18th Street, Brooklyn, N.Y., U.S.A. Chemical Engineer.
O.M. Brunner, H., Holly Mount, Tarbock Road, Huyton, near Liverpool, Chemical Manufacturer.
1894. Brunner, H. Bertram, Winnington Park, Northwich, Chemist and Electrician.
1887. Brunner, J. F. L., 23, Wetherby Gardens, London, S.W., Chemical Manufacturer.
O.M. Brunner, Sir J. T., Bart., M.P., Druid's Cross, Wavertree, Liverpool, Chemical Manufacturer.
1902. Brunner, Roscoe, c/o Messrs. Brunner, Mond, and Co., Ltd., Northwich, Alkali Manufacturer.
1894. Brunton, J. Dixon, Wire Mill, Musselburgh, N.B., Wire Manufacturer.
1903. Bryant, V. Seymour, The Bank, Camborne, Cornwall, Analytical Chemist.
1890. Bryce, John Annan, Messrs. Wallace Bros., 8, Austin Friars, London, E.C., Merchant.
1894. Bryce, Thos., Tharsis Mines, Huelva, Spain, Chemist.
1897. Bryson, Jas., Pumpherston Oil Works, Midcalder, N.B., Oil Works Manager.
1892. Buchanan, D. G., Mount Vernon House, Glasgow, Analyst.
1902. Buchanan, Duncan G., 500, Church Street, Toronto, Ont., Canada, Chemist.
1901. Buchanan, E. F., 712, Payne Avenue, Akron, Ohio, U.S.A., Chemist.
1888. Buchanan, Jas., jun., Caledonia Foundry, Brasenose Road, Liverpool, Engineer.
1897. Bucher, Prof. John E., Brown University, Providence, R.I., U.S.A., Assistant Professor.
1897. Buck, Chas. A., 521, Locust Street, South Bethlehem, Pa., U.S.A., Chief Chemist (Bethlehem Iron Co.).
1897. Bucknill, Jno. A., P.O. Box 52, Government Patent Office, Pretoria, Transvaal, Comptroller General of Patents.
O.M. Budden, E. R., 13, Heath Mansions, Hampstead, N.W., Consulting Chemist.
1900. Bull, Dr. Benjamin S., 104, Humber Road, Blackheath, S.E., Technical Chemist.
1902. Bull, Irving C., P.O. Box, 294, Middletown, N.Y. U.S.A., Chemist.
1892. Bull, Johannes C., Athelstone, Havelock Street, Helensburgh, N.B., Chemical Engineer.
O.M. Bullock, J. L., 3, Hanover Street, Hanover Square, London, W., Manufacturing Chemist.
1899. Bult, Herbert J., 18, Billiter Street, London, E.C., Chemist.
O.M. Bumby, H., Coltness Ironworks, Newmains, N.B., Ironworks Manager.
O.M. Bunker, H. E., 19, Napier Street, Toronto, Ont., Canada, Technical Chemist.
1901. Bunting, Henry H., c/o Peruvian Corporation, Ltd., Lima, Peru, Analyst.
1894. Bunting, W. Lightfoot, Forest Bank, Crawshawbooth, near Manchester, Calico Printer.
1893. Burbridge, Jas., India-rubber Mills, Tottenham, N., India-rubber Manufacturer.
1886. Burdekin, G., jun., Park Villa, Prescot Road, St. Helens, Chemical Works Manager.
1896. Burford, Samuel F., The Firs, Kirby Muxloe, near Leicester, Analytical Chemist.
1898. Burge, Chas. H., Government Laboratory, Clement's Inn Passage, Strand, W.C., Analyst.
1889. Bürger, Dr. J., 1, Birch Avenue, Talbot Road, Old Trafford, Manchester, Technical Chemist.
1901. Burgess, Prof. C. F., University of Wisconsin, Madison, Wis., U.S.A., Electro-chemical Engineer.
1889. Burgess, Geo., Hale Road, Ditton, Widnes, Chemist.
1889. Burgess, Wm. T., 46, Portland Road, Holland Park, London, W., Analytical Chemist.
O.M. Burghardt, Dr. C. A., Butcombe, Blagdon, Bristol, Consulting Chemist.
1902. Burk, W. E., Male High School, Louisville, Ky., U.S.A., Chemist and Teacher.
1902. Burkard, Dr. Ernst, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.
1899. Burkhardt, Dr. G., c/o Soc. Romana de Produse Chimiche, Valea Calugareasca, Roumania, Chemist.
1897. Burland, Lt.-Col. Jeffrey H., 824, Sherbrooke Street, Montreal, Canada, Paper and Card Manufacturer.
1896. Burland, Richard O., Bishopgate, Wigan, Manufacturing Chemist.
1900. Burleigh, Wm. F., c/o Murphy Varnish Co., Newark, N.J., U.S.A., Technical Chemist.
1897. Burls, Frank B., 4, Dyers Hall Road, Leytonstone, Essex, Chemist.
1898. Burls, Herbert T., (Journals) c/o Royal Societies Club, St. James Street, S.W., and (communications) Foulis Terrace, Onslow Gardens, S.W., Mechanical Engineer.
1901. Burnand, Sydney, Manbré Saccharine Co., Ltd., Hammersmith, W., Manager.
O.M. Burnard, R., Plymouth Chemical Works, Plymouth, Chemical Manufacturer.

1891. Burnet, Henry K., North Brook Vitriol Works, Bradford, Yorks., Vitriol Maker.

1897. Burnet, Jno. Jas., 18, University Avenue, Glasgow, Architect.

1893. Burnham, J. C., Cordite Factory, Wellington, Nilgiri Hills, India, Analytical Chemist.

1900. Burnside, Chas. F., c/o International Smokeless Powder Co., Parlin, N.J., U.S.A., Chemist.

1890. Burn-Murdoch, J. V., Neuck, Larbert, N.B., Assayer.

1900. Burr, Edmund C., 1722, Vallejo Street, San Francisco, Cal., U.S.A., Manufacturer.

1903 Burr, Edwin H., 18, Cedar Street, New York City. U.S.A., Importer of Essential Oils.

1900. Burr, E. Willard, Alvarado, Alameda Co., Cal., U.S.A., Sugar Manufacturer.

O.M. Burrell, B. A., 5, Mount Preston, Leeds, Analytical Chemist.

1892. Burrough, Horace, jun., 509, West Lombard Street, Baltimore, Md., U.S.A., Technical Chemist.

1888. Burrows, Edw., Home Villa, Low Fell, Gateshead-on-Tyne, Alkali Works Manager.

1901. Burton, Alf., c/o Merchants' Dyeing and Finishing Co., Ltd., 42, Front Street West, Toronto, Canada, Dyer and Finisher.

1903. Burton, Jno., 2, Green Street, Bethnal Green, E., Dye and Chemical Manufacturer.

1889. Burton, Wm., The Hollies, Clifton Junction, near Manchester, Potter's Chemist.

1897. Burwell, A. W., Kyle Street, Lakewood, *via* Cleveland, Ohio, U.S.A., Consulting Chemist.

1885. Bury, J. H., Church Chemical Works, near Accrington, Chemical Manufacturer.

1897. Bush, J. M., c/o W. J. Bush and Co., Ltd., Ash Grove, Hackney, E., Manufacturing Chemist.

1897. Butler, David B., 41, Old Queen Street, Westminster, S.W., Cement Expert.

1903. Butler, Fredk., Ash Lane, Hough Green, near Widnes, Manager (Ditton Copper Works).

1890. Butler, Paul, Lowell, Mass., U.S.A., Ammunition Manufacturer.

1885. Butler, Samuel, The Cedars, Compton, Wolverhampton, Brewer.

1886. Butler, W. W., Southfield, Norfolk Road, Edgbaston, Birmingham, Brewer.

1903. Buttenshaw, E. L., 31, Edge Lane, Chorlton-cum-Hardy, Manchester, Analytical Chemist.

O.M. Butterfield, J. C., 79, Endlesham Road, Balham, S.W., Analytical Chemist.

1892. Butterfield, W. J. A., Overdale, Bletchingley, Surrey, Analytical Chemist.

1897. Butters, Charles, 28-31, Bishopsgate Street Within, London, E.C., and (Journals) 220, Crocker Building, San Francisco, Cal., U.S.A., Metallurgist.

1900. Butterworth, Elwell R., c/o Reversible Collar Co., 111, Putnam Avenue, Cambridge, Mass., U.S.A., Chemist.

1902. Butterworth, F. J., P.O. Box 54, Newark, N.J., U.S.A., Chemist.

1892. Buttfield, Horace V., 13, Wellington Road, Bush Hill Park, Enfield, N., Chemical Demonstrator.

O.M. Byard, A. G., c/o Burt, Boulton, and Heywood, Apartado 8, Bilbao, Spain, Technical Chemist.

1899. Byrnes, Eugene A., 918, F. Street, N.W., Washington, D.C., U.S.A., Examiner in Electro-Chemistry.

1893. Byrom, T. H., Laboratory, Wigan Coal and Iron Co., Wigan, Analytical Chemist.

1887. Bythway, M., 44, Lloyd Street, Albert Street, Manchester, Drysalter.

C

1884. Cabot, Godfrey L., 82, Water Street, Boston, Mass., U.S.A., Chemist.

1889. Cadett, Jas., Ashtead, Surrey, Photographic Dry Plate Maker.

1902. Cady, Walter B., c/o Wabash Portland Cement Co., Stroh Ind., U.S.A., Chemist.

1901. Cady, Wm. H., 13, North Water Street, Philadelphia, Pa., U.S.A., Colour Chemist.

1891. Caines, G. S. A., 7, Rochester Terrace, Camden Road, London, N.W., Analytical Chemist.

1900. Cairns, Adam, Thistle Rubber Mills, Commerce Street, Glasgow, Manager.

1896. Cairns, F. Irvan, Anaconda, Mont., U.S.A., Metallurgist.

1897. Cairns, Wm., 5, Carlton Place, Glasgow, Plumber.

1891. Caldecott, W. Arthur, Box 67, Johannesburg, Transvaal, South Africa, Metallurgist.

1897. Calder, W. A. S., The Hollies, South Road, Smethwick, Chemical Manufacturer.

1888. Caldwell, Wm., Murray Street, Paisley, N.B., Drysalter.

1891. Calkin, Wm. S., Spring Forge, Pa., U.S.A., Paper Pulp Works Chemist.

1902. Calm, Chas. E., 190, Michigan Street, Chicago, Ill., U.S.A., Manufacturing Chemist.

1901. Calvert, Jos. E., 293, Butler Street, Etna, Allegheny Co., Pa., U.S.A. Analytical Chemist.

1899. Calvert, Sidney, State University, Columbia, Mo., U.S.A., Professor of Chemistry.

1895. Cambier, Jacob, 910, Spruce Street, Pueblo, Colo., U.S.A., Chemist.

1894. Cameron, Alex., Kronthal im Taunus, Germany, Chemical Engineer.

1891. Cameron, Jas., 70, Old Chester Road, Woodhey, near Birkenhead, Chemist.

1888. Cameron, Peter, Bath Bridge Colour Works, Bristol, Colour Works Manager.

O.M. Cammack, J., 51, Denton's Green Lane, St. Helens, Technical Chemist.

1886. Campbell, Andrew, c/o Burmah Oil Co., Ltd., Dunneedaw, Rangoon, Burmah, Analytical Chemist.

O.M. Campbell, Archibald, Berry Lodge, Rugeley, Staffordshire, Technical Chemist.

1902. Campbell, Ashley, Colonial Sugar Refining Co., Ltd., Pyrmont Refinery, Sydney, N.S.W., Australia, Analytical Chemist.

1899. Campbell, Jas. Eunyce, Hotel Stanwix, Chandler Street, Worcester, Mass., U.S.A., Chemical Engineer.

1886. Campbell, John, 75, Hudson Street, New York City U.S.A., Dye Manufacturer.

1901. Campbell, Kenneth F., M.Inst.C.E., 1, Peel Street, Huddersfield, Civil Engineer.

1897. Canfield, F. D., jun., c/o Cuban Sugar Refining Co., Cardenas, Cuba, Sugar Refiner.

1893. Cannon, J. C., 12, Western Road, Shoreham, Sussex, Analyst.

O.M. Cannon, M., 25, Stormont Road, Clapham Common, S.W., Vinegar Works Manager.

1891. Canziani, Enrico, 3, Palace Green, Kensington, W., Civil Engineer.

1891. Carden, Albert J., Dunster House, 12, Mark Lane, E.C., Distiller.

1893. Carey, Arthur, 1, Grassendale Road, Cressington, near Liverpool, Chemist.

O.M. Carey, Eustace, 20, Alexandra Drive, Sefton Park, Liverpool, Chemical Manufacturer.

O.M. Carlile, T., 23, West Nile Street, Glasgow, Chemical Manufacturer.

1895. Carlsson, Hugo, c/o Dominion Iron and Steel Co., Sydney, C.B., Canada, Analytical Chemist.

1893. Carmichael, Dr. H., 176, Federal Street, Boston, Mass., U.S.A., Analytical Chemist.

1896. Carmichael, Herbert, Bureau of Mines, Victoria, British Columbia, Public Analyst and Assayer.

1884. Carmody, Prof. Patrick, Government Laboratory, Port of Spain, Trinidad, Analytical Chemist.

1903. Carneiro da Cunha, J. M., Comp. Agricola & Mercantil, Rua do Apollo 28, Pernambuco, Brazil, Manager.

1897. Carnell, Wm. C., c/o Tacony Chemical Works, Bridesbury, Philadelphia, Pa., U.S.A., Chemist.

O.M. Caro, Dr. H., Mannheim, Germany, Technical Chemist.

1893. Carpenter, C. C., South Metropolitan Gas Co., 709A, Old Kent Road, London, S.E., Civil Engineer.
1900. Carpenter, Frank B., Crenshaw Building, Richmond, Va., U.S.A., Chemist.
1900. Carpenter, Harry B., c/o Lister's Agricultural Chemical Works, Newark, N.J., U.S.A.
1903. Carpenter, H. C. Harold, The National Physical Laboratory, Bushy House, Teddington, Middlesex, Chemist and Metallurgist.
O.M. Carpenter, R. Forbes, Prestwich, Greencroft Gardens, West Hampstead, N.W., Chief Inspector under the Alkali, &c. Works Acts.
1885. Carruthers, J. G., Burnbrae House, Milngavie, N.B., Dyeworks Manager.
1903. Carson, Archd., The Cedars, Cranford, Middlesex, Colour Manufacturer.
1901. Carson, Geo. C., c/o Fred. Hurst, Redding, Shasta Co., Cal., U.S.A., Mining Engineer.
O.M. Carteighe, M., 180, New Bond Street, London, W., Pharmaceutical Chemist.
1902. Carter, Jno. P., 626, South 24th Street, Philadelphia, Pa., U.S.A., Analytical Chemist.
1895. Carter, Stewart F., Windsor Printworks, North Adams, Mass., U.S.A., Technical Chemist.
1903. Carter, Thomas, 322, Scarr Hill, Bradford, Yorks, Works Chemist.
1886. Carter, W. Chas., Hotel Alfonse, Sydney, Cape Breton, Nova Scotia, Canada, Analytical Chemist.
1889. Carulla, F. J. R., 84, Rose Hill Street, Derby, Chemical Manufacturer.
1903. Caspari, Dr. W. A., 5, Park Lane, Teddington, Chemist and Physicist.
1902. Catchpole, Albert A., Ravensdeane, Grove Park, Lee, Kent, Works Chemist.
1895. Catlin, Chas. A., 133, Hope Street, Providence, R.I., U.S.A., Chemist (Rumford Chemical Works).
1896. Caven, Robt. M., University College, Nottingham, Lecturer in Chemistry.
O.M. Cawley, G., 25, Victoria Street, Westminster, S.W., Chemical Engineer.
O.M. Cawley, J., 278, Passaic Street, Newark, N.J., U.S.A., Analytical Chemist.
1897. Cawley, Thos. A., British Gelatin Works, New Bedford Road, Luton, Beds., Gelatin Manufacturer.
1900. Cayvan, Llewellyn L., 817, Pennsylvania Avenue, Kansas City, Mo., U.S.A., Chemist.
1902. Cerasoli, Alburto, 29, West Kensington Mansions, London, W., Engineer.
1891. Chadwick, Walter M., 24, West 3rd Street, Bayonne, N.J., U.S.A., Chemical Works Manager.
1897. Challen, Matthew B., School of Mines, Daylesford, Victoria, Australia, Assayer.
O.M. Chaloner, G., 30, Weston Park, Crouch End, N., Chemical Lecturer.
1894. Chaloner, G. W., 26, Eagle Wharf Road, Hoxton, N., Chemical Manager.
1901. Chamberlain, G. E., 5169, Delmar Building, St. Louis, Mo., U.S.A., Chemist.
1902. Champion, Edmund C., c/o Iola Portland Cement Co., Iola, Kas., U.S.A., Chemist.
O.M. Chance, A. M., Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.
O.M. Chandler, Dr. C. F., Columbia University, West 116th Street, New York City, U.S.A., Professor of Chemistry.
1900. Chandler, Prof. W. H., Lehigh University, South Bethlehem, Pa., U.S.A., Professor of Chemistry.
1893. Chaplin, Dr. Edw. M., Public Analyst's Laboratory, Wakefield, Yorks, Analytical Chemist.
1890. Chapman, Alf. C., 8, Duke Street, Aldgate, E.C., Analytical Chemist.
1903. Chapman, Geo. W., Swift Fertilizer Works, 913, Prudential Building, Atlanta, Ga., U.S.A., Superintendent.
O.M. Chapman, S., 36, Mark Lane, E.C., Chemical Manufacturer.
1894. Charlier, A. C. J., 54, Hornsey Rise, Crouch End, N., General Manager and Chemist.
1902. Charlton, Thos., 2926, Webster Street, San Francisco, Cal., U.S.A., Manufacturing Chemist.
1900. Chase, March F., c/o New Jersey Zinc Co., Palmerton, Pa., U.S.A., Chemist.
1889. Chase, R. L., Arnold Printworks, North Adams, Mass., U.S.A., Printworks Chemist.
1894. Chatard, Dr. T. M., 1716, Rhode Island Avenue, Washington, D.C., U.S.A., Chemical Engineer.
1900. Chattaway, Wm., Apothecaries' Hall, London, E.C., Consulting Chemist.
1898. Chattock, Herbert E., 23, Apsley Road, Clifton, Bristol, Oilcake Manufacturer.
1901. Cheetham, Howard, 18, St. Ann Street, Manchester, Chartered Patent Agent.
1894. Cheney, J. P., c/o Cheney Bros., South Manchester, Conn., U.S.A., Silk Manufacturer's Chemist.
1885. Cheyne, A. M., c/o Messrs. Burgoyne, 16, Coleman St., E.C., Analytical Chemist.
1902. Chilwell, John, Oakeswell, Wednesbury, Analyst.
1893. Cholerton, A. F., 40½, Belgrave Gate, Leicester, Manufacturing Chemist.
1890. Chorley, Jno. C., Lodge Lane, Bewsey, Warrington, Analytical Chemist.
O.M. Christie, J., Levenfield, Alexandria, N.B., Dyer and Printer.
1903. Christie, John, c/o The British Explosives Syndicate, Ltd., Pitsea, Essex, Analytical Chemist.
1898. Christison, Geo., Cremona, Cambridge Drive, Glasgow, Engineer.
1883. Christy, Thos., The Manor House, Wallington, Surrey; and 4, 10, and 12, Old Swan Lane, London, E.C., Chemical Botanist.
O.M. Chrystal, W. J., Shawfield Works Rutherglen, near Glasgow, Chemical Manufacturer.
O.M. Church, Professor A. H., F.R.S., Shelsley, Kew, Surrey, Professor of Chemistry in the Royal Academy.
1890. Church, Elihu D., jun., 63, Wall Street, New York City, U.S.A., Soda Manufacturer.
1904. Cirkel, Fritz, 80, Stanley Street, Montreal, P.Q., Canada, Mining Engineer.
1896. Claflin, Alan, Littleton, Mass., U.S.A., Manufacturing Chemist.
1900. Clamer, Guilliam H., 46, Richmond Street, Philadelphia, Pa., U.S.A., Chemist.
1885. Clanahan, H. C., 79, Mosley Street, Manchester, Chemical Merchant.
1901. Clapham, Henry E., Laurel Bank, Wilsden, near Bradford, Yorks., Technical Chemist.
1891. Clapp, Ralph R., c/o Standard Ammonia Co., Ltd., Iceland Wharf, Old Ford, E., Ammonia Works Manager.
1889. Clapperton, J., jun., 36, Ashton Gardens, Hillhead, Glasgow, Analytical Chemist.
1903. Clare, Henry, 107, Newgate Street, Morpeth, Northumberland, Schoolmaster.
1903. Clark, Augustus, Fundicio do Bowman, Caixa 57, Recife, Pernambuco, Brazil, Mechanical Engineer.
1896. Clark, Donald, Bairnsdale, Victoria, Australia, Director of School of Mines.
1903. Clark, Edmund, Board of Health, 6th Avenue, and 55th Street, New York City, U.S.A., Chemist.
1901. Clark, Herbert Noel, West Ham Gasworks, Stratford, E., Gas Engineer.
O.M. Clark, Dr. J., 138, Bath Street, Glasgow, Analytical Chemist.
1900. Clark, Jno., Broadway Works, Millwall Dock, London, E., Manufacturing Chemist.
1902. Clark, Robt. M., Rockbank, Partickhill, Glasgow, Chemist.
1903. Clark, Dr. W. Inglis, 104, South Canongate, Edinburgh, Manufacturing Chemist.
1902. Clark, Wm. Linus, Champion Coated Paper Co., Hamilton, Ohio, U.S.A., Chemist.
1891. Clarke, Goddard, South Lodge, Champion Hill, S.E., Drysalter.
1898. Clarke, J. F. Wyllie, Messrs. J. and R. Tennent, Wellpark Brewery, Glasgow, Managing Director.

1903. Clarke, Robt. W., c/o Clinical Research Association, Ltd., 1, Southwark Street, London, S.E., Analyst.

1897. Clarke, Wm. B., Edison-Swan Electric Works, Ponders End, N., Electro-Chemist.

O.M. Claudet, A. C., 6, Coleman Street, E.C.; and (Journals) 9, Daleham Gardens, Hampstead, N.W., Metallurgist.

O.M. Claudet, F. G., 181, Willesden Lane, N.W., Assayer and Metallurgist.

1889. Claus, Wm. H., c/o Claus and Ree, Clayton, Manchester, Manufacturing Chemist.

O.M. Clayton, E. G., Chemical Laboratory, 32, Holborn Viaduct, London, E.C., Consulting Chemist.

1895. Clayton, Dr. G. C., Maldon Lodge, Wavertree, Liverpool.

1899. Clayton, Harold, 51, Smallbrook Lane, Westleigh, Lancashire, Colourist and Chemist.

1891. Clayton, J. W., c/o Clayton and Jowett, Ltd., Concert Street, Liverpool, Essence Distiller.

1894. Clayton, Robt. H., 12, Park Avenue, Southport, and (Journals) 37, George Street, Cheetham Hill, Manchester, Chemist.

1893. Clemes, J. H., The Bracken, Newquay, Cornwall.

1886. Cleminshaw, E., Alkali Works, Oldbury, near Birmingham, Technical Chemist.

1883. Clemons, G. H., Cudbear Street, Hunslet Road, Leeds, Dyeware Manufacturer.

1884. Clerk, Dugald, 18, Southampton Buildings, Chancery Lane, W.C., Engineer.

1899. Cleveland, D. B., 116, Olive Street, Cleveland, Ohio, U.S.A., Chemist.

1884. Cliff, Stephen, Wortley, near Leeds, Firebrick Maker.

1900. Clifford, Wm., Glenhurst, Sewage Outfall Works, Wolverhampton, Sewage Works Manager.

O.M. Cloud, T. C., 4, Lloyd's Avenue, Fenchurch Street, E.C., Metallurgist and Manager.

O.M. Clowes, Prof. F., 40, Craven Street, Charing Cross, W.C.; and The Grange, College Road, Dulwich, S.E., Chief Chemist (L.C.C.).

1891. Clutton, J. H., Elliott's Metal Co., Ltd., Burry Port, R.S.O., Carmarthenshire, Assayer.

1900. Clymer, Wm. R., c/o National Carbon Co., Cleveland, Ohio, U.S.A., Chemist.

1899. Coates, Chas. E., jun., Louisiana State University, Baton Rouge, La., U.S.A., Professor of Chemistry.

1888. Coats, Jno. T., 105, Broughton Street, Edinburgh, Manufacturing Chemist.

1893. Cebb, Jno. W., Farnley Ironworks, near Leeds, Technical Assistant to Managing Director.

1904. Coblentz, Lambert, 122, Broderick Street, San Francisco, Cal., U.S.A., Chemist.

1894. Coblentz, Dr. Virgil, College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Chemical Lecturer.

1899. Cochran, Alfred, 559, Madison Street, Brooklyn, N.Y., U.S.A., Chemist.

1904. Cochran, C. B., 514, South High Street, West Chester, Pa., U.S.A., Teacher of Chemistry.

1898. Cochrane, A. Lynde, 55, Kilby Street, Boston, Mass., U.S.A., Clerk (Cochrane Chemical Co.).

1895. Cochrane, Jno., Watford Bridge, New Mills, viâ Stockport, Calico Printer.

1901. Cockburo, John A., Ardeer, Stevenston, Ayrshire, Analytical Chemist.

1902. Cocking, Allan T., The Grove, Stanford-le-Hope, Essex, Ammunition Manufacturer.

1903. Cofman-Nicoresti, J., 41, Hart Street, Bloomsbury, W.C., Chemist.

1903. Coggesball, Dr. G. W., Chestnut Street, Dedham, Mass., U.S.A., Chemical Manufacturer.

1887. Coghill, P. de G., Borax Works, Old Swan, Liverpool, Technical Chemist.

1884. Cogswell, W. B., Syracuse, N.Y., U.S.A., Chemical Engineer.

1899. Cohen, Dr. Hermann, c/o S. Mandle, 3943, West Pine Boulevard, St. Louis, Mo., U.S.A., Organic Chemist.

O.M. Cohen, Dr. J., Yorkshire College, and (Journals) 13, Cardigan Road, Leeds, Analytical Chemist.

1900. Cohen, R. Waley, 11, Hyde Park Terrace, London, W., Chemist.

1897. Cohn, Alfred J., c/o Merck and Co., 13–19, University Place, New York City, U.S.A., Chemist.

1901. Cohn, Sigmund, 13, Dutch Street, New York City, U.S.A., Metallurgical Chemist.

1903. Colbert, W., British S.A. Dynamite Factory, Modderfontein, Transvaal, Analytical Chemist.

1891. Colby, Albert L., c/o International Nickel Co., 43, Exchange Place, New York City, U.S.A., Metallurgical Engineer.

1899. Colby, E. A., Baker Platinum Works, Newark, N.J., U.S.A., Metallurgical Chemist.

O.M. Colby, W. H., Carreg-wen, Aberystwith, Wales.

1893. Colefax, Dr. Arthur, 85, Onslow, London, S.W., Barrister-at-Law.

1893. Coleman, W. H., 299, North Road, Clayton, Manchester, Tar Works Chemist.

O.M. Collens, E., Vinegar Works, Stourport, Worcestershire, Vinegar Works Manager.

1887. Collett, J. M., Hillfield, Gloucester, Chemical Manufacturer.

1901. Colley, Bernard T., c/o American Smelting and Refining Co., Aguas Calientes, Mexico, Assayer.

1902. Colley, Hyltou H., c/o Dr. Bedford, Ponsonby, Auckland, New Zealand, Chemist.

1903. Collier, Pierre, Companhia Industrial Pernambucana, Pernambuco, Brazil, Civil Engineer.

1893. Collin, Dr. C. A., Ferguslie Threadworks, Paisley, N.B., Textile Chemist.

1898. Collingridge, Frank, 4, Wyndham Road, Edgbaston, Birmingham, Chemist.

1883. Collins, J. H., 702, Salisbury House, Finsbury Circus, London, E.C., Technical Chemist.

1899. Collins, S. Hoare, Durham College of Science, Newcastle-on-Tyne, Agricultural Chemist.

1888. Collins, W. Hepworth,
Analytical Chemist.

1899. Collis, Walter T., Swinford House, Stourbridge, Worcestershire, Chemist.

1891. Colman, Dr. H. G., Elmside, Worcester Park, Surrey, Analytical Chemist.

1892. Colquhoun, Lewis, c/o South African Explosives Co., Modderfontein, Transvaal, Analytical Chemist.

1894. Colquhoun, W., Plas Penyddol, Bersham, near Wrexham, North Wales, Engineer.

1901. Colwell, J. Kear, Finsbury Town Hall, Rosebery Avenue, E.C., Analytical and Consulting Chemist.

1900. Comey, Arthur M., 12, Pearl Street, Boston, Mass., U.S.A., Technical Chemist.

1899. Conant, Francis M., c/o Sanderson and Porter, Mishawaka, Ind., U.S.A., Chemical Engineer.

1901. Connah, Jas., Normanhurst, Park Road, Sidcup, Kent, Government Analyst.

1902. Conner, Robt. S., c/o Newaygo Portland Cement Co., Newaygo, Mich., U.S.A., Chemist.

1883. Connor, C. C., 4, Queen's Elms, Belfast, Ireland, Chemist.

1891. Conradson, Pontus H., Galena Oilworks, Franklin, Pa., U.S.A., Analytical Chemist.

1889. Conroy, Dr. Jas. T., 13, Heward Drive, Grassendale, Liverpool, Chemist.

1887. Constable, W. H., Australian Alum Works, Runcorn; (communications) 19, Stocks Lane, Chester, Analytical Chemist.

1902. Converse, W. A., Rooms 27–34, Rialto Building, Chicago, Ill., U.S.A., Chemist.

1891. Coode, J. Charles, 19, Freeland Road, Ealing, W., Civil Engineer.

1902. Cook, Arthur Jas., 167, Richmond Road, Hackney, N.E., Chemist (Cement Works).

O.M. Cook, H. J., The Firs, Woodford Green, Essex, Soap Manufacturer.

1903. Cook, Jas. W., London and Provincial Dye Works, Hackney Wick, N.E., Dyer.

1888. Cook, Jno. J., Atlas Foundry, St. Helens, Lancashire, Ironfounder.

1899. Cook, R. Anderson, New Brunswick, N.J., U.S.A., Chemist.

1898. Cook, Thos. Alex., East London Soap Works, Bow, E., Soapmaker.
1899. Cook, Walter G., 9, Hendon Lane, Finchley, N., Analytical Chemist.
1894. Cook, Wm. Martyn, Cecilhurst, Uplands Park, Enfield, N., Analytical Chemist.
1891. Cooke, Arthur W., c/o Brotherton and Co., Holmes Street, Dewsbury Road, Leeds, Analytical Chemist.
1901. Cooper, T. S., Beckfoot, Manchester, S.E., Calico Printing Chemist.
1891. Cooper, Walter J., (communications) c/o South Wales Cement Co., Penarth, Cardiff; and (Journals) The Elms, Lower Penarth, South Wales, Cement Works Manager.
1897. Cooper, Wm. R., 113, Tulse Hill, S.W., Electrical Engineer.
1890. Corcoran, Bryan, 31, Mark Lane, London, E.C., Chemical Engineer.
1887. Cordner-James, J. H., Finsbury House, Blomfield Street, London, E.C., Mining Engineer.
1899. Cornelison, Dr. Robt. W., Bloomfield, N.J., U.S.A., Consulting Chemist.
1887. Cornett, Jas. P., Ford Paper Works, Hylton, near Sunderland, Paper Maker.
1903. Corrêa de Brito, Dr. L., Rua do Commercio, 6, Recife, Pernambuco, Brazil, Civil Engineer.
1889. Corrie, David, c/o Nobel's Explosives Co., Ltd., Polmont Station, N.B., Technical Chemist.
1902. Corse, Wm. Malcom, 1283, Third Avenue, Detroit, Mich., U.S.A., Chemist.
1903. Cortright, R. M., 20, South Centre Street, Bethlehem, Pa., U.S.A., Assistant Chemist.
1894. Coste, J. H., 40, Craven Street, W.C.; and (Journals) 206, Amhurst Road, Hackney, E., Analytical Chemist.
1901. Costobadio, H. A., Overdale, Mottram-in-Longdendale, near Manchester, Calico Printer.
1891. Cotton, W. F., Hollywood Roebuck, Co. Dublin, Gas Works Manager.
1898. Coupe-Annable, H. W., c/o Tungsten and Rare Metals Co., Queen's Road, Battersea, S.W., Chemist.
1894. Court, Heywood, 67, Surrey Street, Sheffield, Analytical Chemist.
1898. Courtney, Samuel, 37, The Mount, Belfast, Ireland, Manager.
1894. Cousins, W. J., 17, Temple Chambers, Temple Avenue, E.C., Consulting Chemist and Director.
1903. Cowan, Wallace, c/o The Stirling Boiler Co., Ltd., Motherwell, N.B., Analytical Chemist.
1893. Cowan, W. J., 12, Park Avenue, Wood Green, N., Fine Colour Manufacturer.
1894. Coward, Percy, Sewage Disposal Works, Deighton, Huddersfield, Chemist.
1897. Cowburn, Arthur W., 29, Princess Street, Manchester, Chemical Merchant and Analytical Chemist.
1894. Cowburn, W. H., 29, Princess Street, Manchester, Chemical Merchant.
1891. Cownley, A. J., 225, Barry Road, Dulwich, S.E., Analytical Chemist.
1891. Cowper-Coles, Sherard Osborn, Grosvenor Mansions, Victoria Street, Westminster, S.W., Metallurgical Engineer.
1902. Coyle, Benj. C., City Laboratory, 17, Castle Street, Dublin, Analytical Chemist.
1884. Craig, Geo., Chemical Laboratory, 95, Bath Street, Glasgow, Technical Chemist.
1895. Craig, Thos. J., c/o Messrs. Peter Spence and Sons, Manchester Alum Works, Manchester, Chemist.
1903. Craine, Chas. R., 42, Pooley Place, Buffalo, N.Y., U.S.A., Chemist.
1886. Crake, Wm., 394, Staniforth Road, Sheffield, Analytical Chemist.
1904. Cramer, A., jun., Cramer and King Co., Paterson, N.J., U.S.A., Chemist.
1901. Crane, Fred. D., 28, Hillside Avenue, Montclair, N.J., U.S.A., Consulting Chemist.
1902. Crane, Jasper E., Technology Chambers, Irvington Street, Boston, Mass., U.S.A., Chemist.
1898. Cranfield, Wm., Higher Grade Board School, Halifax, Yorks, Teacher of Chemistry.
1903. Cranmer, Ridgeway, 170, 88th Street, Bay Ridge, Brooklyn, N.Y., U.S.A., Chemist.
1902. Craven, Alfd. B., 91, Fielding Terrace, Armley, Leeds, Analytical Chemist.
1889. Craven, Chas. E., Oak Villa, Bramley, near Leeds, Dyer.
1899. Craven, Jas., The Netherlands, Broughton Park, Manchester, Chemist.
1891. Craven, Jno., jun., c/o Dominion Tar and Chemical Co., Ltd., Sydney, Nova Scotia, Chemist.
1885. Craw, John, 15, Cadogan Street, Glasgow, Drysalter.
O.M. Crawford, D., Langdale's Chemical Manure Co., Lim., St. Laurence, Newcastle-on-Tyne, Manager.
1884. Crawford, D., 12, Abbey Grove, Eccles, Manchester, Dyer and Printer.
1890. Crawshaw, E., 25, Tollington Park, London, N., Dye Merchant.
1900. Crayen, Dr. Gustav, 146, West 23rd Street, New York City, U.S.A.
1895. Cremer, John H., 24, Superior Street, Cleveland, Ohio, U.S.A., Chemist and Metallurgist.
O.M. Cresswell, C. G., Ermyngarth, Ashtead, Surrey; and 9, Bridge Street, Westminster, S.W., Chemist.
1901. Cribb, Cecil, 136, Shaftesbury Avenue, London, W., Analytical and Consulting Chemist.
1890. Criper, Wm. R., Cossipore Chemical Works, Cossipore, Calcutta, India, Manufacturing Chemist.
1902. Cripps, R. A., The Laboratory, Hayward's Heath, Sussex, Analyst.
1902. Croasdale, Dr. Stuart, 1574, York Street, Denver, Col., U.S.A., Mining Engineer and Metallurgist.
1898. Crompton, Benj. F., Haigh Dyeworks, near Wigan, Lancs., Dyer.
1885. Crompton, Percy R., Elton Paper Mills, near Bury, Lancashire, Paper Maker.
1901. Cronquist, G. W., Klagstorps Aktiebolag, Klagshamn, Sweden, Technical Chemist.
1889. Cronquist, Prof. A., Werner, 4, Kammakasegatan, Stockholm, Sweden, Consulting Chemist.
O.M. Crookes, Sir Wm., F.R.S., 7, Kensington Park Gardens, Notting Hill, W., Analytical Chemist.
1896. Crosby, Thos., Llanelly Steelworks, Llanelly, South Wales, Metallurgist.
O.M. Crosfield, A. L., 46, Bidston Road, Oxton, Birkenhead, Analytical Chemist and Assayer.
1896. Crosfield, Capt. G. R., Volunteer Quarters, Sankey Street, Warrington, Soap Manufacturer.
1884. Cross, C. F., 4, New Court, Lincoln's Inn, London, W.C., Analytical Chemist.
1900. Crosskey, Alex., N., c/o Dr. Crosskey, Lewes, Sussex, Chemist.
1894. Crossley, Dr. Arthur W., Chemical Laboratory, St. Thomas' Hospital, London, S.E., Organic Chemist.
1900. Crossley, Frank, Duchy Bank, Seedley Road, Pendleton, Manchester, Analytical Chemist.
1902. Crossley-Holland, F. W., 68, Parade, Leamington, Chemist and Druggist.
1892. Crossman, Tom, Albion Brewery, Coldhurst Street, Oldham, Brewing Chemist.
1884. Crow, Dr. J. K., 2, Ulundi Road, Blackheath, S.E., Technical Chemist.
1894. Crow, Henry W., 94, Romford Road, Stratford, E., Tar Distiller.
1902. Crowell, Henry H., Delewanna, N.J., U.S.A., Dyer.
1893. Crowther, Edw., Woodland Dyeworks, Headingley, Leeds, Dyer.
1883. Crowther, Horace W., The Beeches, West Bromwich, Technical Chemist.
1899. Crowther, J., South Australian School of Mines, Adelaide, Metallurgist.
1884. Crowther, W. M., Field House, Gomersal, near Leeds, Manufacturing Chemist.
1884. Crumbie, W. D., 146, Washington Street, East Orange, N.J., U.S.A., Analytical Chemist.
1902. Crush, E. H., 3, Westcombe Park Road, Blackheath, S.E., Technical Chemist.

1903. Cullen, W. H., The Castner-Kellner Alkali Co., Ltd., Weston Point, near Runcorn, Cheshire, Engineer.
1892. Cullen, Wm., Dynamite Factory, Modderfontein, Transvaal, Chemist.
1897. Culmann, Dr. Julius, 525, Norwood Avenue, Buffalo, N.Y., U.S.A., Chemist and Colourist.
1904. Culmer, Harry H., 6200, Madison Avenue, Chicago, Ill., U.S.A., Chemist and Tar Distiller.
1883. Cuming, James, jun., Chemical Works, Yarraville, Melbourne, Australia, Manure Manufacturer.
1897. Cunliffe, Albert J., Kern Mill Printworks, Whittle-le-Woods, Lancashire, Calico Printer.
1893. Cunningham, Edw., Mission Ridge, Sta. Barbara, Cal., U.S.A., Chemical Engineer.
O.M. Curphey, W. S., Borva, Lenzie, N.B., Alkali Works Inspector.
1902. Currier, Edw. Eug., 15, Ferry Street, Everitt, Mass., U.S.A., Chemist.
1898. Curtis, Marvin, 123, California Street, San Francisco, Cal., U.S.A., Wine Chemist.
1903. Cushing, Robt. P., Lock Haven, Pa., U.S.A., Chemist.
1902. Cuthbush, Chas. G., 149, Westcombe Hill, Blackheath, London, S.E., Electrical Engineer.
1884. Cuthbertson, Sir J. N., 29, Bath Street, Glasgow, Chemical Broker.
1899. Cutler, Fred. F., 183, Essex Street, Boston, Mass., U.S.A., Publisher.
1904. Cutts, Henry E., 55, Fulton Street, New York City, U.S.A., Technical Chemist.

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1904. Dale, G., Waverley Terrace, Hood Lane, Warrington, Technical Chemist.
1887. Dale, Jas., c/o Jas. H. Dale, 1, Dorothy Villas, Cavendish Road, West Croydon, Coppersmith.
1897. Dancer, Wm., Millgate Hall, Newbridge Lane, Stockport, Analytical Chemist.
1884. Daniell, Louis C., (Journals) Royal Standard Brewery, Tamworth, New South Wales; and (subs.) c/o W. T. Allen & Co., 132, Queen Victoria Street, London, E.C., Brewer.
1903. Dannenbaum, Dr. H., 3346, Frankland Avenue, Philadelphia, Pa., U.S.A., Secretary and Treasurer (National Ammonia Co.).
1902. Danziger, Jos. L., Columbia University, New York City, U.S.A., Analytical Chemist.
1885. Darby, Jno. H., Brymbo Hall, near Wrexham, Ironmaster.
1894. Darling, G. A., Robinson G. M. Co., Box 1,024, Johannesburg, S.A., Metallurgical Chemist.
O.M. Darling, W. H., 126, Oxford Street, Manchester, Analytical Chemist.
1887. Davenport, Dr. B. F., 161, Tremont Street, Boston, Mass., U.S.A., Consulting, Sanitary, and Toxicological Chemist.
1900. Davidson, Alex., jun., 2, Hamilton Park Terrace, Hillhead, Glasgow, Analytical Chemist.
1899. Davidson, Charles, 37, Heriot Street, Pollokshields, Glasgow, Analytical Chemist.
1901. Davidson, G. M., Chicago & N. W. Railroad Shops, P.O. Station E., Chicago, Ill., U.S.A., Chemist.
1883. Davidson, J. E., 40, Percy Gardens, Tynemouth, Chemical Manufacturer.
1891. Davidson, Richard, 44, High Street, Dundee, Oil Merchant's Clerk.
O.M. Davidson, R. Holden, c/o United Alkali Co., Ltd., Ammonia Soda Works, Fleetwood, Works Manager.
1904. Davidson, Robert, c/o Dalgety & Co., Ltd., 15, Bent Street, Sydney, N.S.W., Australia.
1897. Davies, Charles T., 207, Windsor Street, Reading, Pa., U.S.A., Chemist.
1889. Davies, G. W., 8, Spring Hill, Stockport, Chemical Lecturer.
1898. Davies, Herbert E., The Laboratory, 28, Chapel Street, Liverpool, Analytical Chemist.
1898. Davies, Leyshon, 1, North Claremont Gardens, Glasgow, Gunpowder Mills Manager.
1896. Davies, Llewellyn J., Bute Chambers, Bute Road, Cardiff, Analytical and Consulting Chemist.
1886. Davies, M. Lloyd, North American Chemical Co., Bay City, Mich., U.S.A., Alkali Works Manager.
1897. Davies, Saml. H., c/o H. S. Rowntree and Co., Cocoa Works, York, Research Chemist.
1903. Davies, Thomas, 56, Wellesley Street, Toronto, Ont., Canada, Manufacturer.
1902. Davies, Wm. Rhys, 60, Northampton Terrace, Bradford, Yorks, Analytical Chemist.
1900. Davis, Arthur C., 2, Downing Grove, Cambridge, Cement Maker.
O.M. Davis, A. R., Havelock Villa, Wellington Road North, Stockport, Analytical Chemist.
1901. Davis, Bernard F., c/o Borneo Co., Boedok, Sambas, Borneo, Metallurgical Engineer.
1902. Davis, Charles B., c/o Dr. Francis Wyatt, 39, South William Street, New York City, U.S.A., Technical Chemist.
1902. Davis, Emerson, 515, Cass Avenue, Detroit, Mich., U.S.A., Chemist.
1893. Davis, Fred., 51, Imperial Buildings, Ludgate Circus, London, E.C., Analytical and Consulting Chemist.
O.M. Davis, George E., Sandilands, Knutsford, Cheshire, Chemical Engineer.
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1903. Davis, Leon K., Room 510, 31, Milk Street, Boston, Mass., U.S.A., Chemical Engineer.
O.M. Davis, T. Sebastian, 199, South Lambeth Road, London, S.E., Vinegar Works Chemist.
1897. Davis, Wm. A., 8, Quenington Mansions, Rostrevor Road, Fulham, S.W., Chemist.
1900. Daw, Fred W., Eureka Place, Ebbw Vale, Mon., Metallurgical Chemist.
1903. Dawes, Arthur W., 3, Madison Place, Albany, N.Y., U.S.A., Chemist.
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1886. Dawson, W. Haywood, British Alizarin Co., Limited, Silvertown, Victoria Dock, E.; and (Journals) 187, Eglinton Road, Woolwich, S.E., Technical Chemist.
1901. Day, Dr. David T., U.S. Geological Survey, Washington, D.C., U.S.A., Geologist.
O.M. Deacon, H. W., 8, Ullet Road, Liverpool, Alkali Manufacturer.
O.M. Deakin, H. T., Dewhurst House, Egerton, near Bolton, Dyer.
1903. Dean, Harry, 23, Spinkfield Road, Birkby, Huddersfield, Chemist.
1899. Deane, Leopold M., Davington House, Faversham, Kent, Chemist (Cotton Powder Co., Ltd.)
1892. Deaville, B., Beech Avenue, Nottingham, Manufacturing Chemist.
1903. De Blois, W. H., c/o Gen. Chemical Co., Camden, N.J., U.S.A., Chemist.
1899. De Castro, J. Paul, Laboratory, Effingham House, Arundel Street, Strand, W.C., Consulting Chemist and Assayer.
1902. De Cew, J. A., c/o Canada Paper Mills, Windsor Mills, Quebec, Canada, Chemist.
1893. De Clerck, Maurice, Heule-lez-Courtrai, Belgium.
1884. Deering, W. H., Chemical Department, Royal Arsenal, Woolwich, S.E., Analytical Chemist.
1900. Deerr, Noel, Mauritius Estates and Assets Co., Ltd., Mauritius, Analytical Chemist.
1902. Deghuée, Dr. Jos. A., 247, Harrison Street, Brooklyn, N.Y., U.S.A., Chemist.

1901. De Jonge, Cornelius, 36, Doughty Street, Brooklyn, N.Y., U.S.A., Pharmaceutical Chemist.

1893. Delahaye, Philibert, 105, Rue St. Lazare, Paris (IX.), Gas Engineer.

1899. Delano, Warren, jun., 1, Broadway, New York City, U.S.A., Mine Operator.

1901. Delany, Chas., c/o Elliott Bros., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Chemist.

1896. De Lessing, Dr. G. C., 945, Park Avenue, New York City, U.S.A., Manufacturing Chemist.

1888. Dempsey, Geo. C., 165, Market Street, Lowell, Mass., U.S.A., Chemist.

1903. Dempsey, Jno. C., 29, North Front Street, Philadelphia, Pa., U.S.A., Aniline Merchant.

1899. Denham, Wm. S., 2, Kelvinside Terrace North, Glasgow, Chemist.

1891. Denison, Joseph R., 18, Duckworth Lane, Bradford, Analytical Chemist.

1897. Dennis, John, Ellonville, Dalkeith, N.B., Contractor.

1898. Dent, Dr. Frankland, Calle San Juan, 63, principal, Burgos, Spain, Consulting Chemist.

1901. Devas, Dr. Ernest W., 74, Woodland Terrace, Old Charlton, Kent, Technical Chemist.

1890. De Velling, F. W., Higher Grade Board School, The Boulevard, Hull, Head Master and Science Lecturer.

1898. Dewar, Alex. H., c/o The Linoleum Manufacturing Co., Staines, Middlesex, Chemist.

O.M. Dewar, Prof. J., F.R.S., Royal Institution, Albemarle Street, W. (Journals); and 1, Scroope Terrace, Cambridge, Professor of Chemistry and Physics.

1894. Dewar, Jno. A., M.P., Murrayshall, Scone, Perthshire, N.B., Distiller.

1889. Dewey, Fred. P., Lanier Heights, Washington, D.C., U.S.A., Metallurgist.

1899. Dewez, Eugène, jun., Herve, Belgium, Tanner.

1891. De Wilde, Prof. P., Soc. Anon. de Prod. Chim. et d'Exploitations Minierès, Bône, Algeria, Professor of Chemistry.

1886. Dey, Preo Lall, 4, Beadon Street, Calcutta, Manufacturing Chemist.

1903. Diamond, Wm., c/o Simon-Carves, Ltd., Barrow Collieries, near Barnsley, Yorks, Works Manager.

O.M. Dibdin, W. J., Edinburgh Mansions, Howick Place, S.W.; and (Journals) Mayfield, Grange Road, Sutton, Surrey; Analytical Chemist.

1897. Dick, Jno., c/o Jno. Dick, Ltd., 77, York Street, Toronto, Ont., Canada, Manufacturer.

1902. Dick, Jno., Wharf Road, Cubitt Town, London, E., Manager and Chemist.

1904. Dick, W. D., 46, Primrose Hill Road, South Hampstead, N.W., Analytical Chemist.

1898. Dickenson, Frank, 26, O'Connell Avenue, Berkeley Road, Dublin.

1896. Dickenson, F. M., c/o Broken Hill Proprietary Co., 3, Great Winchester Street, E.C., Secretary.

1902. Dickerman, Judson C., 10, Minot Street, Woburn, Mass., U.S.A., Chemical Engineer.

1893. Dickerson, E. N., 141, Broadway, New York City, U.S.A., Lawyer.

O.M. Dickinson, A. J., Neptune Tar and Chemical Works, Deptford, S.E.; and (Journals) 57, Lewisham High Road, S.E., Tar Distiller.

1887. Dickson, Jno., Easter Fluchter, Baldernock, near Glasgow.

1898. Dickson, Samuel, 2, Broadway, Westminster, S.W., Analytical Chemist.

1899. Dieckmann, Dr. Otto, 1182, Harrison Avenue, Cincinnati, Ohio, U.S.A., Chemist.

1901. Diehl, Oscar C., c/o Saginaw Salt Co., St. Charles, Mich., U.S.A., Chemist.

1894. Diestel, Wm., 77, William Street, New York City, U.S.A., Dyestuff Importer.

1898. Dillon, Wm., 28, Oakwood Avenue, Roundhay, Leeds, Oil, Colour, and Varnish Manufacturer.

O.M. Divers, Dr. E., F.R.S., 3, Canning Place, Palace Gate, London, W., Professor of Chemistry.

1903. Divine, Robt. E., Hamburg, Erie Co., N.Y., U.S.A., Chemist.

1899. Dixon, Fred. W., Longfellow House, Wellesley Hills, Mass., U.S.A., Dyer.

1888. Dixon, Prof. Harold B., F.R.S., Owens College, Manchester, Professor of Chemistry.

1885. Dixon, Jos., Spring Grove, near Sheffield, Paper Maker.

1884. Dixon, Wm., 102, Spring Street, Bury, Lancashire, Science Master.

1902. Dixon, Wm. A., 97, Pitt Street, Sydney, N.S.W., Australia, Public Analyst and Assayer.

1892. Dobb, Thos., 54, Riverdale Road, Sheffield, Pharmaceutical Chemist.

O.M. Dobbie, Dr. J. J., Museum of Science and Art, Chambers Street, Edinburgh, Director.

1901. Dobbie, Jas., Laurel Bank, Broomfield Road, Ayr, N.B., Tanner.

O.M. Dobbin, Dr. L., Chemical Laboratory, University, Edinburgh, Professor of Chemistry.

1890. Dodd, A. J., River View, Belvedere, Kent, Oil Refiner.

1902. Dodd, T. H., 6, Granville Park, Blackheath, S.E., Chemist (Royal Arsenal).

1889. Dodd, W. Ralph, Trederwen, Village Road, Enfield, Middlesex, Chemical Works Manager.

1901. Dodds, Roger, 4, Marlborough Terrace, Scotland Gate, R.S.O., Morpeth, Technical Chemist.

1900. Dodge, Dr. Francis D., c/o Dodge and Olcott, 137, Water Street, Brooklyn, N.Y., U.S.A., Chemist.

1897. Doerflinger, Wm. F., Acker Process Co., Niagara Falls, N.Y., U.S.A., Research Chemist.

1897. Dohme, Dr. Alf. R. L., Messrs. Sharp and Dohme, Baltimore, Md., U.S.A., Manufacturing Chemist.

1885. Doidge, H., 145, Church Street, Pietermaritzburg, Natal.

1903. Dole, Richard B., U.S. Geological Survey, 618, Boylston Building, Chicago, Ill., U.S.A., Chemist.

1897. Dolge, Carl B., Westport, Conn., U.S.A., Manufacturer of Instruments and Antiseptics.

1884. Donald, Jas., 96, Anerley Park, Anerley, S.E., Manufacturing Chemist.

1903. Donald, Dr. Jas. T., 112, St. François Xavier Street, Montreal, Canada, Analytical and Consulting Chemist.

O.M. Donald, W., Saltcoats, N.B., Analytical Chemist.

1900. Donald, Wm., Ridgefield Park, Bergen Co., N.J., U.S.A., Assayer and Chemist.

1902. Donaldson, Thos., c/o British South African Explosives Co., Ltd., Modderfontein, Transvaal, Chemist.

1901. Donnelly, Francis, 335, Hyde Road, Ardwick, Manchester, Manager (Varnish Co.).

1886. Doolittle, Orrin S., 445, Oley Street, Reading, Pa., U.S.A., Chemist, Philadelphia and Reading Railroad.

1890. Dore, Jas., Copper Works, High Street, Bromley-by-Bow, E., Distiller's Engineer.

1896. Doremas, Dr. Chas. A., 59, West 51st Street, New York City, U.S.A., Professor of Chemistry.

O.M. Dott, D. B., Abbey Hill Chemical Works, Edinburgh, Analytical Chemist.

1883. Dougall, Archibald, Gasworks, Kidderminster, Gas Engineer.

1897. Douglas, Geo., Heather Bank, Bingley, Yorks, Dyer.

1894. Douglas, Loudon M., Baltic Wharf, Putney, S.W., Chemical Manufacturer.

1884. Douglas, William, Diamond Plantation, Demerara, British Guiana, Chemical Engineer.

1900. Doulton, H. Lewis, Lambeth Pottery, London, S.E., Potter.

1902. Doveton, Godfrey D., 319, Majestic Building, Denver, Colo., U.S.A., Metallurgist.

1900. Dow, Allan W., 2016, Hillyer Place, Washington, D.C., U.S.A., Chemist (District Engineer's Dept.).

1898. Dow, Herbert H., Midland, Mich., U.S.A., Manufacturing Chemist.

1885. Dowson, J. Emerson, 39, Victoria Street, Westminster, S.W., Civil Engineer.

1902. Dowzard, Edwin, The Haven, Barton Heys Road, Formby, Lancashire, Analyst.

1901. Doxrūd, Christian, Christiania, Norway, Professor of Chemical Technology.

1902. Drake, Bryant S., Peyton Chemical Co., Martinez, Cal., U.S.A., Chemist.

1885. Drake, Chas. A., Three Mills Distillery, Bromley-by-Bow, E., Brewer.

1886. Dreaper, W. P., c/o Courtauld and Co., Ltd., Bocking, near Braintree, Essex, Technical Chemist.

1901. Dreghorn, David, Greenwood, Pollokshields, Glasgow, Soap Maker.

O.M. Drew, D., Lower House Printworks, near Burnley, Calico Printer.

1896. Drewsen, Dr. Viggo B., 5, Beekman Street, New York City, U.S.A., Wood Pulp and Paper Expert.

O.M. Dreyfus, Dr. C., Clayton Aniline Co., Ltd., Clayton, Manchester, Dye Manufacturer.

1904. Dreyfus, Dr. L. A., c/o The Muralo Co., New Brighton, S.I., N.Y., U.S.A., Chemist.

1893. Dreyfus, S., Clayton Aniline Co., Ltd., Clayton, Manchester, Chemist.

1899. Dreyfus, Dr. Wm., 162, East 95th Street, New York City, U.S.A., Chemist.

O.M. Driffield, V. C., Appleton, Widnes, Chemical Engineer.

1899. Drobegg, G., 81, Maiden Lane, New York City, U.S.A., Superintending Chemist.

1887. Drown, Prof. T. M., The Lehigh University, South Bethlehem, Pa., U.S.A., Professor of Analytical Chemistry.

1889. Drummond, Hon. G. A., Montreal, Canada.

1898. Drummond, Dr. Isaac W., 436, West 22nd Street, New York City, U.S.A., Chemist.

1904. Dubois, Norman A., 405, Euclid Avenue, Syracuse, N.Y., U.S.A., Instructor in Chemistry.

1903. Dubuque, Edwin D., 32, Eagle Street, Albany, N.Y., U.S.A., Chemist.

1899. Ducas, B. P., 151, Front Street, New YorkCity, U.S.A., Chemical and Dyestuff Importer.

1897. Duckham, Alex., Phœnix Wharf, West Ferry Road, Millwall, E., Works Chemist.

1902. Duckworth, Wm. H., Moorfield, Sylvan Avenue, Sale, Cheshire, Manufacturing Chemist.

1899. Dudderidge, Frank R., 55, Northumberland Street, Newcastle-on-Tyne, Teacher of Chemistry.

1890. Dudley, Dr. C. B., 1219, 12th Avenue, Altoona, Pa., U.S.A., Analytical Chemist.

1887. Dudley, Prof. W. L., Vanderbilt University, Nashville,Tenn., U.S.A., Professor of Chemistry.

1899. Duff, Wm. S., Woodland View, Cleveland Road, South Woodford, Essex, Manufacturing Chemist.

1901. Dufty, Lawrence, 23, Broomhall Place, Sheffield, Analytical Chemist.

O.M. Duggan, T. R., 17, Foyle Road, Blackheath, S.E., Analytical Chemist.

1898. Duguid, Jas., 10, Godliman Street, London, E.C., Journalist.

1858. Duisberg, Dr. Carl, The Bayer Co., Ltd., (Journals) Elberfeld, Germany, (subscriptions) 19, St. Dunstan's Hill, E.C., Chemist.

1888. Dukes, T. William, Box 10, Vryheid, South Africa, Merchant.

1889. Duncan, Arthur W., 1, Trafalgar Road, Higher Bentcliffe, Pendleton, Manchester, Analytical Chemist.

O.M. Duncan, Jas., 52, Shakespeare Street, Hove, Sussex, Sugar Refiner.

1904. Duncan, Wm. Wheeler, 406, Massachussetts Avenue, Boston, Mass., U.S.A., Chemist.

1898. Dunham, Edw. K., 338, East 26th Street, New York City, U.S.A., Professor of Bacteriology and Hygiene.

1901. Dunham, Henry V., c/o Casein Co., 22, Rue du 4 Septembre, Paris, Chemist.

1889. Dunlop, Robt., Shettleston Oil and Chemical Works, Shettleston, Glasgow, Oil Works Manager.

1892. Dunn, Fred., 193, Collins Street, Melbourne, Victoria, Analytical Chemist.

O.M. Dunn, J., Northern Assurance Buildings, Albert Square, Manchester, Chemical Manufacturer.

O.M. Dunn, Dr. J. T., 75, The Side, Newcastle-on-Tyne, Consulting Chemist.

O.M. Dunn, P., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.

1901. Dunn, Wm. R., 157, South 6th Street, Easton, Pa., U.S.A., Cement Works Manager.

1902. Dunning, D. M., junr., Auburn, N.Y., U.S.A., Gas Engineer.

1901. Dunsford, Geo., Laboratory, Wigan Coal and Iron Co., Ltd., Wigan, Analytical Chemist.

O.M. Dupré, Dr. A., F.R.S., Edinburgh Mansions, Howick Place, S.W., Consulting Chemist.

1897. Durant, H. T., P.O. Box 603, Buluwayo, Matabeleland, South Africa, Metallurgist.

1897. Durkee, Frank W., Tuft's College, Mass., U.S.A., Assistant Professor of Chemistry.

1899. Duryea, Chester B., 80, Madison Avenue, New York City, U.S.A., Starch Manufacturer.

1891. Duttson, W. H., Southwood, Silverdale, Sydenham, S.E., Merchant.

1891. Dvorkovitch, Dr. P., 26, Bevis Marks, London, E.C., Technical Chemist.

1903. Dyck, George E., The National Provisioners' Laboratory, 78—80, Broad Street, New York City, U.S.A., Analytical Chemist.

O.M. Dyer, Dr. B., 17, Great Tower Street, London, E.C., Analytical and Consulting Chemist.

O.M. Dyson, C. E., Flint, North Wales.

1902. Dyson, George W., 89, Cowlishaw Road, Sheffield, Analyst.

1892. Dyson, Septimus, 8, Belmont Avenue, Harrogate, Manufacturing Chemist.

E

1839. Earnshaw, Edward H., 22nd and Filbert Streets, Philadelphia, Pa., U.S.A., Chemist (Gas Improvement Co.).

1902. Earp, Dr. Francis S., 72, Addis Street, Kalgoorlie, W. Australia, Metallurgical Chemist.

O.M. Earp, W. R., Preston Brook, Warrington, Chemical Manufacturer.

1902. Easterbrooks, Frank D., Raritan Copper Works, Perth Amboy, N.J., U.S.A., Chemist.

1884. Eastick, C. E., 7, King Edward Street, Whitechapel, E., Sugar Works Manager.

O.M. Eastick, J. J., Millaquin Refinery, Bundaberg. Queensland, Sugar Works Manager.

1898. Eastick, S. Philip, 25, Woodville Road, Ealing, W., Chemical Engineer.

1890. Eastlake, A. W., Caenwood House, Grove Road, Clapham Park, S.W., Petroleum Works Manager.

1891. Eastwick, Jos. H., 2216, North 51st Street, Philadelphia, Pa., U.S.A., Chemist.

1885. Eastwood, Edw., c/o Lever Brothers, Ltd., Port Sunlight, Birkenhead, Soapmaker.

1902. Eastwood, Robert F., 128, Derby Road, Widnes, Chemist.

1903. Eaton, Edward N., 1628—315, Dearborn Street, Chicago, Ill., U.S.A., Chemist.

1898. Eavenson, Alban, 2013 Vine Street, Philadelphia, Pa., U.S.A., Soap Works Chemist.

1902. Eckel, Edwin Clarence, U.S. Geological Survey, Washington, D.C., U.S.A., Geologist.

1892. Eddy, Harrison P., Sewage Purification Works, Worcester, Mass., U.S.A., Superintendent.

1901. Eddy, W. Clifton, Box 21, Rocky Ford, Colo., U.S.A., Superintendent.

1894. Ede, Henry E., c/o Copaquire Copper Sulphate Co., Ltd., (Journals) Iquique, Chile; (subscriptions) 101, Leadenhall Street, London, E.C., Analytical Chemist.

1885. Edge, Anthony, 79, Milton Street, Readville, Mass., U.S.A., Chemist.

1900. Edgerley, Daniel W., Chilton Manufacturing Co., College Point, Long Island, N.Y., U.S.A., Chemist.

1902. Edison, Thos. Alva, Edison Laboratory, Orange, N.J., U.S.A., Inventor and Manufacturer.

1903. Edkins, Geo. J., 41, Parkholme Road, Hackney, N.E., Oil Refiner.

1902. Edwards, H. Seaton, 19, Park Road, Port Sunlight, Cheshire, Analyst.

1903. Edwards, R. S., Rockland Rockport Lime Co., Rockland, Me., U.S.A., Chemist.

1885. Ehrenfeld, Prof. Chas. H., York Collegiate Institute, York, Pa., U.S.A., Professor of Chemistry.

1896. Ehrhardt, Ernest F., Badische Anilin und Soda Fabrik, Ludwigshafen a/Rhein, Germany, Research Chemist.

1895. Ekenberg, Dr. M., Stockholm, Sweden, Technical Chemist.

O.M. Ekman, C. D., Overcliffe, Gravesend, Kent, Technical Chemist.

1885. Elborough, T., 59, Mark Lane, London, E.C., Manure Manufacturer.

1901. Elkan, Leo A., 594, Dearborne Avenue, Chicago, Ill., U.S.A., Tanner.

1901. Elkins, Arthur W., 520, Park Avenue, East Orange, N.J., U.S.A., Civil Engineer.

1892. Elliot, John, Free Library, Wolverhampton, Librarian.

1884. Elliott, Dr. A. H., Consolidated Gas Co., 4, Irving Place, New York City, U.S.A., Analytical Chemist.

1896. Elliott, Dr. J. F., c/o Grimwade and Co., 6, Trinity Square, E.C.; and (Journals), O'Connell Street, Sydney, N.S.W., Manufacturing Chemist.

1902. Elliott, Victor G., Chemical Works, Rozelle, Sydney, N.S.W., Australia, Manufacturing Chemist.

1903. Ellis, A. W., 10, Endymion Road, Brixton Hill, S.W., Analytical Chemist.

1903. Ellis, Chas. E., Iowa State College, Ames, Iowa, U.S.A., Agricultural Chemist.

1885. Ellis, C. J., Almorah Villa, Milngavie, near Glasgow, Technical Chemist.

1893. Ellis, E. Victor, 21, Castle Street, Edinburgh, Analytical Chemist.

1902. Ellis, Frederick R., 15, Shadwell Road, Bishopston, Bristol, Chemist and Druggist.

1894. Ellis, G. Beloe, 70, Chancery Lane, W.C., Patent Agent.

O.M. Ellis, H., 112, Regent Road, Leicester, Chemical Merchant.

1891. Ellis, Prof. W. Hodgson, School of Practical Science, Toronto, Ont., Canada, Professor of Applied Chemistry.

1891. Ellison, Henry, Northfield, Cleckheaton, Yorks, Manufacturing Chemist.

1901. Ellms, Jos. W., Laboratory, East Court and Martin Street, Cincinnati, Ohio, U.S.A., Chemist.

O.M. Elmore, A. S., 4, Broad Street Place, London, E.C., Electro-Metallurgist.

1885. Elworthy, H. S., 239, Dashwood House, New Broad Street, London, E.C., Sugar Works Chemist.

1901. Emerson, Dr. W. H., Georgia School of Technology, Atlanta, Ga., U.S.A., Professor of Chemistry.

1902. Emery, Arthur L., 83—85, New Montgomery Street, San Francisco, Cal., U.S.A., Chemical Engineer.

1899. Emery, E. G., c/o Franklin H. Kalbfleisch Co., 31—35, Burling Slip, New York City, U.S.A., Chemist.

O.M. Endemann, Dr. H., 23, William Street, New York City, U.S.A., Analytical Chemist.

1897. Enequist, Erik W., North 8th and Roebling Streets, Brooklyn, N.Y., U.S.A., Chemist.

1894. Enequist, John, 556, Greene Avenue, Brooklyn, N.Y., U.S.A., Chemical Engineer.

1899. Engledue, Col. W. J.,
Colonel (late) Royal Engineers.

1895. English, Frank H., 217, Strone Road, Manor Park, E., Analytical Chemist.

1899. Enright, Bernard, 330, East 4th Street, South Bethlehem, Pa., U.S.A., Analytical Chemist.

1902. Erhart, Wm. H., 11, Bartlett Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.

1888. Erkine, J. K., (Journals) New Kleinfontein Co., Benoni, Transvaal, and (subscriptions) 102, Palmerston Crescent, Palmer's Green, London, N., Analytical Chemist.

1886. Ermen, F., jun., Nassau Mills, Patricroft, Manchester, Dyer and Bleacher.

1897. Escher, Paul, c/o Swift & Co., National Stockyards, St. Clair Co., Ill., U.S.A., Chemist.

1884. Esilman, A., 25, Roe Lane, Southport, Lancashire, Analytical Chemist.

O.M. Estcourt, C., Seymour House, 5, Seymour Grove, Old Trafford, Manchester, Consulting Chemist.

1903. Euler, C. G., 18—20, Platt Street, New York City, U.S.A., Agent for Essential Oils.

1883. Evans, Enoch, 660, Coventry Road Birmingham, Accountant.

1898. Evans, Ernest D., The Western Tanning Co., Bedminster, Bristol, Tanner.

1903. Evans, F. Sparke, Avonside Tannery, Bristol, Tanner.

1883. Evans, Sir John, K.C.B., F.R.S., Nash Mills, Hemel Hempstead, Herts, Paper Maker.

1889. Evans, R. E., 3, Glencoe, Stratford-on-Avon, Brewing Chemist.

1896. Evans, Dr. Thos., University of Cincinnati, Ohio, U.S.A., Instructor in Technical Chemistry.

1903. Evans, Wm. J., 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.

1898. Evans, Wm. Perceval, Canterbury College, Christchurch, New Zealand, Professor of Chemistry.

O.M. Evershed, F., Atlas Works, Hackney Wick, N.E., Colour Chemist.

1903. Evershed, John, Union Oil Mills, Copenhagen Place, Limehouse, E., Chemist.

1894. Ewan, Dr. Thos., 30, Lansdowne Crescent, Kelvinbridge, Glasgow, Chemist (Aluminium Co.).

1903. Eweli, E. E., German Kali Works, 22½ S. Broad Street, Atlanta, Ga., U.S.A., Chemical Works Manager.

1892. Exley, Arthur, Braemore, Vesper Road, Kirkstall, Leeds, Tanner.

F

1898. Fadé, Louis, c/o Dr. F. Stockhausen, Deutsche Gold und Silber Scheide-Anstalt, Frankfort a/M., Germany, Chemist and Director.

O.M. Fahlberg, Dr. C., Saccharin Fabrik, Salbke-Westerhüsen a/Elbe, Germany, Manufacturing Chemist.

1902. Fahrig, Dr. Ernst, 3615, Locust Street, Philadelphia, Pa., U.S.A., Chief of Laboratories (Commercial Museum).

1902. Faill, Jas., 51, Partickhill Road, Glasgow, Technical Chemist.

1902. Fairchild, Benj. T., 76, Laight Street, New York City, U.S.A., Manufacturing Chemist.

1903. Fairhall, E. J., (Journals) c/o A. Boake, Roberts, and Co., Stratford, E., and (Subscriptions) 29, Winsham Grove, Clapham Common, S.W., Analytical Chemist.

O.M. Fairley, T., 17, East Parade, and (Communications) 8, Newton Grove, Leeds, Analytical Chemist.

O.M. Fairlie, H. C., Camelon Chemical Works, Falkirk, N.B., Chemical Manufacturer.

1901. Fairlie, Jas., Camelon Chemical Works, Falkirk, N.B., Manufacturing Chemist.

1894. Fairweather, Wallace, 65—66, Chancery Lane, W.C., Patent Agent.

1902. Fairweather, Wallace C., 62, St. Vincent Street, Glasgow, Engineer.

1898. Falding, F. J., 52, Broadway, New York City, U.S.A., Chemical Engineer.

1891. Fallon, J. H. M., 61, Birdhurst Rise, South Croydon, Fertiliser Expert.

1897. Farmer, John E., Beddington Farm, Beddington Lane, near Croydon, Assistant Manager (Sewage Works).

O.M. Farrant, N., c/o J. Nicholson and Sons, Chemical Works, Hunslet, Leeds, Analytical and Metallurgical Chemist.
1897. Farrell, Frank J., 24, Primrose Mansions, Prince of Wales Road, S.W., Analytical Chemist.
O.M. Farries, T., 12, Coleman Street, London, E.C., Manufacturing Chemist.
O.M. Farrington, T., 5, Summerhill Terrace, Cork, Ireland, Chemical Engineer.
1902. Fasnacht, E. A., The Hollies, Clayton Bridge, Manchester, Technical Chemist.
O.M. Faulkner, F., The Laboratory, 65, Bath Row, Birmingham, Consulting Brewer's Chemist.
1891. Faweett, Jas. H., Lanzi, Campiglia Marittima, Toscana, Italy, Metallurgist.
1884. Fawsitt, C. A., Atlas Chemical Works, East Nelson Street, Glasgow, Chemical Manufacturer.
1903. Fawsitt, Dr. Chas. E., Chemical Department, The University, Edinburgh, Assistant in Chemistry.
1903. Faxon, W. A., 101, Main Street, Buffalo, N.Y., U.S.A., Chemist.
1903. Feilmann, Dr. M. E., c/o Messrs. Brooke, Simpson, and Spiller, Ltd., Hackney Wick, N.E., Chemist.
1892. Feld, Walther, Hönningen a/Rhein, Germany, Chemical Works Director.
1897. Felix, Dr. Lorenz, 53, Rue Petit, St. Denis s/Seine, France, Technical Chemist.
1899. Ferguson, Geo., Gleniffer Soap Works, Paisley, N.B., Soap Manufacturer.
1900. Ferguson, Geo. A., College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Professor of Analytical Chemistry.
1896. Ferguson, J. Hart, Loch Katrine Distillery, Camlachie, Glasgow, Distillery Manager.
O.M. Ferguson, Prof. J., The University, Glasgow, Professor of Chemistry.
1902. Fergusson, Donald M., c/o Acadia Sugar Refining Co., Halifax, N.S., Canada, Analytical Chemist.
1883. Fergusson, H., Prince Regent's Wharf, Victoria Docks, E., Technical Chemist.
1901. Ferrell, Jos. L., 2220, Race Street, Philadelphia, Pa., U.S.A., Mechanical Engineer.
1901. Ferris, Wm. S., c/o Miami Mining Co., Concord, N.C., U.S.A., Chemist.
1893. Fiebing, John H., 644, 28th Street, Milwaukee, Wis., U.S.A., Leather Trade Chemist.
1885. Field, E. W., Clond House, Sandiacre, near Nottingham, Brewer.
1887. Field, S. S., 3, Glenluce Road, Blackheath, S.E., Manufacturing Chemist.
1891. Field, Wm. Eddington, 65, Sutherland Road, Armadale, Melbourne, Victoria, Analytical Chemist.
1884. Filcock, P., Cumberland House, Cumberland Street, Macclesfield, Analytical Chemist.
1900. Fillis, Frank, 43, Romilly Road, Barry, Glam., Cement Works Chemist.
1902. Finch, Chas. Allt., 130, King Street, Sydney, N.S.W., Australia, Analytical and Pharmaceutical Chemist.
1904. Finch, Martin L., Vitriol and Chemical Works, Cattedown, Plymouth, Chairman of Directors of Jas. Gibbs and Finch, Ltd.
1899. Fingland, Jno. J., Minas de Aznalcollar, Prov. de Sevilla, Spain, Analytical Chemist.
1899. Finley, Norval H., 6638, Deary Street, Sta. A., Pittsburg, Pa., U.S.A., Chemist.
1904. Finn, Cornelius P., Farnley Iron Works, Farnley, Leeds, Technical Chemist.
1903. Fischer, Dr. Carl, 213—215, Water Street, New York City, U.S.A., Chemist.
1903. Fish, Chas. C. R., 10, Park Square, Boston, Mass., U.S.A., Chemist.
1902. Fisher, Fred., Marlborough, Mich., U.S.A., Chemist.
1900. Fisher, Henry, 57, East 83rd Street, New York City, U.S.A., Teacher of Chemistry.
1902. Fisher, Pearson, c/o Messrs. Manlove, Alliott, and Co., Ltd., Bloomsgrove Works, Nottingham, Mechanical Engineer.
1901. Fisher, Wm. Elbertson, 67, Argyle Street, Toronto, Canada, Master Dyer.
O.M. Fisher, W. W., 5, St. Margaret's Road, Oxford, Chemical Lecturer.
1895. Fison, Jno., Messrs. Jas. Fison and Sons, Thetford, Norfolk, Chemical Manufacturer.
1904. Fitch, A. J., Grange Road, Canonbury, N., Brewers' Chemist.
O.M. Fitzbrown, G., Ditton Copper Works, Widnes, Metallurgist.
1897. Fitzgerald, Francis A. J., P.O. Box 118, Niagara Falls, N.Y., U.S.A., Chemical Engineer.
1902. FitzGibbon, Thos., 14A, Kenyon Street, Fulham, S.W., Analytical Chemist.
1900. Fitz-Randolph, R. B., State Laboratory of Hygiene, Trenton, N.J., U.S.A., Bacteriologist and Chemist.
1896. Flammer, E., Heilbronn a/N., Germany, Manufacturing Chemist.
1892. Flanagan, Chas. A., 54, Gorse Street, Stretford, Manchester, Manufacturing Chemist.
1901. Flavelle, Jos. W., c/o Wm. Davies Co., Toronto, Canada, Merchant.
1892. Fleming, J. Arnold, Britannia Pottery, 136, Glebe Street, Glasgow, Potter.
1903. Fleming, Jno. A., Vulcan Copper Works, 465, East Front Street, Cincinnati, Ohio, U.S.A., Civil Engineer.
O.M. Fletcher, A. E., Coombe Lea, Dorking, Surrey, Ex-Chief Inspector Alkali, &c. Works.
1893. Fletcher, E. Morley, 3, Woodhouse Cliff, Leeds, Alkali Works Inspector.
O.M. Fletcher, F. W., Beauchamp Lodge, Enfield, Manufacturing Chemist.
1891. Fletcher, R. Jaques, North Geelong, Victoria, Manufacturing Chemist.
1904. Fleurent, Dr. E., 5, Villa du Chateau, Bois Colombes (Seine), France, Professor of Chemistry.
1892. Flintoff, R. J., Daisy Villa, Todmorden Road, Littleboro', Lancs., Chemist.
1899. Focht, Louis, 105, E. Hanover Street, Trenton, N.J., U.S.A., Civil Engineer.
1890. Foden, Alfred, 19, Lancaster Avenue, Sefton Park, Liverpool, Metallurgical Chemist.
1900. Foersterling, Dr. H., c/o The Roessler and Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Chemist.
1900. Fogetti, Lucien, Chemist.
1895. Fogg, Chas. A., Graythorne, Albert Road, Bolton-le-Moors, Lecturer in Chemistry.
1901. Folsom, Herbert A., 254, Knight Street, Providence, R.I., U.S.A., Textile Chemist.
1900. Forbes, Eli, Lancaster Mills, Clinton, Mass., U.S.A., Chemist.
1895. Forbes, Paul R., 37, Avenue de l'Alma, Paris, Chemist and Assayer.
1893. Ford, J. B., jun., Michigan Alkali Co., Wyandotte, Mich., U.S.A., Secretary and Treasurer.
1889. Ford, Jno. S., Abbey Brewery, Edinburgh, Analyst.
1899. Forel, Geo., 18, Rue Hohenlohe, Strasburg, Alsace, Chemist.
1885. Formoy, J. Arthur, Chestham, Grange Road, Sutton, Surrey, Oil Expert.
1898. Forrest, J. Kerr, 97, Jeffcott Street, Melbourne, Victoria, Australia, Manufacturing Chemist.
1890. Forrester, A. M., c/o Laidlaw, Mackill, and Co., 3400—3500, Williamsburg Avenue, Richmond, Va., U.S.A., Analytical Chemist.
1902. Forstall, Alf. E., 58, William Street, New York City, U.S.A., Consulting Gas Engineer.
1899. Forster, Dr. Martin O., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry
1901. Forster, Miss E. L. B., King's College, Strand, London, W.C., Analyst.
1884. Forster, Ralph C., c/o Messrs. Bessler, Waechter, & Co., 18 and 19, Fenchurch Street, E.C., Chemical Merchant.
1884. Forth, Henry, Meadowcroft, Marple, near Stockport, Drysalter.
1895. Foster, Jas., 42, Herriet Street, Pollokshields, Glasgow, Engineer.

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1888. Foster, Wm., St. Martin's Terrace, Newton Park, Leeds, Manufacturing Chemist.

1903. Fotheringham, John, Nansori Mill, Rewa River, Fiji, Chemist.

1891. Fowler, Gilbert J., Broad Oak, Urmston, near Manchester, Superintendent and Chemist (Manchester Corporation Sewage Works).

1898. Fowler, Theo. V., P.O. Box 168, Buffalo, N.Y., U.S.A., Chemical Works Manager.

1886. Fox, A. Stanley, 23, South Road, Faversham, Kent, Chemist (Cotton Powder Co., Ltd.).

1898. Fox, Jno., 76, Butler Street, Oldham Road, Manchester, Analyst.

1888. Fox, J. Wesley, 7, Bushell Street, Wapping, E., Salt Merchant.

O.M. Fox, T., jun., Tonedale, Wellington, Somerset, Wool Manufacturer.

1901. France, G. Herbert, Woodroyd Dyeworks, Low Moor, Bradford, Yorks., Dyer.

1899. Franchot, Stanislaus P., c/o National Electrolytic Co., Niagara Falls, N.Y., U.S.A., Manufacturing Chemist.

1885. Francis, Edwd., Park Ravine, Nottingham, Chemical Lecturer.

O.M. Francis, E. G., 29, Matheson Road, West Kensington, W., Glucose Works Manager.

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1894. Franck, Jerome W., 29, Broadway, New York City, U.S.A., Chemist.

1903. Francksen, Dr. Aug., 4803, Garden Street, Bridesburg, Philadelphia, Pa., U.S.A., Chemist.

1886. Frankenburg, Isidor, Greengate Rubber Works, Salford, Manchester, India-rubber Manufacturer.

1895. Frankforter, Dr. G. B., University of Minnesota, Minneapolis, Minn., U.S.A., Professor of Chemistry.

O.M. Frankland, Prof. P. F., F.R.S., The University, Birmingham, Professor of Chemistry.

O.M. Frankland, H., Streonshalh, The Crescent, Linthorpe, Middlesbro', Analytical Chemist.

1902. Franklin, Chas. R., Gibbstown, Gloucester Co., N.J., U.S.A., Analytical Chemist.

1901, Frasch, Hans A., c/o F. T. Falding, 52, Broadway, New York City, U.S.A., Manager.

1900. Frasch, Herman, 681, Euclid Avenue, Cleveland, Ohio, U.S.A., Oil Refiner.

1891. Fraser, Leslie McG., 98, Commercial Road East, London, E., Chemical Engineer.

1902. Fraser, R. A., The Serpentine S., Blundellsands, near Liverpool, Fellmonger.

1886. Fraser, W. J., 121, Adelaide Road, London, N.W., Mechanical Engineer.

1902. Frederick, Geo. E., jun., P.O. Box 762, New York City, U.S.A., Chemical Merchant.

1903. Free, R. E., The Elms, Mistley, Essex, Maltster.

1885. Freear, H. M., Hardwick Road, Woburn Sands, Beds., Analytical Chemist.

1903. Freeman, L. E., Room 503, 26, Broadway, New York City, U.S.A., Technical Chemist.

1899. French, Alf., St. Bartholomew's Hospital, Rochester, Kent, Dispenser.

1900. French, Thos., 1, Kelvinside Terrace West, Glasgow, Chemist.

1898. French, Wm., Storey Institute, Lancaster, Science Teacher.

1902. Frenzel, Arthur B., 1.540 Sherman Avenue, Denver, Colo., U.S.A., Consulting Engineer.

1903. Frerichs, F. W., c/o Merck and Co, St. Louis, Mo., U.S.A., Manufacturing Chemist.

1888. Frew, Dr. Wm., King James' Place, Perth, N.B., Brewing Chemist.

1903. Frew John, Dunrod Cottage, Hamilton, N.B., Chemist.

1886. Fries, Dr. Harold H., 92, Reade Street, New York City, U.S.A., Chemical Manufacturer.

1902. Fries, Jno. W., Winston, Salem, N.C., U.S.A., Cotton Manufacturer.

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1901. Fritchle, Oliver P., c/o Boston and Colorado Smelting Co., Argo, Colo., U.S.A., Metallurgical Chemist.

1898. Frith, J. Mason, Linden Lodge, Runcorn, Cheshire, Lime Burner.

1899. Fritzsche, Karl, c/o Schimmel and Co., Miltitz, near Leipzig, Germany, Manufacturer of Essential Oils.

1890. Frost, Dr. Howard V., 3958, Drexel Boulevard, Chicago, Ill., U.S.A., Professor of Chemistry.

1884. Frost, Joe, Storths Mill, Moldgreen, Huddersfield, Manufacturing Chemist.

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1903. Fudge, T., 397, Avenue E., Bayonne, N.J., U.S.A., Chemist.

1894. Fuerst, Dr. Alex. F.,

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1889. Fuerst, Jos. F., 17, Philpot Lane, London, E.C., Chemical and Oil Merchant.

1895. Fuerst, W. F., 2, Stone Street, New York City, U.S.A., Chemical Merchant.

1894. Fuller, Chas. J. P., L. and Y. Railway Works, Horwich, near Bolton, Analytical Chemist.

1902. Fuller, Henry C., 83, North Washington Street, Boston, Mass., U.S.A., Analytical Chemist.

1899. Fuller, Robt. F., Neston Park, Corsham, Wilts, Rubber Manufacturer.

1899. Fuller, W. M., c/o Morris and Griffin, Ltd., Maindee, Newport, Mon., Chemical Manufacturer.

O.M. Fuller, Wm., 8, Orchard Road, Blackheath, S.E., Chemist.

1898. Fulmer, Elton, Pullman, Wash., U.S.A., Professor of Chemistry.

1896. Fulton-Smith, J., 20, Bold Street, Warrington, Brewer.

1885. Fyfe, Jno., 7, West George Street, Glasgow, Oil Works Director.

G

1898. Gabain, Chas. E., Messrs. Gabain Frères, Havre, France, Manufacturer of Edible Fats.

O.M. Gabbett, E. R., 64, Vanbrugh Road, Blackheath, S.E., Chemical Engineer.

1890. Gajjar, T. K., Techno-chemical Laboratory, Girgaum, Bombay, India, Consulting Chemist.

1884. Gall, Henry, 5, Rue Albert Joly, Versailles (S. et O.), France, Technical Chemist.

1897. Galletly, J. C., 101, Armadale Street, Dennistoun, Glasgow, Assistant to Professor of Metallurgy.

1901. Gallivan, Frank B., 56, Prospect Place, Brooklyn, N.Y., U.S.A., Chemist.

1903, Gallum, Albert F., Milwaukee, Wis., U.S.A., Tanner.

1901. Gallup, W. Arthur, Arnold Printworks, North Adams, Mass., U.S.A., Printer.

1901. Galpin, Harry T., 55, West 57th Street, New York City, U.S.A., Chemist.

1891. Galt, Hugh Allen, Columbia Chemical Co., Barberton, Ohio, U.S.A., Works Manager.

O.M. Gamble, Sir David, Bart., Windlehurst, St. Helens, Chemical Manufacturer.

1887. Gamble, Jas. N., The Laboratory, Procter and Gamble Co., Ivorydale, Ohio, U.S.A., Soap Manufacturer and Oil Refiner.

O.M. Gamble, J. C., Haresfinch, St. Helens, Chemical Manufacturer.

1902. Gamer, A. C. C., P.O. Box 70, Bellingham, Wash. U.S.A., Chemist.

1894. Gane, Eustace H., 95, Fulton Street, New York City U.S.A., Pharmaceutical Chemist.

1888. Gans, Adolf, Farbenfabrik von L. Cassella & Co., Frankfort o/Main, Germany, Dye Works Manager.

1901. Gansser, Dr. A., c o Messrs. Lepetit, Dollfus and Gansser, Garessio-Ponte (Provincia di Cuneo), Italy, Chemical Engineer.
1896. Gardair, Aimé, 51, Rue St. Ferréol, Marseilles, France, Director of Chemical Co.
1893. Gardiner, H. J., 90, Cannon Street, London, E.C., Chemical Manufacturer.
1891. Gardner, Walter M., Municipal Technical College, Bradford, Director of Chemistry and Dyeing Department.
1897. Garfield, Jos., Thackley, Bradford, Yorks, Civil Engineer.
1888. Garibaldi, Joachim A., 21, Church Place, Gibraltar, Analytical Chemist.
1890. Garrett, F. C., Durham College, of Science, Newcastle-on-Tyne, Teacher of Science.
1901. Garroway, Jno., 58, Buchanan Street, Glasgow, Manufacturing Chemist.
1899. Garroway, Wm., 694, Duke Street, Glasgow, Chemical Manufacturer.
1898. Garry, H. Stanley, 9, Clipstone Avenue, Nottingham, Manure Works Manager.
O.M. Garton, R. (Hill, Garton, & Co.), Southampton Wharf, Battersea, S.W., Glucose Manufacturer.
1893. Garton, Rd. S., Woodycrest Avenue, Highbridge, New York City, U.S.A., Chemist.
1886. Gascoyne, Dr. W. J., 36, South Holliday Street, Baltimore, Md., U.S.A., Analytical Chemist.
O.M. Gaskell, Holbrook, Woolton Wood, Woolton, near Liverpool, Alkali Manufacturer.
O.M. Gaskell, Holbrook, jun., Erindale, Frodsham, Cheshire, Alkali Manufacturer.
1902. Gaskell, Holbrook (III.), Erindale, Frodsham, Cheshire, Engineer.
1901. Gass, Jas. Kelly, 113, Vanhook Street, Camden, N.J., U.S.A., Dyer.
1897. Gaster, Leon, 32, Victoria Street, Westminster, S.W., Electrical Engineer.
1895. Gate, Tom Erskine, (Journals) c/o Calder and Mersey Extract Co., Ltd.; and (subscriptions) Calder House, Dewsbury, Yorks, Manufacturing Chemist.
O.M. Gatheral, Geo., 174, Soho Hill, Handsworth, Birmingham.
1903. Gaylord, Wallace K., Throop Polytechnic Institute, Pasadena, Cal., U.S.A., Professor of Chemistry.
1891. Gesler, Dr. Jos. F., New York Mercantile Exchange Building, 6, Harrison Street, New York City, U.S.A., Consulting Chemist.
1901. Gemmell, G. H., 4, Lindsay Place, George IV. Bridge, Edinburgh, Analytical Chemist.
1901. Gent, Percy W., 792½, Ridge Street, Forest Hill, Newark, N.J., U.S.A., Chemist.
1897. Gent, Wm. T., Springfield, Misterton, near Gainsboro', Metallurgical Chemist.
1896. Genth, Fred. A., jun., 222, Walnut Street, Philadelphia, Pa., U.S.A., Chemist.
1902. George, Wm. K., 80, Glen Road, Toronto, Ont., Canada, Manufacturer.
1894. Georgi, Carl, 77, John Street, New York City, U.S.A., Aniline Colour Importer.
1903. Georgii, Max, 606, F Street, N.W., Washington, D.C., U.S.A., Patent Attorney.
O.M. Gerland, Dr. B. W., 105, Plantation Street, Accrington, Consulting Chemist.
1903. Ghose, Anukul, 42, Shambazar Street, Calcutta, India, Analyst.
1891. Gibb, Thos., Mount Perry, Queensland. Metallurgist.
1903. Gibbings, Wm., 11, Howard Drive, Grassendale, Liverpool, Works Manager.
O.M. Gibbins, H. B., 177, Redland Road, Bristol.
1902. Gibbon, Edw., Ynys House, Clydach, R.S.O., Glam., Works Chemist.
1883. Gibbs, D. Cecil, Soap Manufacturer.
O.M. Gibbs, Wm. P., Fabriken, Hjerpen, Jemtland, Sweden, Analytical Chemist.
1893. Gibbs, W. T., Buckingham, Prov. Quebec, Canada, Manufacturing Chemist.
O.M. Gibson, Dr. J., 20, George Square, Edinburgh, Chemical Lecturer.
O.M. Gibson, J. M., c/o Buckley Brick and Tile Co., Buckley, *viâ* Chester, Brick and Tile Manufacturer.
1899. Gifford, Wm. E., 408, New Jersey Railroad Avenue, Newark, N.J., U.S.A., Chemist.
1892. Gilbard, T. Francis H., 245, Dalston Lane, Hackney, N.E., Analytical Chemist.
1903. Gilby, Joseph W., Berners Street, Peterson Road, Wakefield, Works Chemist.
O.M. Gilchrist, P. C., F.R.S., Metallurgist.
1884. Gilchrist, Peter S., Charlotte, N.C., U.S.A., Chemical Engineer.
1900. Gildersleeve, W. H., Middleboro', Ky., U.S.A., Chemist.
O.M. Giles, W. B., The Grange, Leyton, Essex, Chemical Manufacturer.
1886. Gill, Dr. Aug. H., Massachusetts Institute of Technology, Boston, Mass., U.S.A., Assistant Professor of Gas Analysis.
1900. Gill, J. Arthur, 10, Manor Road, Rusthall, Tunbridge Wells, Analyst.
1901. Gill, Wm. S., 40, St. Paul Street, Aberdeen, Colour and Varnish Manufacturer.
1903. Gillean, R. Hampson, c/o General Chemical Co., Bayonne, N.J., U.S.A., Chemist.
1901. Gilles, Wm. S., Bradford Street, Bocking, near Braintree, Essex, Technical Chemist.
1903. Gillett, Wm. Lowry, Hotel San Remo, Central Park West, and 75th Street, New York City, U.S.A., Chemical Engineer.
1888. Gillman, Gustave, A M.I.C.E. Ferrocarril de Murcia, á Granada, Aguilas, Prov. de Murcia, Spain, Civil Engineer.
1892. Gilmour, J. D., 190, Butterfiggins Road, Glasgow, Chemist.
1891. Gimingham, Edw. A., 1, Cranbourne Mansions, Cranbourne Street, W.C., Electrician.
1900. Ginder, Wm. H., c/o American Sheet Steel Co., Vandergrift, Pa., U.S.A., Analytical Chemist.
1896. Girdwood, Dr. G. P., 111, University Street, Montreal, Canada, Professor of Chemistry.
1903. Gladding, Thos. S., 55, Fulton Street, New York City, U.S.A., Analytical Chemist.
1886. Glaeser, F. A., Carpenter's Road, Stratford, E., Varnish Manufacturer.
1889. Glaser, Chas., 21, South Gay Street, Baltimore, Md., U.S.A., Analytical and Consulting Chemist.
1889. Glatz, Jos., 485—493, Kent Avenue, Brooklyn, N.Y., U.S.A., Chemical Manufacturer.
1901. Glegg, Robt., 29, Kimberley Street, Liverpool, Analytical Chemist.
1894. Glen, Chas., Glengowan Printworks, Caldercruix, N.B., Calico Printer.
1890. Glen, J., jun., Glengowan Printworks, Caldercruix, N.B., Calico Printer.
1900. Glendenning, Arthur, 31, Bright Street, Middlesbrough, Analytical Chemist.
1884. Glendinning, H., Winnington Park, Northwich, Cheshire, Technical Chemist.
1904. Glendinning, T. A., 31, Garthland Drive, Dennistoun, Glasgow, Brewery Chemist.
1895. Glenn, Wm., Baltimore Chrome Works, 1348, Block Street, Baltimore, Md., U.S.A., Chrome Manufacturer.
1888. Gloag, Robt. F., Grove Hill, Middlesbrough, Secretary.
O.M. Glover, G. T., 24, Craven Hill Gardens, Lancaster Gate, W., Chemical Works Manager.
1896. Glover, H., East Falls, Schuylkill, Philadelphia, Pa., U.S.A., Chemical Works Superintendent.
O.M. Glover, W., Rio Tinto Mines, Huelva, Spain, Technical Chemist.
1903. Goetschius, Howard B., Little Ferry, N.J., U.S.A., Chemist.
1896. Goetz, Isidore, 2, Kelfield Gardens, North Kensington, W., Mine Manager.
1898. Golding, Jno., Midland Agricultural and Dairy Institute, Kingston, and (Journals) Ashby Road, Kegworth, Derby, Agricultural Chemist.

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1897. Goldschmiedt, Dr. Guido, Laboratory, II. Salmgasse 1, Prag, Austria, Professor in Imperial German University.
1895. Goldsmith, Byron B., 19, East 74th Street, New York City, U.S.A., Vice-President (American Lead Pencil Co.).
1899. Goldsmith, Jno. N., British Xylonite Co., Ltd., Manningtree, Essex, Chemist.
1900. Goodchild, Wm. H., Elmwood Lodge, Long Lane, Finchley, London, N., Chemical Student.
1898. Goode, J. Archibald, 16, Crampton Street, London, S.E., Analytical Chemist.
1899. Goodhue, Francis A., 32, India Street, Boston, Mass., U.S.A., Aniline Colour Importer.
1898. Goodrich, Chas. G., Akron, Ohio, U.S.A., Rubber Manufacturer.
1884. Goodwin, C. C., The White House, St. John's Road, Bowdon, Cheshire, Soapmaker.
1894. Goodwin, Dr. W. L., The School of Mining, Kingston, Canada, Professor of Chemistry.
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1901. Gordon, A. T., c/o Oliver Iron Mining Co., Mount Iron, Minn., U.S.A., Chemist.
1898. Gordon, Colin, Storer's Wharf, Cubitt Town, E., and (Journals) Lynwood, Vanbrugh Hill, Blackheath, S.E., Chemical Engineer.
1884. Gordon, J. G., Queen Anne's Mansions, Westminster, S.W., Steel Manufacturer.
1883. Gore, Dr. G., F.R.S., 20, Easy Row, Birmingham Metallurgist.
1901. Gornall, Frank H., 256, Park Road, Crouch End, N., Chemist.
1891. Gorvin, Jno. C., English Crown Spelter Co., Ltd., Swansea, Works Manager.
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1897. Gossage, W. Winwood, Widnes, Lancashire, Soap Manufacturer.
1904. Gotthelf, August H., Hastings-on-Hudson, N.Y., U.S.A., Chemist.
1890. Goulding, Wm. Joshua, 25, Eden Quay, Dublin, Manure Manufacturer.
1903. Govers, F. X., 250, Main Street, Owego, Tioga Co., N.Y., U.S.A., Manager and Chemist.
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1886. Goyder, G. A., 12, Pirie Street, Adelaide, South Australia, Chemist.
1890. Grabfield, Dr. J. P., 4712, Greenwood Avenue, Chicago, Ill., U.S.A., Chemist.
1900. Grabill, Clarence A., Val Verde, Yavapai Co., Arizona, U.S.A., Chemist.
1883. Graesser, R., Cefn, near Ruabon, North Wales; and Argoed Hall, Llangollen, North Wales, Manufacturing Chemist.
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1897. Granger, Dr. J. Darnell, 43, Myrtle Road, Acton, W., Analytical Chemist.
1900. Granja, Rafael, Kingston, N.Y., U.S.A., Chemist.
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1896. Graves, Geo. H., c/o General Chemical Co., Bridgeport, Conn., U.S.A., Manufacturing Chemist.
1896. Graves, Walter G., 364, Harkness Avenue, Cleveland, Ohio, U.S.A., Chemist.
1895. Gray, Elisha B., c/o United Oil and Refining Co., Beaumont, Texas, U.S.A., Oil Inspector and Chemist.
1903. Gray, G. Oscar, Iron Gate, Va., U.S.A., Chemist.
1884. Gray, G. Watson, 8, Inner Temple, Dale Street, Liverpool, Consulting Chemist and Assayer.
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1904. Gray, Jas., Box 5, Fordsburg, Johannesburg, Transvaal, Chemist.
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1902. Gray, John, Port Credit, Ont., Canada, Starch Manufacturer.
1896. Gray, Dr. Thos., 204, George Street, Glasgow, Lecturer in Chemistry.
1903. Gray, Wm. S., 76, William Street, New York City, U.S.A., Chemical Merchant.
1901. Greaves, Albert E., c/o P. Spence and Sons, Ltd., Goole Alum Works, Goole, Yorks, Works Chemist.
1891. Greaves, I. A. R., Morton, Gainsborough, Brewer.
1894. Greaves, Wm., Powell Duffryn Steam Coal Co., Aberaman, Aberdare, South Wales, Chemical Engineer and Chemist.
1894. Greeff, R. W., 20, Eastcheap, London, E.C., Chemical Agent.
1890. Green, Alfred H., Oaklands, Lowton, Newton-le-Willows, Lancashire, Manufacturing Chemist.
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1888. Green, Jno. Edw., Broadlea, Urmston, near Manchester, Soap Works Manager.
1836. Green, Jno. Wilberforce, 55, The Avenue, Kew Gardens, S.W., Technical Chemist.
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1884. Greenhalgh, Jas. Herbert, Whitebirk, Green Mount, near Bury, Lancs., Assistant Manager of Printworks.
O.M. Greenway, T. J., Chillagoe, North Queensland, Australia, Metallurgist.
1902. Greenwood, Conrad Varley, Green Hill, Colne, Lancs., Cotton Mill Manager.
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1897. Gref, Anthony, 40, Stone Street, New York City U.S.A., Patent Lawyer.
1904. Gresty, Jas. E., 135, Oxford Street, Manchester, Chemical Engineer.
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1900. Griffin, Dr. Jno. J., Catholic University of America, Washington, D.C., U.S.A., Professor of Chemistry.
1890. Griffin, John R., 20—26, Sardinia Street, Lincoln's Inn Fields, W.C., Chemical Apparatus Maker.
1886. Griffin, Martin L., Mechanicville, Saratoga Co., N.Y., U.S.A., Analytical Chemist (and Consulting) (Fibre, Paper, Clays).
O.M. Griffith, R. W. S., Eyeworth Lodge, Lyndhurst, Hants, Gunpowder Manufacturer.
1902. Griffiths, Manfred E., Fernside, Childer Road, Stowmarket, Explosives Chemist.
1894. Griffiths, Thos., The Cedars, Clapham Common, S.W., Manufacturing Chemist.
1902. Grimwade, Wilfrid R.; (Journals) 342, Flinders Lane, Melbourne, Vic., Australia; (subscriptions) c/o Grimwade, Ridley, and Co., 6, Trinity Square, London, E.C., Manufacturing Chemist.
O.M. Grimwood, R., 41, Lady Margaret Road, London, N.W., Analytical Chemist.
1900. Grimwood, Robt. G., 17, Dagmar Road, Stroud Green, N., Analytical Chemist.

O.M. Grindley, J., Upper North Street, Poplar, London, E., Tar Distiller.

1888. Gripper, Harold, Great Central Railway, Gorton, Manchester, Analytical Chemist.

1903. Griswold, Geo. G., Globe Plant, A. S. and R. Co., Denver, Colo., U.S.A., Assistant Superintendent.

1897. Gronemeyer, Herman H., 315, Amesbury Avenue, Cleveland, Ohio, U.S.A., Chemical Superintendent.

1900. Gross, Abraham, 341, Oakland Avenue, Pittsburg, Pa., U.S.A., Technical Chemist.

O.M. Grossmann, Dr. J., Northern Assurance Buildings, Albert Square, Manchester, Consulting Chemist and Chemical Engineer.

1896. Grosvenor, Wm. M., jun., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Electro-Chemist.

O.M. Groves, C. E., F.R.S., 352, Kennington Road, London, S.E., Chemist (Thames Conservancy).

1903. Grundy, F. Barnes, Victoria Mills, Bredbury, near Stockport, Technical Chemist.

1899. Gudemann, Dr. Edw., 4319, Vincennes Avenue, Chicago, Ill., U.S.A., Chemist.

1902. Guenther, Felix, jun., c/o Crescent Portland Cement Co., Wampum, Pa., U.S.A., Chemist.

1898. Guess, Harry A., Silver Lake Mines, Silverton, Colo., U.S.A., Chemist.

1899. Guest, Edw. Graham, 5, Churchhill, Edinburgh, Cereals Chemist.

1903. Guest, Hon. Lionel G., 205, St. James Street, Montreal, Quebec, Canada, Engineer.

1899. Guild, Frank N., University of Arizona, Tucson, Arizona, U.S.A., Professor of Chemistry.

1900. Guitermann, Edw. W., Passaic Printworks, Passaic, N.J., U.S.A., Chemist.

1894. Gulliver, Geo. W., c/o Burt, Boulton, and Haywood, Selzaete, Belgium, Chemist.

1903. Gunn, Gilbert, 80, Prettywood, Bury, Lancs., Paper Mill Chemist.

1883. Gunn, W. L., Broad Plain Soap Works, Bristol, Analytical Chemist.

1900. Günther, Chas. E., Liebig's Extract of Meat Co., Ltd., 4, Lloyd's Avenue, London, E.C., Merchant.

1902. Günther, Wm. J. W., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Inspector.

1894. Gurney, J. Clare, Fabrica Roma, La Union, Prov. de Murcia, Spain, Analytical Chemist.

1899. Gutcher, Wm., Singapore Oil Mills, Singapore, S.S., Superintendent Engineer.

1903. Guthrie, Alan, c/o Cooper, Allen, and Co., Cawnpore, India, Leather Trades Chemist.

1903. Guthrie, Alex, The Cottage, Bocking, Braintree, Essex, Manager.

1892. Guthrie, John, Trentham Street, Dewsbury Road, Leeds, Chemical Works Manager.

1901. Guthrie, John M., 199, Ferry Road, Leith, N.B., Analytical Chemist.

1903. Guttmann, Dr. Leo F., 18, Aberdare Gardens, West Hampstead, N.W., Research Chemist.

1892. Guttmann, Oscar, 12, Mark Lane, London, E.C., Consulting Chemical Engineer, M. Inst. C. E.

H

1902. Haas, Herbert, c/o Great Western Gold Co., Redding, Cal., U.S.A., Chemist and Metallurgist.

O.M. Habirshaw, W. M., Glenwood Works, Yonkers, N.Y., U.S.A., Chemical Engineer.

1883. Hacking, W. H., The Grange, Clayton-le-Moors, near Accrington.

1900. Haddock, Arthur G., c/o Castner-Kellner Alkali Co., Ltd., Weston Point, Runcorn, Cheshire, Technical Chemist.

1898. Haddow, Geo., Parkview, Redding, Polmont Station, N.B., Chemist.

1887. Hadfield, R. A., Newhall Road, Attercliffe, Sheffield, Steel Founder.

1884. Hadkinson, F., Pamphila Oil and Soap Works, Mitylene, Mediterranean, Oil Refiner and Soap Manufacturer.

O.M. Hadkinson, R., Smyrna, Asia Minor, Oil Refiner.

1904. Hadley, Geo., 58, Halesowen Street, Blackheath, Staffs., Spelter Works Manager.

1902. Haff, Max M., 77, Gloucester Street, Ottawa, Canada, Chemist.

1887. Haig, Robert, Mechanical Retorts Co., Limited, Murray Street, Paisley, N.B., Chemical Engineer.

1896. Haigh, De Lagnel, 33, Norwood Avenue, Summitt, N.J., U.S.A., Chemist.

1898. Haigh, Fred., 141, Autumn Street, Passaic, N.J., U.S.A., Chemist (Flax Spinning Co.).

1898. Haigh, Percy, c/o Messrs. Bird Bros, Duxford, Cambridge, Analytical Chemist.

1888. Hailes, A. J. de, 15, Red Lion Square, W.C., Analytical Chemist.

1889. Haines, Reuben, Haines Street, near Chew Street, Germantown, Philadelphia, Pa., U.S.A., Analytical Chemist.

O.M. Hake, C. N., 423, Flinders Lane, Melbourne, Victoria, Inspector of Explosives.

1903. Halbert, Thos., c/o British South African Explosives Co., Modderfontein, Transvaal, Analytical Chemist.

1903. Hale, Dr. Frank E., Mount Prospect Laboratory, Flatbush Avenue and Eastern Parkway, Brooklyn, N.Y., U.S.A., Chemist.

1888. Hale, Edw. P., c/o Wakefield & Co., Gatebeck Kendal, and (communications) Endmoor, near Kendal, Analytical Chemist.

1887. Hall, Allan T., c/o Sissons Bros. & Co., Ltd., Hull, Oil Refiner and Varnish Manufacturer.

1886. Hall, Archibald D., 7, Fenchurch Avenue, London, E.C., Analytical Chemist.

1898. Hall, Clarence A., 517, North American Building, Philadelphia, Pa., U.S.A., Chemist.

O.M. Hall, Edgar, Silver Spur, Stanthorpe, Queensland, Australia, Technical Chemist.

1902. Hall, Geo., c/o A. A. Vantine and Co., Broadway and 18th Street, New York City, U.S.A., Chemist.

1902. Hall, Henry, c/o Booth and Co., Irk Vale Works, Middleton, Lancashire, Dyer and Finisher.

1893. Hall, Jas. W., Bombay, Baroda, and Central India Railway, Sabarmati, near Ahmedabad, India, Linseed Oil Mills Manager.

1885. Hall, Jno. A., Victoria Chemical Works, Victoria, British Columbia, Analytical Chemist.

1900. Hall, Jcs. J., 414, Fifth Avenue, Cedar Rapids, Iowa, U.S.A., Chemist.

1900. Hall, Prof. Robt. W., Havemeyer Laboratory, University Heights, New York City, U.S.A., Professor of Analytical Chemistry.

O.M. Hall, S., East London Soap Works, Bow, London, E. Soap Manufacturer.

1896. Hall, S. G., East London Soap Works, Bow E., Soap Maker.

1898. Hall, Wm. F., c/o Wanderer G. M. Co., Selukwe, Rhodesia, Cyanide Manager.

1886. Haller, Geo., Sussex House, 52, Leadenhall Street, London, E.C., Chemical Merchant.

1893. Haller, H. Left, 26, Scale Lane, Hull, Analytical Chemist.

1895. Halliwell, Edw., c/o Ribble Joint Committee, 16, Walton's Parade, Preston, Chief Inspector.

1901. Hallock, Dr. Albert P., 440, First Avenue, New York City, U.S.A., Chemist.

1892. Hamaguchi, K., Hiro Mura, Arito Gori, Wakayama Ken, Japan, Soy Manufacturer.

1897. Hambly, Fred. J., Buckingham, Quebec, Canada, Chemist.

1901. Hambuechen, Carl, 113, West Gorham Street, Madison, Wis., U.S.A., Electro-Chemist.

1887. Hamilton, Jas. C., Arncliffe, Arnside, viâ Carnforth, Chemical Works Manager.

1885. Hamilton, Oswald, Lancaster Cottage, Old Stratford, near Stony Stratford, Chemical Engineer.

1884. Hamilton, Robert, Glengarnock Chemical Co., Ltd., Glengarnock, N.B., Works Manager.

1892. Hamilton, Robt., 62, Tempest Road, Beeston Hill, Leeds, Analytical Chemist.

O.M. Hammill, M. J., The Gables, St. Helens, Alkali Manufacturer.

1898. Hammersley, W. Stanley, Longjumeau, S. et O., France, Tanner.

1892. Hammond, Geo. W., Yarmouthville, Maine, U.S.A., Paper Co.'s Agent.

1904. Hammond, H. S., Government Laboratory, Kingston, Jamaica, Analyst.

O.M. Hammond, J., Gas Works, Eastbourne, Sussex, Gas Manager.

1902. Hampson, B. A., "Hampson's Buildings," Smith Street, Durban, Natal, S. Africa, Assayer and Geologist.

1900. Hampton, F. T., Hill City, Tenn., U.S.A., Civil Engineer.

1900. Hancock, Walter C., 10, Upper Chadwell Street, Myddelton Square, London, E.C., Analytical Chemist.

1896. Hand, Daniel, 30, Mount Pleasant Avenue, Newark, N.J., U.S.A., Chemist.

1889. Handy, Jas. O., 325, Water Street, Pittsburg, Pa., U.S.A., Chemist.

1888. Hanks, Abbot A., 531, California Street, San Francisco, Cal., U.S.A., Assayer.

1901. Hanna, Charles E., 316, St. James' Street, Montreal, Canada, Secretary.

1899. Hanna, Dillinger C., 4262, Parkside Avenue, Philadelphia, Pa., U.S.A., Chemist and Superintendent.

O.M. Hanson, A. M., Abbey Printworks, Whalley, Blackburn, Print Works Chemist.

1901. Hardcastle, G. Fred., 9, Newtown Street, Leicester, Teacher of Science and Technology.

1894. Harden, Dr. Arthur, c/o British Institute of Preventive Medicine, Grosvenor Road, London, S.W., and (communications) 2, Marlborough Road, Richmond, S.W., Lecturer in Chemistry.

1900. Hardwick, W. Roscoe, 13, Batavia Buildings, Hackins Hey, Liverpool, Chemist.

1902. Hardy, G. B., Belmont Gold Mine, Cordova, Ont., Canada, Metallurgist.

1897. Harger, Dr. Jno., 11, Ivy Mount, Sutton-on-Hull, Chemist.

1896. Hargreaves, Jas., Farnworth, Widnes, Lancashire, Chemical Engineer.

O.M. Hargreaves, Jno., Widnes, Alkali Manufacturer.

O.M. Harland, R. H., Plough Court, 37, Lombard Street, London, E.C., Consulting Chemist.

1904. Harley, B., 12, Russell St., Falkirk, N.B., Analytical Chemist.

1893. Harlock, E. B., Newton Farm, Middlewich, Chemical Manufacturer.

1898. Harman, Edw. A., Gas Works, Huddersfield, Gas Engineer, M. Inst. C. E.

1903. Harrington, E. M., Aetna, Lake Co., Ind., U.S.A., Explosives Manufacturer.

O.M. Harrington, W. B., Leeview, Montenotte, Cork, Chemical Manufacturer.

1893. Harris, Arthur, 22, Marsh Gate Lane, Stratford, E., Soap Maker.

1885. Harris, Booth, jun., Beeleigh, Victoria Road Buckhurst Hill Essex, Soap Maker.

O.M. Harris, D., 16, Merchiston Avenue, Edinburgh, Chemical Manufacturer.

1897. Harris, Fred. W., Sanitary Chambers, Chemical Department, Glasgow, Public Analyst.

1900. Harris, Dr. Harry B., 212, Jones Street W., Savannah, Ga., U.S.A., Chemist.

1900. Harris, L. A., Wyoming, Wood Vale, Lordship Lane, London, S.E., Chemist.

1896. Harris, Wm. T. A., Ideal Soapery, East Street, Brempton, Adelaide, South Australia, Soap Maker.

O.M. Harrison, A., Thames Sugar Refinery, Silvertown, London, E., Sugar Works Chemist.

O.M. Harrison, G. D., Netham Chemical Works, Bristol, Chemical Manufacturer.

1883. Harrison, G. H., Hagley, near Stourbridge, Firebrick Maker.

1884. Harrison, G. King, Hagley, near Stourbridge, Fireclay Mine Owner.

1892. Harrison, Prof. John B., C.M.G., Government Laboratory, Georgetown, Demerara, B.G., Government Analyst.

1898. Harrison, Wm. H., 29, Avenue Crescent, Harehills Lane, Leeds, Analytical Chemist.

1896. Hart, Bertram, c/o Tennants and Co., Clayton, Manchester, Analyst.

1886. Hart, Bertram H., The Elms, Old Charlton, S.E., Analytical Chemist.

O.M. Hart, Dr. E., Gayley Hall, Lafayette College, Easton, Pa., U.S.A., Professor of Chemistry.

1890. Hart, H. W., 13, Lynwood Villas, Darwen, Lancashire, Analytical Chemist.

1897. Hart, Wm. Beamont, Manchester Laboratory, 8, Exchange Street, Manchester, Consulting Chemist.

1886. Hartley, Arthur, The Brewery, Emsworth, Hants, Brewer.

1883. Hartley, Joseph, 102, Kirkmanshulme Lane, Longsight, Manchester, Technical Chemist.

1889. Hartley, R. Kent, Springwood House, Middleton Junction, near Manchester, Chemical Works Manager.

O.M. Hartley, Prof. W. N., D.Sc., F.R.S., Royal College of Science, Dublin, Professor of Chemistry.

1897. Hartmann, Ernest E., Waialua, Oahu, Hawaii, Chemist.

1891. Hartog, Philip J., 22, Brondesbury Villas, London, N.W., Analytical Chemist.

1892. Hartridge, Jas. Hills, Holmwood, Hendon, Manufacturing Chemist.

1901. Hartwell, S. Warren, 215, North 2nd Street, Easton, Pa., U.S.A., Chemist.

1901. Hartzell, Harry S., 126, North 4th Street, Allentown, Pa., U.S.A., Chemist.

1899. Harvey, Chas., 38, Shakespeare Crescent, Manor Park, E., Manufacturing Chemist.

1892. Harvey, E. Feild, Omrac, St. John's, Newfoundland, Chemist.

1885. Harvey, Ernest W., Stoneleigh, Grove Road, Clapham Park, S.W., A.R.S.M. Engineer.

1888. Harvey, H. C., Raglan House, Brooklands, near Manchester, Chemist.

1891. Harvey, Sidney, South-Eastern Laboratory, Canterbury, Analytical Chemist.

1899. Harvey, Thos. F., 84, Henry Road, West Bridgford, Nottingham, Analyst (Drug Co.).

1883. Harvey, T. H., Cattedown, Plymouth, Chemical Manufacturer.

1903. Hasenclever, Max, Chemische Fabrik Rhenania, Aachen, Prussia, Chemical Manufacturer.

1900. Haslwanter, Chas., 908, Willoughby Avenue, Brooklyn, N.Y., U.S.A., Analytical Chemist.

1897. Hasslacher, Jacob, P. O. Box 1999, New York, U.S.A., President of Roessler-Hasslacher Chemical Co.

1903. Hasting, J. J., c/o Benjamin Moore and Co., 244–259, Water Street, Brooklyn, N.Y., U.S.A., Chemist.

1894. Hatfield, Jno. A., c/o J. Lysaght, Ltd., Orb Ironworks, Newport, Mon., Analytical Chemist.

1903. Hatschek, Emil, c/o The Niles-Bement-Pond Co., 138, Liberty Street, New York City, U.S.A., Engineer.

1887. Hatton, Wm. P., c/o W. R. Hatton & Sons, Wormwood Scrubs, W., Starch Works Manager.

1899. Haus, Simon V., c/o Eastman Kodak Co., Rochester, N.Y., U.S.A., Photographic Chemist.

1900. Havens, Dr. F. S., c/o Franklin H. Kalbfleisch Co., 35, Burling Slip, New York City, U.S.A., Silk Conditioner.

1899. Hawdon, H. S., Harton Road, Westoe, South Shields, Manager.

1895. Hawker, E. W., Adelaide Club, Adelaide, South Australia, Metallurgist.

1902. Hawkins, Clement C., c/o The Chatfield Mfg. Co., Carthage, Ohio, U.S.A., Chemist.

1897. Hawkins, Ernest M., Lime Tree Farm House, Stone Street, Petham, Canterbury, Chemist.

O.M. Hawkins, H., Concord Junction, Mass., U.S.A., Explosive Works Manager.
1893. Hawkins, J. Dawson, c/o Colo. Phila. Reduction Co., Colorado City, Col., U.S.A., Smelting Works Manager.
1887. Hawliczek, Josef, 77A, Lord Street, Liverpool, Consulting Chemical Expert.
1899. Haworth, Dr. Edw., Sunnyside, Norman Road, Runcorn, Cheshire, Chemist.
1903. Haworth, Herbert, Crown Works, Appley Bridge, near Wigan, Director (Grove Chemical Co.).
1904. Hawthorn, J. H., Municipal Technical School, Leicester, Head Master.
1895. Hay, Alex. B., Kelvindock Chemical Works, Maryhill, Glasgow, Manufacturing Chemist.
1898. Haycraft, Jos. H., St. Peter's, Adelaide, South Australia, Metallurgical Chemist.
1894. Haynes, David O., 8, Spruce Street, New York City, U.S.A., Proprietor of "Pharmaceutical Era."
1902. Hays, B. F., c/o Fraser Tablet Co., 454474, 18th Street, Brooklyn, N.Y., U.S.A., Chemist.
1902. Hazard, Dr. Elmer C., Shrewsbury, N.J., U.S.A., Chemist.
1903. Hazen, Chas. R., Collingwood, Ohio, U.S.A., Chemist.
1894. Heal, Carlton, Duston, near Northampton; (Journals) c/o Northampton Tanning Co., St. James' End, Northampton, Chemical Student.
1903. Heald, Henry I., Cliffe House, Kilnhurst, near Rotherham, Yorks., Manager of Earthenware Factory.
1899. Healey, Alfred E., Willesden Paper and Canvas Works, Willesden Junction, N.W., Managing Director.
1890. Heape, Chas., 19, George Street, Manchester, Calico Printer.
1898. Heasman, Walter, Castle Brewery, Bridgnorth, Salop, Brewer.
O.M. Heath, R. C., Myton Grange, near Warwick, Chemical Manufacturer.
1897. Heaton, John, 3, Belle Vue Park, Sunderland, Brewer and Chemist.
1895. Hebden, Jno. C., 64, Exchange Place, Providence, R.I., U.S.A., Works Manager and Chemist.
1895. Hecker, Paul, 102, Fenchurch Street, London, E.C., Chemical Merchant.
1900. Heckman, J. Conrad, (Journals) c/o Larkin Soap Manufacturing Co., Seneca Street, Buffalo, N.Y., U.S.A., Chemist.
1889. Heckmann, C., 9, Görlitzerufer, Berlin, S.O., Germany, Chemical Apparatus Maker.
1885. Hedley, Armorer, Durrant House, Bournemouth, Hants, Soap Manufacturer.
1895. Hedley, Geo. H., Hedge Mill, Loudwater, Bucks, Chemical Manufacturer.
1902. Heebner, Prof. Chas. F., Ontario College of Pharmacy, Toronto, Canada, Professor of Pharmaceutical Chemistry.
1903. Hegeman, John W., 102, Barbey Street, Brooklyn, N.Y., U.S.A., Chemist.
O.M. Hehner, Otto, 11, Billiter Square, London, E.C., Analytical and Consulting Chemist.
1902. Heidenhain, Dr. Henry, 108, Gitschinerstrasse, Berlin, S.W., Chemist.
1902. Heike, Rudolph E., American Sugar Refining Co., P.O. Box L., Jersey City, N.J., U.S.A., Chemist.
1898. Heileman, W. H., (communications) U.S. Department of Agriculture, Bureau of Soils, Washington, D.C.; and (Journals) Elwell, Iowa, U.S.A., Expert Field Assistant.
1887. Hellier, E. A., Avonside Varnish Works, Bristol, Varnish Manufacturer.
1885. Hellon, Dr. R., 40, New Lowther Street, Whitehaven, Analytical and Consulting Chemist.
O.M. Helm, H. J., Simonstone, Hammelton Road, Bromley, Kent, Government Analyst.
1903. Helps, D. H., c/o Reading Gas Co., King's Road Works, Reading, Engineer and Manager.
1898. Hemingway, Frank C. R., 133, Front Street, New York City, U.S.A.
1883. Hemingway, H., (Journals) Baglan Lodge, Briton Ferry, S. Wales, and (communications) Marsh Gate Lane, Stratford, E., Chemical Manufacturer.
1884. Hempleman, F. S., Wennington House, Wennington, Romford, Essex, Manure Manufacturer.
1903. Hemstreet, George P., Hastings-on-Hudson, N.Y., U.S.A., Mechanical Engineer.
1888. Henderson, Prof. G. G., The Technical College, George Street, Glasgow, Professor of Chemistry.
1902. Henderson, Jas. A. Russell, 33, Blythswood Drive, Glasgow, Technical Chemist.
1900. Henderson, J. Brownlie, Government Analyst's Office, Brisbane, Queensland, Government Analyst.
1902. Henderson, J. C. A., 4, Sun Court, Cornhill, London, E.C., Gentleman.
1894. Henderson, Jos., Thornaby Ironworks, Thornaby-on-Tees, Metallurgical Chemist.
1894. Henderson, Norman M., Broxburn Lodge, Broxburn, N.B., Oil Works Manager.
O.M. Henderson, W. F., Moorfield, Claremont Gardens, Newcastle-on-Tyne.
1893. Hendrick, Jas., Marischal College, Aberdeen, Lecturer on Agricultural Chemistry.
1889. Hennin, Alphonse, Portoferraio, Elba, Italy, Metallurgical Chemist.
1904. Henshaw, Percy B., 3, Dobbin Hill, Endcliffe, Sheffield, Steel Chemist.
1894. Henshaw, Sam., Glenthorne, Wolstanton, Stoke-on-Trent, Chemical Works Manager.
1894. Hepburn, J. G., Priory Works, Dartford, Kent, Leather Manufacturer.
1894. Heriot, T. H. P., 23, Wolseley Road, Crouch End, N., Analytical Chemist.
O.M. Herman, W. D., Holm Lea, Rainhill, Lancashire, Glass Works Chemist.
O.M. Heron, J., 110, Fenchurch Street, London, E.C., Brewing Chemist.
1903. Herreshoff, J. B. F., 40, West 59th Street, New York City, U.S.A., Chemical Engineer.
1899. Herrick, Rufus F., 16, Herrick Street, Winchester, Mass., U.S.A., Chemist.
1887. Herriot, Wm. Scott, 19, Kier Street, Pollokshields, Glasgow, Chief Engineer.
O.M. Herrmann, R. W., 59, Mark Lane, London, E.C., Chemical Merchant.
1891. Hersam, Ernest A., University of California, Berkeley, Cal., U.S.A., Assistant Professor of Metallurgy.
O.M. Herschel, Prof. A. S., F.R.S., Observatory House, Slough, Bucks, Hon. Professor of Experimental Physics.
1898. Hersey, Milton L., 146, St. James' Street, Montreal, Canada, Consulting Chemist.
1901. Hershey, Aldus N., c/o Sharp and Dohme, Baltimore, Md., U.S.A., Chemist.
1903. Herstein, Dr. Bernard, 118, Humphry Avenue, Bayonne, N.J., U.S.A., Technical Chemist.
1898. Heslop, Oliver, 55, Sandown Lane, Wavertree, Liverpool, Analytical Chemist.
1885. Hess, Dr. Adolph, Kirkstall Road, Leeds, Chemical Manufacturer.
1891. Hetherington, Dr. Albert E., Ammonia Soda Works, Fleetwood, Lancashire, Analytical Chemist.
1894. Hewitt, A. H., The Green Island Cement Co., Lim., Hong Kong, China, Engineer.
O.M. Hewitt, Dr. D. B., Oakleigh, Northwich, Cheshire, Alkali Manufacturer.
1899. Hewitt, Edw. R., 13, Burling Slip, New York City, U.S.A., Glue Manufacturer.
1903. Hewitt, H. R., 329, Bradford Road, Manchester, Chemical Works Manager.
1896. Hewitt, Dr. J. Theo., 8, Montpelier Road, East Twickenham, Lecturer.
1890. Hewlett, John C., 40—42, Charlotte Street, Great Eastern Street, London, E.C., Manufacturing Chemist.
1893. H y, Harry, 2, Ash Terrace, Savile Town, Dewsbury, Dyer.

1894. Heyl-Dia, G. Edw., 236, Great Clowes Street, Higher Broughton, Manchester, Chemical and Electrical Engineer.

1901. Heys, Thos., 114, Bay Street, Toronto, Canada, Consulting Chemist.

1884. Heys, W. E., Llanberis, Bushey Hall Road, Watford, Consulting Engineer.

1883. Heywood, J. H., 231, Drake Street, Rochdale, Technical Chemist.

O.M. Heywood, J. S., 7, Caledonian Road, King's Cross, London, N., Chemical Manufacturer.

1897. Hibbard, Paul L., 2657, North 42nd Court, Chicago, Ill., U.S.A., Starch Chemist.

1901. Hiby, Dr. Walter, 4, Southampton Row, London, W.C., Chemical Engineer.

1897. Hicks, Edwin F., 94, Hamilton Place, New York City, U.S.A., Analytical Chemist.

1893. Hicks, Jas. A., c/o Dr. B. Redwood, 4, Bishopsgate Street Within, London, E.C., Analytical Chemist.

O.M. Higgin, W. H., Hollywood, Lostock, near Bolton-le-Moors, Chemical Manufacturer.

1901. Higginbottom, Alf., Quarry Bank, New Mills, near Stockport, Colourist.

1886. Higgins, C. L., Muspratt's Works, Widnes; and (Journals) 79, Bedford Street South, Liverpool, Manufacturing Chemist.

1901. Highley, Arnold, 20, Spotland Road, Rochdale, Chemist.

1903. Hill, Chas. Alex., 64, Park Street, Southwark, S.E., Wholesale Druggist.

1897. Hill, George, Barton-on-Humber, Chemical Works Manager.

1897. Hill, Dr. Herbert M., University of Buffalo, N.Y., U.S.A., Professor of Chemistry and Toxicology.

O.M. Hill, J. K., 13, Osborne Place, Copland Road, Govan, near Glasgow, Manufacturing Chemist.

1892. Hill, Sydney, c/o Blundell Spence and Co., Ltd., Hull, Analytical Chemist.

1903. Hill, W. Basil, James Street Leather Works, York, Tanner.

1902. Hill, Wm. G. H., jun., American Rubber Co., East Cambridge, Mass., U.S.A., Chemist.

1898. Hill-Jones, Thos., 30, Bisham Gardens, Highgate, N., Manufacturing Chemist.

O.M. Hills, C. H., Anglesea Copper Works, Low Walker, Newcastle-on-Tyne, Copper Smelter.

1894. Hills, Harold F., Commercial Gas Works, Stepney, London, E., Analytical Chemist.

1898. Hills, Thos. Herbert, Chemical Works, Deptford, S.E., Chemical Manufacturer.

O.M. Hills, W., 225, Oxford Street, London, W., Pharmaceutical Chemist.

1893. Hilton, Edgar G., 17, Howard Drive, Grassendale, Liverpool, Varnish and Paint Manufacturer.

1899. Hinchley, J. W., Royal Mint, Bangkok, Siam, Chemical Engineer.

O.M. Hindle, J. H., 8, Cobham Street, Accrington, Dyeworks Manager.

1883. Hinds, James, 127, Gosford Street, Coventry, Pharmaceutical Chemist.

1899. Hinks, Percy J., Tavern Street, Stowmarket, Chemist.

1891. Hinman, Bertram C., 23, Trewsbury Road, Sydenham, S.E., Metallurgical Chemist.

1892. Hinshelwood, Thos., Glasgow Oil and Paint Works, Glenpark Street, Glasgow, Oil Refiner.

1900. Hirsh, Jos. E., 1245, 85th Street, Brooklyn, N.Y., U.S.A., Chemist.

19 3. Hirshfield, E., 14, Lancaster Street, Albany, N.Y., U.S.A., Chemist.

1895. Hirst, H. Reginald, Croft House, Batley, Yorks, Works Chemist.

1886. Hislop, Geo. R., (Journals) Gas Works, (communications) Greenhill House, Underwood Road, Paisley, N.B., Gas Enginner and Manager.

1900. Hobbs, Alex. F., Merrimack Manufacturing Co., Lowell, Mass., U.S.A., Printworks Superintendent.

1900. Hobbs, Dr. Perry L., Western Reserve Medical College, Cleveland, Ohio, U.S.A., Professor of Chemistry.

1894. Hodge, Andrew, 28, Grosvenor Road, Heaton Moor, near Stockport, Printworks Chemist.

1890. Hodges, Harry B., Long Island Railroad Co., Long Island City, N.Y., U.S.A., Chemical Engineer.

1902. Hodgkins, David H., 19, East Park Street, Newark, N.J., U.S.A., Manufacturing Chemist.

O.M. Hodgkinson, Dr. W. R., (Journals) 18, Glenluce Road, Blackheath, S.E.; and Royal Artillery College, Woolwich, S.E., Professor of Chemistry.

O.M. Hodgson, Chris., 33, Oakdale Road, Nether Edge, Sheffield, Metallurgical Chemist.

1897. Hodgson, Matthew, Ardmore, Wicklow, Ireland, Technical Chemist.

1890. Hodgson, Wm., 66, Deansgate, Manchester, Oil and Colour Broker.

1903. Hoffmann, W. F., 23, Division Place, Newark, N.J., U.S.A., Chemical Merchant.

1886. Hogben, W., c/o Viscoloid Co., Leominster, Mass., U.S.A., Chemist and Superintendent.

O.M. Hogg, T. W., (Journals) c/o John Spencer and Sons, Newburn Steelworks, Newcastle-on-Tyne; and (communications) Castlenock, Ryton-on-Tyne, Metallurgical Chemist.

1903. Holde, Prof. Dr. D., Geisbergstrasse 30, Berlin, W., Germany, Principal (Kgl. Versuchsanstalt).

1899. Holden, Archie Neill, c/o Hardman and Holden, Ltd., Miles Platting, Manchester, Chemist.

1903. Holden, G. E., 21, Durnford Street, Middleton, near Manchester, Works Chemist.

1887. Holden, G. H., Manchester Oxide Co., Ltd., Canal Street, Miles Platting, Manchester, Chemist.

1904. Holden, Norman N., c/o Messrs. Hardman and Holden, Miles Platting, Manchester, Manufacturing Chemist.

1902. Holdsworth, Ernest T., Westholme, Great Horton, Bradford, Dyer.

1904. Holgate, Arthur, Rigby Street Mills, Liverpool, Corn Miller.

1885. Holgate, T. E., 173, Hollins Grove, Darwen, Lancashire, Metallurgist.

1884. Holgate, Thos., 5, Victoria Street, Westminster, S.W., Gas Engineer.

O.M. Holland, Philip, 22, Taviton Street, Gordon Square, London, W.C., Analytical Chemist.

1892. Holland, Philip H., 958, Sherbrooke Street, Montreal, Canada, Merchant.

1901. Hollick, Herbert, c/o General Chemical Co., Camden, N.J., U.S.A., Works Manager.

1902. Holliday, Lionel B., Lunnclough Hall, Huddersfield, Chemical Manufacturer.

1896. Hollings, J. Spencer, Brymbo, North Wales, Works Manager.

1903. Hollinshead, Peter, New Field House, Wimboldsley, near Middlewich, Cheshire, Chemist.

1900. Hollinshead, W. H., Vanderbilt University, Nashville, Tenn., U.S.A., Teacher of Chemistry.

1890. Holloway, G. T., 57 and 58, Chancery Lane, W.C., Analytical and Consulting Chemist.

1900. Hollway, Jno., 6, Highbury Grange, London, N., Mine Owner.

1883. Holmes, Ellwood, Wyncote, Jesmond Park East, Newcastle-on-Tyne, Colour Manufacturer.

O.M. Holmes, F. G., 31, St. George's Road, Waterloo, Liverpool, Technical Chemist.

1900. Holthouse, Harold B., 12, Melton Grove, West Bridgford, Nottingham, Chemist.

1902. Holton, Alf. L., 385, Bradford Road, Manchester, Chemist.

1892. Holton, E. C., Sherwin-Williams Co., 100, Canal Street, Cleveland, Ohio, U.S.A., Chemist.

1893. Holzapfel, Max., Maritime Buildings, Quayside, Newcastle-on-Tyne, Manufacturer.

1893. Homfray, D., 6, Dartmouth Row, Greenwich, S.E. Analytical Chemist.

O.M. Hooper, E. Grant, Government Laboratory, Clement's Inn Passage, Strand, W.C.; and (Journals) 16, Royal Avenue, Sloane Square, S.W., Analytical Chemist.

1889. Hooper, Ernest F., Wear Fuel Works, Hendon Dock, Sunderland, Technical Chemist.

1888. Hope, Jas., Dean House, Lenzie, N.B., Nickel Works Manager.

1904. Hopewell, Fredk., 86, Youville Square, Montreal, Canada, Manager.

1892. Hopkins, Erastus, Lake Helen, Fla., U.S.A., Consulting Chemist.

1893. Hopkins, Gerald V., Nicholaston House, Penmaen, near Swansea; and (Journals) Silico, Rossland, Canada, Metallurgist.

1894. Hopkins, Herbert W., (Journals) c/o Waihi G. M. Co., Waihi, Paeroa, N.Z.; and 13, Harrington Gardens, South Kensington, S.W., Metallurgist.

1891. Hopkinson, John, Marion Street, Lister Hills, Bradford, Yorks, Lubricant Manufacturer.

1898. Hopwood, Wm. H., Bella Vista, Strines, near Stockport, Printworks Chemist.

1895. Horne, Dr. W. D., Yonkers, N.Y., U.S.A., Consulting Chemist.

1904. Hornsey, J.W., 914, New England Building, Cleveland, Ohio, U.S.A., Chemical Engineer.

1900. Horsfall, Jno., 4, Grange Avenue, Rawtenstall, Manchester, Analytical and Consulting Chemist.

1902. Horsfall, L. H., c/o Binny and Co., Madras, India, Chemist.

1901. Horton, Edw., jun., 8, Orford Street, Chelsea, S.W., Student.

1889. Horton, William, 12, Princes Road, Liverpool, Analytical Chemist.

1902. Hosford, Roger F., 125, Milk Street, Boston, Mass., U.S.A., Chemical Engineer.

1890. Huskins, A. Percy, Gordonville House, Rosetta Park, Belfast, Ireland, Analytical Chemist.

1899. Hoskins, Wm., Room 55, 81, South Clark Street, Chicago, Ills., U.S.A., Chemist.

1899. Houlder, Bertram E., 11, Portland Road, Southall, Middlesex, Chemist.

1892. Houston, John, 26, Princess Street, Manchester, Drysalter.

1888. Houston, Robt. S., Hawkhead Road, Paisley, N.B., Analytical Chemist.

1891. Hovenden, Fred., Glenlea, Thurlow Park Road, West Dulwich, S.E.

O.M. Howard, A. G., Burnt House, Chigwell, Essex, Chemical Manufacturer.

1901. Howard, Bernard F., Devon House, Buckhurst Hill, and (Journals) Lavender Mount Works, Ilford, Essex, Chemical Student.

O.M. Howard, D., Devon House, Buckhurst Hill, Essex, Chemical Manufacturer.

1887. Howard, D. Lloyd, City Mills, Stratford, E., Chemical Manufacturer.

1903. Howard, Fred. A., 254, Montello Street, Brockton, Mass., U.S.A., Chemist.

1898. Howard, Henry, 175, Mountfort Street, Brookline, Mass., U.S.A., Chemical Engineer.

1902. Howard, Nelson A., c/o General Chemical Co., Hegewisch, Ill., U.S.A., Chemist.

1904. Howard, T., Hibernia House, Hibernia Road, Hounslow, Chemist.

O.M. Howard, W. D., City Mills, Stratford, London, E., Chemical Manufacturer.

1903. Howe, Jas. Lewis, Washington and Lee University, Lexington, Va., U.S.A., Professor of Chemistry.

1904. Howell, Walter L., c/o Appraiser's Office, Custom House, New Orleans, La., U.S.A., Chemist.

1899. Howles, Fred., c/o McDougall Bros., Millwall Docks, London, E., Chemist.

1889. Howorth, F. Wise, c/o Lloyd Wise, 46, Lincoln's Inn Fields, W.C., Technical Chemist and Chartered Patent Agent.

1896. Hoyte, Percy S., Gas Works, Coxside, Plymouth, Gas Engineer.

1900. Hübner, Julius, 24, Delaunay's Road, Crumpsall, Manchester, Director of Dyeing and Papermaking Departments (Municipal School of Technology).

1898. Hudson, Albert W., 312, Colorado Building, 16th and California Streets, Denver, Colo., U.S.A., Assayer.

1902. Hudson, C. Edward, c/o E. G. Jepson and Co., Albion Walk Chambers, Leeds, Drysalter.

1899. Hudson, Dr. Edw. J., c/o Pioneer Iron Co., Marquette, Mich., U.S.A., Chemist.

O.M. Hughes, J., 79, Mark Lane, London, E.C., Agricultural Chemist.

1898. Hughes, Raymond M., Oxford, Butler Co., Ohio, U.S.A., Professor of Chemistry and Physics.

1903. Hullegard, H., c/o Orford Copper Co., New Brighton, N.Y., U.S.A., Chemical Engineer.

1900. Hulley, Geo. D., c/o J. Eavenson and Sons, 20th and Wood Streets, Philadelphia, Pa., U.S.A., Soapworks Chemist.

1893. Humfrey, Chas., Hilderstone, Hartford, Cheshire, Alkali Works Manager.

1896. Humphrey, H. A., 38, Victoria Street, Westminster, S.W., Consulting Engineer.

1901. Humphrey, Henry C., c/o New York Glucose Co., Edgewater, N.J., U.S.A., Chemist.

1903. Humphrey, John, 17, Bloomsbury Square, London, W.C., Editor ("British and Colonial Druggist").

1902. Humphrey, Rich. L., 1001, Harrison Building, Philadelphia, Pa., U.S.A., Civil Engineer.

1903. Humphreys, A. C., 31, Nassau Street, New York City, U.S.A., Engineer.

1901. Humphreys, Otho F., Patton Paint Co., Milwaukee, Wis., U.S.A., Paint Manufacturer.

O.M. Humphrys, N. H., Gasworks, Salisbury, Wilts, Gas Engineer.

1895. Hunicke, Dr. H. Aug., 3532, Victor Street, St. Louis, Mo., U.S.A., Prof. of Applied Chemistry.

1900. Hunt, Arthur V., 76, Cromwell Street, Stretford, Lancashire, Analytical Chemist.

O.M. Hunt, Bertram, Tres Amigos Mine, Puntarenas, Costa Rica (*viâ* New Orleans and Port Limon), Technical Chemist.

O.M. Hunt, Chas., 15, Victoria Street, Westminster, London, S.W., Gas Engineer.

O.M. Hunt, E., Myvod House, Wood Green, Wednesbury, Staffs., Chemical Manufacturer.

1883. Hunt, J. S., Appleton, Widnes.

1903. Hunt, P. C. Holmes, Metropolitan Gas Co., Flinders Street, Melbourne, Vic., Australia, Gas Engineer.

O.M. Hunt, W., Hampton House, Wood Green, Wednesbury, Staffordshire, Chemical Manufacturer.

1897. Hunter, Prof. A. G. Kidston, (subs.) c/o John Hunter, 18, Great Clyde Street, Glasgow; and (Journals) P.O. Box 164, Dunedin, N.Z., Prof. of Chemistry.

1903. Hunter, H. B., Dennery Factory, St. Lucia, West Indies, Sugar Works Manager.

1902. Hunter, Hy. Blount, Hunter Chemical Co., Norfolk, Va., U.S.A., Industrial Chemist.

1893. Hunter, Prof. Matthew, Rangoon College, Rangoon, Burmah, Prof. of Chemistry.

1892. Hunter, Sidney H., 202, Bow Road, E., Mechanical Engineer.

O.M. Huntington, Prof. A. K., King's College, Strand, London, W.C., Professor of Metallurgy.

1902. Huntly, Geo. N., 96, Gower Street, London, W.C., Analytical and Consulting Chemist.

1902. Huntoon, Louis D., Paterson, N.J., U.S.A., Mining Engineer.

1904. Huntzinger, Alfred, 3, Egerton Road, Chorlton-cum-Hardy, near Manchester, Chemist and Colourist.

1900. Hurd, Geo. E., 72, Michigan Avenue, Chicago, Ill., U.S.A., Food Products Manufacturer.

1903. Hurlburt, Allen S., c/o Thomsen Chemical Co., Baltimore, Md., U.S.A., Chemist.

1894. Hurry, E. H., 122-1, Broadway, New York City, U.S.A., Mechanical Engineer.

1884. Hurst, G. H., 22, Blackfriars Street, Salford, Manchester, Analytical Chemist.

1901. Hurty, Jno. N., Cor. Penn and Ohio Streets, Indianapolis, Ind., U.S.A., Analytical Chemist.

O.M. Huskisson, P. L., 77, Swinton Street, London, W.C., Chemical Manufacturer.

O.M. Huson, C. W., 18, Batavia Buildings, Hackins Hey, Liverpool, Analytical Chemist.

1894. Hutcheson, Jno. F., 22, St. Enoch Square, Glasgow, Chemical Manufacturer.

O.M. Hutchinson, C. C., 3, Harcourt Buildings, Temple, E.C., Barrister-at-Law and Chemical Engineer.

1900. Hutchinson, Edw. G., Gas Offices, Pontefract Road, Barnsley, Yorks, Assistant at Gasworks.

O.M. Hutchinson, T. J., Aden House, Manchester Road, Bury, Analytical and Consulting Chemist.

1901. Hutton, Robt. S., Owens College, Manchester, Lecturer on Electro-Chemistry.

O.M. Huxley, Jas. H., c/o Vickers, Son, and Maxim, Ltd., River Don Works, Sheffield, Metallurgical Chemist.

1897. Hyams, Geoffrey M., P.O. Box 5104, and 312, Sears Building, Boston, Mass., U.S.A., Mines Manager.

1902. Hyde, Austin T., Box 365, Rumford Falls, Maine, U.S.A., Chemical Engineer.

1897. Hyde, B. T. Babbitt, c/o B. T. Babbitt, 82, Washington Street, New York City, U.S.A., Soap Manufacturer.

1899. Hyde, Fred. S., 215, Schermerhorn Street, Brooklyn, N.Y., U.S.A., Research Chemist.

1897. Hyde, Henry St. John, 210, East 18th Street, New York City, U.S.A.

1899. Hyde, Wm. Grantley, 26, Winsham Street, Clapham Common, S.W., Assayer.

1901. Hyman, Leonard W., 342, South Pearl Street, Albany, N.Y., U.S.A., Analytical Chemist.

1896. Hyndman, H. H. Francis, 27, Pembroke Square, Kensington, W., Analytical and Consulting Chemist.

I

1898. Ibbotson, E. C., 3, Ashgate Road, Sheffield, Metallurgist.

1900. Ichioka, Dr. Tajiro. 19, Maruyama Shinmachi, Hongo, Tokio, Japan, Chemist (Imperial Japanese Navy).

1885. Idris, T. H. W., 110, Pratt Street, Camden Town, N.W., Mineral Water Manufacturer.

1902. Ibart, John P., 427, West 38th Street, New York City, U.S.A., Technical Chemist.

1900. Imrie, John, 415, Shields Road, Pollokshields, Glasgow, Analytical Chemist.

1900. Ingalls, Walter R., 229, Ocean Street, Lynn, Mass., U.S.A., Mining Engineer and Metallurgist.

1889. Ingle, Dr. Harry, 15, John Street, Kirkcaldy, Fifeshire, Organic Chemist.

1891. Ingle, Herbert, c/o Dept. of Agriculture, Government Buildings, Pretoria, Transvaal, Govt. Agricultural Chemist.

1884. Inglis, R. A., Culrain, Bothwell, N.B., Analytical Chemist.

1904. Irlam, H. A., 31, East Street, Faversham, Kent, Chemist.

1884. Irving, J. M., 17A, Dickinson Street, Cooper Street, Manchester, Chemical Merchant.

O.M. Irwin, W., Inglehurst, Stand, near Manchester, Analytical Chemist.

1893. Isaac, J. F. V., Research Chemist.

1888. Isaac, T W. Player, Barton Court, Abingdon, Chairman of Waterworks Co.

1896. Isaacs, Louis A., 110, Greencroft Gardens, West Hampstead, N.W.; (Journals), c/o Yeatman and Co., Ltd., Denmark Street, E., Manufacturer.

1901. Isakovics, Alois von, Monticello, N.Y., U.S.A., Manufacturing Chemist.

O.M. Isler, Otto, 35–37, Dickinson Street, Manchester, Chemical Merchant.

1900. Ittner, Dr. Martin H., c/o Colgate and Co., Jersey City, N.J., U.S.A., Soap and Essential Oil Chemist.

J

1890. Jackman, E. J., 60, Belgrave Road, Ilford, Essex, Technical Chemist.

1898. Jackson, Alf. Greville, George Street, Brisbane, Queensland, Electro-Chemical Engineer.

1901. Jackson, Daniel D., Mount Prospect Laboratory, Flatbush Avenue and Eastern Parkway, Brooklyn, N.Y., U.S.A., Chemist.

1903. Jackson, D. H., 47, Mecklenburgh Square, London, W.C., Chemist.

O.M. Jackson, Edward, Clovelly, Grove Avenue, Moseley, Birmingham, Alkali Works Inspector.

1891. Jackson, F., Smedley Bridge Works, Cheetham, near Manchester, Chemical Apparatus Maker.

1883. Jackson, Frederick, 14, Cross Street, Manchester, Laboratory Furnisher.

1901. Jackson, Henry A., 1101, Washington Street, Wilmington, Del., and Columbia University, New York City, U.S.A., Chemist.

1886. Jackson, John, 98, Dobbie's Loan, Glasgow, Lubricant Manufacturer.

1901. Jackson, Percy G., Chemical Laboratory, Locomotive Department, Midland Railway, Derby, Chemist.

O.M. Jackson, R. V., c/o Scotch and Irish Oxygen Co., Polmadie, Glasgow, Technical Chemist.

1890. Jackson, Saml., c/o Binny and Co., Madras, India, Analytical Chemist.

1902. Jackson, Samuel, Wm. Metcalf, Ltd., Church, near Accrington, Director (Tar Distillery).

1898. Jackson, Thos., Clayton Chemical Works, Clayton, Manchester, Chemical Manufacturer.

1900. Jackson, Victor G., 167, Grove Lane, Denmark Hill, S.E., Chemist.

1901. Jackson, W. B., Glengowan Printworks, Caldercruix, N.B., Chemist.

1903. Jackson, Wm. D. N., 78, North Road, Wallsend-on-Tyne, Analytical Chemist.

1900. Jackson, Dr. W. Hatchett, Radcliffe Library, University Museum, Oxford, Librarian and Science Tutor (Keble College).

1903. Jackson, W. H., 50 & 52, North Front Street, Philadelphia, Pa., U.S.A., Chemist and Importer.

1893. Jackson, Rt. Hon. W. L., F.R.S. See Allerton, Rt. Hon. Lord.

1899. Jackson, W. Morton, c/o Manchester Oxygen Co., Ltd., Great Marlborough Street, Manchester, Manager.

O.M. Jackson, W. P., Saxilby, near Lincoln, Chemical Works, Manager.

1901. Jacobs, Charles B., 44, Broad Stecet, New York City, U.S.A., Chemist.

1901. Jacobsen, Rudolph C., 154, Lake Street, Chicago, Ill., U.S.A., Editor "Hide and Leather."

1900. Jacoby, Areli H., c/o New York and Boston Dyewood Co., 156, William Street, New York City, U.S.A., Chemist.

1897. Jacqué, Maurice, "La Cantabrica," Galdacano, cerca Bilbao, Spain, Chemical Engineer.

1901. Jadhava, Khasberao B., Baroda, Bombay Presidency, India, Collector and District Magistrate.

1900. Jäger, B. M., c/o Geo. Jäger and Sons, 77, Burlington Street, Liverpool, Chemist, Sugar Refinery.

1886. Jago, Wm., Godrevy House, Wilbury Avenue, Hove, Sussex, Chemical Engineer.

1889. James, Alf., 56, New Broad Street, London, E.C., Mining Engineer.

1883. James, E. T., British Alizarin Co., Ltd., Silvertown, Victoria Docks, E., Secretary.

1885. James, Dr. J. Wm., Aylmer House, Weston-super-Mare; and (Journals) 29, Redcliff Street, Bristol, Chemical Lecturer.

1893. James, Lawrence S., 32, Hawley Street, Boston, Mass., U.S.A., Gas Inspector.

1902. Jameson, Lewis, 83, Queen Victoria Street, London, E.C., Consulting Chemist.

1903. Janes, Frank W., Wolseley Street, Surrey Hills, Vic., Australia, Assayer.

1890. Jantzen, Paul, 133, Fenchurch Street, London, E.C., Chemical Merchant.

O.M. Japp, Dr. F. R., F.R.S., The University, Aberdeen, Professor of Chemistry.

1890. Jarmain, Geo. S., Hazeldene, Edgerton, Huddersfield, Wool Extractor.

O.M. Jarmay, G., Hartford Lodge, Hartford, Cheshire, Alkali Manufacturer.

1884. Jarves, Deming, Michigan Carbon Works, Detroit, Mich., U.S.A., Manufacturing Chemist.

1900. Jarvie, Jas., Monkland House, Kirkintilloch, N.B., Chemist.

O.M. Jayne, Dr. H. W., 931, North Broad Street, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

O.M. Jekyll, J., Castle Moat House, Lincoln, Chemical Manufacturer.

1892. Jenkin, W. A., 5, Bella Vista, Minas de Rio Tinto, Provincia de Huelva, Spain, Metallurgical Chemist.

1894. Jenkins, John H. B., Laboratory, G.E.R. Works, Stratford, E., Analytical Chemist.

1894. Jenks, Robt. L., 89, Bartholomew Close, London, E.C., Chemist.

O.M. Jenner, E., 209, Markhouse Road, Walthamstow, Essex, Chemical Manufacturer.

1903. Jennings, Henry, 42, Marlowes, Hemel Hempstead, Herts, Analyst.

1899. Jennings, Thos., Brookfield, Cork, Ireland, Chemical Manufacturer.

1899. Jerdan, Dr. David S., c/o J. and G. Cox, Ltd., Gorgie Mills, Edinburgh, Chemist (Gelatin Works).

1899. Jessop, Louis V., 8, Rockmead Road, Victoria Park, N.E., Chemist.

1896. Job, Robt., 109, Windsor Street, Reading, Pa., U.S.A., Analytical Chemist.

1886. Johnson, A. E., Claremont, Lyndhurst Road, Wolverhampton, Analytical Chemist.

1900. Johnson, Albert C., 320, East 25th Street, Baltimore, Md., U.S.A., Chemical Engineer.

1902. Johnson, Chas. M., 701, Orchard Street, Avalon, Allegheny Co., Pa., U.S.A., Chemist.

1891. Johnson, Edmond E., Corsden, Harold Wood, Essex, Chemical Engineer.

1900. Johnson, Edw., c/o Pereira, Carneiro, & Co., Rua do Commercio, No. 6, Pernambuco, Brazil, Sugar Works Manager.

1902. Johnson, Emil F., 96–98, Maiden Lane, New York City, U.S.A., Consulting Chemist.

1900. Johnson, F. Carter, National Acid Co., 714, Union Street, New Orleans, La., U.S.A., Chemical Engineer.

1904. Johnson, F. M. G., 286, Peel Street, Montreal, Canada, Chemist.

1903. Johnson, Horace, Waialua, Oahu, Hawaii, U.S.A., Chemist.

O.M. Johnson, J. E., 40, Idmiston Road, Stratford, London, E., Manufacturing Chemist.

1884. Johnson, J. Grove, 23, Cross Street, Finsbury, London, E.C., Assayer.

1895. Johnson, Jesse F., 58, Metcalfe Street, Montreal, Canada, Chemical Engineer.

1900. Johnson, Jno. E., c/o John Johnson and Co., 95–97, Liberty Street, New York City, U.S.A., Chemical Engineer.

1900. Johnson, Jno. W. H., (communications) York House, Thornhill, Dewsbury, (Journals) West Riding Rivers Board, Wakefield, Yorks, Analytical Chemist.

O.M. Johnson, S. H., Warren Hill House, Loughton, Essex, Chemical Engineer.

O.M. Johnson, T. A., Field House, Winnington Park, Northwich, Cheshire.

1903. Johnson, Thos., Caixa 149, Pernambuco, Brazil, Manager.

1895. Johnston, Alex. R., 18, Percy Street, Ibrox, Glasgow, Analytical Chemist.

1894. Johnston, G. Lawson. *See* Lawson-Johnston, G.

1889. Johnston, Thos., Nobel's Explosives Co., Ltd., 195, West George Street, Glasgow, Manager.

1904. Johnston, Thos. J., 4, Garriock Drive, Kelvinside North, Glasgow, Chemist.

1890. Johnston, Wm. A., The S. S. White Dental Manufacturing Co., Prince's Bay, Staten Island, N.Y., U.S.A., Dental Enamel Manufacturer.

1894. Johnston, Wm. E. Lawson. *See* Lawson-Johnston, W. E.

O.M. Johnston, Wm. G., Anchor Chemical Works, 1005, Garngad Road, Glasgow, Technical Chemist.

O.M. Johnstone, Jas., Shawfield Works, Rutherglen, Glasgow, Technical Chemist.

1903. Johnstone, S. J., 15, Springfield Road, New Southgate, N., Research Chemist.

O.M. Johnstone, W. G., The Brewery, Newark-on-Trent, Chemist.

1902. Jollyman, Walter H., Government Laboratory, P.O. Box 1080, Johannesburg, Transvaal.

1903. Jones, Alfred O., c/o Carr and Co., Caldewgate, Carlisle, Works Chemist.

1897. Jones, Chas. H., El Cobre Mines, Santiago de Cuba, Cuba, Technical Chemist.

1902. Jones, David R., Standard Chemical Co., Deseronto, Ont., Canada, Chemical Engineer.

1902. Jones, E. Strangways, Sulphide Corporation, Ltd., Cockle Creek, N.S.W., Australia, Metallurgical Chemist.

O.M. Jones, E. W. T., 10, Victoria Street, Wolverhampton, Analytical Chemist.

1897. Jones, Fred. W., 96, Downs Park Road, Clapton, N.E., Explosives Works Manager and Chemist.

1896. Jones, G. Cecil, Wisteria Cottage, Manningtree, Essex, Works Chemist.

1903. Jones, G. Robert, Gas Works, Caixa 147, Pernambuco, Brazil, Gas Engineer.

1898. Jones, Henry, Broughton Bridge Mills, Salford, Dyer and Finisher.

O.M. Jones, H. Chapman, Royal College of Science, South Kensington, S.W., Senior Demonstrator in Chemistry.

1893. Jones, Herbert. *See* Sefton-Jones, H.

1901. Jones, Herbert J., c/o The Scottish Acid and Alkali Co., Ltd., Kilwinning, N.B., Chemist.

1899. Jones, Llewellyn J. W., Tacoma Smelting Co., Tacoma, Wash., U.S.A., Metallurgist.

1898. Jones, Martin L., c/o Ooregum G. M. Co., Oorgaum, Mysore State, India, Metallurgical Chemist.

1894. Jones, M. W., Greystonedale, Kensington Hill, Bristol, Manager (Oil and Colour Works).

1887. Jones, T. Tolley, 356, Little Collins Street, Melbourne, Victoria, Explosives Manufacturer.

1903. Jones, Wm. App, c/o Boston Artificial Leather Co., 12, E. 18th Street, New York City, U.S.A., Chemist.

1903. Jones, Wm. James, jun., Purdue University, La Fayette, Ind., U.S.A., Chemist.

O.M. Jones, W. Norris, Lancashire Metal Works, Widnes, Technical Chemist.

1902. Jonker Czn., Hendrik, Hotel zum Weiszen Ross, Worth a S, Germany, Chemical Engineer.

1899. Joplin, Geo. C., 12, Harrington Street, Sydney, N.S.W., Australia, Analyst.

1904. Jordan, Stanley, 100, William Street, New York City, U.S.A., Importer of Chemicals.

1897. Jorissen, Dr. Wm. P., Koninklijk Inst. v. d. Marine, Willemsoord, Holland, Editor.

1900. Josephson, Edgar, 131, Amity Street, Brooklyn, N.Y., U.S.A.

1891. Joslin, Omar T., 3223, Spring Grove Avenue, Cincinnati, Ohio, U.S.A., Chemical Engineer.

1887. Joüet, Dr. C. H., Roselle, Union Co., N.J., U.S.A., Technical Chemist.

1889. Journand, Louis, 21, Grand Rue, Bourg-de-Péage, Drôme, France, Technical Chemist.

1888. Joy, Douglas G., The Rookery, Stevenage, Herts, Oil Refiner.

1903. Joyce, Clarence M., c/o Arlington Co., Arlington, N.J., U.S.A., Chemist.

1887. Jürgensen, Dr. Rolof, Karlsgasse 5, Prag-Zizkov, Austria, Chemist.

1900. Just, Jno. A., Jefferson Avenue and Delano Street, Pulaski, Oswego Co., N.Y., U.S.A., Chemist.

O.M. Justice, P. M., 55–56, Chancery Lane, London, W.C., Patent Agent.

K

1898. Kahn, Julius, 100, West 80th Street, New York City, U.S A., Manufacturer of Rubber Goods.

1896. Kalbfleisch, Franklin H., 33–35, Burling Slip, New York City, U.S.A., Chemical Manufacturer.

1884. Kalle, Dr. Wm., Biebrich-am-Rhein, Germany, Colour Manufacturer.

1899. Karas, Jno., c/o Buffalo Shirt Co., 565-577, Washington Street, Buffalo, N.Y., U.S.A., Laundryman.

1901. Kasson, Henry R , 1209, Stock Exchange Building, Chicago, Ill., U.S.A., Asphalt Chemist.

1903. Katz, Dr. B. Alexander, Patentbureau Richard Lüders, Görlitz, Schlesien, Germany, Patent Agent.

1901. Kauder, Dr. E., c/o Merck and Co., Rahway, N.J., U.S A., Chemist.

1903. Kauffman, Milton H., American Smelting and Refining Co., Durango, Colo., U.S.A., Chemist.

1892. Kaufmann, Dr. Herbert M., c/o Mutual Chemical Co., Jersey City, N.J., U.S.A., Chemist.

1904. Kawai, I., 54, Shidamachi Shirokane, Shiba, Tokyo, Japan, Chemist.

1885. Kawakita, Michitada, Imperial Engineering College, Tokio, Japan, Analytical Chemist.

O.M. Kay, Wm. E., Marple Lodge, Marple, Cheshire, Printworks Chemist.

1897. Kearns, Jno. S., Baxenden House, near Accrington, Chemist and Dyer.

1894. Kebler, Lyman F., Department of Agriculture, Bureau of Chemistry, Washington, D.C., U.S.A., Chief of Drug Laboratory.

1886. Keiser, Prof. E. H., Washington University, St. Louis Mo., U.S.A., Professor of Chemistry.

1900. Kelf, Henry C.,
Sugar Chemist.

1900. Kellner, Dr. Carl, (Journals) Laby., Borschkegasse No. 8, Vienna, IX 2; and (Subscriptions) Hohe Warte No. 29, Vienna XIX., Austria, Paper Chemist.

885. Kellner, Dr. Wm., 135, Victoria Road, Old Charlton, S.E., Chemist to War Department.

901. Kelsey, Jas. W., c/o Pharmacie Swann, 12, Rue Castiglione, Paris, France, Chemist and Metallurgist.

1889. Kempson, John F., Pye Bridge Chemical Works, near Alfreton, Derbyshire, Chemical Manufacturer.

1901. Kennedy, Alex., Kenmill House, Bothwell, N.B., Rosin Distiller.

1903. Kennedy, Hugh Watson, 626, South 19th Street, Philadelphia, Pa., U.S.A., Chemist.

1891. Kenrick, Prof. Edgar B., 282, Assiniboine Avenue, Winnipeg, Manitoba, Canada, Prof. of Chemistry.

1901. Kenrick, Dr. Frank B., 209, John Street, Toronto, Canada, Lecturer on Chemistry.

1888. Kent, Wm. J., "Parterre," Sandown, I. of W., Assayer and Chemical Engineer.

1903. Kenyon, Percy S., 15, Rook Street, Manchester, Drysalter.

1889. Kenyon, Thos., The Shrubbery, Hilton Park, Prestwich, near Manchester, Manufacturing Chemist.

1900. Keppelmann, Alf. J., P.O. Box 1549, Philadelphia, Pa., U.S.A., Chemical Merchant.

1888. Ker, Alan D., Millburn Chemical Works, Garngad Hill, Glasgow, Chemical Manufacturer.

1899. Kern, Walter P., 282, Lafayette Avenue, and (Journals) c/o General Chemical Co., Dundee Works, Passaic, N.J., U.S.A., Chemist.

1894. Kerr, Jas., Surgeons Hall, Edinburgh, Lecturer on Chemistry.

1890. Kerr, Saml. T., 516, North Delaware Avenue, Philadelphia, Pa., U.S.A., Salt Manufacturer.

1897. Kerr, Wm. M., c/o General Chemical Co., 608, Philadelphia Bourse, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

1896. Kershaw, Jno. B. C., Faraday House, 8, Charing Cross Road, London. W.C., Analytical Chemist.

1902. Kessler, Henry W., Brandt, Susquehanna Co., Pa., U.S.A., Manufacturing Chemist.

1903. Kessler, R., jun., Brandt, Susquehanna Co , Pa , U.S.A., Chemical Manager.

1893. Kestner, Paul, 5, Rue de Toul, Lille, France, Chemist.

1898. Keswick, Wm., M.P., 3, Lombard Street, London, E.C., Merchant.

1900. Kewley, Jas., Arbory Road, Castletown, Isle of Man, Technical Chemist.

1890. Keys, W. H., Lyndon House, West Bromwich, Oil and Chemical Manufacturer.

1892. Kibble, W. Oakes, G.P.O., Denver, Colo., U.S.A., Chemical Engineer.

1896. Kier, Thos., Thornliebank, Glasgow, Chemist.

1900. Kilgore, Benj. W., Raleigh, N. Carolina, U.S.A., Chemist.

1901. Kilmer, Fred. B., New Brunswick, N.J., U.S.A., Chemical Manufacturer.

O.M. Kinch, E., Royal Agricultural College, Cirencester, Professor of Chemistry.

O.M. King, A. J., (Journals) Ingersley Vale, and (communications) Rock Bank, Bollington, near Macclesfield, Bleacher and Finisher.

1884. King, C. M., Campsie Alum Works, Lennoxtown, N.B., Alum Manufacturer.

O.M. King, J. Falconer, 20, Chambers Street, Edinburgh, Consulting Chemist.

1897. King, Joshua, Clarewood, Camberley, Surrey, Indian Civil Service (retired).

1887. King, Robt., 115, Wellington Street, Glasgow, Chemical Manufacturer.

1895. King, Sidney J., 49, Arundel Square, Barnsbury, N., Colour and Dyestuff Traveller.

O.M. King, Walter R., (Journals) Avalon, Trinity Avenue, Southend-on-Sea; and (Subscriptions) 16, Mincing Lane, E.C., Chemical Manufacturer.

1903. King, William, c/o Natal Estates, Ltd., South Coast Junction, Natal, S. Africa, Analytical Chemist.

1899. King, Wm. R., Box 695, Summit, N.J., U.S.A., Mechanical Engineer.

1896. Kingdon, G. Holman, 27, Grappenhall Road, Stockton Heath, Warrington, Technical Chemist.

1883. Kingsford, T. P., Oswego, N.Y., U.S.A., Starch Manufacturer.

O.M. Kingzett, C. T., Elmstead Knoll, Chislehurst, Kent, Technical Chemist.

1892. Kinnicutt, Professor L. P., 77, Elm Street, Worcester. Mass., U.S A., Professor of Chemistry (Worcester Polytechnic Institute).

1897. Kipping, Dr. F. Stanley, F.R.S., University College, Nottingham, Prof. of Chemistry.

1898. Kirkland, Archd., 78, High Street, Irvine, N.B., Baker.

1897. Kirkland, Robt., Grand Junction Glue and Chemical Co., Ltd., Market Harborough, Chemist.

1900. Kirkpatrick, Stafford F., 96, Barrie Street, Kingston, Ont., Canada, Assayer.

1887. Kitamura, Y. (Journals), c/o R. Fujihanaya, Yokoyamacho Sanchome, Tokyo, Japan, Agricultural Chemist.

1902. Kitchen, Wm. J., Port Melbourne North, Vic., Australia, Soap and Candle Manufacturer.

1891. Kitson, Sir James, Bart., M.P., Gledhow Hall; and (Journals) Monkbridge Iron and Steel Co., Ltd., Leeds, Iron and Steel Manufacturer.

1883. Kitto, B., 26, Lancaster Road, Finsbury Park, London, N., Analytical Chemist.

1900. Kittredge, H. G., 42, Linden Avenue, Dayton, Ohio, U.S.A., Chemist.

1900. Kleber, Dr. Clemens, Union Avenue, Clifton, N.J., U.S.A., Director (Fritzche Bros.' Laboratory).

1888. Kleemann, Dr. S., Farben Fabrik, Forchheim, Bavaria, Analytical Chemist.

1898. Klein, Otto H., Room 110, Stewart Building, 280, Broadway, New York City, U.S.A., Consulting Engineer.

1903. Kline, Clarence M., c/o Smith, Cline, and French Co., Canal and Poplar Streets, Philadelphia, Pa, U.S.A., Wholesale Druggist.

1889. Klipstein, A., 122, Pearl Street, New York City, U.S.A., Chemical Manufacturer.

1902. Klipstein, Ernest C., 116, Prospect Street, East Orange, N.J., U.S.A., Chemical Manufacturer.

1891. Knaggs, Alfred B., Bradley Lane, Huddersfield, Technical Chemist in Dyeworks.

1900. Knapp, Rudolf E., 208, Observatory Street, Ann Arbor, Mich., U.S.A., Chemist.

1892. Knecht, Dr. E., Municipal School of Technology, Manchester: and (Journals) 5, Station Road, Crumpsall, Manchester, Professor of Tinctorial Chemistry.

1887. Knight, A. H., 2, Gerald Road, Oxton, Cheshire, Assayer.

1903 Knight, Harley F., 64, Amhurst Park, Stamford Hill, N., Analyst.

1384. Knight, Henry, Stanley House, 73, Anfield Road, Liverpool, Colour and Varnish Manufacturer.

O.M. Knight, J. B., Silvertown Soapworks, Silvertown, London, E., Soap Manufacturer.

1887. Knights, J. West, Public Laboratory, Tenison Road, Cambridge, Analytical Chemist.

1885. Knipler, F., c/o R. Harper and Co., Port Melbourne, Victoria, Starch Manufacturer.

1883. Knowles, Joshua, Stormer Hill, Tottington, near Bury, Calico Printer.

1886. Knox, E. W., Colonial Sugar Refining Co., Sydney, N.S.W.; and c/o Parbury Henty & Co., 20, Eastcheap, London, E.C., Sugar Manufacturer and Refiner.

1902. Knudsen, Hans, 29A, Gillingham Street, London, S.W., Inventor.

1904. Koch, J. A., Bluff and Pride Streets, Pittsburg, Pa., U.S.A., Chemist.

1903. Koch, Walter E., c/o Lustre Mining Co., Sta. Maria del Oro, *via* Parral, Ese Durango, Mexico, Metallurgical and Mining Engineer.

1904. Koebig, Dr. J., 828, East 3rd Street, Los Angeles, Cal., U.S.A., Chemical Engineer.

1895. Koechl, Victor, P.O. Box 159, New York City; (Journals) 47, Montgomery Place, Brooklyn, N.Y., U.S.A., Dye Merchant.

1901. Koehler, Dr. H., c/o Roessler and Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Manager.

1884. Kohn, Dr. Charles A., M.Sc., Sir John Cass' Technical Institute, Jewry Street, Aldgate, E.C., Principal.

1902. Kohnstamm, Lothair S., 87, Park Place, New York City, U.S.A., Chemist.

1884. Kolb, J., Soc. Anon. des Manuf. de Produits Chimiques, Lille, France, Chemical Manufacturer.

1902. Kottmann, Dr. Gustav, Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.

O.M. Kraftmeier, E., 54, Parliament Street, Westminster, S.W., Explosives Manufacturer.

1894. Krause, Dr. Albert H., 32, Wellington Avenue, Cleveland, Ohio, U.S.A., Chemist (Grasselli Chemical Co.).

O.M. Krause, Prof. Dr. G., "Chemiker-Zeitung," Cöthen, Germany, Editor.

O.M. Krause, O. H., c/o American Sugar Refining Co., Jersey City, N.J., U.S.A., Chemical Engineer.

1898. Krebs, H. J., Wilmington, Del., U.S.A., Manufacturing Chemist.

1903. Kremer, Frank N., 646, Broadway, Milwaukee, Wis., U.S.A., Chemist.

1900. Kremers, Dr. Edw., Madison, Wis., U.S.A., Professor (University of Wisconsin).

O.M. Kühl, W. H., 73, Jägerstrasse, Berlin, Germany, Bookseller.

1900. Kunheim, Dr. Erich, 32, Dorotheenstrasse, Berlin, N.W., Germany, Chemist.

1885. Kupferberg, Dr. H., 19, Schulstrasse, Mainz, Germany, Technical Chemist.

1896. Kuttroff, Adolf, 128, Duane Street, New York City, U.S.A., Chemical Merchant.

1900. Kuttroff, Fred., 128, Duane Street, New York City, U.S.A., Merchant.

1904. Kyle, J., Canada Paint Co., Ltd., 572, William Street, Montreal, Canada, Analytical Chemist.

O.M. Kynaston, J. W., 3, Oak Terrace, Beech Street, Liverpool, Chemical Engineer.

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1897. Lahonde, Dr. Leon, 172, South Main Street, Albion, Orleans Co., N.Y., U.S.A., Consulting Chemical Engineer.

1890. Lacey, E. C., 10, Clarence Road, Croydon, Manufacturing Chemist.

O.M. Lacey, T. S., Gas Works, York Road, King's Cross, London, N.W., Gas Engineer.

1899. Lachman, Albert, California Wine Association, San Francisco, Cal., U.S.A., Wine Merchant.

1903. Lachman, Dr. Arthur, 131, Second Street, San Francisco, Cal., U.S.A., Chemical Engineer.

1888. Lagerwall, Dr. Ivar, Sunthorpe, Wallington, Surrey, Petroleum Manufacturer.

O.M. Laidler, C. P., 20, Noble Terrace, Gateshead-on-Tyne, Analytical Chemist.

1902. Laist, Fredk., Chemical Department, University of Utah, Salt Lake City, Utah, U.S.A., Chemist.

O.M. Lake, G., jun., 83, Primrose Lane, Glossop, Derbyshire, Analytical Chemist.

1900. Lamar, Wm. R., c/o Mallinckrodt Chemical Works, St. Louis, Mo., U.S.A., Chemist.

1898. Lamb, Morris Chas., 151, Westcombe Hill, Blackheath, S.E., Chemist.

1900. Lambert, Walter S., Morriston Place, Clydach, R.S.O., Glamorgan, Analyst.

1899. Lamborn, Leebert Lloyd, 134, Willoughby Avenue, Brooklyn, N.Y., U.S.A., Factory Superintendent.

1895. Lancaster, Jno. C., 260, Alfreton Road, Nottingham, Engineering Works Manager.

1904. Lancey, Darragh de, Great Barrington, Mass., U.S.A. Secretary and Assistant General Manager of Stanley Instrument Co.

1900. Lander, Geo. D., Royal Veterinary College, Camden Town, N.W., Lecturer.

1895. Landin, John, 40, Drottninggatan, Stockholm, Sweden, Public Analyst.

1903. Lane, Nathaniel J., U.S. Laboratory, 641, Washington Street, Manhattan Borough, New York City, U.S.A., Analytical Chemist.

1890. Lang, Jas. G., Dominion Hotel, Victoria, B.C., Canada, Analytical Chemist.

1893. Lang, Dr. Wm. R., University of Toronto, Canada, Professor of Chemistry.

O.M. Langdon, Dr. M. J., 16, Harriet Street, Stretford, Manchester, Analytical Chemist.

1890. Lange, Dr. Martin, 28, Hermitage Road, Crumpsall, Manchester, Analytical Chemist.

1892. Langer, Dr. Carl, Ynyspenllwch, Clydach, R.S.O., Glamorganshire, Analytical Chemist.

1897. Langmuir, Arthur C., c/o Marx and Rawolle, 9, Van Brunt Street, Brooklyn, N.Y., U.S.A., Analytical Chemist.

1902. Langmuir, F. Leighton, Beau Séjour, Freiburg i/B, Germany, Chemist.

1898. Langstaff, Wm., c/o Grasselli Chemical Co., Tremley, N.J., U.S.A., Chemist.

1900. Lant, Herbert, "Ivy Bank," Wath-on-Dearne, near Rotherham, Yorks., Chemist and Manager.

1903. Larter, Alfred T., The Basingstoke Ironworks, Basingstoke, Hants, Chemist.

1884. Latham, Baldwin, Parliament Mansions, Victoria Street, Westminster, S.W., Civil Engineer.

1889. Latham, J. J., Mill House, Bold, Widnes, Chemical Works Manager.

O.M. Lawrence, Jas., Box 707, Joplin, Mo., U.S.A., Explosives Manufacturer.

O.M. Laws J. P., 2, Aigburth Vale, Liverpool, S., Analytical Chemist.

1885. Lawson, Arthur J., Marsh Soapworks, Bristol, Soap Manufacturer.

1900. Lawson, Wm., c/o Utah Sugar Co., Salt Lake City, Utah, U.S.A., Chemist.

1894. Lawson Johnston, G., c/o Bovril, Ltd., 152, Old Street, London, E.C., Vice-Chairman.

1894. Lawson-Johnston, W. E., c/o Bovril, Ltd., 152, Old Street, London, E.C., Director.

1893. Lawton, Thos., Calthorpe House, Aldridge Road, Perry Barr, Birmingham, Chemical Works Manager.

1890. Laycock, Dr. W. F., 46, Boar Lane, Leeds, Analytical Chemist.

1902. Lazell, Ellis Warren, 1619, Filbert Street, Philadelphia, Pa., U.S.A., Chemist.

1898. Lean, Geo., 15, Park Terrace, Glasgow, Chemist.

1897. Leathart, Thos. H., Lead Works, Newcastle-on-Tyne, Lead Manufacturer.

O.M. Leather, Dr. J. Walter, Dehra Dun, United Provinces, India, Government Agricultural Chemist.

1893. Le Boutillier, Clement, c/o Taylor Iron and Steel Co., High Bridge, N.J., U.S.A., Chemist.

1896. Lecomber, W. G., Beech House, Ashton Grove, Ashton-on-Mersey, Cheshire, Engineer.

1896. Lederle, Dr. E. J., Health Department, New York City, U.S.A., Chief Chemist.

1892. Ledoff, Prof. A., Technological Institute, Kharkoff, Russia, Professor of Chemistry.

1895. Ledoux, Dr. Albert R., 99, John Street, New York City, U.S.A., Chemist.

1903. Ledoux, Aug. D., 68, Beaver Street, New York City, U.S.A., Importer of Pyrites.

1901. Lee, FitzHugh, c/o Grasselli Chemical Co., Cleveland, Ohio, U.S.A., Superintendent.

1898. Lee, Jno. L., Woodfield, Lytham, Lancashire, Dyer and Bleacher.

1885. Lee, S. Wright, 6–10, Whitechapel, Liverpool, Wholesale Druggist.

1899. Lee, Waldemar, 4620, Wayne Street, Philadelphia, Pa., U.S.A., Chemist.

1886. Leeds, F. H., 26, East Bank, Stamford Hill, N., Analytical Chemist.

1903. Leerburger, Henry, 54, Beekman Street, New York City, U.S.A., Essential Oil Merchant.

1889. Leese, Joseph, 3, Lord Street West, Southport.

1903. Leese, Jos., jun., 392, Dickenson Road, Longsight, Manchester, Analytical and Technical Chemist.

1901. Lefebvre, Georges, Compagnie du Phospho-Guano, 60, Rue de Bondy, Paris, Director.

1901. Leffler, Rudolf L., c/o Thos. Firth and Sons, Ltd., Norfolk Works, Sheffield, Metallurgical Chemist.

1901. Leibfried, Jno. E., Bethlehem, Pa., U.S.A., Analytical Chemist.

1888. Leigh, Cecil, Birmingham Metal and Munition Co., Adderley Park Rolling Mills, Birmingham, Technical Chemist.

1902. Leighton, A. E., Aruvankad, Nilgiris, India, Analytical Chemist.

1894. Leitch, Jno. W., Milnsbridge Chemical Works, near Huddersfield, Aniline Dye Manufacturer.

1898. Leman, Wm. T., c/o Lake Carriers Oil Co., Coraopolis, Pa., U.S.A., Oilworks Manager.

1901. Lengfeld, Dr. Felix, 202, Stockton Street, San Francisco, Cal., U.S.A., Manufacturing Chemist.

1883. Lennard, F., 70, Gracechurch Street, E.C.; and (Journals) 29, Adelaide Crescent, Hove, Sussex, Chemical Manufacturer.

1884. Leonard, Wm. J., Hope Chemical Works, Hackney Wick, E., Naphtha Distiller.

1903. Lepsius, Prof. Dr. B., Griesheim a/M., Germany, Director (Chem. Fabr. Griesheim Elektron).

1888. Lequin, E., Directeur Général des Usines de Produits Chimiques de la Société de St. Gobain, 1, Place des Saussaies, Paris (VIII^e.).

1894. Leslie, Hugh M., Marikuppam, Mysore State, South India, Chemical Engineer.

1899. Lesser, Wm., P.O. Box 162, Albany, N.Y., U.S.A., Manufacturing Chemist.

1901. Lessing, Dr. Rudolf, c/o The Gas Light and Coke Co., Tar and Liquor Works, Beckton, and (Journals) 98, Milton Avenue, East Ham, E., Chemist.

1900. Lessner, Chas. B., San Finx Tin Mines, Ltd., Carrill, Spain, Metallurgical Chemist.

1896. Lester, Isaac E., 57, Westminster Road, Handsworth, Birmingham, Steelworks Manager.

1892. Lester, J. H., Royal Exchange, Manchester, Analytical Chemist.

1899. Le Sueur, Dr. Henry R., Chemical Laboratory, St. Thomas' Hospital, London, S.E., Demonstrator.

1894. Lett, Stephen J., 149, Lupus Street, London, S.W., Chemical Engineer.

1898. Leuthardt, Peter, 33, Rydal Gardens, Streatham, London, S.W., Chemical Manufacturer.

1891. Lever, Wm. H., Thornton House, Thornton Hough, Cheshire, Soap Manufacturer.

1901. Levett, Walter, Fairview, St. Margaret's Avenue; and (Journals) Mines Safety Explosives Co., Stanford-le-Hope, Essex, Factory Manager.

1903. Levi, Louis E., c/o Pfister and Vogel Leather Co., Milwaukee, Wis., U.S.A., Chemist.

1900. Levine, Edmund J., c/o The Fiberloid Co., 7, Waverley Place, New York City, U.S.A., Chemist.

1901. Levinstein, Dr. Herbert, (Journals) Hawkesmoor, Fallowfield, and (communications) 21, Minshull Street, Manchester, Chemist.

O.M. Levinstein, Ivan, (Journals) Hawkesmoor, Fallowfield, and (communications) 21, Minshull Street, Manchester, Colour Manufacturer.

1903. Levy, Arthur G., 219, Elgin Avenue, Maida Vale, W., Chemist.

1901. Levy, Dr. Albert, The Mond Nickel Co., Ltd., Clydach, R.S.O., Glamorgan, Works Chemist.

1887. Lewes, Prof. Vivian B., Royal Naval College, Greenwich, S.E. Professor of Chemistry.

1898. Lewin, H. James, Royal Victoria Yard, Deptford, S.E., Analytical Chemist.

1889. Lewis, A. E., 56, Thomas Lane, Knotty Ash, Liverpool, Analytical Chemist.

1896. Lewis, Daniel C., c/o Millville Manufacturing Co., Millville, N.J., U.S.A., Dye and Bleach Works Chemist.

1900. Lewis, Ernest A., 310, Dudley Road, Birmingham, Chemist and Metallurgist.

1904. Lewis, E. W., 97, Belgrave Road, Ilford, E., Chemist.

1902. Lewis, Fredk. H., Fordwick, Va., U.S.A., Manager (Virginia Portland Cement Co.).

1903. Lewis, Fred. J., c/o Moss Chemical Co., 15, Carlaw Avenue, Toronto, Ont., Canada, Manufacturing Chemist.

1900. Lewis, John, 10, Windsor Road, Denmark Hill, S.E., Cashier (Paint Works).

1900. Lewis, Saml. J., 122, Newington Causeway, London, S.E., Pharmaceutical Chemist.

1889. Lewkowitsch, Dr. Julius, 71, Priory Road, West Hampstead, N.W., Consulting Chemist.

1901. Lichtenstein, Alf. S., Arnold Printworks, North Adams, Mass., U.S.A., Chemist.

O.M. Lichtenstein, Theodore, Chemical Works, Silvertown, E., Manufacturing Chemist.

1892. Liddle, G. A., 469, Walmersley Road, Bury, Lancs., Chemist, Dyewood Extract Works.

1885. Liddle, W. T., 14, Willows Avenue, Ansdell, Lytham, Lancs., Manager, Dyewood Extract Works.

O.M. Liebmann, Dr. A., 10, Marsden Street, Manchester, Analytical Chemist.

1899. Liedbeck, P. F. Alarik, 43, Strandwagen, Stockholm, Sweden, Chemical Engineer.

O.M. Lightfoot, T. E., 88, Arden Terrace, Accrington, Calico Printer's Chemist.

1898. Lilly, Josiah K., c/o Eli Lilly and Co., Indianapolis, Ind., U.S.A., Manufacturing Pharmacist.

1885. Lilly, Oliver M., The Croft, Spondon, Derby, Colour Manufacturer.

1903. Lindmueller, C., c/o The Ohio Farmers' Fertilizer Co., 882, Prospect Street, Cleveland, Ohio, U.S.A., Chemist.

1897. Lindsay, Robt., Rosshead, Alexandria, N.B., Chemist.

1901. Lindsay, Robt. D., P.O. Box 4654, Johannesburg, Transvaal, Chemist.

1890. Ling, Arthur R., Laboratory, 74, Great Tower Street, E.C., and (Journals) Hazeldene, Kingston Road, New Malden, Analytical and Consulting Chemist.

1904. Link, J., 92, Harrow Road, Leytonstone, N.E., Chemical Manufacturer.

1901. Lippincott, Warren B., c/o American Smelting and Refining Co., Argentine, Kansas, U.S.A., Chemist.

1896. Lishman, Geo. P., Bunker Hill, Fence Houses, Co. Durham, Colliery Chemist.

1896. Littell, R. Ballantine, 50, South Walnut Street, East Orange, N.J., U.S.A., Chemist.

1901. Little, C. A., Elyria, Ohio, U.S.A., Analytical Chemist.

1889. Little, Wm. G., Blendon Grove, Bexley, Kent, Chemical Manufacturer.

O.M. Littlejohn, Jas., c/o African Banking Corporation, Johannesburg, Transvaal, Analytical Chemist.

1902. Littlewood, Dr. Jas. B., U.S. Patent Office, Washington, D.C., U.S.A., Chemical Examiner.

1904. Livermore, W. D., Washington Mill, Lawrence, Mass., U.S.A., Chemist.

1886. Liversedge, A. J., Clock House, Arundel Street, Strand, W.C., Mechanical Engineer.

O.M. Liversidge, Prof. A., F.R.S., Professor of Chemistry.

1883. Livingston, W. J., London County Council, Spring Gardens, London, S.W., Analytical Chemist.

1903. Llewellyn, Ivor P., c/o Peter Spence and Sons, Ltd., Manchester Alum Works, Manchester, Chemist.

1899. Lloyd, Charles, (subscriptions) c/o Lake View Consols, Ltd., Salisbury House, London Wall, London, E.C.; and (Journals) c/o Manager, Lake View Consols, Ltd., Boulder, Western Australia, Secretary.

1900. Lloyd, Fred. J., Muscovy House, Trinity Square, London, E.C., Analyst.

1900. Lloyd, Thos. H., c/o Quibell Bros., Newark, Analyst.

1901. Lober, Jno. B., Vulcanite Portland Cement Co., 1230, Land Title Building, Philadelphia, Pa., U.S.A., Cement Manufacturer.

1899. Loder, Francis H., 9, St. John's Park, Blackheath, S.E., Director.

1888. Lodge, Edw., 25, Seale Hill, Cowcliffe, Huddersfield, Teacher of Wool Dyeing.

1900. Loeb, Dr. Morris, New York University, University Heights, New York City, U.S.A., Professor of Chemistry.

1891. Loewenthal, Dr. R., Uhlandstrasse, 39, Frankfurt a/M., Germany, Textile Chemist and Lecturer on Dyeing.

1899. Logan, John, Offendene, Oakfield Drive, Ashton-on-Mersey, Indigo-Blue Dyer.

O.M. Lomas, T., 5, Esmond Gardens, Bedford Park, W., Chemical Manufacturer.

1888. Lombard, Emile, 12, Rue Breteuil, Marseilles, France, Director of Pyrites Co.

1901. Long, Eugene J., c/o E. O'Callaghan and Son, City Tannery, Limerick, Ireland, Tanner.

1902. Longden, Alf. Hy., Stanton-by-Dale, Nottingham, Analytical Chemist.

1898. Longstaff, Jas. P., Chemical Department, The University, Edinburgh, Assistant.

1901. Loomis, Dr. H., 58, West 40th Street, New York City, U.S.A.

1902. Loomis, Henry M., Box 166, Niagara Falls, N.Y., U.S.A., Chemist.

1890. Lord, F. J., 4, Winmarleigh Street, Warrington, Analytical Chemist.

1896. Lord, Jno. Lloyd, 23, Park View, Elton, Bury, Lancs., Chemist and Manager.

1897. Lord, N. W., 338, West 8th Avenue, Columbus, Ohio, U.S.A., Professor of Metallurgy.

O.M. Lorenz, H., 7 and 8, Idol Lane, London, E.C., Chemical Merchant.

O.M. Lorimer, J., Britannia Row, Islington, N., Manufacturing Chemist.

O.M. Lorrain, J. G., Norfolk House, Norfolk Street, Strand, London, W.C., Civil Engineer.

O.M. Lott, F. E., The Laboratory, Bridge Chambers, Burton-on-Trent, Consulting Brewing Chemist.

O.M. Louis, D. A., 77, Shirland Gardens, London, W., Metallurgist and Mining Engineer.

1891. Louis, Prof. Henry, Durham College of Science, Newcastle-on-Tyne, Professor of Mining.

O.M. Love, Dr. E. G., 80, East 55th Street, New York City, U.S.A., Analytical Chemist.

1899. Love, Wm., 28, Royal Exchange Square, Glasgow, Managing Director (Broxburn Oil Co., Ltd.).

1895. Lovejoy, Frank W., Kodak Park, Rochester, N.Y., U.S.A., Chemical Engineer.

1904. Loveland, Jas. W., 8, Kenwood Street, West Somerville, Mass., U.S.A., Superintendent of Soap Works.

O.M. Lovibond, J. W., Lake House, Salisbury, Tintometer Manufacturer.

O.M. Lovibond, T. W., West Jesmond House, Newcastle-on-Tyne, Brewer.

1897. Low, Albert H., P.O. Drawer 1537, Denver, Colo., U.S.A., Metallurgical Chemist.

1900. Low, Prof. Wilson H., Cudahy Packing Co., South Omaha, Neb., U.S.A., Chemist.

1887. Lowe, Clement W., Cornbrook, Legh Road, Knutsford, Cheshire, Manufacturing Chemist.

O.M. Lowe, W. F., 9, Hough Green, Chester, Analytical Chemist.

1885. Lowson, J. G. F., Hollycot, Lasswade, N.B., Paper Maker.

1895. Lucas, Alf., Survey Department, Public Works Ministry, Cairo, Egypt, Analyst.

1892 Lucas, Bernard R., 3, Dyar Terrace, Winnington, Northwich, Alkali Works Manager.

O.M. Lucas, R., Alwinenstrasse 11, Wiesbaden, Germany, Technical Chemist.

O.M. Luck, Alf., Luck's Explosives, Ltd., Stowmarket, Suffolk, Explosives Chemist.

1900. Lummus, Walter E., 62, Newhall Street, Lynn, Mass., U.S.A., Manager (Commonwealth Manufacturing Co.).

1903. Lumsden, Alex. A., Forth Chemical Works, Bo'ness, N.B., Technical Chemist.

1888. Lund, Jas., 142, Hawthorne Street, Malden, Mass., U.S.A., Ammonia Works Manager.

1888. Lundholm, Carl O., Journals to Nobel's Explosives Co., Ltd., Ardeer Factory, Stevenston, Ayrshire, Explosives Works Manager.

1898. Lundteigen, Andreas, Union City, Mich., U.S.A., Chemist.

O.M. Lunge, Prof. Dr. G., Steinwiesstrasse 40, Zürich, V., Switzerland, Professor of Chemistry.

1894. Lungwitz, Theo., c/o Chas. Pfizer and Co., 81, Maiden Lane, New York City, U.S.A., Superintending Chemist.

1885 Lupton, Sydney A., 102, Park Street, Grosvenor Square, London, W.

1890. Luthy, Edmund O., 2419, Ohio Avenue, Cincinnati Ohio, U.S.A., Distiller.

1884. Lüthy, Otto, Maywood, N.J., U.S.A., Analytical Chemist.

1895. Luxmoore, Dr. Chas. M., University College, Reading, Lecturer on Chemistry.

1899. Luxton, Thos., 28, Albany Street, Hull, Teacher of Chemistry.

1903. Lye, Ernest B., Leagrave Hall, near Luton, Beds., Straw Plait Dyer and Bleacher.

1885. Lye, W. T., Leagrave Hall, near Luton, Beds, Straw Dyer.

1884. Lyle, James, Ardenco, Plaistow Wharf, Victoria Docks, E., Sugar Refiner.

1885. Lyle, Jno., 21, Mincing Lane, London, E.C., Sugar Refiner.

1902. Lyle, Robert F., Berry Yards Sugar Refinery, Greenock, N.B., Analytical Chemist.

1889. Lymn, Arthur H., 125, Alexandra Road, Wimbledon, Chemical Works Manager.

1899. Lynn, R. Rankine, 7, Highburgh Terrace, Dowanhill, Glasgow, Chemical Engineer.

1899. Lynn, Vaughan G., , Merchant.

1898. Lynne, Miss Mary S., 421, Wood Street, Pittsburg, Pa., U.S.A., Chemist.

1902. Lyon, Edwd. H., 520, West 27th Street, New York City, U.S.A., Manufacturing Chemist.

O.M. Lyon, J. G., The Aire Tar Works, Knottingley, Yorks, Tar Distiller.

O.M. Lyte, F. Maxwell, 60, Finborough Road, Radcliffe Square, London, S.W., Chemical Manufacturer.

O.M. Lytle, A. M., North of Ireland Chemical Co., Ltd., 31, Victoria Street, Belfast, Ireland, Chemical Manufacturer.

M

1898. Maass, Frank, P.O. Box 507, Paterson, N.J., U.S.A., Silk Dyer.

1887. Mabery, Prof. Chas. F., Case School of Applied Science, Cleveland, Ohio, U.S.A., Professor of Chemistry.

1894. Mabey, Fred O., 196, Amhurst Road, Hackney, N.E., Wine Merchant.

1891. Macadam, Herbert E., Milton House, Selsdon Road, Wanstead, E., Manure Works Manager.

1894. Macadam, Stevenson, 55, York Place, Edinburgh, Analytical Chemist.

1894. McAlley, Robt., Bankside, Falkirk, N.B., Paint Works Manager.

1891. Macallan, J., 3, Rutland Terrace, Clontarf, Dublin, Analytical Chemist.

1892. Macara, Thos., jun., c/o Jas. Robertson and Sons, Thrushgrove Works, Paisley, N.B., Chemist.

1889. McArthur, Jno., 196, Trinity Road, Wandsworth Common, S.W., Chemist.

1887. McArthur, J. B., Price's Patent Candle Co., Limited, Bromborough Pool, near Birkenhead, Oil Works Chemist.

1886. Macarthur, J. G., 98, Dobbie's Loan, Glasgow, Lubricant Manufacturer.

O.M. McArthur, J. S., 45, Renfield Street, Glasgow, Consulting Chemist and Metallurgist.

1901. MacArthur, Jno. S., 15, St. John's Road, Pollokshields, Glasgow, Paint and Varnish Manufacturer.

1892. McArthur, Thos., 7, Temple, Dale Street, Liverpool, Drysalter and Dyewood Extractor.

1901. McCaffery, Richard S., San Pedro, New Mexico, U.S.A., Mining Engineer and Metallurgist.

1898. MacCallum, D. A., 389, Central Chambers, 93, Hope Street, Glasgow, Chemist.

O.M. McCallum, J. M., Southdene, Paisley, N.B., Soap Manufacturer.

1903. McCandless, Jno. M., State Laboratory, Atlanta, Ga., U.S.A., Analytical Chemist.

1894. McCann, Owen, c/o J. Gilton and Co., Oriel Street, Vauxhall Road, Liverpool, Printing Ink Manufacturer.

1893. McCombie, C., 19, St. Dunstan's Hill, London, E.C., Drug and Chemical Merchant.

1903. McCourt, Cyril D., 52, Victoria Road, Clapham, S.W., Research Chemist (Morgan Crucible Co.).

O.M. McCowan, W., Neilston, N.B.

1897. McCrae, Dr. John, jun., 7, Kirklee Gardens, Kelvinside, Glasgow, Chemical Demonstrator.

1898. McCreath, Wm. D., c/o Quantock Vale Cider Works, North Petherton, Bridgewater, Cider Manufacturer

1884. McCulloch, J., Oakleigh, Rose Street, Garnet Hill, Glasgow, Chemical Works Manager.

1900. McCulloch, John, Glencoe, Lostock Gralam, Cheshire, Chemical Engineer.

1903. McCully, R. E. J., 251, Maidstone Road, Rochester, Kent, Analytical Chemist.

O.M. McDaniel, J. J., Woodlands, Bandon, Ireland, Distiller.

O.M. Macdonald, A., 72, Great Clyde Street, Glasgow.

1897. MacDonald, G. W., c/o Curtis's and Harvey, Ltd., Dartford, Kent, Explosives Chemist.

O.M. Macdonald, J. W., c/o Messrs. H. Tate and Sons, Thames Sugar Refinery, Silvertown, E., and Cleveland, The Glebe, Blackheath, S.E., Analytical Chemist.

1902. Macdonald, Peter, jun., Mazapil Copper Co., Ltd., Concepcion del Oro, Zacatecas, Mexico, Analytical Chemist.

1899. MacDonald, S. Fremont, c/o Ashtabula Hide and Leather Co., Ashtabula, Ohio, U.S.A., Tanner.

O.M. McDonald, T. M., Walilabo Estate, St. Vincent, West Indies, Sugar Chemist.

1899. McDougall, Hugh, Mount Pleasant, Uddingston, N.B.; (Journals to) Johnson's Cement Works, Gateshead-on-Tyne, Chemical Engineer.

1895. McDougall, Isaac, jun., The Orchard, Hale, near Manchester, Student.

1895. McDougall, Isaac S., The Orchard, Hale, near Manchester, Manufacturing Chemist.

1890. McDougall, J. T., Dunolly, Morden Road, Blackheath, S.E., Manufacturing Chemist.

1889. MacEwan, Peter, 64, Southwood Lane, Highgate, N., Editor of "Chemist and Druggist."

1891. McEwen, Atholl F., 1, Northbrook Road, Lee, S.E., Analytical Chemist and Assayer.

1901. McEwen, Duncan C., c/o British and Korean Corporation, Ltd., Gwendoline, Korea, Metallurgical Chemist.

1902. McFarland, Alan R., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Works Manager.

O.M. Macfarlane, R. F., Tharsis Copper Works, East Moors, Cardiff, Technical Chemist.

1884. Macfarlane, Thos., 317, Queen Street, Ottawa, Canada, Analyst to Dominion of Canada.

1901. McFarlane, Walter, Sunnyside, Mansewood, Pollockshaws, Glasgow, Printworks Manager.

1890. McFarlane, W. W., 522, West 9th Street, Chester, Pa., U.S.A., Dyeworks Manager.

1893. McGhie, T. Burns, c/o Quirk, Barton, and Co., Normandy Wharf, Rotherhithe, S.E., Analytical Chemist and Assayer.

1891. McGill, Dr. J. T., Vanderbilt University, Nashville, Tenn., U.S.A., Adjunct Professor of Chemistry.

1899. MacGillivray, Wm. A., c/o Swansea Safety Fuse Co., Pipe House Wharf, Swansea, Analytical Chemist.

1887. McGlashan, John, Cawnpore Sugar Works, Cawnpore, India, Technical Chemist.

1902. McGovney, Chas. S., Experiment Station, West La Fayette, Ind., U.S.A., Chemist.

1884. McGowan, John, Ash House, Talke, near Stoke-upon-Trent, Colliery Manager.

1896. McIlhiney, Dr. Parker C., 145, East 23rd Street, New York City, U.S.A., Chemist.

1894. McIlwaine, Alf. W., Stoneferry, Hull, Oil Manufacturer.

O.M. MacIndoe, G. D., Ettrick Street, Invercargill, New Zealand, Chemical Works Manager.

1903. Macintire, Benj. Gould, P.O. Box 365, Rumford Falls, Maine, U.S.A., Chemist.

1901. Macintosh, John, Minnie Bank, Cromwell Street, Dunoon, N.B., Analytical Chemist.

1888. MacKean, Wm., Welsbach Incandescent Gas Light Co., Ltd., Broomhill Road, Wandsworth, S.W., Technical Chemist.

O.M. McKechnie, D., Grange Mount, Cowley Hill, St. Helens, Lancashire, Copper Extractor.

O.M. McKechnie, D. M., Metal Works, Widnes, Lancashire, Copper Extractor.

1904. McKechnie, R. D. c/o The British Explosives Syndicate, Ltd., Pitsea, Essex, Chemist.

1887. McKellar, W. G., c/o United Alkali Co., Ld., Eglinton Works, Irvine, N.B., Technical Chemist.

1895. McKenna, Dr. Chas. F., 221, Pearl Street, New York City, U.S.A., Chemist.

1903. McKenny, Chas., Bayview House, Drogheda, Ireland, Chemical Engineer and Manure Manufacturer.

1899. Mackensie, Alex. H., 12, Hale Street, North Adams, Mass., U.S.A., Colour Mixer.

1900. Mackenzie, J. Kenneth, 1120, Rookery Building, Chicago, Ill., U.S.A., Mining Engineer.

1884. Mackenzie, Dr. W. Cossar, Tewfikieh College of Agriculture, Ghizeh, Egypt, Analytical Chemist.

1893. McKerrow, C. A., Eversley, Wilmslow, Cheshire, Analytical and Consulting Chemist.

1893. McKesson, John, 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.

1891. Mackey, W. McD., Victoria Chambers, Leeds, Analytical Chemist.

1900. McKillop, George F., Broxburn Oilworks, Broxburn, N.B., Works Chemist.

1890. McKillop, Jno., 99, Brook Green, London, W., Metallurgist.

1902. McKim, Wm., 25, Fairview Street, Yonkers, N.Y., U.S.A., Colour Maker.

1884. McKinlay, R. W., Ameliaville, Aytoun Road, Pollokshields, N.B., Metal Merchant.

1904. Mackintosh, Jno. C., Canada Iron Furnace Co., Midland, Ont., Canada, Chemist.

1898. McLaurin, Robt., 414, Sauchiehall Street, Glasgow, Chemist.

1888. MacLean, Alex. S., 31, Bank Street, Greenock, N.B., Soap Refiner.

O.M. McLellan, J. Y., Beech Cottage, Boothferry Road, Goole, Chemical Manufacturer.

1892. McLeod, Jas., Westhill, Cardross Road, Dumbarton, N.B., Analytical Chemist and Gas Examiner.

1903. MacMahon, F. W., 8, Viederwald Road, Sydenham, S.E., Chemist (Oxychlorides, Ltd.).

1896. McMaster, Daniel, c/o Oxford Paper Co., Rumford Falls, Maine, Paper Mill Manager.

1894. Macmillan, Arch., 12, Hastings Street, Sunderland.

1903. McMullan, Charles, 20, Corn Market, Belfast, Ireland, Chemist.

1889. McMurtrie, J. M., 21, Princes Street, Pollokshields, Glasgow, Brass Founder.

1900. McMurtrie, Dr. Wm. T., 144, West 49th Street, New York City, U.S.A., Chemist.

1895. McMurtry, G. C., Wallaroo Smelting Works, Wallaroo, South Australia, Manager.

1884. Macnab, C., Lillyburn, Milton of Campsie, N.B., Calico Printer.

O.M. Macnab, W., Edinburgh Lodge, Howick Place, Victoria Street, S.W., Analytical Chemist.

1892. McVie, Jas. P., Ravenscraig, Canning Street, Hebburn-on-Tyne, Analytical Chemist.

1894. McVitie, Robt., 25, Nicoll Road, Harlesden, N.W., Biscuit Manufacturer.

1901. Maertens, Emile, P.O. Box 1002, Providence, R.I., U.S.A., Engineer.

1895. Magnus, Isidor, 52, Leadenhall Street, London, E.C., Chemical Merchant.

1901. Magruder, Egbert W., Department of Agriculture, Richmond, Va., U.S.A., Chemist.

1885. Mahon, R. W., N.Y. Central and Hudson River Railroad, West Albany, N.Y., U.S.A., Analytical Chemist.

1898. Main, Wm., 299, Jefferson Avenue, Brooklyn, N.Y., U.S.A., Chemical Expert.

O.M. Major, J. Lewis, Sculcoates, Hull, Tar Distiller and Chemical Manufacturer.

1886. Mallinckrodt, Edw., Mallinckrodt Chemical Works, St. Louis, Mo., U.S.A., Manufacturing Chemist.

1897. Mallory, J. Halsey, Drawer 69, Columbia, S.C., U.S.A., Assistant Chemist (The American Cotton Oil Co.).

1896. Mann, E. A., Government Laboratory, Perth, Western Australia, Government Analyst.

1893. Mann, Harold H., Indian Tea Association, Royal Exchange Buildings, Calcutta, India, Research Chemist.

1899. Mann, Jas. S., 97, Greengate Street, Plaistow, Essex, Analyst.

1891. Mann, John C., c/o Major and Co., Ltd., Sculcoates, Hull, Chemist.

1903. Mannhardt, Hans, 1641, Melrose Street, Chicago, Ill., U.S.A., Analytical Chemist.

O.M. Mannington, H. T., Marshlea, Beaconsfield Road, Farnworth, Widnes.

1892. Mansbridge, Wm., 27, Elmbank Road, Sefton Park, Liverpool, Chemist.

1893. Marchlewski, Dr. L., Strzelecka, 9, Krakow, Austria.

1903. Mardick, Jno. R., c/o Wm. F. Moser and Co., Du Bois, Pa., U.S.A., Chemical Engineer.

1904. Maréchal, H., Eugene Maréchal et fils, Vénissier (Rhone), France, Oilcloth Manufacturer.

1883. Markel, Dr. K., Lodge Lane, Bewsey, Warrington, Technical Chemist.

1886. Markham, A. D., 71, Queen Street, Hull, Pharmaceutical Chemist.

1902. Marriott, F. Grant, 14, Selby Street, Toronto, Canada, Chemical Student.

1901. Marsden, Dr. Fred, Dyeing Department, Yorkshire College, Leeds, Chemist.

O.M. Marsh, J. T., Ammonia Soda Works, Fleetwood, Lancashire, Chemist.

1883. Marsh, W., Union Alkali Co., Soho Works, Manchester, Chemical Manufacturer.

1895. Marshall, Arthur, Hope Cottage, Church Hill, Loughton, Essex, Explosives Chemist.

1891. Marshall, Dr. Hugh, 12, Lonsdale Terrace, Edinburgh, Professor of Chemistry.

1895. Marshall, Frank G., 4, Woodhouse Terrace, Bewick Road, Gateshead, Technical Chemist.

1901. Marshall, Jos. W., Boulevard Higher Grade School, Hull, Science Lecturer.

1896. Marshall, Percy S., Union Laboratory, Half Moon Street, Huddersfield, Assistant Chemist.

1883. Marshall, Wm., Carisbrook, Queen's Road, Cheadle Hulme, Cheshire, Dyer.

1884. Marshall, Wm., Barkley, Teddington, Middlesex, Analytical Chemist.

1894. Martin, Alex. M., Douglas Villa, Dunbeth Road, Coatbridge, N.B., Analytical Chemist.

1895. Martin, Chas. H., 14, Aldred Street, Crescent, Salford, Oil and Soap Works Assistant Manager.

1885. Martin, H., 67, High Street, Wellington, Somerset, Manure Works Manager.

O.M. Martin, N. H., Ravenswood, Low Fell, Gateshead-on-Tyne, Manufacturing Chemist.

1899. Martin, Wm E., c/o Kynoch Ltd., Arklow, Co. Wicklow, Ireland, Chemist.

O.M. Martin, W. H., 183B, King's Road, Chelsea, London, S.W., Analytical Chemist.

1887. Martineau, Sydney, Northwood, Rydal Road, Streatham, S.W., Sugar Chemist.

1894. Martyn, T. Graham, 11, Stratton Terrace, Truro, Cornwall, Metallurgist.

1902. Marx, Joseph S., California Powder Works, Pinole, Cal., U.S.A., Chemist.

1887. Mason, J. Francis, Eynsham Hall, Witney, Oxon.

1892. Mason, Thos., Beech Avenue, Nottingham, Manufacturing Chemist.

1903. Massey, Joseph B., 60, Colne Road, Burnley, Chief Sanitary Inspector.

O.M. Masson, Prof. D. Orme, University of Melbourne, Victoria, Australia, Professor of Chemistry.

1889. Master, Ardesheer B., 679, Tardeo, Bombay, India, Chemical Manufacturer.

1901. Master, Chaturbhai G., Khodi-Ambli, Ahmedabad, India, Size and Chemical Manufacturer.

1902. Masujima, Bunjiro, 19, Honjoku Midoricho Sanchome, Tokyo, Japan, Prof. of Applied Chemistry.

1903. Masure, Gaston, 7, Rue de Constantine, Rouen, France, Chemist.

1902. Masury, Fred. L. M., Sharon, Pa., U.S.A., Explosives Manufacturer.

O.M. Mather, J., Blaydon Chemical Works, Blaydon-on-Tyne, Manager.

1900. Mather, Wm., c/o British Aluminium Co., Ltd., Larne Harbour, co. Antrim, Ireland, Chemist.

1890. Matheson, W. J., 182–184, Front Street, New York City, U.S.A., Chemical Merchant.

1901. Mathew, W. E. B. de Vere, Shanklin, Lucien Road, Upper Tooting, S.W., Analytical Chemist.

1900. Mathews, Dr. Jno. A., c/o Crucible Steel Co. of America, Syracuse, N.Y., U.S.A., Chemist.

1898. Mathewson, E. P., Anaconda, Mont., U.S.A., Metallurgist.

1888. Mátos, Louis J., 105, North 19th Street, East Orange, N.J., U.S.A., Chemist.

1896. Matsui, G., c/o Japan Sugar Refinery Co., Onagigawa, Tokio, Japan, Chemical Engineer.

1899. Matthews, Dr. J. Merritt, 425, South Broad Street, Philadelphia, Pa., U.S.A., Professor of Chemistry and Dyeing (Philadelphia Textile School).

1889. Mawdsley, W. H., c/o Gold Mining Co., Ltd., Mount Morgan, Queensland, Chemist.

1903. Maxim, Hudson, 891, Sterling Place, Brooklyn, N.Y., U.S.A., Chemist and Mechanical Engineer.

1894. Maxwell, Jno., Solway Chemical Works, Silloth, and (communications) English Street, Carlisle. Cumberland, Chemical Manure Manufacturer.

1903. Maxwell, Orin P., Piedmont, Mineral Co., West Va., U.S.A., Chemist.

1897. May, George H., c/o Fabrikoid Co., Newburgh, N.Y., U.S.A., Assistant Chemist

1901. May, Dr. Sidney, 313, East 112th Street, New York City, U.S.A., Lecture Assistant.

1884. Mayenfeld, Dr. E. von Salis. See under "Salis."

1903. Mayer, Andrew, jun., c/o Carnegie Steel Co., Edgar Thompson Works, Braddock, Pa., U.S.A., Chemist.

1896 Mayfield, A. S., 14, Beresford Avenue, Hull, Analyst.

1892. Mayfield, H. B., Normanhurst, Mundy Street, Heanor, near Nottingham, Dyer.

1901. Mayfield, Thos., Fair View House, Heanor, near Nottingham, Hosiery Manufacturer.

1885. Mayhew, E. W. A., High Street, Freemantle, Western Australia, Manufacturing Chemist.

1900. Maywald, F. J., 1028, 72nd Street, Brooklyn, N.Y., U.S.A., Technical Chemist.

1892. Meacham, Chas. S., c/o Ohlsson's Cape Breweries, Ltd., Cape Town, South Africa, Brewer.

1902. Meade, Richd. K., 12, Chestnut Terrace, Easton, Pa., U.S.A., Chemist.

1903. Mears, James, 77, Arden Road, Handsworth, Birmingham, Analytical Chemist.

1898. Meeds, Alonzo D., 103, Boston Block, Minneapolis, Minn., U.S.A., Analytical Chemist.

1896. Meggitt, Loxley, Wheatsheaf Works, Alexandrina, Sydney, N.S.W., Australia, Analytical Chemist.

1901. Meier, Dr. Franz, Basle Chemical Works, Basle, Switzerland, Chemist.

1888. Meikle, Jno., 8, Melrose Street, Great Western Road, Glasgow, Journalist.

1902. Melcher, Arthur C., 58, Bowen Street, Newton Centre, Mass., U.S.A., Chemist.

O.M. Meldola, Prof. R., F.R.S., 6, Brunswick Square, London, W.C., Professor of Chemistry.

1901. Meldrum, And. N., 92, Bonnymuir Place, Aberdeen, Lecturer on Chemistry.

1891. Meldrum, Jas. Jones, Timperley, Cheshire, Manufacturing Engineer.

1891, Mellen, E. D., 1590, Massachusetts Avenue, Cambridge, Mass., U.S.A., Treasurer (Curtis, Davis, and Co.)

O.M. Mellon, W. W., 9, Glenart Avenue, Blackrock, Co. Dublin, Ireland, Manufacturing Chemist.

1902. Mellor, Percy H., Burton Road, Woodville, near Burton-on-Trent, Pottery Manager.

O.M. Mellor, S., Magnesium Metal Co., Patricroft, Manchester, Metal Refiner.

1884. Melville, D., P.O. Box No. 1, Woodmere, Wayne Co., Mich., U.S.A., Chemical Works Manager.

1900. Mende, Alex. P., 120, Liberty Street, New York City, U.S.A., Manufacturing Chemist.

1893. Mensching, Dr. C., 3, Geismar-Chaussée, Göttingen, Germany, Chemist.

O.M. Menzies, R. C., Inveresk Mills, Musselburgh, N.B., Paper Maker.

1892. Mercer, C. A., 22, Streathbourne Road, Upper Tooting, S.W., Chemical Apparatus Maker.

1886. Mercer, J. B., 330, Lower Broughton Road, Manchester.

O.M. Mercer, F. M., 34, Camomile Street, London, E.C., Manufacturing Chemist.

1890. Merck, E., Darmstadt, Germany, Maunfacturing Chemist.

1887. Merrell, Geo., Lock Box 786, Cincinnati, Ohio, U.S.A., Manufacturing Chemist.

1903. Merrill, Mrs. Frances B., Merrill Process Co., Jones Point, N.Y., U.S.A., President.

1899. Merrill, Frank H., Los Angeles Soap Co., Los Angeles, Cal., U.S.A., Factory Superintendent

1903. Merrill, Herbert C., 38, Main Street, Peabody, Mass., U.S.A., Chemical Engineer (Leather Factory).

1902. Merritt, Wm. G., 643, Second Avenue, Detroit, Mich., U.S.A., Chemist.

1904. Merry, Jno. B., Ashfield, Ash Lane, Hough Green, near Widnes, Works Chemist.

1903. Mersan, Ferdinand de, 17, Cecil Street, Gainsborough, Lincolnshire, Chemist.

1903. Mersereau, G., Susquehanna Dyeworks, Williamsport, Pa., U.S.A., Chemist.

1901. Merson, Geo. F., 24, Newgate Street, Newcastle-on-Tyne, Manufacturing Pharmaceutical Chemist.

1897. Meslans, Prof. M., 59, Quai de la Baronnie, Ablon (Seine et Oise) France, Professor of Chemistry.

O.M. Messel, Dr. R., 147, Victoria Street, London, S.W., Chemical Manufacturer.

1899. Metcalf, Howard F., Farr Alpaca Co., Holyoke, Mass., U.S.A.

1886. Metcalf, Jno., Moorfield, Altham, near Accrington, Tar Distiller.

1898. Metz, Herman A., P.O. Box 2178, New York City, U.S.A. (Victor Koechl and Co., Dyestuffs and Chemicals).

1900. Mewborne, Robt. G., c/o Kentucky Tobacco Product Co., Louisville, Ky., U.S.A., Chemist.

1902. Meyer, August R., Room 402, New England Building, Kansas City, Mo., U.S.A., Metallurgist.

1898. Meyer, Dr. Franz, 68, Broad Street, New York City, U.S.A., Metallurgical and Chemical Engineer.

1902. Meyer, Dr. Fredk. L., 2028, Park Avenue, Philadelphia, Pa., U.S.A., Chemist.

1900. Meyer, Karl, Osterbrogade, 60, Kopenhagen, O., Denmark, Chemist.

1902. Meyrick, L. J., 137, City Road, Birmingham, Assistant Analyst.

1903. Miall, Dr. Stephen, 6, Stone Buildings, Lincoln's Inn, London, W.C., Solicitor.

1896. Miles, G. Wellington, 29, Central Street, Boston, Mass., U.S.A., Analytical Chemist.

1889. Milestone, W. C., 7, Heathfield Road, Wandsworth Common, S.W., Chemical Works Manager.

1899. Millar, Jas. H., P.O. Box 2070, Johannesburg, Transvaal, Laboratory Manager.

1897. Millard, Edgar J., 40–42, Charlotte Street, London, E.C., Chemist and Manager.

1903. Millen, J. Dunlop, Mount Bischoff Smelting Works, Launceston, Tasmania, Analyst and Assayer.

1883. Miller, Dr. A. K., Kilvert's Buildings, Withy Grove, Manchester, Analytical Chemist.

1884. Miller, A. Russell, Hill Park, Bothwell, N.B., Printworks, Chemist.

O.M. Miller, E. V., Sugar Works, Chelsea, Auckland, New Zealand, Sugar Works Chemist.

1889. Miller, Geo., 54, Ramilies Road, Sefton Park, Liverpool, Technical Chemist.

1897. Miller, Dr. Edmund H., School of Mines, Columbia University, New York, U.S.A., Chemist.

1900. Miller, Hampton K., Lake City, Fla., U.S.A., Chemist (Florida A. & M. College).

1893. Miller, Dr. Harry E., 1015, Chestnut Street, Oakland, Cal., U.S.A., Chemist.

1902. Miller, H. Harold, Consumers' Gas Co., 269, Front Street, E., Toronto, Canada, Chemist.

1883. Miller, Dr. H. von, III. Beatrixgasse 32, Wien, Austria, Chemical Manufacturer.

1894. Miller, Dr. John A., 40–45, Lewis Block, Buffalo, N.Y., U.S.A., Consulting Chemist, State Analyst.

1897. Miller, Jas., Minas de São Bento, Santa Barbara de Matto Dentro, Minas Geraes, Brazil, Metallurgical Chemist.

1894. Miller, J. Carlile, 89, Rumford Street, Bridgeton, Glasgow, Manufacturing Chemist.

1888. Miller, J. Hopkins, 5, Catherine Street, Parliamentary Road, Glasgow, Dyeworks Chemist.

1889. Miller, Jno. Poynter, Sandilands Chemical Works, Aberdeen, Technical Chemist.

1884. Miller, Dr. N. H. J., Harpenden, near St. Albans, Agricultural Chemist.

1899. Miller, P. Schuyler, Mount Prospect Laboratory, Flatbush Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1898. Miller, Rudolf E. W., 8, Stanley Villas, Greenway Road, Runcorn, Chemist.

1901. Miller, Stuart B., 701, South 20th Street, Birmingham, Ala., U.S.A., Chemical Engineer.

1884. Miller, T. Paterson, The Cairns, Cambuslang, near Glasgow, Dyer and Printer.

1901. Miller, W. Lash, 50, St. Alban Street, Toronto, Canada, Associate Professor of Physical Chemistry.

1884. Miller, W. M., Caledonia Estate, Prov. Wellesley, Penang, S.S., Sugar Chemist.

1902. Milligan, R. E., New York Continental Jewell Filtration Co., 15, Broad Street, New York City, U.S.A., Chemical Engineer.

1903. Millington, Abraham, c/o J. Parry, E.V. Wharf, The Docks, Newport, Mon., Metallurgical Chemist.

O.M. Mills, Prof. E. J., F.R.S., 11, Greenhill Road, Harrow, Professor of Chemistry.

1903. Milnes, Cresswell, Arlesey, near Hitchin, Herts., Chemist.

1887. Milnes, Edmund, Seedfield, Bury, Lancashire, Dyeing Extract Maker.

1902. Milnes, Ernest E., c/o Joseph Smithson, Ltd., India Buildings, Halifax, Yorks, Chemist.

1901. Milroy, Andrew, House Hill Muir, Nitshill, N.B., Manager.

1895. Miner, Harlan S., c/o Welsbach Light Co., Gloucester City, N.J., U.S.A., Technical Chemist.

1889. Miniati, T., Penketh, near Warrington, Chemist.

1895. Mitchell, Chas. A., c/o Beaufoy and Co., South Lambeth Road, S.W., Analyst.

1901. Mitchell, Frank H., Orono, Penobscot Co., Maine, U.S.A., Tutor in Chemistry.

1898. Mitchell, G. D. H., c/o S. S. White Dental Manufacturing Co., Prince's Bay, Staten Island, N.Y., U.S.A., Chemist.

1902. Mitchell, John, c/o W. Mitchell and Sons, Ayr, N.B., Provision Curer.

1883. Mitchell, J. W., Plantation House, Clough Fold, near Manchester, Waste Bleacher.

1904. Mitsugi, R., Naoki Match Manufactory, Aratamachi, Kobe, Japan, Chemist.

O.M. Mitting, E. K., 43, Highfield South, Rock Ferry, Cheshire, Technical Chemist.

1900. Mixner, Albert F., c/o Homeward Bound G. M. Co., Yalwal, viâ Nowra, N.S.W., Australia, Metallurgist.

1895. Moale, Dr. Philip R., c/o Asheville Printing Co., 3, West Court Square, Asheville, N.C., U.S.A., Analytical Chemist.

1902. Möckel, Heinrich A., c/o D. M. Base and Co., Roaring Springs, Pa., U.S.A., Chemist and Engineer.

1903. Möhlau, Prof. Dr. Richard, Semperstrasse 4, Dresden, A., Germany, Professor of Colour Chemistry.

O.M. Mohr, Dr. B., 69A, Parliament Hill, Hampstead, N.W., Consulting Chemist and Metallurgist.

1894. Mole, Herbert B., The Croft, Shepton Mallet, Somerset, Brewer.

1902. Molesworth, F. H., 46, West Street, North Sydney, N.S.W., Australia, Analytical Chemist.

1903. Mommers, Richard, c/o Illinois Sugar Refining Co., Pekin, Ill., U.S.A., Chemical Engineer.

O.M. Mond, Dr., L., F.R.S., 20, Avenue Road, Regent's Park, N.W.; and 64, Via Sistina, Rome, Alkali Manufacturer.

1891. Mond, Robt. L., Winnington Hall, Northwich, Chemist.

1890. Moodie, Wm. E., Alexandria Works, Alexandria, N.B., Analytical Chemist.

1901. Moody, Chas. J., Lake View Consols Mine, Boulder, West Australia, Analyst and Assayer.

1898. Moody, Dr. Herbert R., Hobart College, Geneva, N.Y., U.S.A., Science Instructor.

1884. Mook, Chas., 2, Kapellenstrasse, Eisenach, Germany, Alkali Works Director.

1903. Mooney, F. M., 118, Pembroke Road, Dublin, Chemical Manure Manufacturer.

1903. Mooney, Geo. A., 2716, St. Catherine Street, Montreal, Canada, Chemical Merchant.

1902. Mooney, Luke, 36, West 52nd Street, Bayonne, N.J., U.S.A.

1887. Moore, Chas. C., Harley Buildings, 11, Old Hall Street, Liverpool, Chemist.

1901. Moore, Chas. W., 33, Demesne Road, Whalley Range, Manchester, Chemical Student.

1902. Moore, Fred., Victoria Chemical Co., Ltd., Victoria, B.C., Canada, Manufacturing Chemist.

1892. Moore, Dr. Geo. D., 201, Salisbury Street, Worcester, Mass., U.S.A., Professor of Chemistry.

1904. Moore, Gerrit J., jun., c/o National Brewers' Academy, 39, South William Street, New York City, U.S.A., Analytical Chemist.

1902. Moore, Jas. H., Saltville, Va., U.S.A., Chemist.

1899. Moore, Quintin, jun., Dalmarnock Chemical Works, 89, Rumford Street, Glasgow, Works Manager.

1899. Moore, Dr. Russell, W., 47, Linden Place, Orange, N.J., U.S.A., Chemist (U.S. Appraiser's Office).

1885. Moore, R. T., 142, St. Vincent Street, Glasgow Mining Engineer.

1890. Moore, Thos., Laboratoire du Service Local, Noumea, New Caledonia, Analytical Chemist.

1903. Moorhouse, J. B., Cecil Mount, Park Avenue, Bradford, Yorks., Dyer.

1903. Moran, Geo. A., 333, Haverhill Street, Lawrence, Mass., U.S.A., Chemist.

1890. Mordle, F. Dare, Guilderoy, Matlock Bath, Derbyshire, Starch Manufacturer.

1902. More, Andrew, Government Laboratory, Clement's Inn Passage, Strand, W.C., Government Analyst.

1901. Morgan, Dr. Gilbert T., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry.

1890. Morgan, J. Jas., 9, Upper Kent Road, Victoria Park, Manchester, Assayer.

1898. Morgan, Thos. M., Longue Pointe, near Montreal, Canada, Manufacturer.

1885. Morgans, Thos., 60, Queen Square, Bristol, Civil Engineer.

1901. Moriarty, John J., 5, D'Arcy Street, Toronto, Canada, Assistant Chemist.

1902. Morison, Jas., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.

1897. Morison, Samuel L., 15, Broad Street, New York City, U.S.A., Water Engineer.

O.M. Moritz, Dr. E. R., 45, Great Tower Street, London, E.C., Brewing Chemist.

1885. Morley, Dr. H. Forster, 5, Lyndhurst Road, Hampstead, N.W., Professor of Chemistry.

1903. Morningstar, Jos., 48, Park Place, New York City, U.S.A., Merchant.

1902. Morrell, Dr. R. S., Gonville and Cains College, Cambridge, Lecturer.

1884. Morrice, Jas. A., 1, Prince's Terrace, Dowanhill, Glasgow, Starch and Gum Manufacturer.

1898. Morris, Edgar F., Grey House, Barrington Road, Altrincham, Cheshire, Research Chemist.

1897. Morris, Harry, Avenue House, Doncaster, Chemical Merchant.

1890. Morris, Herbert N., Gorton Brook Chemical Works, Manchester, Technical Chemist.

O.M. Morris, J. Haydn, 9, Rathbone Road, Wavertree, Liverpool, Technical Chemist.

1902. Morrison, Jos., Wellfield, Farnworth, Widnes, Manager.

1901. Morse, Willard S., Apartado A., Aguascalientes, Mexico, Assistant Manager.

O.M. Morson, T., 31, Southampton Row, London, W.C., Manufacturing Chemist.
1904. Morson, Thos. D., c/o T. Morson and Son, Summerfield Works, Ponders End, N., Chemist.
1889. Morton, Jas., Dalquhurn Works, Renton, N.B., Dyeworks Manager.
1897. Morton, Jno.. North Road, St. Helens, Lancashire, Analytical Chemist.
1902. Mosbaugh, Francis R., c/o Huntsville and Bracebridge Tanning Co., Huntsville, Ont., Canada, Chemist.
1888. Mosenthal, Henry de, 220, Winchester House, Old Broad Street, E.C., Explosives Company Manager.
1903. Moses, Herhert B., c/o National Battery Co., Buffalo, N.Y., U.S.A., Electro-chemist.
1903. Mosher, Walter R., 1274, West Avenue, Buffalo, N.Y., U.S.A., Chemist.
1894. Moszczenski, J. von, Tartar Chemical Co., Ninth Street and Gowanus Avenue, Brooklyn, N.Y., U.S.A., Consulting Chemist.
1897. Motion, Jno., c/o Valvoline Oil Co., Edgewater, N.J., U.S.A., Oil Refinery Chemist.
1887. Moul, Frank, Aldersgate Chemical Works, Southall, Technical Chemist.
1901. Moule, Jno. W., Sulphide Corporation, Ltd., Cockle Creek, N.S.W., Metallurgical Chemist.
1884. Moult, J., Underhill, Low Fell, Gateshead-on-Tyne, Secretary.
1898. Moulton, Prof. Chas. W., Vassar College, Poughkeepsie, N.Y., U.S.A., Professor of Chemistry.
1892. Mount, Edw., Oaklands, Aughton, near Ormskirk, Assistant Secretary (United Alkali Company).
O.M. Muir, J. P., 233, Camden Road, London, N., Chemist.
1890. Muir, Jas. Stanley, 8, Westminster Gardens, Glasgow, W., Chemist.
1896. Muir, Wm., 97, Church Street, Edmonton, Middlesex, Merchant.
1894. Muir-Smith, W., c/o A. B. Fleming & Co., Ltd., Caroline Park, Edinburgh, Oil Works Manager.
O.M. Müller, Dr. H., F.R.S., 13, Park Square East, Regent's Park, London, N.W., Research Chemist.
1896. Mundy, Lionel, 27, Merton Road, Kensington, W., Importer of Unfermented Wines.
1887. Munroe, Prof. Chas. E., Columbian University, Washington, D.C., U.S.A., Professor of Chemistry and Dean.
1900. Munsell, Dr. Chas. E., c/o Devor and Raynolds Co., 110, Horatio Street, New York City, U.S.A., Colour Chemist.
1903. Munsterman, Carl A., 216, South Utica Street, Waukegan, Ill, U.S.A., Chemist.
1900. Munton, Fred. T., Beaconsfield, Western Road, Runcorn, Cheshire, A.R.S.M., Analytical Chemist.
1897. Murch, D. Wilshin, 6, Victoria Road, Wednesbury, Staffs., Chemist.
1886. Murdoch, R. H. M., Shore Road, Stevenston, Ayrshire, Explosives Chemist.
1899. Murphy, Albert J., The Laboratory, 11, Lyddon Terrace, Leeds, Brewer's Chemist.
1901. Murray, Benjamin L., c/o Merck and Co., University Place, New York City, U.S.A., Chemist.
1903. Murray, Chas. B., c/o St. Louis Plate Glass Co., Valley Park, Mo., U.S.A., Chemist.
1899. Murray, Jas. J., Iron King Mines, Val Verde, Arizona, U.S.A., Mining Engineer.
1901. Murray, Jas. P., Toronto Carpet Manufacturing Co., Ltd., King Street and Fraser Avenue, Toronto, Canadu, Carpet Manufacturer.
1896. Murray, Dr. Thus. S., 1, Nelson Street, Dundee, Professor of Chemistry.
1898. Murray, Rd., Laurel Bank, Potternewton Lane, Chapel Allerton, Leeds, Analyst.
O.M. Muspratt, E. K., Seaforth Hall, near Liverpoo, Alkali Manufacturer.
1894. Muspratt, Max, 2, Mannering Road, Sefton Park, Liverpool, Technical Chemist.
O.M. Muspratt, S. K., 9, Church Street, Flint, North Wales, Alkali Manufacturer.
O.M. Muter, Dr. Jno., Winchester House, Horley, Surrey, Chemical Lecturer.
1895. Muurling, T. J. R., P.O. Box 2660, New York City, U.S.A., Dyestuff Importer.
1903. Myers, Edgar C., (Journals) New Franklin, Mo., and 1107, Paquin Street, Columbia, Mo., U.S.A., Agricultural Chemist.
1897. Myers, Dr. Henry C., University of California, Berkeley, Cal., U.S.A., Prof of Chemistry.
1891. Myers, Wm. S., Nitrate of Soda Propaganda, 12, John Street, New York City, U.S.A., Director.

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1884. Naef, Dr. P., U.S.A., Technical Chemist.
1903. Naef, Jno. J., 416, Eleventh Avenue, Paterson, N.J., U.S.A., Chemist.
1903. Nagel, Dr. Oscar, 90, Wall Street, New York City, U.S.A., Chemist.
1903. Nagel, Oskar H. L., Glenbrook, Conn., U.S.A., Superintendent (Chemical Works).
1897. Nairn, Michael, Ben Dhu, Kirkcaldy, N.B., Linoleum Manufacturer.
1901. Nakagawa, Sōsuke, Hokkaidō Cement Co., Kamüso, near Hakodate, Japan, Chief Engineer.
1903. Nakayama, Takakichi, c/o Fuji Paper Co., Sanjikkenbori, Tokyo, Japan, Chemist.
1901. Nanabhai, Krishnalal, 8–10, Nepean Sea Road, Malabar Hill, Bombay, India, Technological Chemist.
1893. Napier, Jno. W., Gas Works, Alloa, N.B., Manager and Chemist.
1903. Nash, A. Douglas, 221, Broadway, Flushing, N.Y., U.S.A., Glass Manufacturer.
1897. Nash, Leonard M., 281, Seven Sisters Road, Finsbury Park, N., Works Chemist.
1900. Nathan, Major Fred. L., R.A., Royal Gunpowder Factory, Waltham Abbey, Essex, Superintendent,
1898. Nation, Edmund C., 237, Smith Street, Peekskill. N.Y., U.S.A., Manager (Highlands Chemical Co.).
1892. Naylor, Wm., 3, Garstang Road, Fulwood, Preston, Lancs., Chemist.
O.M. Naylor, W. A. H., 38, Southwark Street, London, S.E., Manufacturing Chemist.
1901. Neale, Percy R., c/o Messrs. Morris and Co., Doncaster, Yorks, Chemical Manufacturer.
1899. Neate, Percy J., " Belsize," Watts Avenue, Rochester, Kent, Director of Cement Co.
1902. Neave, Geo. B., Technical College, 204, George Street, Glasgow, Assistant to Professor of Chemistry.
1898. Neil, Jas. Millar, 176, Roxborough Street East, Rosedale, Toronto, Canada, Technical Chemist.
1890. Neill, Geo. D., Drumslea, Greenock, N.B., Sugar Refiner.
1898. Neilson, Alex. McG., c/o Arthur May and Co., Durban, Natal, Analytical Chemist.
1889. Neilson, Thos., Metallurgical Chemist.
1902. Neish, Arthur C., Columbia University, New York City, U.S.A., Chemist.
1893. Nelson, Arthur J., 381, Edge Lane, Droylsden, Manchester, Chemist.
1898. Nelson, Elnathan K., c/o Nelson Morris and Co., Chicago, Ill., U.S.A., Chemist.
1897. Nelson, Walter, Emscote Mills, Warwick, Gelatin Manufacturer.
1903. Nemian, Howard S., 122, Hudson Street, New York City, U.S.A., Manufacturing Chemist.
902. Nesbitt, Dr. Beattie, 71, Grosvenor Street, Toronto, Canada, Physician.
1901. Neufville, Dr. Rudolf de, c/o Metallurgische Gesellschaft, Frankfort a/M., Germany.
1902. Neumann, Dr. Edgar, 60, Chancery Lane, London, W.C.

1903. Neumann, Dr. Max, Hohenstaufenstr. 32, Berlin, W. 30, Germany.
1903. Nevin, Jas. Victor, Bristol Dispensary, Bedminster, Bristol, Pharmacist.
O.M. Newall, F. S., Washington, co. Durham, Chemical Manufacturer.
1889. Newberry, Spencer B., Sandusky Portland Cement Co., Sandusky, Ohio, U.S.A., Cement Works Manager.
1896. Newcomen, Thos., Chemical Works, Lydbrook, near Ross; Wood Distiller.
O.M. Newlands, B. E. R., 2, St. Dunstan's Hill, London, E.C., Analytical and Consulting Chemist.
O.M. Newlands, W. P. R., 232, Amesbury Avenue, Streatham Hill, S.W., Sugar Chemist.
1884. Newton, Jno., Park Green, Macclesfield, Silk Dyer.
O.M. Newton, Jno., Manor Works, Rotherhithe New Road, London, S.E., Manure Manufacturer.
1900. Newton, Dr. Wm., 39, Mincing Lane, London, E.C., Chemist.
1901. Nibelius, Axel W. T., American Forcite Powder Manufacturing Co., Landing, N.J., Chemist.
1904. Nichols, C. W., 406, Clinton Avenue, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1884. Nichols, J. A., Stanley Mount, New Mills, near Stockport, Teacher of Science.
1888. Nichols, W. H., The Nichols Chemical Co., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
1897. Nicholson, Harry, Tyn-y-vardd, Llaneltyd, Dolgelly, North Wales, Assayer.
1904. Nicholson, Wilfred E., Hunslet Chemical Works Leeds, Chemical Manufacturer.
1897. Nicholson, Wm. J., Ardeer, Stevenston, Ayrshire, N.B., Chemist.
1897. Nickel, Herman, c/o The N. K. Fairbank Co., 3rd and Convent Streets, St. Louis, Mo., U.S.A., Chemist.
1888. Nickolls, John B., The Laboratory, Grange, Guernsey, Analytical Chemist.
O.M. Nicol, Dr. W. W. J., 15, Blacket Place, Edinburgh, Chemical Lecturer.
1903. Nicoll, Frank, 221, Walmersley Road, Bury, Lancs., Chemist.
1900. Nield, J. H., c/o General Chemical Co., Bayonne Works, Bayonne, N.J., U.S.A., Superintendent.
1898. Nightscales, Geo., 13, Spring Street, Hull. Oil Merchant.
1899. Nihoul, Dr. Edw., Waremme, Belgium, Director of the Liège Tannery School.
O.M. Nimmo, Jas., Penshurst, 8, Lawrence Road, South Norwood, S.E., Analytical Chemist.
1885. Nishigawa, T., Ryuso Kaisha, Osaka, Japan, Director of Sulphuric Acid and Soda Works.
1898. Nishikawa, T., c/o Nippon, Seimikaisha, Onoda, Nagato, Japan, Chemist.
O.M. Nolting, Dr. E., Ecole de Chimie, Mulhouse, Alsace, Germany, Professor of Chemistry.
O.M. Norman, F. J., Lyndhurst, Higher Runcorn, Cheshire, Chemical Manufacturer.
1900. Norman, Geo. M., 929, University Avenue, Madison, Wis., U.S.A., Chemist.
1892. Norman, J. T., 23. Leadenhall Street, E.C., Consulting Chemist.
1898. Norris, Albert P., 760, Massachusetts Avenue, Cambridgeport, Mass., U.S.A., Assistant Chemist.
1904. Norris, Cassius W., 612, Commerce Street, Milwaukee, Wis., U.S.A., Tannery Chemist.
1899. Norris, Geo. L., Standard Steel Works, Burnham, Mifflin Co., Pa., U.S.A., Chemist.
1893. Norris, Wm. M., Princeton, N.J., U.S.A., Leather Chemist.
1902. North, Barker, Glenholme, Glenholme Road, Manningham, Bradford, Lecturer in Chemistry.
1890. North, E. Gordon N., Jubiles, Alpujarra, Prov. de Granada, Spain, Technical Chemist.
1903. North, Henry A., 649, Green Avenue, Brooklyn, N.Y., U.S.A., Chemist.
O.M. Northing, J., The Murrough, Wicklow, Ireland, Technical Chemist.
O.M. Norton, Dr. S. A., 363, East Town Street, Columbus, Ohio, U.S.A., Professor of Chemistry (Ohio State University).
1887. Norton, Dr. T. H., U.S. Consulate, Mezereh, Mamouret-ul-Aziz, Turkey-in-Asia, open Mail, *viâ* Constantinople, Ph.D., Sc.D., U.S. Consul.
1901. Novarine, John L., 79, Main Street, Brooklyn, N.Y., U.S.A., Chemist.
1899. Noyes, Henry, (Subscriptions) c/o J. C. Lanyon and Sons, Gresham House, Old Broad Street, London, E.C.; and (Journals), 17, Queen Street, Melbourne, Vic., Australia, Engineer.
1901. Noyes, Dr. Wm. A., Johns Hopkins Univ., and 1505, Bolton Street, Baltimore, Md., U.S.A., Editor (J. Amer. Chem. Society).

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1894. Oakes, Geo. A., Bloomfield, N.J., U.S.A., Woollen Mill Owner.
1884. O'Beirne, W. G., British Chemical Works, Clydebank, Glasgow, Manufacturing Chemist.
1904. Oberländer, Dr. Otto, 62, Delaunay's Road, Crumpsall, Manchester, Technical Chemist.
1900. O'Brien, Frederick, 9, Elvaston Road, Victoria Park, Bedminster, Bristol, Analytical Chemist.
1900. O'Byrne, Leo C., 996, Washington Boulevard, Chicago, Ill., U.S.A., Chemist.
1902. Oekel, Reinhold, 9, Walton New Road, Warrington, Technical Chemist.
1901. O'Connor, Chas. P., 149, Clinton Street, Brooklyn, N.Y., U.S.A., Analytical Chemist.
1887. Oddie, Jas., School of Mines, Ballarat, Australia, Chemical Lecturer.
1888. Oddy, Robert W., 60, Waterhouse, Toad Lane, Rochdale, Chemist.
1901. Odling, Francis J., Box 314, G.P.O., Melbourne, Vic., Australia, Mining Engineer.
1884. Oehler, K., Offenbach-am-Main, Germany, Colour Manufacturer.
1888. Ogata, Saburo, Zohei Shikyoku, Okurasho, Tokyo, Japan, Assayer.
1901. Ogden, Richard L., 314, North Main Street, Bethlehem, Pa., U.S.A., Chemist (U.S. Navy).
1896. Ogilvy, D. J., Gest Street; and C. H. and O. R. R., Cincinnati, Ohio, U.S.A., Manufacturing Chemist.
1902. Oglesby, Wm. R., Wabash Portland Cement Co., Stroh, La Grange Co., Ind., U.S.A., Chemist.
1901. Ogston, Alex. G., Ardoe, near Aberdeen, N.B., Soap Manufacturer.
1903. Ohlenschlager, J. G., jun., 2, Fowkes Buildings, Great Tower Street, London, E.C., Chemical Merchant.
1898. Olden, Chas., Hunstanton, Norfolk, Metallurgical Engineer.
1903. Oldham, E. W., St. Louis Portland Cement Co., St. Louis, Mo., U.S.A., Chemist.
1884. Oliver, F., 31, Horsley Hill Road, Westoe, South Shields, Analytical Chemist.
1902. Oliver, Frank M., 755, North 38th Street, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1888. Oliver, Wm. Letts, 101, Vernon Street, Oakland, Cal., U.S.A., Mining Engineer.
1901. Olivier, Dr. Louis, 22, Rue du Général-Foy, Paris, 8^{e}, Directeur (Revue Générale des Sciences).
O.M. Ollerenshaw, S., 96, Davyhulme Lane, Urmston, Manchester, Technical Chemist.
1903. O'Loughlin, C. C., Northern Aluminium Co., Shawenegan Falls, Quebec, Canada, Analyst.
1899. Olsson, Gustav, c/o Hecla Compressed Gas Co., West 3rd Street, Chelsea, Mass., U.S.A., Manufacturing Chemist.
1902. O'Neill, Chas., c/o Messrs. Wilson and Carlisle. Calle Maipu, Buenos Ayres, Argentina, Chemist and Colourist
O.M. O'Neill, E. H., Johnson's Saccharum Co., Limited, Stratford, London, E., Managing Director.

1898. Ormerod, Ernest, Chem. Laboratorium, Polytechnikum, Zurich, Switzerland, Chemical Student.

1894. Ormerod, John, Globe Leather Works, Castleton, Manchester, Tanner and Currier.

O.M. Orr, A., 35A, Bligh Street, Sydney, New South Wales, Analytical Chemist.

O.M. Orr, J. B., Chestnut Lodge, Widnes, Lancashire, Chemical Manufacturer.

1884. Orr, Robert; c/o Jas. Miller, Son, and Co., 79, West Nile Street, Glasgow; and (Journals), Kinnaird, Larbert, N.B., Manufacturing Chemist.

1899. Orr, Thos. W., Esperanza Nitrate Co., Taltal, Chile, Chemist.

1890. Orsman, Wm. Jas., Chemical Laboratory, Gathurst, near Wigan, Explosives Chemist.

1897. Osborne, Thos. B., P.O. Box 485, New Haven, Conn., U.S.A., Chemist.

1900. Osbourne, Jno. P., 572, Alexandra Parade, Dennistoun, Glasgow, Analytical Chemist.

1896. Osmond, Jno. H., c/o Smith, Bell, & Co., Manila, Sugar Works and Technical Chemist.

1900. O'Shaughnessy, Francis R., Home Farm, Tyburn, Birmingham, Chemist.

1885. O'Shea, L. T., University College, Sheffield, Chemical Lecturer.

O.M. O'Sullivan, C., F.R.S., 140, High Street, Burton-on-Trent, Brewer and Chemist.

1883. O'Sullivan, J., High Bank, Burton-on-Trent, Brewing Chemist.

1898. Oushkoff, John P., c/o P. K. Oushkoff & Co., Moscow, Russia, Chemical Manufacturer.

1903. Outwater, Raymond, 1312, B. Street S.W., Washington, D.C., U.S.A., Chemist.

1887. Overtoun, Lord, 7, West George Street, Glasgow, Chemical Manufacturer.

1904. Owen, Halsall, Newholme, Latchford, Warrington, Engineer.

1891. Owens, Caradoc, 88, Great Clowes Street, Lower Broughton, Manchester, Dyer's Manager.

1903. Ozias, Ramon E., 732, Clinton Avenue, Newark, N.J., U.S.A., Assayer.

P

1904. Packard, C. T., Millbank, Bramford, near Ipswich, Manager of Chemical Works.

O.M. Packard, E., jun., Bramford, near Ipswich, Manure Manufacturer.

1899. Paessler, Dr. Joh., Vorstand der Deutschen Versuchsanstalt für Lederindustrie, Freiberg in Sachsen, Germany, Chemist.

O.M. Page, F. J. M., 54, Sutherland Street, Pimlico, S.W., Chemical Lecturer.

1901. Page, Ralph H., Chemist (Solvay Co.).

1886. Pagès, Albert, 34, Boulevard Henri IV., Paris, Technical Chemist.

1892. Paine, Augustus G., 60, Times Building, and (Journals) 41, Park Row, New York City, U.S.A., President of Paper Making Co.

O.M. Paine, S., Devisdale, Bowdon, and (Journals) Otter Works, Manchester, Pharmaceutical Chemist.

1902. Pakes, Dr. Walter C. C., Box 1080, Johannesburg, Transvaal, S. Africa, Analyst and Bacteriologist.

1903. Palmenburg, O. W., 107, West 70th Street, New York City, U.S.A., Chemist.

1887. Palmer, T. Chalkley, Box 19, Chester, Pa., U.S.A., Manufacturing Chemist.

1887. Palmer, Thos. C., Beechwood, Moss Lane, Pinner, Engineer.

1902. Paquin, Felix, Memphis, Tenn., U.S.A., Chemist.

O.M. Park, J., Millburn Chemical Works, Garngad Hill, Glasgow, Chemical Manager.

1888. Parker, Chas. E., Vine House, Penketh, Warrington, Tanner.

1894. Parker, Chas. E., 164, New Street, New Brunswick, N.J., U.S.A., Chemist.

1898. Parker, Charles H., Craigside, Clark Street, Wolverhampton, Chemist.

1891. Parker, Edw., Laburnum House, Rushford Park, Levenshulme, Manchester, Analytical Chemist.

1904. Parker, G. H., c/o Messrs. Haddock, Parker, and Co., 14, Chapel Street, Liverpool, Chemical Broker.

1894. Parker, Dr. J. Gordon, Herold's Institute, Drummond Road, Bermondsey, S.E., Head of Tanning School.

1897. Parker, Matthew A., 13, Hamilton Crescent, Partick, Glasgow, Assistant to Professor of Chemistry.

1901. Parker, Richard H., N.Y. Testing Laboratory, Long Island City, N.Y., U.S.A., Analytical Chemist.

O.M. Parker, Thos., Manor House, Tettenhall, Wolverhampton, Electrical Engineer.

1891. Parker, Thos. J., Bayonne, N.J., U.S.A., Chemical Works Manager.

1903. Parker, Wm. B., t, Manor Road, Park Estate, Rugby, Chief Chemist (British Thomson-Houston Co., Ltd.).

1901. Parker, Dr. Wm. Huntington, 177, State Street, Boston, Mass., U.S.A., Chemist in Charge (U.S. Appraiser).

1898. Parker, W. W., Whitehouse Street Tannery, Bristol, Tanner.

1901. Parkes, Albert E., 43, Whitehorse Street, Stepney, E., Analytical Chemist.

1898. Parrish, Saml., 80, Grange Avenue, Chapeltown Road, Leeds, Teacher of Chemistry.

1896. Parry, John, Ebbw Vale Wharf, Newport, Mon., Analytical Chemist.

1901. Pass, James, Onondaga Pottery Co., Syracuse, N.Y., U.S.A., Pottery Manufacturer.

1902. Patch, Prof. Jas. A., Syrian Protestant College, Beirût, Syria, Prof. of Chemistry.

1902. Patchett, Isaac, 11, Field Hill, Batley, Yorks, Science Master.

1897. Patchett, Jas., Oakworth, Hadley, Wellington, Salop, Ironmaster.

1901. Paterson, David, Leabank, Rosslyn, Midlothian, Colour Chemist.

1884. Paterson, John, Belle Isle Place, Workington, Cumberland, Mechanical Engineer.

1887. Paton, J. M. C., Messrs. Manlove, Alliott & Co., Ltd., Nottingham, Mechanical Engineer.

1886. Paton, W. Grant, 18, Bertram Road, Liverpool, Alkali Works Manager.

1901. Patterson, Chas. A., c/o Repauno Chemical Co., Chester, Pa., U.S.A., Analytical Chemist.

1903. Patterson, E. V., University Club, Baltimore, Md., U.S.A., Textile Colourist.

O.M. Patterson, Geo., c/o The Manbré Saccharine Co., Ltd., Fulham Palace Road, Hammersmith, W., Technical Chemist.

1893. Patterson, Harry J., College Park, Prince George's Co., Md., U.S.A., Agricultural Chemist.

O.M. Patterson, T. L., Maybank, Finnart Street, Greenock, N.B., Sugar Works Manager.

1902. Patterson, Wm. Hamilton, Fernlea, Danes Road, Rusholme, Manchester, Student.

1881. Pattinson, Dr. H. Salvin, 75 Side, Newcastle-on-Tyne, Analytical Chemist.

O.M. Pattinson, J., 75, The Side, Newcastle-on-Tyne, Consulting Chemist.

O.M. Pattison, Jas., Drimnamona, Kilmalcolm, N.B., Chemical Merchant.

1889. Pattison, Percy J., 5, Kingsley Road, Forest Gate, E., Technical Chemist.

1900. Paul, Dr. L. Gordon, Market Hall Chambers, Huddersfield, Consulting Chemist.

1891. Paul, Jas. H., 19, Glenluce Road, Blackheath, S.E., Analytical Chemist.

1902. Pauli, Dr. Hermann, Rusterstrasse 15, Frankfurt a/M., Germany, Chemist.

1902. Pay, Walter Herbert, Government Laboratory, Durban, Natal, S. Africa, Chemist and Assayer.

O.M. Payne, J. B., 15, Mosley Street, Newcastle-on-Tyne, Manufacturing Chemist.

1898. Pearce, Edw. D., Messrs. T. P. Shepard and Co., P.O. Box 1336, Providence, R.I., U.S.A., Manufacturing Chemist.
1894. Pearce, Jas. Stanley, Clements, Snaresbrook, Essex, Chemical Manufacturer.
1897. Pearce, Richard, Argo, Col., U.S.A., Smelting Works Manager.
1903. Pearce, Sidney H., P.O. Box 149, Johannesburg, Transvaal, South Africa, Metallurgist.
1883. Pearce, W., Chemical Works, Bow Common, London, E., Chemical Manufacturer.
1903. Pearcy, A. C., 40, St. Kilda's Road, Stoke Newington, N., Director, Explosives Co.
1903. Pears, Thos., The Laboratory, Soap Works, Isleworth, Soap Manufacturer.
1893. Pearson, Frank P., Arnold Printworks, North Adams, Mass., U.S.A., Printworks Manager.
1894. Pearson, Wm. H., 6, Fenchurch Buildings, London, E.C., Analytical Chemist.
O.M. Pechiney, A. R., Salindres, Gard, France, Chemical Engineer.
1898. Peck, Dr. Ernest L., Claremont, Merrilocks Road Blundellsands, near Liverpool, Analytical Chemist.
1898. Peckham, Stephen F., Room 104, 280, Broadway, New York City, U.S.A., Chemist.
1894. Peden, Jno., 30, Ardgowan Street West, Greenock, N.B., Analytical Chemist.
O.M. Pedler, Prof. A., C.I.E., F.R.S., Writer's Buildings, Calcutta, India, Director of Public Instruction.
1886 Pedler, J. R., 47, Tregunter Road, South Kensington, S.W., Clerk.
1903. Peffer, Harry C., c/o Pittsburgh Reduction Co., East St. Louis, Ill., U.S.A., Manufacturing Chemist.
1899. Pell, A., 7, Elphinstone Circle, Bombay, India, Chemist.
1897. Pellew, Chas. E., Columbia University, New York City, U.S.A., Adjunct Professor of Chemistry.
1896. Penney, Mulgrave D., 11, High Street, Hull, Analytical Chemist.
1903. Pennington, R. W. R., "Carbonic," Mazagon, Bombay, India, General Manager and Engineer (Sirdar's Carbonic Acid Co., Ltd.).
1890. Pennock, J. D., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Technical Chemist.
1885. Pentecost, S. J., Nottingham Road, New Basford, and (Journals), Sherwood Hill Works, Sherwood Rise, Nottingham, Lace Dresser.
1887. Pentermann, H. T., 37, Clifton Crescent, Peckham, S.E., Brewing Chemist.
1892. Peploe, D. H. T., Underriver House, Sevenoaks, Kent.
1899. Peppel, S. Vernon, 431, Main Street, Louisville, Ky., U.S.A., Chemist.
1885. Perkin, A. G., F.R.S., 8, Montpelier Terrace, Hyde Park, Leeds, Technical Chemist.
1898. Perkin, Dr. F. Mollwo, Borough Polytechnic Institute, Borough Road, S.E., Head of Chemical Department.
O.M. Perkin, Dr. W. H., F.R.S., The Chestnuts, Sudbury, Harrow, Research Chemist.
1887. Perkin, Dr. W. H., jun., F.R.S., Fairview, Wilbraham Road, Fallowfield, Manchester, Professor of Chemistry.
1903. Perkins, Frank G., Lake Mary, Florida, U.S.A., Starch Manufacturer.
1893. Perkins, T. S., 155, Bushkill Street, Easton, Pa., U.S.A., Chemist.
1899. Perks, Walter G., (Journals) Glanafon, and (communications) c/o National Explosives Co., Ltd., Hayle, Cornwall, Manufacturer.
1904. Perrott, Bert, County School, Neath, Glamorgan Demonstrator in Chemistry.
1901. Perry, Chas. M., 4, Catalpa Road, Providence, R.I., U.S.A., Bleach and Dyeworks Chemist.
1887. Perry, D., Norwood, Lenzie, N.B., Manufacturing Chemist.
1895. Perry, Jos. H., 276, Highland Street, Worcester, Mass., U.S.A., Teacher of Chemistry.
1903. Perry, M. J. T., Australian Drug Co., O'Connell Street, Sydney, N.S.W., Australia, Manufacturing Chemist.
1903. Perry, Robt. Swain, c/o Harrison Bros. and Co., Inc., 35th Street and Gray Ferrry Road, and (Journals) Station D., Philadelphia, Pa., U.S.A., President.
1901. Persons, Ashton C., 315, Prospect Street, Willimantic, Conn., U.S.A., Chemist.
1897. Peter, Dr. A. H., c/o Zinsser and Co., Hastings-on-Hudson, N.Y., U.S.A., Chemist.
1893. Pethybridge, Walter, 3, Rhodesia Road, Clapham Rise, S.W., Chemist and Assayer.
1903. Petrie, Jas. M., The University, Sydney, N.S.W., Australia, Chemist.
1902. Petsche, B. W., 25, Fairview Street, Yonkers, N.Y., U.S.A., Chemist.
1883. Pettigrew, J., 6, St. Helen's Place, Bishopsgate, E.C., Technical Chemist.
1892. Pettigrew, Robt., c/o Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Electrochemist.
1902. Pettitt, Alf., 691, Fulton Street, Brooklyn, N.Y., U.S.A., Chemist.
O.M. Peyton, E. P., Chemical Works, Lister Street, Birmingham, Chemical Manufacturer.
1900. Peyton, Wm. C., c/o Peyton Chemical Co., Room 30, 4th Floor, Mills Building, San Francisco, Cal., U.S.A., Chemist.
1888. Philip, Arnold, Chemical Laboratory, H.M. Dockyard, Portsmouth, Electro-Metallurgist and Electrical Engineer.
1903. Philipp, Herbert, 92, Gordon Street, Perth Amboy, N.J. U.S.A., Chemist and Electrochemical Engineer.
1886. Phillips, A. G., 11, Essex Villas, Phillimore Gardens, Kensington, W., Barrister-at-Law.
1891. Phillips, G. Brinton, (Journals) 622, Race Street; (communications) 2007, De Lancey Place, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
O.M. Phillips, Harcourt, 9, Crawford Avenue, Bolton, Analytical Chemist.
1895. Phillips, S. Chas., 47, Cannon Street, London, E.C., Chemical Engineer.
1904. Phillips, V. C., Haselmere, Morris Avenue, Manor Park, E., Chemist.
1898. Phillips, Wm. H., 100, Milton Avenue, East Ham, E., Soapmakers' Assistant.
1883. Phipson, Dr. T. L., Casa Mia, Putney, S.W., Analytical and Consulting Chemist.
1894. Picard, Hugh F. K., 44, London Wall, London, E.C., Metallurgist.
O.M. Pick, Dr. S., Direction der Soda Fabrik, Szczakowa, Galizien, Austria, Chemical Engineer and Manager.
1902. Pickard, R. H., Merlin Road, Blackburn, Teacher and Analyst.
1897. Pickert, Leo. W., American Sugar Refining Co., Granite Street, South Boston, Mass., U.S.A., Chemist.
1904. Pickup, Edgar H., 348, Great Clowes Street, Higher Broughton, Manchester, Calico Printer.
1899. Pidduck, E. W., University College of Wales, Aberystwith, Wales, Assistant Chemist.
1901. Pierce, Ira L., Woodbury, Gloucester Co., N.J., U.S.A., Chemist (Repauno Chemical Co.).
1897. Pilhashy, Benj. M., 1325, Lincoln Avenue, Walnut Hills, Cincinnati, Ohio, U.S.A., Chemist (Pure Culture Yeast Co.).
1888. Pilkingten, G., Laboratory, Victoria Buildings, Silver Street, Bury, Lancashire, Analytical Chemist.
1893. Pilley, Thos. W., 33, Grove Hill Road, Denmark Hill, S.E., Analytical Chemist.
1894. Pilling, John E., Agnew Villas, 78, Whitegate Drive, Blackpool, Chemist.
1883. Pipe, Jas., Messrs. Wm. Henderson & Co., Irvine, N.B., Chemical Manufacturer.
1896. Piper, Walter E., Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.
1899. Pirie, Alex. G., Messrs. Alex. Pirie and Sons, Ltd., Stoneywood Works, Bucksburn, Aberdeenshire, Paper Manufacturer.
1900. Pitman, Jno. R., c/o Laflin and Rand Powder Co., Haskell, N.J., U.S.A., Chemist.

O.M. Pitt, T., 16, Coleman Street, London, E.C., Manufacturing Chemist.
1902. Pittard, Jno., 30, Mansfield Road, Ilford, Essex, Chemical Manufacturer.
1884. Pittuck, F. W., 15, Stratford Grove, Heaton, Newcastle-on-Tyne, Technical Chemist.
1899. Pizey, Jas. H., 22, Duke's Avenue, Muswell Hill, N., Chemist.
1894. Platten, Frank, c/o Elliot's Metal Co., Limited, Selly Oak Works, near Birmingham, Metallurgical Chemist.
1890. Platts, Jno. C., Heaton Moor Lodge, Heaton Chapel, near Stockport, Metallurgical Chemist.
1896. Plaut, Albert, 128, William Street, New York City, U.S.A., Wholesale Druggist.
1888. Playfair, David J., 7, Victoria Crescent, Dowanhill, Glasgow, Manufacturing Chemist.
1891. Pocklington, Hy., 41, Virginia Road, Leeds, Assurance Co.'s Local Manager.
1901. Pollard, Wm., Museum, Jermyn Street, London, S.W., Chemist (H.M. Geological Survey).
1902. Pollitt, Jas. C. T., c/o Kynoch, Ltd., Witton, near Birmingham, Managing Chemist.
1893. Pollitt, R. B., De Beers Explosives Works, Somerset West, C.C., South Africa, Civil Engineer.
1883. Pollock, A., Kirkland, Bonhill, Dumbartonshire, Dyeworks Manager.
1890. Pomeroy, Dr. Chas. T., 55, Broad Street, Newark, N.J., U.S.A., Ink Manufacturer.
1896. Pond, Prof. G. G., State College, Centre Co., Pa., U.S.A., Professor of Chemistry.
O.M. Pond, J. A., 99, Queen Street, Auckland, New Zealand, Analytical Chemist.
1900. Pont, Francis G. du, Montchanin, Del., U.S.A., Manufacturer.
1895. Pont, Pierre S. du, Wilmington, Del., U.S.A., Explosives Manufacturer.
1896. Poole, Herman, 157, West 106th Street, New York City, U.S.A., Manufacturing Chemist.
O.M. Pooley, T. A., Beverley, Hersham Road, Walton-on-Thames, Analytical Chemist.
1892. Pope, Frank, c/o The Dunwoody Bros. Soap Co., Denver, Col., U.S.A., Chemist.
O.M. Pope, S., 35, Victoria Road, Runcorn, Chemical Works Manager.
1899. Pope, Thos. H., The University, Birmingham, Chemist.
1900. Pope, Prof. W. J., F.R.S., Municipal School of Technology; and (Journals), 16, Hope Street, Higher Broughton, Manchester, Professor of Chemistry.
1900. Popplewell, Jos. M., c/o Brotherton and Co., Holmes Street, Dewsbury Road, Leeds, Chemist.
1899. Porter, A. Felix, Haskell, N.J., U.S.A., Explosives Chemist.
1896. Porter, Herbert, 80, Lancaster Avenue, Fennel Street, Manchester, Alkali Inspector.
1902. Porter, J. Edw., P.O. Box 785, and 205, W. Genesee Street, Syracuse, N.Y., U.S.A., Chemist.
1901. Porter, Jno. L., New Orleans Sewerage Board, 602, Carondelet Street, New Orleans, La., U.S.A., Chemist.
1899. Potter, Chas. A., 198, Waterman Street, Providence, R.I., U.S.A., Chemist.
1884. Potter, Chas. E., Love Lane Sugar Refinery, Liverpool, Sugar Works Chemist.
1888. Potter, Chas. J., Heaton Hall, Newcastle-on-Tyne, Cement Manufacturer.
O.M. Potter, E. P., Salwick Hall, near Preston, Alkali Manufacturer.
1899. Potter, Rowland S., 97, Belgrave Road, Ilford, Essex, Chemist.
1902. Potts, Cuthbert, Hawkesbury Agricultural College, Richmond, N.S.W., Lecturer in Chemistry.
1900. Potts, Geo., E., Dover, N.J., U.S.A., Explosives Manufacturer.
1902. Potts, Henry Wm., Hawkesbury Agricultural College, Richmond, N.S.W., Chemist and Principal.
1892. Potts, Joseph T., Price's Patent Candle Co., Bromboro' Pool, near Birkenhead, Chemist.
1900. Pough, Frank H., c/o T. and S. C. White Co., 28, Burling Slip, New York City, U.S.A., Manager.
1889. Powell, A. Ernest, Craigowan, Clarendon Road Whalley Range, Manchester, Oil Merchant.
1900. Powell, Harry J., 506, Lordship Lane, S.E., Glass Manufacturer.
1884. Powell, L. S., St. John's Cottage, Hildenborough, Tonbridge, Electrician.
1897. Power, Dr. Fred. B., Wellcome Research Laboratories, 6, King Street, Snow Hill, London, E.C., Director.
1902. Powney, Wm. E. F., 9, Lancaster Road, Stroud Green, N., Analytical Chemist.
1900. Pratt, N. P., Laboratory, Atlanta, Ga., U.S.A., Manufacturing Chemist.
1889. Pratt, Walter E., 17, East Road, Lancaster, Analytical Chemist.
1897. Prentice, Dr. Bertram, Royal Technical Institute Salford, Lecturer on Chemistry.
1902. Prentice, Dr. David, 30, Whitefield Road, Stockton Heath, Warrington, Chemist.
1903. Prentice, Jas., Cossipore Sugar Works, Calcutta, India, Chemist.
1888. Prescott, Dr. Albert B., Ann Arbor, Mich., U.S.A.
1900. Prescott, Saml. C., Mass. Inst. of Technology, Boston, Mass., U.S.A., Instructor in Bacteriology.
1891. Preston, Alf., 29, Southfields, Manchester Road, Bury, Lancs., Chemist.
1883. Preston, R., Grasmere, Whitefield, near Manchester, Manufacturing Chemist.
O.M. Price, A. F., 524, Sacramento Street, San Francisco, Cal., U.S.A., Analytical Chemist.
1904. Prichard, Norman B., Capelton, Quebec, Canada, Chemical Engineer.
1902. Pringsheim, Dr. H. H., Boylston Hall, Harvard University, Cambridge, Mass., U.S.A., Chemist.
1899. Prinsen-Geerligs, H. C., Tegal, Java, Netherlands Indies, Director of Sugar Cane Experimental Station.
1893. Pritchard, Edgar J., North Hill, Swansea, Works Manager.
1903. Pritchard, Philip M., Chief Engineer's Office, United Alkali Co., Widnes, Engineer.
1896. Prochazka, Dr. Geo. A., 138, West 13th Street, New York City, U.S.A., Colour Manufacturer.
1897. Prochazka, John, 15, East 12th Street, New York City, U.S.A., Coal-Tar Colour Chemist.
O.M. Procter, Prof. H. R., Yorkshire College, Leeds; and (Journals) Rowangarth, Ben Rhydding, near Leeds, Yorks, Lecturer on Tanning.
1884. Procter, J. W., Skeldergate Bridge, York, Manure Manufacturer.
1890. Proctor, Miss Anne J., Free Library, Widnes, Librarian.
O.M. Proctor, C., 99, Underhill Road, East Dulwich, S.E., Analytical Chemist.
O.M. Proctor, W. W., 33, The Side, Newcastle-on-Tyne Assayer and Analytical Chemist.
1901. Propach, C., 189, East Kinzie Street, Chicago, Ill., U.S.A., Colour Merchant.
1894. Proude, Jas., 30, Cromwell Terrace, Halifax, Yorks, Soap Works Chemist and Manager.
1899. Pullar, Edmund, Keirfield, Bridge of Allan, N.B., Manufacturer.
1894. Pullar, Herbert S., Pullar's Dyeworks, Perth, N.B., Dyer.
O.M. Pullar, Sir Robert; Journals to Jas. Craigie, Sandeman Public Library, Perth, N.B., Dyer.
O.M. Pullar, R. D., Pullar's Dyeworks, Perth, N.B., Dyer.
1903. Pullin, Sydney R., 10, Newton Grove, Chapeltown Road, Leeds, Chemist.
1902. Puntan, H. H. C., 10, London Chambers, Durban, Natal, Public Analyst.
1894. Purdie, Dr. Thos., F.R.S., 14, South Street, St. Andrews, N.B., Professor of Chemistry.

Q

1903. Queeny, Jno. F., Monsanto Chemical Works, 1806—1818, South 2nd Street, St. Louis, Mo., U.S.A., Chemical Manufacturer.

1903. Queneau, Augustin L., c/o New Jersey Zinc Co., South Bethlehem, Pa., U.S.A., Mining Engineer.

1887. Quibell, Oliver, Shalem Lodge, Newark-on-Trent, Manure Manufacturer.

1902. Quinan, Kenneth B., c/o De Beers Explosives Works, Somerset West, Cape Colony, South Africa, Chemist.

1897. Quinan, Wm. R., (Journals) General Manager, De Beers Explosives Works, Cape Town, South Africa; and (subscriptions) c/o De Beers Consolidated Mines, 15, St. Swithin's Lane, E.C., Superintendent (Powder Works).

1897. Quirk, Jno. S., Lead Smelting Works, St. Helens, Lancs., Manager.

R

1898. Radcliffe, Lionel G., 6, Alma Terrace, Old Trafford, Manchester, Chemist.

1904. Rademacher, Dr. Ferdinand, Prag Carolinenthal, Austria, Chemical Manufacturer.

1884. Rademacher, H. A., Arlington Mills, Lawrence, Mass., U.S.A., Chemical Expert.

1900. Radley, Ernest G., 49, Ernest Street, West Norwood, S.E.

1897. Rae, Roderic H., Claremont, Turner's Hill, Cheshunt, Herts, Engineer (Edison-Swan Electric Works).

1895. Raegener, Louis C., 141, Broadway, New York City, U.S.A., Lawyer.

1901. Ralston, Wm., Government Chem. Laboratory, Lagos, West Africa, Government Chemist.

1902. Ramsay, A. Alexander, Laboratory, Department of Agriculture, 136, George Street, Sydney, N.S.W., Assistant Chemist.

O.M. Ramsay, Sir William, K.C.B., D.Sc., LL.D., F.R.S., University College, Gower Street, London, W.C.; Journals to 19, Chester Terrace, N.W., Professor of Chemistry.

1888. Ramsay, W., c/o Laird Bros., Ironworks, Birkenhead, Chemist and Assayer.

1898. Ramsden, Andrew, Deccan Sugar Co., Ltd., Samalkot, Godaveri District, India, Manager.

1901. Ransom, Francis, The Chilterns, Hitchin, Herts, Manufacturing Pharmaceutical Chemist.

1898. Raschen, Dr. Julius, The Highlands, Runcorn, Cheshire, Consulting Chemist (United Alkali Co.).

1893. Ratcliff, Frank D., The Cottage, Green Hill, Bromsgrove, Worcestershire, Vinegar Brewer.

1904. Ratcliffe, C. F., Tar Works, Pontefract Road, Leeds, Tar Distiller.

1898. Ratcliffe, Walter, 21, Mawdsley Street, Bolton, Analytical Chemist.

1895. Rau, Dr. H. M., 130–132, Pearl Street, New York City, U.S.A., Chemist.

1901. Rauter, Dr. G., Cauerstrasse 2, Charlottenburg 1, bei Berlin, Germany, Engineering Chemist.

1901. Rawlins, Herbert J. L., The Cottage, Rainhill, Lancashire, Managing Director.

1903. Rawolle, Frederick C., c/o Marx and Rawolle, 100, William Street, New York City, U.S.A., Chemist.

O.M. Rawson, Chris., 44, St. Augustine Road, Bedford, Anal. and Cons. Chemist.

1883. Rawson, Dr. S. G., Technical Schools, Huddersfield, Analytical Chemist.

1904. Ray, Wm., 65, Wellington Road, Fallowfield, Manchester, Colourist.

1895. Read, E. J., St. Ives, The Avenue, Gravesend, Kent, Analyst.

1890. Reade, Thos., Sebright House, Tettenhall Wood, Wolverhampton, Manufacturing Chemist.

1903. Reading, Richard W., Knight's Deep, Ltd., P.O. Box 143, Germiston, Transvaal, S. Africa, Assayer and Mechanical Engineer.

O.M. Readman, Dr. J. B., Mynde Park, Hereford, Analytical and Consulting Chemist.

1902. Redfern, C. G., 4, South Street, Finsbury, London E.C., Patent Agent.

1890. Redgate, J. G., Traffic Street, Nottingham, Aërated Water Manufacturer.

1901. Redpath, Leon W., International Smokeless Powder and Dynamite Co., Parlin, N.Y., U.S.A., Chemist.

O.M. Redwood, Dr. Boverton, 4, Bishopsgate Street Within, London, E.C., Petroleum Expert.

1884. Redwood, I. I., Bantry House, Picardy Hill, Belvedere, Kent, Technical Chemist.

1887. Redwood, Robt., 4, Bishopsgate Street Within, London, E.C., Secretary.

1891. Redwood, T. Horne, Olveston, Sedlescombe Road, St. Leonard's-on-Sea, Analytical Chemist.

1886. Rée, Dr. A., 15, Mauldeth Road, Withington, Manchester, Aniline Dye Manufacturer.

1884. Reed, Albert E., The Grange, Leigham Court Road, Streatham, S.W., Paper Works Chemist.

1902. Reed, Herbert C., c/o Stamford Manufacturing Co., Stamford, Conn., U.S.A., Chemist.

1895. Reed, Dr. J. Hastings, Hambledon Mill, *viâ* Cairns, North Queensland, Sugar Manufacturer.

1893. Reekie, J. A., Blackford House, Whitefield, near Manchester, Calico Printer's Colour Mixer.

1883. Reeks, T. H., 106, Queen Victoria Street, London, E.C., Analytical and Consulting Chemist.

1901. Rees, Harald B., c/o Harris-Rees Tanning Co., Sylva, N.C., U.S.A., Tanner and Currier.

1897. Rees, W. H., Big Pine, Inyo Co., Cal., U.S.A., Chemist.

1900. Reese, Dr. Chas. L., c/o Repauno Chemical Co., Chester, Pa., U.S.A., Chemist.

1897. Reid, Andrew, 133, Minard Road, Crossmyloof, Glasgow, Chemist.

1896. Reid, Robt., Oil Mills, Horbury Bridge, near Wakefield, Chemical Student.

1895. Reid, T. Anderson, c/o Johnsen, Jörgensen, and Wettre, 38, Victoria Buildings, Manchester, Works Manager.

O.M. Reid, Walter F., Fieldside, Addlestone, Surrey, Technical Chemist.

1893. Reid, Wm., jun., Bombay Dyeworks, Dadur, Bombay, India, Dyer.

1898. Reitmeyer, Robt. E. D., 1 & 2, Rangoon Street London, E.C., Chemical Merchant.

1901. Remington, J. Percy, jun., U.S.A., Chemist.

1900. Remington, J. Stewart, Aynsome, Grange-over-San R.S.O., Lancs., Consulting Chemist.

1903. Remsen, President Ira, Johns Hopkins University, Baltimore, Md., U.S.A., President.

1884. Renaut, F. W., 17, Emanuel Avenue, Friar's Park, Acton, W., Secretary.

O.M. Rennie, Dr. E. H., University of Adelaide, South Australia, Professor of Chemistry.

O.M. Reunoldson, W. L., c/o United Alkali Co., Ltd., Hebburn-on-Tyne, Manager.

1901. Renwick, Frank F., Glengall, Woodford Green, Essex, Chemist (Photographic Works).

1894. Rettie, Theodore, 16, Great King Street, Edinburgh. Metallurgical Chemist.

1895. Reubens, Chas. M., c/o Brady Brass Co., 202, Tenth Street, Jersey City, N.J., U.S.A., Chemist.

1902. Reuterdahl, Arvid, 194, Calla Street, Providence, R.I., U.S.A., Consulting Electrical Chemist.

O.M. Reynolds, Dr. J. Emerson, F.R.S., 29, Campden Hill Court, Kensington, W., Professor of Chemistry.

O.M. Rhodes, E., c/o Thos. Vickers & Sons, Widnes, Technical Chemist.

1892. Rhodes, Jos., Church Bridge House, Accrington Print Works Chemist.

1902. Rhodin, B.E.F., Sault Ste. Marie, Ont., Canada, Chemical Engineer.

1895. Ricarde-Seaver, Major F. J., 16, Grafton Street, Bond Street, W., Metallurgist.

1901. Richard, Geo. A., Mount Morgan Mine, Queensland, Australia, Metallurgical Engineer.

1889. Richards, Edgar, 341, West 88th Street, New York City, U.S.A., Analytical Chemist.

1888. Richardson, Clifford, New York Testing Laboratory, Long Island City, N.Y., U.S.A., Chemical Engineer.

1888. Richardson, D. B., Aucheneck, Killearn Station, N.B., Chemical Merchant.

1903. Richardson, F. J., Chemical Works, Ringsend Docks, Dublin, Ireland, Chemical Manure Manufacturer.

1884. Richardson, F. W., Oak Lea, Menston, Yorkshire, Analytical Chemist.

1892. Richardson, G. E., Branch House, Batley, Yorks Manufacturing Chemist.

1900. Richardson, Jno. H., c/o H. D. Pochin and Co., Ltd., Salford, Manchester, Manager.

1889. Richardson, S. M., 415, Main Street, Bonhill, N.B. Analytical Chemist.

1891. Richardson, Walter W., 1, Montpellier Terrace, Cliff Road, Leeds, Manufacturing Chemist.

1903. Richardson, Wm., 2, Oakfield Terrace, Headingley, Leeds, Drysalter.

1894. Richardson, Wm. H., Newsky Thread Mills, Malaja Bolotnaja, St. Petersburg, Russia, Textile Chemist.

1886. Richmond, H. D., Fair Holm, Grimwood Road, Twickenham, Chief Chemist (Aylesbury Dairy Co.).

1898. Richmond, Jno. R., Stalheim, Eccleston Park, Prescot, Lancs., Alkali Works Manager.

1901. Richmond, Sylvester O., c/o A. H. Allen, 67, Surrey Street, Sheffield, Analytical Chemist.

1884. Richmond, W. H., Stalheim, Eccleston Park, Prescot, Alkali Manufacturer.

1886. Riddell, R., 87, Horninglow Street, Burton-on-Trent, Brewer.

1894. Ridding, Howard C., School of Mines, Redruth, Cornwall, Principal.

1884. Rideal, Dr. Samuel, Chemical Laboratory, 28, Victoria Street, Westminster, S.W., Analytical and Consulting Chemist.

O.M. Ridsdale, C. H., Ferndale, Linthorpe, Middlesbrough, Yorks, Analytical Chemist.

1899. Riederer, Emil J., Forcite Powder Co., Landing, P.O., N.J., U.S.A., Chemist.

1902. Riederer, Dr. Herman S., Newton, Sussex Co., N.J., U.S.A., Chemist.

1892. Riker, Jno. J., 45, Cedar Street, New York City, U.S.A., Merchant.

O.M. Riley, E., 2, City Road, Finsbury Square, London, E.C., Metallurgical Chemist.

1902. Riley, Fred., 43, Grampian Way, Savin Hill, Boston, Mass., U.S.A., Traveller.

O.M. Riley, J. E., Arden Hall, near Accrington, Chemical Manufacturer.

1884. Riley, Jno., Mayfield, Thornliebank, near Glasgow, Print Works Manager.

1893. Riley Wm., Castleton, Manchester, Chemical Manufacturer.

1904. Riley, W. A., Brunswick Lodge, Newmarket Road, Norwich, Brewer.

1899. Rink, Arnold, 9, Butler Street, Milton Street, London, E.C., Tannin Extract Manufacturer.

1889. Rintoul, Wm., Royal Gunpowder Factory, Waltham Abbey, Essex, Explosives Chemist.

1901. Ripley, Philip F., c/o American Woollen Co., Maynard, Mass., U.S.A., Chemist.

1900. Rising, Willard B., Berkeley, Cal., U.S.A., Professor of Chemistry.

1885. Ritson, T. N., 1, West Cliff Villas, West Cliff Road, Ramsgate, Gas Engineer.

1899. Rivington, W. John, 24, Mark Lane, London, E.C., Newspaper Proprietor.

O.M. Rix, W. P., Ashfield Cottage, Liverpool Road, Newcastle, Staffordshire, Potter.

1890. Roberts, C. F., Linfitts, Delph, viâ Oldham, Chemical Merchant.

O.M. Roberts, F. G. Adair, Oak Hill Lodge, Frognal, N.W., Chemical Manufacturer.

1901. Roberts, H. E. U. (Journals), 11, Albion Terrace, Faversham, Kent; and 9, St. James' Street, Bath, (Cotton Powder Co., Ltd.), Chemist.

1885. Roberts, R. Wightwick, 22, Calle Arturo Prat, Valparaiso, Chili, Analytical and Consulting Chemist.

1900. Roberts, Wm. Brittain, Wilderspool House, Warrington, Brewer and Analyst.

1902. Roberts, Wm. H., 1, Newborough Avenue, Sefton Park, Liverpool, S., Analytical Chemist.

1902. Robertshaw, Chas. D., c/o Chas. Price and Co., Oilworks, Belvedere, Kent, Analytical Chemist.

1894. Robertson, Alex., Argyle Chemical Works, Oban, N.B., Manufacturing Chemist.

1891. Robertson, Alex. A., 12, Bennison Drive, Grassendale, Liverpool, Technical Chemist.

1897. Robertson, Andrew J., 17, South 12th Street, Richmond, Va., U.S.A., Analytical Chemist.

1903. Robertson, Fred., 128, Wellington Street, Glasgow, Analytical Chemist.

1900. Robertson, Jas., 103, Whifflet Street, Coatbridge, N.B., Analytical Chemist.

1891. Robertson, Dr. Robt., (communications) 9, Sewardstone Road; (Journals) Royal Gunpowder Factory, Waltham Abbey, Essex, Analytical Chemist.

1901. Robertson, Robert, California Powder Works, Santa Cruz, Cal., U.S.A., Superintendent.

1903. Robertson, W. Crum, 15, Commerce Street, Glasgow, Oil Merchant and Importer.

1895. Robins, Walter, Wanstead Cottage, New Wanstead, Essex, Chemist.

1897. Robinson, Clarence J., Westerleigh, West New Brighton, N.Y., U.S.A., Chemist.

1900. Robinson, Edw. B., Victoria Oil Works, Nitshill, near Glasgow, Oil Distiller.

1902. Robinson, Hy. Fishwick, Culcheth Chemical Works, Newton Heath, Manchester, Manufacturing Chemist.

O.M. Robinson, H. H., 75, Finborough Road, West Brompton, S.W., Analytical Chemist.

O.M. Robinson, Jno., 8, Kaludah Terrace, Albert Road, Widnes, Chemical Engineer.

O.M. Robinson, Jos., Farnworth, Widnes, Chemical Manufacturer.

1387. Robinson, Thomas, (Journals) 401, West Street, Glasgow; and (communications), The Villa, Nitshill, N.B., Chemical Works Manager.

1902. Robitschek, Carl, 200, Worth Street, New York City, U.S.A., Scientific Brewer.

1894. Robson, Jas., 204, George Street, Glasgow, Chemist.

1903. Robson, Tom, Caixa 149, Pernambuco, Brazil, Engineer.

1894. Rodda, Edw. D., 6, Gold Street, Roath, Cardiff, Engineer.

1884. Rodger, Edw., 1, Clairmont Gardens, Glasgow, W.

1904. Roeber, Dr. E. F., 114, Liberty Street, New York City, U.S.A., Editor of "Electrochemical Industry."

1903. Roelofsen, Dr. J. A., c/o Coal Distillation Co., Middlesborough, Yorks., Works Manager.

1900. Rogers, Geo. J., Wallaroo Smelting Works, South Australia, Chemist.

1890. Rogers, Harry, 5, Stoke Newington Common, London, N.

1899. Rogers, John, Ardeer Factory, Stevenston, Ayrshire, N.B., Chemist.

1901. Rogerson, John W., 5, Ashley Gardens, London, S.W.., Maltster.

1898. Roller, H. C., 139, Henry Street, Brooklyn, N.Y., U.S.A., Superintendent.

1899. Rollin, Chas., Bylton, East Jarrow-on-Tyne, Chemical Manufacturer.

O.M. Rollin, J. C., 1, St. Nicholas Buildings, Newcastle-on-Tyne, Chemical Manufacturer.

1898. Roode, Rudolf de, International Paper Co., Glens Falls, N.Y., U.S.A., Chemist and Superintendent.

O.M. Roscoe, Sir Henry, F.R.S., 10, Bramham Gardens, South Kensington, S.W., Consulting Chemist.

1901. Roscow, Jas., 471, Park Avenue, Paterson, N.J., U.S.A., Colourist and Chemist.

1893. Roscow, Jno. F., c/o United States Finishing Co., Norwich, Conn., U.S.A., Print Works Chemist.

1899. Roscow, Wm., 24, Prince Street, Pawtucket, R.I., U.S.A., Analytical Chemist.

1904 Rose, Jno., 121, Lovely Lane, Warrington, Technical Chemist.

1901 Rose, Jno. Leonard, Porton Brook Chemical Works, Manchester, S.E., Chemist.

1902. Rosebrugh, Prof. T. R., 666, Spadina Avenue, Toronto, Canada, Professor of Electrical Engineering.

1897. Rosengarten, Dr. Geo. D., 1700, Fitzwater Street, Station D, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

1896. Rosenheim, Dr. Otto, 68, Belsize Park Gardens, Hampstead, N.W., Analytical and Research Chemist.

1887. Ross, Alex. J. J., Tayavalla, Falkirk, N.B., Chemical Manufacturer.

1893. Ross, Arthur, 1, Glengall Road, Old Kent Road, London, S.E., Analytical Chemist.

1901. Ross, Herbert W., 1070, 16th Street, Oakland, Cal., U.S.A., Chemist.

1887. Ross, Jas. G., (Journals) 5–9. Sunbury Place, Belford Road; and (subscriptions) 47, Comely Bank Place, Edinburgh, Analytical Chemist.

1900. Ross, Raymond, Public Analyst's Office, Burnley, Lancashire, Analytical Chemist.

1888. Rothwell, C. F. Seymour, Film and Paper Factory, Mobberley, Cheshire, Chemist.

O.M. Rottenburg, Paul, Messrs, Leisler, Bock & Co., 105, West George Street, Glasgow, Chemical Merchant.

1896. Round, Wm., Albion Street, Birmingham, Analytical Chemist.

1899. Rouse, H. W., 62, Russell Road, Custom House, E., Foreman (Sulphuric Acid Works).

1903. Rouse, Wm., 63, John Street, Alexandria, Dumbartonshire, Chemist.

O.M. Rowland, W. L., 4800, Chester Avenue, Philadelphia, Pa., U.S.A., Chemist.

1904. Rowley, Ernest W., Chemical Laboratory, Locomotive Department, North Eastern Railway, Gateshead-on-Tyne, Analytical Chemist.

1901. Rowley, Walter Eugene, c/o Schoellkopf, Hartford, and Hanna Co., 100, William Street, New York City, U.S.A.

1904. Rowling, S. R., 1, Beechwood, Kendal, Westmoreland, Analyst.

1899. Roy, Benjamin, Ailsa Lodge, 17, Whitelow Road, Chorlton-cum-Hardy, Manchester, Chemist.

1896. Royal-Dawson, H., (Journals) 22, Lyndhurst Gardens, Creffield Road, Ealing, W., Brewer's Chemist.

1898. Royle, Chas. L., c/o East India Distilleries and Sugar Factories, Ltd., Nellikuppam, S. Arcot, Madras, India, Sugar Chemist.

1898. Royle, Thos. H., Bareilly, United Provinces, India, Chemist.

O.M. Royle, T., 329, Upton Lane, Forest Gate, Essex, Chemical Engineer.

O.M. Royse, S. W., St. Andrew's Chambers, 20, Albert Square, Manchester, Chemical Engineer.

1902. Rücker, Dr. Hermann von, 13, Post Strasse, Hof, Bavaria, Germany, Chemist.

1896. Ruddock, Fred. G., Egypt Street Chambers, Warrington, Analytical Chemist.

1895. Rudge, Alfred, Sutton Alkali Works, St. Helens, Analytical Chemist.

1884. Ruffle, Jno., Musley, Ware, Herts., Consulting Chemist and Electrician.

1898. Ruhl, Louis, c/o Roessler and Hasslacher Chemical Co., P.O. Box 1999, 100, William Street, New York City, U.S.A., Chemical Merchant.

1902. Ruhoff, O. E., c/o Mineral Point Zinc Co., Mineral Point, Wis., U.S.A., Chemist.

O.M. Rumble, C., Belmont Works, Battersea, London, S.W., Candle Works Chemist.

1899. Rumbold, Wm. R., Mill House, Holmwood, Surrey, Electro-Metallurgist.

1895. Rump, Ernst, The Leeds Phosphate Works, Hunslet, Leeds, Manager.

1903. Runting, D. A., 60, Market Street, Melbourne, Vic., Australia, Assayer.

1903. Runyan, Elmer G., Hutchins Building, Washington, D.C., U.S.A., Chemist and Gas Inspector.

1899. Rushby, Wm., 22, Surrey Street, Batley, Yorks, Analyst.

1901. Rushton, Benjamin, Waterloo, Whalley Road Accrington, Analytical Chemist.

1887. Russell, D., Cadham, Markinch, Fife, N.B., Paper Maker.

1884. Russell, Jno., Anchor Brewery, Britten Street, Chelsea, London, S.W., Brewer.

1903. Russell, T. A., Walmer Road, and (Journals) Queen's Hotel, Toronto, Ont., Canada, Manufacturer (Bicycles and Automobiles).

O.M. Russell, Dr. W. J., F.R.S., 34, Upper Hamilton Terrace, London, N.W., Professor of Chemistry.

1901. Rust, Robt. R., c/o Mineral Point Zinc Co., North Chicago, Ill., U.S.A., Chemist.

1884. Ryland, Howard P., Agricultural Chemist.

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1895. Saalfeld, Adolphe, 2, South King Street, Manchester, Chemical Merchant.

1895. Saarbach, Dr. L., 114, Pearl Street, New York City, U.S.A., Consulting Chemist.

1883. Sadler, A. E., Sand Hall, Ulverston, Lancashire, Manufacturing Chemist.

O.M. Sadler, Dr. S. A., M.P., Middlesbrough-on-Tees, Colour Manufacturer.

1884. Sadtler, Dr. S. P., 145, North 10th Street, Philadelphia, Pa., U.S.A., Consulting Chemist.

1896. Sadtler, Dr. S. S., N.E. corner of 10th and Chestnut Streets, Germantown, Pa., U.S.A., Chemist (U.S. Customs).

1897. Sage, C. Edward, 2, Charterhouse Street, London, E.C., Consulting Chemist.

1902. Sahm, Louis N., 22, Cliff Street, New York City, U.S.A., Chemist.

1897. St. John, Harry, Queen Street Brewery, Sunderland, Brewer and Analyst.

1884. Salamon, A. G., 1, Fenchurch Avenue, London, E.C., Consulting Chemist.

1885. Salamon, Jno., Rainham, S.O., Essex, Manufacturing Chemist.

1884. Salis-Mayenfeld, Dr. E. von., P.O. Box 165, Albany, N.Y., U.S.A., Technical Chemist.

1902. Salter, M. J., 65, Park Road, Crouch End, London, N., Analytical Chemist.

O.M. Samuel, W. Cobden, 66, Croxted Road, West Dulwich, S.E., Analytical Chemist.

O.M. Samuelson, Rt. Hon. Sir Bernhard, Bart., F.R.S., 56, Prince's Gate, London, S.W., Ironmaster.

1896. Samuelson, Francis A. E., Sir B. Samuelson and Co., Ltd., Middlesbrough, Ironmaster.

1895. Samuelson, Godfrey B., c/o Messrs. W. T. Glover and Co., Salford, Electrical Manufacturer.

1901. Sanders, C. Newell, Roanoke, Va., U.S.A., Railway Chemist.

1902. Sanders, Warren W., c/o Jarecki Chemical Co., Station P., Cincinnati, Ohio, U.S.A., Chemist.

1895. Sanderson, John, c/o B. S. Cohen, Ltd., 15, Clerkenwell Close, London, E.C., Chemist.

1898. Sanderson, T. C., Richmond Avenue, Port Richmond, Staten Island, N.Y., U.S.A., Chemical Engineer.

1884. Sandon, R., 42, Lewisham Road, Dartmouth Park, N.W., Examiner at Patent Office.

O.M. Sanford, P. Gerald, 25, Canterbury Road, West Croydon, Public Analyst and Consulting Chemist.

1890. Saniter, E. H., 51, Grange Road West, Middlesbrough, Analytical Chemist.

1901. Sargent, Dr. Geo. W., Carpenter Steel Co., Reading, Pa., U.S.A., Chemist and Metallurgist.

1903. Saunders, Lewis E., Niagara Research Laboratories, Niagara Falls, N.Y., U.S.A., Electro-Chemical Engineer.

1896. Saunders, Walter M., 20, Dewey Street, Olneyville, R.I., U.S.A., Analytical Chemist.

1895. Savage, Arthur E., Charles Street, Elsternwick, Victoria, Australia, Metallurgist.

1903. Savage, George M., c/o C. G. Euler, Platt and Gold Street, New York City, U.S.A., Chemist.

1895. Sawers, Wm. D., 1, Athole Gardens Place, Glasgow, Chemist.

1903. Sawin, Luther R., Mount Prospect Laboratory, Flatbush Avenue and Eastern Parkway, Brooklyn, N.Y., U.S.A., Bacteriologist.

1901. Sawyer, Harris E., 27, Bellevue Street, Dorchester, Mass., U.S.A., Chemist and Bacteriologist.

1903. Saxby, Fred. W., c/o P. Haulgrave and Co., 25, Hill Street, Liverpool, Tar Distiller.

1898. Saxe, Sigmond, 107, Manhattan Avenue, New York City, U.S.A., Manufacturing Chemist.

1895. Sayer, Harry, 82, Victoria Street, London, S.W., Metallurgical Chemist.

1894. Sayers, Jos. J., Mayville, Stevenston, Ayrshire, Explosives Chemist.

1895. Scales, F. Shillington, "Jersey," St. Barnabas Road, Cambridge.

1899. Schaak, Dr. Milton F., 108, Penn Street, Brooklyn, N.Y., U.S.A., Chemist.

O.M. Schack-Sommer, Dr. G., 48, Marlborough Mansions, Victoria Street, S.W., Sugar Refiner.

1899. Schaefer, Dr. L., Maywood, N.J., U.S.A., Manufacturing Chemist.

1898. Schaffer, Herbert A., 321, Spring Garden Street, Easton, Pa., U.S.A., Chemist (Portland Cement).

1903. Schanche, Herman G., 3401, Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemist.

1903. Scheidel, Dr. Aug., Union Club, Sydney, N.S.W., Australia, Managing Director.

1886. Schellhaas, Henry Alf., Thornhill, Beach Road, Hartford, Northwich, Mechanical Engineer.

1894. Schidrowitz, Dr. P., 57, Chancery Lane, W.C., Research Chemist.

1895. Schieffelin, Dr. W. Jay, 841, Southern Boulevard, New York City, U.S.A., Manufacturing Chemist.

1901. Schieren, G. Arthur, Dixie Tannery, Bristol, Tenn., U.S.A., Mechanical Engineer and Tanner.

1902. Schjölberg, T. E., Taltal, Chile, S. America, Chemist.

1902. Schlegel, Jno. Wm., 602, East 5th Street, New York City, U.S.A., Chemist.

1893. Schleicher, Francis J., 38, West Tenth Street, Long Island City, N.Y., U.S.A., Technical Chemist.

1902. Schlesinger, Basil E., 92, Mount Vernon Street, Boston, Mass., U.S.A., Chemist.

1901. Schlichting, Emil, 61, Hicks Street, Brooklyn, N.Y., U.S.A., Chemist.

1902. Schloss, Joseph A., Apartado, 65, Monterey, Mexico, Analytical Chemist.

1901. Schneider, Edw. J., c/o Union Carbide Co., Sault Ste. Marie, Mich., U.S.A., Chemist.

1899. Schniewind, Dr. F., c/o United Coke and Gas Co., 17, Battery Place, New York City, U.S.A., Chemist.

1897. Schoder, Dr. Robt., c/o Deutsche Gasglühlicht Act.-Ges., 13, Alte Jakobstrasse, Berlin, Chemist.

1902. Schofield, Jas. A., The University, Sydney, N.S.W., Australia, Lecturer in Chemistry.

O.M. Scholefield, H. E., Edge Hill Chemical Works, Liverpool, Chemical Manufacturer.

1898. Scholes, Geo. R., Liebig's Extract of Meat Co., Ltd., 21, Longue Rue des Claires, Antwerp, Belgium, Analytical Chemist.

1902. Schoonmaker, H., c/o R. A. Perez, 120, North Main Street, Los Angeles, Cal., U.S.A., Metallurgical Chemist.

1895. Schroeder, E. August, c/o Church and Co., 36, Ash Street, Brooklyn, N.Y., U.S.A., Chemist.

1901. Schultze, Wm., 194, Academy Street, Jersey City Heights, N.J., U.S.A., Chemist.

1902. Schulze, Emil A., 15, Stanthorpe Road, Streatham, S.W., Incandescent Mantle Manufacturer.

1893. Schüpphaus, Dr. R. C., 171, Broadway, New York City, U.S.A., Consulting Chemist.

1893. Schwab, Dr. L. C., Sedanstrasse 53, Bernburg, Anhalt, Technical Chemist.

1901. Schwartz, David, c/o Southern Cotton Oil Co., Gretna La., U.S.A., Chemist.

1902. Schwarz, Gustav A. (Grasselli Chemical Co.), 63, Wall Street, New York City, U.S.A., Manager.

1900. Schwarz, Dr. Henry P., c/o Western Sugar Refining Co., Potrero, San Francisco, Cal., U.S.A., Chemist.

1889. Schweich, Emil, 20, Hyde Park Square, London, W., Technical Chemist.

1903. Schweickert, Karl, c/o Egyptian Lacquer Manufacturing Co. and (Journals), 6, Oliver Street, Rahway, N.J., U.S.A., Chemist.

1894. Schweitzer, Dr. H., 40, Stone Street, New York City, U.S.A., Analytical Chemist.

1891. Scott, Andrew, Royal Gunpowder Factory, Waltham Abbey, Essex, Analytical Chemist.

1889. Scott, Ernest G., 2, Talbot Court, Gracechurch Street, London, E.C., Soap Works Chemist.

1898. Scott, Jas., Cawnpore Woollen Mills, Cawnpore, India, Chemist.

1894. Scott, Jno. Gillespie, Annislea, Northfield, Liberton, near Edinburgh, Analytical Chemist.

1901. Scott, Leonard C., c/o Kennicott Water Softener Co., 29, Great St. Helens, London, E.C., Chemist.

1894. Scott-Smith, G. E., 67, Surrey Street, Sheffield, Analytical Chemist.

1902. Scott, Walter, 83, Albert Road, Levenshulme, Manchester, Chemist.

1889. Scovell, M. A., Lexington, Kentucky, U.S.A., Agricultural Chemist.

1887. Scrutton, Willis J. C., 18, Billiter Street, London, E.C., Analytical Chemist.

1896. Scrymgeour, Wm., Whistlebrae, Lamington Heights, Kalgoorlie, West Australia, Chemist.

O.M. Scudder, F., Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Analytical Chemist.

1895. Seabrooke, H. Cecil, Black Ash, Grays, Essex, Research Chemist.

1900. Searby, Fred. M., West Berkeley, Cal., U.S.A., Oilworks Superintendent.

1889. Searl, Albert, Montreux, Victoria Road, Sidcup, Kent, Technical Chemist.

1898. Searle, Alf. B., 280, Western Bank, Sheffield, Analytical Chemist.

1896. Sedding, G. H. P., c/o Florida Syndicate, Jacksonville, Florida, U.S.A., Chemist.

1901. Sederholm, Erik, 28, Jakopsgatan, Stockholm, Sweden, Chemist (Royal Navy Board).

1901. Seeler, Dr. F., c/o Merck and Co., Rahway, N.J., U.S.A., Manufacturing Chemist.

1893. Sefton-Jones, Herbert, c/o W. P. Thompson and Co., 322, High Holborn, W.C., Analytical Chemist.

1902. Segaert, Edw., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.

1899. Seher, A., c/o Maas and Waldstein, Riverside Avenue, Newark, N.J., U.S.A., Chemist.

1896. Seldner, Rudolph L., 1395, Dean Street, Brooklyn, N.Y., U.S.A., Instructor in Chemistry.

1904. Seligman, Richard, Messrs. J. and W. Seligman, Mills Buildings, New York City, U.S.A., Chemist.

1884. Semet, Louis, 217, Chaussée de Vleurgat, Brussels, Alkali Manufacturer.

1898. Sen (Gupta), Nagendra Nath, 18, Lower Chitpur Road, Calcutta, India, Physician and Chemist.

1895. Senger, Robt., 37, Warren Street, New York City, U.S.A., Manufacturing Chemist.

1899. Senior, Francis L., Lock 28, Sanford, Maine, U.S.A., Mill Chemist.

O.M. Sevin, C., 68, Central Hill, Upper Norwood, S.E., and (Journals) c/o Dollman & Pritchard, 9 and 10, King Street, Cheapside, E.C., Chemical Engineer and Oil Refiner.

1900. Seward, Geo. O., Holcomb Rock, Va., U.S.A., Chemist.
1896. Seyler, Clarence A., Technical Institute, Nelson Terrace, Swansea, Chemist and Assayer.
1889. Seymour-Jones, A., Pendower, Wrexham, Leather Manufacturer.
1903. Shacklady, T. G., Addiscombe Villas, Cliffe-at-Hoo, Rochester, Technical Chemist.
1892. Shanks, Arch., Bridgend Mills, Dalry, Ayrshire, N.B., Chemist.
1883. Sharp, James, Shirley Manor, Wyke, near Bradford, Yorks, Dyer.
1891. Sharpe, Granville H., 11 & 12, Great Tower Street, London, E.C., Analytical Chemist.
1884. Sharples, Stephen P., 26, Broad Street, Boston Mass., U.S.A., Analytical Chemist.
1896. Sharpley, Wm. P., c/o Jno. Fleming, P O. Box 1878, Johannesburg, S. Africa, Analytical Chemist.
1900. Sharwood, Wm. J., 2119, Durant Avenue, Berkeley, Cal., U.S.A., Metallurgical Chemist.
1900. Shattuck, A. F., The Solvay Process Co., Detroit, Mich., U.S.A., Chemist.
1885. Shaw, F. W., Temple House, Heapey, near Chorley, Lancashire, Analytical Chemist.
1883. Shaw, Geo., 35, Temple Row, Birmingham, Patent Agent.
1890. Shaw, H. Dixon, Bond Street, Dewsbury, Yorks, Analytical and Consulting Chemist.
1902. Shaw, Wm. R., Oak Lea, Carlton Road, Godley, near Hyde, Cheshire, Chemist (Tennants and Co.).
O.M. Shearer, A., 43 Derby Road, Burton-on-Trent, Technical Chemist.
1903. Sheldon, Dr. N. L., Cordite Factory, Arwankad, Nilgiri Hills, India, Works Manager.
1903. Shenk, F. D., 138, Monroe Avenue, Detroit, Mich., U.S.A., Chemist.
O.M. Shenstone, W. A., F.R.S., Tuffleigh, St. Vincent Rocks, Clifton, Bristol, Chemical Lecturer.
1892. Shenton, Jas. P., 37, Torbay Road, Chorlton-cum-Hardy, near Manchester, Analytical Chemist.
1902. Shepard, Chas. H., Chemical Laboratory, Union Iron Works, San Francisco, Cal., U.S.A., Chemist.
1889. Shepard, Dr. Chas. U. (communications) P.O. Box 42, Summerville, S.C., and (Journals) 56, Broad Street, Charlston, S.C., U.S.A.
1904. Shepherd, A. B., c/o British Oil and Cake Mills, Ltd., 151, Cleveland Street, Hull.
1900. Shepherd, E. Sanger, 5-7, Gray's Inn Passage, Holborn, W.C., Scientific Instrument Maker.
1893. Shepherd, H. H. B., Northcote, Mount Pleasant Lane, Upper Clapton, N.E., Chemist.
1898. Shepherd, Reginald des F., c/o Calico Printers' Association, 56, Mosley Street, Manchester, Printworks Chemist.
1895. Sherman, G. W., Akron, Ohio, U.S.A., General Manager.
1899. Shero, John E., c/o Pittsburg Reduction Co., Niagara Falls, N.Y., U.S.A., Chemist.
1893. Shields, Dr. John, Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.
1899. Shillitoe, Frank, 35, Pontefract Road, Castleford, Yorks, Chemist.
1896. Shimomura, K., c/o Osaka Seimi Works Co., Kawagishicho, Nishiku, Osaka, Japan, Chemist.
1886. Shimosé, Masachika, Shimosé Powder Works, Takinogawa, near Oji, Tokyo, Japan, Chemical Engineer.
1902. Shimotome, Henyi, Higher Technical School, Asakusa, Tokyo, Japan, Professor of Chemistry.
1888. Shishkoff, Sergius A., Mojga, Elabouga, Govt. of Viatka, Russia, Manufacturer Glass Works.
1899. Sholes, Chas. E., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemical Salesman.
1900. Shonk, Albert, 6, York Road, West Hendon, Analytical Chemist.
1899. Shores, Dr. Jeff. H., Derby Road, Farnworth, Widnes, Chemist.
1897. Shorey, Dr. Edmund C., Office of Board of Health, Honolulu, H.I., Chemist.
1904. Short, Andrew, Choppington, Morpeth, Works Chemist.
1903. Shorter, A. E., 64, Garden Reach, Calcutta, India, Soap and Candle Manufacturer.
1902. Shoubridge, Sydney Y., M.I.C.E., Gasworks, Lower Sydenham, S.E., Gas Engineer.
1901. Shukoff, Dr. Alexis A., Borowaja, No. 86, St. Petersburg, Russia, Technical Chemist.
1899. Shuler, Darius P., Mine La Motte, Mo., U.S.A., Chemist.
1890. Shutt, Frank T., Central Experimental Farm, Ottawa, Canada, Agricultural Chemist.
1901. Siau, Raymond L., Springfield Brewery, Wolverhampton, Carbohydrate Research Chemist.
1902. Sibley, Samuel E., 3, Rutland Road, Ilford, Essex, Technical Chemist.
1902. Siebold, Alfred, Eglinton Dyewood Mills, Alloa, N.B., Technical Chemist.
1901. Silberrad, Dr. Oswald, Hill Top, Shooter's Hill, Kent, Research Chemist.
1903. Silva, Alfredo, Rua do Commercio, No. 4, Recife, Pernambuco, Brazil, Cotton Mill Manager.
1892. Silvester, Harry, 78, Holyhead Road, Handsworth, Birmingham, Analytical and Consulting Chemist.
1901. Sim, Wilfrid A., c/o Wm. Sim and Son, 40, Jane Street, Leith, N.B., Colour Manufacturer.
1903. Simmons, Wm. H., Oakleigh, Stoke Newington Common, N., Analytical Chemist.
1898. Simon, Dr. A., 55-56, Bishopsgate Street, E.C., Chemical Engineer.
1890. Simonds, Dr. F. M., 159, Front Street, New York City, U.S.A., Mining Engineer and Assayer.
1902. Simonson, Wm., 126, West 9th Street, Cincinnati, Ohio, U.S.A., Chemist.
1897. Simpson, E. S., Geological Survey Laboratory, Museum Street, Perth, West Australia, Assayer.
O.M. Simpson, W. S., 17, Lakeside Road, Palmers Green, N., Analytical Chemist.
1900. Sims, W. Edgar, Portinscale Lodge, Higher Crumpsall, Manchester, Technical Chemist.
1894. Sinclair, Dr. W., 60, Stirling Road, Trinity, Edinburgh, Chemist.
1890. Sindall, R. W., 201, Wellmeadow Road, Catford, S.E., Paper Mills Chemist.
1889. Singer, Ignatius, Horsforth, near Leeds, Manufacturing Chemist.
1899. Singmaster, J. Arthur, c/o New Jersey Zinc Co. of Penna., Palmerton, Pa., U.S.A., Chemist.
1901. Sinnatt, Frank S., Glenside, Church Lane, Moston, Manchester, Demonstrator of Chemistry.
O.M. Sisson, G., jun., c/o Washington Chemical Co., Ltd., Washington Station, R.S.O., Co. Durham, Works Manager.
1885. Skaife, Wilfred T., 630, Sherbrooke Street, Montreal, Canada, Sugar Chemist.
1894. Skelton, John R., c/o Norwich Crape Co., Ltd., St. Augustine's, Norwich, Technical Chemist.
1897. Skertchley, W. P., Laboratory, 11, Billiter Square, E.C., Analytical Chemist.
1904. Skerten, Wm. B., 25, Broad Street, New York City, U.S.A., Chemical Accountant.
1891. Skilton, C. F. E., Brewery House, Staines, Brewer.
1901. Skinner, Hervey J., c/o Little and Walker, 7, Exchange Place, Boston, Mass., U.S.A., Chemist.
1904. Skirrow, Dr. F. W., c/o The Manchester Oxide Co., Canal Street, Miles Platting, Manchester, Research Chemist.
1903. Skoglund, Jean V., 142, West 117th Street, New York City, U.S.A., Chemist.
1896. Skurray, Thos., United Breweries, Abingdon, Berks, Brewer.
1897. Skvortzoff, Basil N., Chemical Technologist.
O.M. Slade, H. E., India Rubber Works, Streatham Common, London, S.W., Rubber Works Manager.
1887. Slatter, Geo. W., Carlton Terrace, Nab Wood, Shipley, Yorkshire, Analytical Chemist.
1895. Slocum, Dr. Frank L., 401, South Linden Avenue, E.E. Pittsburg, Pa., U.S.A., Chemist.

1899. Slosson, Edwin E., University of Wyoming, Laramie, Wyoming, U.S.A., Professor of Chemistry.
1883. Smail, J. I., Warren Wood, Hayes Common, Beckenham, Kent. Chemical Manufacturer.
1901. Smale, Dr. F. J., c/o Wm. Davies Co., Toronto Canada, Chemist.
1898. Small, Fritz H., c/o Graton and Knight Manufacturing Co., Worcester, Mass., U.S.A., Chemist.
O.M. Smetham, A., 16, Brunswick Street, Liverpool, Analytical Chemist.
1884. Smiles, Jas., 173, Bruntsfield Place, and (Journals) Blandfield Chemical Works, Lower Broughton Road, Edinburgh, Manufacturing Chemist.
1904. Smith, Albert E., c/o Mount Hope Finishing Co., North Dighton, Mass., U.S.A., Superintendent.
1886. Smith, Alfred, Excelsior Chemical Works, Clayton. Manchester, Manufacturing Chemist.
1898. Smith, Alf. B., Whiteley House, Glossop, Derbyshire, Bleacher and Dyer's Manager.
1897 Smith, Allan, c/o Kellner-Partington Paper Pulp Co., Hallein, bei Salzburg, Austria, Paper Mills Chemist.
1898. Smith, Andrew B., P.O. Box 90, Queenstown, C.C., S. Africa, Chemist.
1896. Smith, Andrew T., c/o Castner-Kellner Alkali Co., Ltd., 43, Castle Street, Liverpool, General Manager.
1893. Smith, Edgar B., Prince Regent's Wharf, Silvertown, E., Chemist.
1895. Smith, Dr. E. Ellsworth, 26, East 29th Street, New York City, U.S.A., Consulting Physiological Chemist.
O.M. Smith, Edgar F., c/o E. M. Robson, Trelawny, Fairfax Road, Bedford Park, W., Analytical Chemist.
1892. Smith, Ernest A., The Assay Office, Leopold Street, Sheffield, Assayer.
1900. Smith, E. Sell, 219, East Market Street, Warren, Ohio, U.S.A., Manufacturing Chemist.
1898. Smith, E. Shrapnell, Cecil Chambers, East Strand, London, W.C., Chemical Engineer.
1903. Smith, Ewing, 19, Queen Street, Perth, N.B., Analytical Chemist.
1903. Smith, F. M., 100, William Street, New York City, U.S.A., President (Pacific Coast Borax Co.).
1891. Smith, Francis P., 20–21, Queenhithe, Upper Thames Street, London, E.C., Chemist.
1902. Smith, Frank Gurney, 7, Luxemburg Gardens, Brook Green, W., Chemical Student.
O.M. Smith, G., Rosehall Terrace, Falkirk, N.B., Explosive Works Manager.
1897. Smith, Sir Geo. J., Messrs. Bickford, Smith, & Co., Ltd., Tuckingmill, Cornwall, Fuse Manufacturer.
1890. Smith, Harry, 74, Holly Avenue, Jesmond, Newcastle-on-Tyne, Colour Works Manager.
1890. Smith, Harry E., L.S. & M.S. Railway, Collinwood, Ohio, U.S.A., Analytical Chemist.
1904. Smith, Henry, 83, Brownlow Road, Horwich, Bolton-le-Moors, Lancs., Analytical Chemist.
1900. Smith, H. Ewing, 22, City Road, London, E.C., Manufacturing Chemist.
1902. Smith, Hy. Geo., Technological Museum, Harris Street, Ultimo, Sydney, N.S.W., Australia, Assistant Curator and Chemist.
1901. Smith, H. Procter, "Gorphwysfa," Shotton, Flintshire, Metallurgical Chemist.
O.M. Smith, H. R., 1, Aubert Park, Highbury, London, N., Analytical Chemist.
1901. Smith, H. Sutcliffe, Edward Ripley and Son, Ltd., Bowling Dyeworks, Bradford, Managing Director.
1890. Smith, H. Wood, c/o John Batt and Co., Ltd., 39, Old Broad Street, London, E.C., Chemist.
1897. Smith, James, 30, Milner Road, Aigburth, Liverpool, Analytical Chemist.
1903. Smith, James, South Bank, Frodsham, Cheshire, Metallurgist.
1893. Smith, Jas. F., 15, Second Avenue, Halifax, Yorks, Analytical Chemist.
O.M. Smith, J., Ash Grove House, Radcliffe, Manchester.
1901. Smith, J. Cruickshank, 28, Westmoreland Road, Westbourne Park, London, W., Technical Chemist.
O.M. Smith, Dr. J. H., Wollishofen, Zürich, Switzerland, Chemical Manufacturer.
1884. Smith, J. Johnstone, Lockwood Brewery, Huddersfield, Brewing Chemist.
1902. Smith, Jno., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia.
1898. Smith, John. Hartley Street Dyeworks, Dewsbury, Yorks, Dyer.
O.M. Smith, Jno. W., 7, Brookfield Street, Roslindale, Boston, Mass., U.S.A., Analytical Chemist.
1896. Smith, Joseph Kent, 32, Hough Green, Chester, Metallurgical Chemist.
1888. Smith, J. Tertius, Richmond House, Plaistow, Essex, Technical Chemist.
1890. Smith, J. Wm., Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Works Manager.
1898. Smith, R. F. Wood, Laboratory, 89, Bartholomew Close, E.C., Consulting Chemist.
1890. Smith, Dr. R. Greig, Linnean Society's House, Elizabeth Bay, Sydney, N.S.W., Bacteriologist and Chemist.
1890. Smith, R. Watson, c/o New Transvaal Chemical Co., Ltd., Knights Dam (Half Weg), Johannesburg, S. Africa, Chemical Works Manager.
1900. Smith, T. Connell, Blandfield Chemical Works, Edinburgh, Manufacturing Chemist.
1897. Smith, Theophilus R., c/o Brotherton & Co., Haigh Park Chemical Works, Stourton, near Leeds, Chemist.
1896. Smith, Walter E., 158, Doyle Avenue, Providence, R.I., U.S.A., Instructor in Chemistry.
1903. Smith, Dr. Warren R., Lewis Institute, Chicago, Ill., U.S.A., Teacher.
O.M. Smith, Watson, 34, Upper Park Road, Haverstock Hill, N.W., Editor of Society's Journal.
O.M. Smith, Wilfred, 182, West Street, Glasgow, Chemical Manufacturer.
1896. Smith, Dr. W. Stanley, Bryntirion, Bersham, near Wrexham, North Wales, Brewer.
O.M. Smithells, Prof. A., F.R.S., Yorkshire College, Leeds, Professor of Chemistry.
1902. Smither, F. W., 310½, Union Street, Nashville, Tenn., U.S.A., Analytical Chemist.
O.M. Smithers, F. O., Dashwood House, 9, New Broad Street, London, E.C., Chemical Agent.
1902. Smoot, Albert M., 1263, Waverly Place, Elizabeth N.J., U.S.A., Analytical Chemist.
1902. Smyth, Dr. Morland, c/o Mander Bros., John Street, Wolverhampton, Chemist.
1902. Smythe, Jno. A., Durham College of Science, Newcastle-on-Tyne, Demonstrator in Chemistry.
1902. Smythe, Dr. J. S., (communications) Rantallard, Lance Lane, Wavertree. Liverpool, and (Journals) c/o W. Meadowcroft and Son, Ltd., Regent Street, Blackburn, Analytical Chemist.
1888. Snape, Dr. H. Lloyd, Balholm, Lathom Road, Southport, Director of Education for Lancashire.
1896. Snowdon, Jno., jun., Messrs. Snowdon, Sons, & Co., Millwall, E., Chemical and Oil Manufacturer.
1902. Snyder, Prof. Harry, 2090, Commonwealth Avenue, St. Anthony Park, Minn., U.S.A., Professor of Agricultural Chemistry.
1900. Sodeau, Wm. H., 114, Park Road, Newcastle-on-Tyne, Chemist.
1903. Sohlman, Ragnar, Bofors, Sweden, Manager (A. B. Bofors' Nobelkrut).
1894. Sohn, Chas. E., 2, Harpur Street, Bedford Row, London, W.C., Analyst.
1895. Solvay, Armand, 25, Rue Prince Albert, Brussels, Gérant de la Société Solvay et Cie.
1884. Solvay, Ernest, 43, Rue des Champs Elysées, Brussels, Alkali Manufacturer.
1903. Somermeier, Edw. E., 1590, Neil Avenue, Columbus, Ohio, U.S.A., Chemist.

1897. Somerset, H. St. John, jun., Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, Assayer.

1884. Sommer, Adolf, corner 1st and Binney Streets, East Cambridge, Boston, Mass., U.S.A., Pharmaceutical Chemist.

1894. Sonstadt, Edw., Church Fields, Cheshunt, Herts, Chemical Technologist.

1896. Sorel, Ernest, 119, Rue Notre-Dame-des-Champs, Paris, VI., Engineer.

1896. Souther, H., 440, Capitol Avenue, Hartford, Conn., U.S.A., Chemical and Metallurgical Engineer.

1892. Southern, Thos., Jr., Wheathill Chemical Works, St. Simon Street, Salford, Manufacturing Chemist.

1883. Soward, A. W., 28, Therapia Road, Honor Oak, S.E., Principal Clerk (Legacy Duty Office).

1890. Sowerby, Thos. H., Canal Soap Works, Verney Road, Rotherhithe New Road, S.E., Soap Manufacturer.

O.M. Sowerby, W. M., c/o United Alkali Co., Ltd., Allhusen Works, Gateshead-on-Tyne, Lancashire, Alkali Works Manager.

1887. Spackman, Chas., Rosehaugh, Clitheroe, Lancashire, Portland Cement Manufacturer.

1901. Sparrow, J. Marcellus, c/o Imperial Varnish and Colour Co., Ltd., 6–22, Morse Street, Toronto, Canada, Varnish and Colour Manufacturer.

1883. Spence, D., Pension Todd, Luttichau Strasse 14, Dresden, Germany, Alum Manufacturer.

O.M. Spence, F., Alum Works, Manchester, Alum Manufacturer.

1900. Spence, Howard, (Journals) Audley, Broad Road, Sale, Cheshire, and c/o Peter Spence and Sons, Ltd., Alum Works, Manchester, Chemical Manufacturer.

1901. Spence, Jno. Davidson (Journals) 2, Hawkhill Place, Dundee; and (Communications) 39, Mincing Lane, London, E.C., Consulting Chemist.

1894. Spence, J. Napier, 69, Frithville Gardens, Shepherd's Bush, W., Teacher of Chemistry.

1883. Spence, Jno. W., Tiviot Colour Works, Manchester Road, Stockport, Drysalter.

1903. Spencer, Arthur G., Truro, Nova Scotia, Canada, Chemist.

1900. Spencer, Harold R.S., Spring Side, Sharples, Bolton, Lancs., Paper Maker.

1884. Spencer, Jno., Globe Tube Works, Wednesbury, Tube Manufacturer.

O.M. Spencer, J. W., Newbiggin House, Kenton, Newcastle-on-Tyne, Steel Manufacturer.

1901. Spencer, Robt., jun., c/o E. Ripley and Son, Ltd. Bowling Dyeworks, Bradford.

1902. Sperry, Elmer A., 855, Case Avenue, Cleveland, Ohio, U.S.A., Electrical Engineer.

1897. Sperry, Erwin S., P.O. Box 656, Bridgeport, Conn., U.S.A., Metallurgist.

1884. Spiegel, Dr. Adolf, Messel, bei Darmstadt, Germany, Analytical Chemist.

1899. Spieler, Aug. J., 543, Gifford Street, Syracuse, N.Y., U.S.A., Stearic Acid Works Superintendent.

1903. Spielmann, P. E., 21, Cadogan Gardens, London, S.W., Chemical Student.

1889. Spies, Adolph, 102, Fenchurch Street, London, E.C., Chemical Merchant.

1889. Spies, Hermann, 102, Fenchurch Street, London, E.C., Chemical Merchant.

1885. Spiller, A., Edison-Swan Electric Co., South Benwell Works, Newcastle-on-Tyne, Electrician.

O.M. Spiller, J., 2, St. Mary's Road, Canonbury, London, N., Consulting Chemist.

1896. Spoor, J. L., Madras Cement Works, Madras, India; and (Journals), Rede Court, Rochester, Kent, Portland Cement Manufacturer.

O.M. Sprengel, Hermann Johann Philipp, Ph.D. (Heidelb.), F.R.S., Royal Prussian Professor (titular); Journals to Prof. Sprengel, F.R.S., Savile Club, 107, Piccadilly, London, W., Chemist.

1900. Spurge, Edw. C., Société Française de l'Industrie Chimique, 7, Quai de Seine, Courbevoie, near Paris, Chemist.

1901. Spurlin, Oscar L., c/o Georgia Cotton Oil Co., 919, Austell Building, Atlanta, Ga., U.S.A., Chemist.

O.M. Squire, P. W., 413, Oxford Street, London, W., Pharmaceutical Chemist.

O.M. Squire, Dr. W. S., Clarendon House, St. John's Wood Park, N.W., Chemical Engineer.

1896. Stafford, Chas. H., (Journals) c/o The Birkacre Printing Co., and Hollyfield, Weldbank, Chorley, Colourist.

O.M. Stahl, Dr. K. F., 57th Street and A. V. Ry., Pittsburg, Pa., U.S.A., Chemical Works Manager.

1903. Stainton, Dr. W. J., 29, Narcessus Road, West Hampstead, N.W., Colour Chemist.

1904. Standfast, Jno. T., c/o Messrs. Burt, Boulton, and Haywood, Ltd., Selzaete, Belgium, Chemist.

1884. Stanning, John, Broadfield, Leyland, near Preston Bleacher.

1888. Stantial, Frank G., c/o Cochrane Chemical Co., Everett, Mass., U.S.A., Technical Chemist.

1885. Staples, H. J., The Old Hall, Spondon, Derby, Colour Manufacturer.

O.M. Stark, J. F., Rosedale, Bromborough, Cheshire, Works Superintendent.

1896. Statham, Noel, Compañia General de Productos Quimicos del Aboño, Gijón, Spain, Engineer.

1895. Stead, J. Christopher, 1, Finsbury Circus, London E.C., Technical Chemist.

O.M. Stead, J. E., 11, Queen's Terrace, Middlesbrough-on-Tees, Analytical Chemist.

1898. Stearns, Theron C., 44, Montgomery Street, Jersey City, N.J., U.S A., Consulting Chemist.

O.M. Stebbins, Dr. J. H., 80, Madison Avenue, New York City, U.S.A., Analytical Chemist.

O.M. Steedman, R. H., Whinfield, Prestwick, Ayrshire, N.B., Chemical Manufacturer.

1896. Steel, Fred. W., c/o Cuming, Smith, and Co., Yarraville, Melbourne, Vic., Analytical Chemist.

1900. Steel, Jno. S., Adelaide Chemical Works, New Thebarton, Adelaide, South Australia, Chemist.

1884. Steel, R. Elliott, 38, East Park Parade, Northampton, Headmaster.

O.M. Steel, Thos., Colonial Sugar Refinery, O'Connell Street, Sydney, N.S.W., Australia, Sugar Chemist.

1897. Stein, Sigmund, 214, Upper Parliament Street, Liverpool, Sugar Refinery Manager.

1897. Steinhart, Dr. Oscar J., 4, Palace Street Mansions, Buckingham Gate, S.W., Manufacturing Chemist.

1901. Steinmetz, Chas. P., Research Laboratory, General Electric Co., Schenectady, N.Y., U.S.A., Electrician.

1903. Stell, S. F., 25, Henry Street, Keighley, Yorks., Teacher of Chemistry.

1887. Stenhouse, T., Townhead, Rochdale, Analytical Chemist.

1903. Stephan, Geo. B., c/o Larkin Soap Co., Buffalo, N.Y., U.S.A., Perfumer.

1904. Stephen, A. E., 33, Victoria Street, Ashfield, Sydney, N.S.W., Australia, Analytical Chemist.

1884. Stephens, H. Chas., M.P., Avenue House, Finchley, N., Ink Manufacturer.

1892. Stephens, M. E., 4, Carlton Gardens, London, S.W.; and (Journals) 57–60, Aldersgate Street, London, E.C., Ink Manufacturer.

1889. Stern, Arthur L., Southbank, Stapenhill Road, Burton-on-Trent, Brewing Chemist.

O.M. Steuart, D. R., Osborne Cottage, Broxburn, West Lothian, N.B., Oilworks Chemist.

1903. Steven, A. B., The Yorkshire College, Leeds, Lecturer on Dyeing.

1899. Stevenot, G. A., c/o Schoellkopf, Hartford, and Hanna Co., 100, William Street, New York City, U.S.A., Chemist.

1898. Stevens, Arthur F., 61, Balfour Road, Highbury New Park, N., Paper Examiner.

1904. Stevens, Edgar B., 688, 7th Street, Buffalo, N.Y., U.S.A., Treasurer and Chemist.

1902. Stevens, Hy. P., The Firs, Ash, Surrey, Demonstrator in Chemistry.

1894. Stevens, Jno. H., 295, Ferry Street, Newark, N.J., U.S.A., Manufacturing Chemist.

1902. Stevens, M. White, H.M. Patent Office, Chancery Lane, London, W.C., Chemist.
1903. Stevens, T. R. B., 39, High Street, Battersea, S.W., Metallurgical Chemist.
1884. Stevens, Wm., The Native Guano Co., Ltd., 29, New Bridge Street, Blackfriars, E.C., Secretary.
1899. Stevenson, Arnold, 4, Porchester Gardens, London, W., Chemist.
O.M. Stevenson, Dr. T., Guy's Hospital, London, S.E., Chemical Lecturer.
O.M. Stevenson, W., Standard Works, 95A, Southwark Street, London, S.E., Chemical Manufacturer.
1901. Stewart, David B. D., Aberdeen Comb Works, Hutcheon Street, Aberdeen, Managing Director.
1903. Stewart, Jas., 3, Ludgate Circus Buildings, London, E.C., Editor ("Gas World").
1890. Stewart, Robt., 14, Grosvenor Road, Ilford, Essex, Chemical Works Manager.
1896. Stewart, R. Patrick, 59, Wellwood Terrace, Kerr Street, Kirkintilloch, N.B., Analytical Chemist.
O.M. Stewart, S., c/o Michael Nairn and Co., Ltd., Linoleum Works, Kirkcaldy, N.B., Technical Chemist.
1899. Stewart, Saml., 16, Great George Street, Westminster, S.W., and (Journals) Parkhurst Park Road, Wallington, Surrey, Managing Director (Explosives Co.).
1904. Stieglitz, Julius, University of Chicago, Chicago, Ill., U.S.A., Associate Professor of Chemistry.
1901. Stifel, Walter H., 1319, Locust Street, Allegheny, Pa., U.S.A., Tanner.
1903. Stillwell, Albert G., 55, Fulton Street, New York City, U.S.A. Chemist.
1903. Stingelin, Dr. Fritz, Union Knitting Mill, Schuylkill Haven, Pa., U.S.A., Chemist.
1886. Stirk, Jos.,Ferncliffe, Elm Bank, Nottingham, Brewer's Engineer.
1893. Stock, F. W. Keating, County Analyst's Office, Darlington, Analytical and Consulting Chemist.
1900. Stockdale, Edgar, Printworks, Birstall, Yorks, Colour Mixer.
1888. Stockdale, Wm., Irwell Printworks, Stacksteads, near Manchester, Calico Printer.
1887. Stocks, H. B., Lynwood, Neston, Cheshire, Analytical Chemist.
1903. Stoddard, Jesse D., c/o Operating Board, American Radiator Co., Lake and Dearborn Streets, Chicago, Ill., U.S.A.
1885. Stoddart, F. Wallis, Western Counties Laboratory, College Green, Bristol, Analytical Chemist.
1899. Stoddart, Reginald T., Corporation Tar Works, Charlestown Road, Halifax, Yorks., Manager.
O.M. Stoer, J., 6, Hanover Quay, Dublin.
1903. Stofer, Richard C., 28, Hayes Street, Norwich, N.Y., U.S.A., Pharmaceutical Chemist.
O.M. Stoker, G. N., 9, Lessar Avenue, Clapham Common, S.W., Analytical Chemist.
1899. Stokes, Alf. W., Laboratory, Vestry Hall, Paddington Green, W., Public Analyst.
1898. Stokes, Dr. Henry N., Bureau of Standards, Washington, D.C., U.S.A., Chemist.
1892. Stone, Frank, Laboratory, 193, Collins Street, Melbourne, Victoria, Analytical Chemist and Assayer.
1900. Stone, Geo. C., c/o New Jersey Zinc Co., 71, Broadway, New York City, U.S.A., Engineer.
1899. Stone, I. F., 100, William Street, New York City, U.S.A., Chemical Merchant.
1888. Stone, Thos. W., Chemical Works, St. George, Bristol, Chemical Manufacturer.
1902. Storar, John, (Journals) Coniston Lodge, Hornsea; and (communications) c/o Messrs. Reckitt and Sons, Hull, Chemical Engineer.
O.M. Storey, I. H., Haverbreaks, Lancaster, Chemical Manufacturer.
1903. Stormer, Edward J., J. J. Case Plow Works, Racine, Wis., U.S.A., Analytical Chemist.
1902. Storr, Bertram V., 27, Belgrave Road, Ilford, Essex, Chemist.
1888. Stowe, W. T., 11, Camphill Avenue, Langside, Glasgow, Analytical Chemist.
1883. Strangman, J. Pim, 9, Clydesdale Road, Notting Hill, W., Bleacher.
1903. Strayer, D. W., 112, Newman Avenue, Bayonne, N.J., U.S.A., Chemist.
1903. Strickler, Emerson H., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemist.
1887. Strong, Colin R., 13, St. Ann Street, Manchester, Oil Merchant.
O.M. Stuart, C. E., 29, Mosley Street, Newcastle-on-Tyne, Chemical Apparatus Dealer.
1896. Stuart, Harry T. R., Know Mill House, Entwistle, near Bolton, Printworks Sub-Manager.
O.M. Stuart, T. W., 7, Livingston Drive, Sefton Park, Liverpool, Alkali Works Manager.
1901. Stuart, Dr. W. Theophilus, 197, Spadina Avenue, Toronto, Canada, Physician and Professor of Chemistry.
1896. Stubbs, Augustus J., 50, Calle de Ferraz, Madrid, Spain.
O.M. Studer, Dr. A., Postgebäude, Olten, Switzerland, Consulting Chemist.
1890. Studer, Simon J., Helvetia, Stockton Heath, near Warrington, Technical Chemist.
1903. Sturrock, Capt. G. C., R.A., Indian Cordite Factory, Aruvinkad, Nilgirio, India, Assistant Superintendent.
1898. Styles, R. Curling, Knockhall, Greenhithe, Kent, Analytical Chemist.
1896. Suckert, Dr. J. J., 253, Broadway, New York City, U.S.A., Manufacturing Chemist.
1895. Sudborough, Dr. J. J., University College of Wales, Aberystwith, Lecturer in Chemistry.
1889. Sulman, H. L., 41, London Wall, London, E.C., Chemist and Metallurgist.
1895. Summers, Bertrand S., 430, The Rookery, Chicago, Ill., U.S.A., Electro-Chemist.
1890. Sumner, Harold, Worthington, near Wigan, Dyer and Bleacher.
1896. Sunderland, A., 84, Hainworth Wood Road, Ingrow, Keighley, Teacher of Chemistry.
1899. Sundström, Carl, c/o Solvay Process Co., Detroit, Mich., U.S.A., Chemist.
1895. Sundström, Karl J., Sibley, Mich., U.S.A., Manufacturing Chemist.
1884. Sutherland, D. A., 13, Victoria Street, Westminster, S.W., Consulting Technical Chemist and Assayer.
1894. Sutherland, Geo., Croft Cottage, Bonhill, N.B., Chemist.
1887. Sutherland, Jas., c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Chemist.
O.M. Sutherland, R. M., Lime Wharf Chemical Works, Falkirk; and Solsgirth, Dollar, N.B., Chemical Manufacturer.
1899. Sutherst, Dr. Walter F., Brimsdown Lead Co., Ponders End, N., Chemist.
1901. Sutro, H. H., 126, Liberty Street, New York City, U.S.A., Chemist.
O.M. Sutton, Francis, Norfolk County Laboratory, Redwell Street, Norwich, Analytical Chemist.
1886. Sutton, F. Napier, 6, Grosvenor Gardens, Willesden Green, N.W., Alkali Works Inspector.
1900. Sutton, W. Lincolne, Hillcroft, Eaton, Norwich, Public Analyst.
O.M. Swan, J. Cameron, 4, Nicholas Buildings, Newcastle-on-Tyne, Manufacturing Chemist.
O.M. Swan, Dr. Jos. W., F.R.S., 58, Holland Park, London, W., Chemist and Electrician.
1898. Swanson, Jas. F., (Journals) 5, Edmiston Terrace, Copeland Road, Govan, N.B.; (subs.) c/o Mr. R. Glover, 13, Belville Street, Greenock, N.B., Technical Chemist.
1884. Swinburne, Geo., (Journals), 99, Queen Street, Melbourne, Australia; (subs.) c/o Jno. Coates and Co., Suffolk House, Laurence Pountney Hill, E.C., Gas Engineer.

1901. Swinton, Ralph S., c/o W. J. Bush, Incorporated, Linden, N.J., U.S.A., Analytical Chemist.

1903. Sykes, Walter F., 85, Water Street, New York City, U.S.A., Chemical Merchant.

1902. Sylow, Paul L. P. G., Korsör, Alexandra Street, Drummoyne, Sydney, N.S.W., Australia, Analytical Chemist.

O.M. Syme, W. B., Elm Cottage, Addiewell, West Calder, N.B., Oil Works Chemist.

1903. Symmes, Whitman, 630, Harrison Street, San Francisco, Cal., U.S.A., Chemical Engineer.

T

1895. Taber, G. H., 814, Frick Building, Pittsburg, Pa., U.S.A., General Manager (Gulf Refinery Co.).

1896. Takagi, T., Kyoikuhin Seizo Kaisha, Asakusa, Sebickihen Cho, Tokyo, Japan, Chemical Engineer.

O.M. Takamatsu, T., Tokyo University, Japan, Analytical Chemist.

O.M. Takamine, Dr. J., 613, West 142nd Street, New York City, U.S.A., Engineer.

1890. Takayama, Jintaro, Nando Machi, 26, Ushigome, Tokio, Japan, Director (Imperial Industrial Experiment Station).

1901. Talati, K. E., Tirvetteyoor, near Madras (Chingulput), India, Leather Dresser.

1903. Talbott, Dr. B. E., Chaneyville, Md., U.S.A., Manufacturing Chemist.

1902. Talley, Thos. Washington, c/o Tuskegee Institute, Tuskegee, Ala., U.S.A., Chemist.

1898. Tanaka, Keishin, Matsuba Hotel, Kudansaka, Uye, Tokio, Japan, Chemist.

1900. Tankard, Arnold R., 67, Surrey Street, Sheffield, Analytical Chemist.

O.M. Tate, F. H., 9, Hackins Hey, Liverpool, Analytical and Technical Chemist.

1902. Tate, Francis G. H., Inglewood, Beckwith Road, Dulwich, S.E., Assistant Analyst (H.M. Customs).

O.M. Tatlock, J., 45, Renfrew Street, Glasgow, Laboratory Furnisher.

O.M. Tatlock, R. R., 156, Bath Street, Glasgow, Consulting Chemist.

1902. Tatters, Hugh Lee, 17, Waterloo Road, Runcorn, Cheshire, Analytical Chemist.

1892. Tatton, Reginald A., Mersey and Irwell Joint Commission, 44, Mosley Street, Manchester, Civil Engineer.

O.M. Taubman, R., 12, Eton Road, Haverstock Hill, N.W., Analytical Chemist.

1901. Taussig, Emil, 26, East 59th Street, New York City, U.S.A., President (West Disinfecting Co.).

1898. Taverner, W., Ashland, Oregon, U.S.A., Analytical Chemist.

1901. Tayler, Jno. Bernard, 2, Alma Terrace, Wavertree, Liverpool, Works Chemist.

1903. Taylor, Alvin M., c/o General Chemical Co., Hudson River Works, Hudson Heights, N.J., U.S.A., Chemist.

1902. Taylor, Arthur P., 460, Jarvis Street, Toronto, Ont., Canada, Manufacturer.

1898. Taylor, B. Franklin, Gainesville Cotton Oil Co., Gainesville, Ga., U.S.A., Manufacturing Chemist.

1902. Taylor, Edward R., Penn Yan, N.Y., U.S.A., Manufacturing Chemist.

1902. Taylor, Francis O., c/o Parke, Davis, and Co., Detroit, Mich., U.S.A., Analytical Chemist.

1886. Taylor, G. Crosland, Ravenscar, Helsby, near Warrington, Electrical Engineer.

1894. Taylor, G. Midgley, 27, Great George Street, Westminster, S.W., Analytical Chemist.

1893. Taylor, G. W., Dinting Vale Printworks, Dinting, near Manchester, Printworks Chemist.

O.M. Taylor, H. E., 702, Alexandra Parade, Dennistoun Glasgow, Lead Works Manager.

1883. Taylor, Jas., Department of Mines, Sydney, N.S.W., Australia, Government Metallurgist.

1888. Taylor, Jas. Davis, 9, Mincing Lane, London, E.C., Chemical Merchant.

1898. Taylor, Jas. M., 59, Kenmare Road, Sefton Park, Liverpool, Analytical Chemist.

1901. Taylor, John, Crawford Municipal Technical School, Cork, Ireland, Science Master.

1901. Taylor, Jno., 3, Rossett Road, Great Crosby, near Liverpool, Works Chemist.

1888. Taylor, J. Scott, c/o Winsor and Newton, Ltd., 38, Rathbone Place, London, W., Technical Chemist.

1896. Taylor, Martin, "The Clough," Buckhurst Hill, Essex, Chemical Works Manager.

1901. Taylor, M. J., 77, Front Street, E., Toronto, Canada, Soap Manufacturer.

1898. Taylor, Newman, Chinchpooghley Road, Parel, Bombay, India, Resident Engineer.

1901. Taylor, Sidney H., 2, Warwick Road, Weston, Bath, Works Chemist.

1902. Taylor, Thos., 12, Ancaster Drive, Great Western Road, Glasgow, Chemical Manufacturer.

1902. Taylor, Tom., jun., c/o Durant, Taylor and Co., 68, Major Street, Manchester, Chemical Merchant.

1898. Taylor, Walter, 20, Canning Street, Bury, Lancs., Technical Chemist.

1903. Tazaki, T. M., 15, Kamiyoshicho, Asakusaku, Tokyo, Japan, Technical Chemist.

1887. Teanby, G. W. A., Elvin Lodge, East Dereham, Norfolk, Analytical Chemist.

1899. Teas, Wm. Holmes, Ridegway, Pa., U.S.A., Chemist.

O.M. Teed, Dr. F. L., Chem. Laby., 9, Mincing Lane, London, E.C., Analytical Chemist.

O.M. Tennant, Sir Chas., Bart., 40, Grosvenor Square, W.; Glen, Peeblesshire, N.B., and Journals to St. Rollox, Glasgow, Alkali Manufacturer.

1884. Tennant, Jas., Alex. Fergusson and Co., Ltd., 38, McAlpine Street, Glasgow, Lead and Colour Manufacturer.

1896. Tennille, Geo. F., c/o Southern Cotton Oil Co., Savannah, Ga., U.S.A., Chemist.

1888. Terry, Albert, Verulam, Mount Albert Road, Balwyn, near Melbourne, Victoria, Brewer.

1884. Terry, Hubert L., 3, Herbert Street, Moss Side, Manchester, Technical Chemist.

O.M. Tervet, R., 54, Penshurst Road, South Hackney, E., Oil Works Manager.

1902. Test, Wm. H., 716, Brown Street, Lafayette, Ind., U.S.A., Assistant Professor of Chemistry.

1893. Tetley, C. F., Messrs. Jos. Tetley and Son, The Brewery, Leeds, Brewer.

1897. Tetlow, Wm. E., Ash Cottage, Ashfield, Dunblane, N.B., Chemist.

1903. Thatcher, Ed. J., Firfield House, Knowle, near Bristol, Merchant and Manufacturer.

1903. Thayer, Harry M., c/o The Procter and Gamble Co., Ivorydale, Ohio, U.S.A., Chemist.

1901. Thiry, Jos., Incheape, Southill Road, Chislehurst, Kent, Manager (Coke Oven Co.).

O.M. Thomas, Chas., J.P., D.L., Pitch and Pay, Stoke Bishop, near Bristol, Soap Manufacturer; Deputy Chairman, Midland Railway.

1894. Thomas, H. Russell, Broad Plain Soap Works, Bristol, Soap Manufacturer.

1902. Thomas, Jas. E., Box 192, Germiston, Transvaal, South Africa, Cyanide Manager.

O.M. Thomas, J. W., Overdale, Shortlands, Kent, Analytical Chemist.

1902. Thomas, Nehemiah M., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia.

1901. Thomas, Octavius, Gas and Water Offices, Pentre, Glamorganshire, Gas and Water Engineer.

1888. Thomas, S. Percy, 2, Landrock Road, Hornsey, N., Technical Chemist.

1898. Thomas, Wm. Harrison, jun., Passaic Print Works, Passaic, N.J., U.S.A., Printworks Chemist.

1885. Thompson, Prof. Claude M., 38, Park Place, Cardiff, Professor of Chemistry.

1898. Thompson, Edw. C., 40, Glenluce Road, Westcombe Park, S.E., Manufacturing Chemist.

1893. Thompson, G. Rudd, 69, Dock Street, Newport, Mon., Analytical and Consulting Chemist.

1895. Thompson, Gustave W., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.

1903. Thompson, Jno. Fairfield, Department of Metallurgy, Columbia University, New York City, U.S.A.

1903. Thompson, Jno. T., Corporation Sewage Works, Knostrop, Leeds, Analyst.

1885. Thompson, W., Sankey Hill, Earlestown, Lancashire, Sugar Refiner.

1884. Thompson, W. G., Colour Manufacturer.

O.M. Thompson, W. P., Patent Office, 6, Lord Street, Liverpool, Patent Agent.

1896. Thomsen, Alonzo L., Maryland Club, 1, East Eager Street, Baltimore, Md., U.S.A., Manufacturing Chemist.

1902. Thomson, Allen B., c/o Spencer, Chapman, and Messel, Ltd., Silvertown, E., Chemical Engineer.

1881. Thomson, G. Carruthers, 53, Bedford Road, Rock Ferry, Birkenhead, Engineer.

1903. Thomson, G. M., 129, Moray Place West, Dunedin, New Zealand, Analyst.

1891. Thomson, Jas. M., Royal Gunpowder Factory, Waltham Abbey, Essex, Manager (Cordite Branch).

1901. Thomson, J. M., New Hermand Oil Co., Ltd., Breich Works, West Calder, N.B., Manager.

1894. Thomson, John, Overlee, Alexandria, N.B., Printworks Manager.

1884. Thomson, Robt. T., 156, Bath Street, Glasgow, Analytical Chemist.

1899. Thomson, Thos., (Journals) Waterproofing Co., Barrhead; and Westlea, Barrhead, near Glasgow, Manufacturer.

O.M. Thomson, W., Royal Institution Laboratory, Manchester, Analytical and Consulting Chemist.

1890. Thomson, Wm. Thos., Royal Gunpowder Factory, Waltham Abbey, Essex, Explosives Chemist.

1902. Thorburn, Jas., Reid's Villas, Stevenston, Ayrshire, N.B., Analytical Chemist.

1900. Thorman, J. Stanley, West Ham Gasworks, Stratford, E., Chemist.

O.M. Thorne, Dr. L. T., 2, Denbigh Gardens, Richmond-on-Thames; and (Journals) Southampton Wharf, Battersea, S.W., Technical Chemist.

O.M. Thorneycroft, Wallace, East Plean House, Bannockburn, N.B., Technical Chemist.

1891. Thornton, Chris., 16, Hillside Avenue, Providence, R.I., U.S.A., Printworks Manager.

1891. Thornton, David H., Brookfoot Dyeworks, Brighouse, Yorks, Dyer.

1887. Thornton, H., Redbourn, Ashford, Middlesex, Analytical Chemist.

1899. Thornton, Wm., (Journals) c/o Isaac Brandon & Bros., Panama, Central America; and (subsn.) c/o Thos. Thornton, Hermand, West Calder, N.B., Chemist.

1895 Thorp, Dr. Frank H., Mass. Inst. of Technology, Boston, Mass., U.S.A., Assistant Professor of Industrial Chemistry.

O.M. Thorpe, Dr. T. E., C.B., F.R.S., Government Laboratory, Clement's Inn Passage, Strand, W.C.; and (Journals) 61, Ladbroke Grove, Notting Hill, W., Chief Chemist (Customs and Inland Revenue).

1902. Thurlow, Nathaniel, 226, East Frederick Street, Lancaster, Pa., U.S.A., Chemist.

1898. Thurnauer, Dr. Gustav, c/o Aurora Metal Co., Aurora, Ill., U.S.A., Chemist.

1904. Thurston, Azor, Grand Rapids, Ohio, U.S.A., Chemist

1904. Tickle, Thos., Laboratory, 83, Queen Street, Exeter, Analyst.

1903. Tighe, Arthur, 20, Marlborough Place, St. John's Wood, London, N.W., Chemical Student.

1901. Tilden, Philip S., c/o Franklin H. Kalbfleisch Co., 35, Burling Slip, New York City, U.S.A., Manufacturing Chemist.

O.M. Tilden, Prof. W. A., F.R.S., The Oaks, Murray Road, Northwood, Middlesex, Professor of Chemistry.

1900. Tilley, Jas. W., Melrose, Raleigh Gardens, Brixton Hill, London, S.W., Research Chemist.

1901. Timmans, W. G., 108, Peel Street, Derby, Chemical Works Manager.

1886. Timmins, A., Argyll Lodge, Higher Runcorn, Civil Engineer.

O.M. Timmis, T. Sutton, Widnes, Chemical Manufacturer.

1894. Tipler, Fred. C., 48, Brooklyn Street, Crewe, Analytical Chemist.

1890. Tobey, C. H., Collingwood, Ontario, Canada, Tannery Chemist.

1894. Toch, Maximilian, 52, 9th Street, Long Island City, N.Y., U.S.A., Chemist.

1893. Tocher, Jas. F., 5, Chapel Street, Peterhead, N.B., Pharmaceutical Chemist.

1886. Todd, A. M., 204, North Rose Street, Kalamazoo, Mich., U.S.A., Manufacturing Chemist.

1899. Tompkins, Vreeland, 533, Communipaw Avenue, Jersey City, N.J., U.S.A., Analytical Chemist.

O.M. Toms, F. Woodland, States Analyst's Office, St. Heliers, Jersey, Analytical Chemist.

1902. Tone, Frank Jerome, c/o The Carborundum Co., Niagara Falls, N.Y., U.S.A., Manager.

1899. Tone, Jay E., 1427, Woodland Avenue, Des Moines Iowa, U.S.A.

1902. Torrey, Charles A., jun., 17, Park Vale, Brookline, Mass., U.S.A., Chemist.

O.M. Towers, J. W., Brantwood, Allerton, near Liverpool, Analytical Chemist.

1903. Townsend, C. Eyre-Coote, 36, Glenluce Road, Blackheath, S.E., Commission Agent.

1893. Townsend, Chas. F., 1, Morgan Road, Bromley, Kent, Chemist.

1892. Townsend, Chas. W., 19, Crawford Street, Port Dundas, Glasgow, Chemical Manufacturer.

1892. Townsend, Oliver C., 1, Horton Crescent, Rugby, Chemical Manufacturer.

1897. Towse, Walter, c/o Messrs. E. and J. Richardson, Elswick Leather Works, Newcastle-on-Tyne, Technical Chemist.

1899. Trantom, Dr. Wm., 10, Field Road, New Brighton, Cheshire, Chemist.

1894. Traphagen, Dr. Frank W., Colorado School of Mines, Golden, Colo., U.S.A., Professor of Metallurgy and Assaying.

1900. Traquair, Jno., Glenfield Starch Works, Paisley, N.B., Analytical Chemist.

1904. Trantwein, Alfred P., Carbondale, Pa., U.S.A., President (Carbondale Chemical Co.).

1893. Travers, Dr. Morris W., University College, Bristol, Chemist.

1889 Trechmann, A. O., Halling Lime and Cement Works, near Rochester, Kent, Cement Works Chemist.

1885. Trechmann, Dr. C. O., Warren Cement Works, Hartlepool, Cement Manufacturer.

1895. Treharne, F. Gwilym, Wranghrook, Llanishen, near Cardiff, Analytical Chemist.

1885. Trewby, Herbert, 62, St. John Street, London, E.C., Analytical Chemist.

1883. Tribe, P. C. M., Rothesay, Datchet, Windsor, Secretary.

1901. Trigger, Oliver, Chem. Dept., Royal Arsenal, Woolwich, S.E., Analytical Chemist.

1898. Tripp, Dr. E. Howard, (Journals) Municipal Technical College; and 46, Terrace Road, Swansea, Science Master.

O.M. Trobridge, A., c/o Trobridge and Co., Ltd., South Shore Road, Gateshead-on-Tyne, Technical Chemist.

1897. Trotman, Saml. R., King's Walk Chambers, Parliament Street, Nottingham, City Analyst.

1900. True, Percival E., Bowker Chemical Co., Elizabeth, N.J., U.S.A., Chemical Engineer.

1887. Tsukiyama, S., Nippon Seito Kaisha, Osaka, Japan, Paper Mills Chemist.

1894. Tucker, Alex. E., Norwich Union Chambers, Congreve Street, Birmingham, Metallurgist and Chemist.

1897. Tucker, Samuel A., Columbia University, New York City, U.S.A., Tutor in Industrial Chemistry.

1886. Tuer, Arthur H., Thornhill, near Wigan, Analytical Chemist.

1903. Tufts, C. G., c/o Semet-Solvay Co., Syracuse, N.Y., U.S.A., Chemical Engineer.

1901. Tulloch, Wm. F., 7, West George Street, Glasgow, Merchant.

1899. Turnbull, Dr. Andrew, Manchester and Liverpool District Tanners' Federation, 3, Lord Street, Liverpool, Consulting Chemist.

1888. Turnbull, G. W., 2, Haws Hill, Carnforth, Lancashire, Metallurgical Chemist.

1884. Turnbull, W. S., 37, West George Street, Glasgow, Chemical Manufacturer.

1902. Turner, Basil, 5, Moore Street, Sydney, N.S.W., Australia, Metallurgist.

1902. Turner, Jos., c/o Read, Holliday, and Sons, Ltd., Huddersfield, Chemist.

1904. Turner, Owen, Park Tower, Ipswich, Tanner and Currier.

1897. Turney, Fred. N., 76, Rue Wilson, Brussels, Belgium, Leather Dresser.

1887. Turney, Sir J., Springfield, Alexandra Park, Nottingham, Tanner.

1891. Turri, Geo. G., Salisbury Building, cor. of Queen and Bourke Streets, Melbourne, Vic., Australia, Patent Agent.

1903. Tutton, Henry Ralph, 19, St. James' Parade, Bath; and (Journals) c/o Burham Cement Works, Aylesford, Kent, Chemist.

1890. Tweedy, Jas., 306A, Burdett Road, Limehouse, E., Metallurgical Chemist.

1891. Twitchell, E., Wyoming, Ohio, U.S.A., Candle Works Manager.

1897. Twynam, H., c/o Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, Mining Engineer.

O.M. Twynam, T., Hawthorne House, Slaid Hill, Moortown, Leeds, Metallurgist.

1901. Tyler, Chas. R., 424, West 57th Street, New York City, U.S.A., Analytical Chemist.

O.M. Typke, P. G. W., Lawn House, New Malden, Surrey, Chemical Manufacturer.

1893. Tyrer, Chas. T., Stirling Chemical Works, Stratford, E., Manufacturing Chemist.

O.M. Tyrer, T., Stirling Chemical Works, Stratford, E., Chemical Manufacturer.

1899. Tysoe, Jos., South Metropolitan Gas Co., East Greenwich, S.E., M. Inst. C.E., Gas Engineer.

U

1894. Uhlig, E. C., 48, Barclay Street, New York City, U.S.A., Glass Works Chemist.

1900. Uhlig, W. C., c/o Hygeia Distilled Water Co., 349, West 12th Street, New York City, U.S.A., Chemist.

1897. Ullman, Jas. A., c/o Sigmund Ullman Co., 146th Street, and Park Avenue, New York City, U.S.A., Printing Ink Manufacturer.

1900. Ulmer, Geo. F., c/o Arbuckle Bros., Sugar Refinery, Foot of Pearl Street, Brooklyn, N.Y., U.S.A., Chemist.

O.M. Umney, C., (Journals) 81, Lawrie Park Road, Sydenham, and (communications) 50, Southwark Street, London, S.E., Manufacturing Chemist.

1889. Underhill, Thos. J., 73, Pepy's Road, New Cross, S.E., Inspector of Stores.

1885. Underwood, G. R., 4, Emerson Street, Peabody, Mass., U.S.A., Glue Works Chemist.

1898. Unglaub, Oscar, Ban Hill House, Bolton Road, Pendleton, Manchester, Soap Manufacturer.

1883. Usmar, J. H., 22, Billiter Street, London, E.C., Chemical Merchant.

1904. Uyeda, Toyokitsu, Takasago, Harima, Japan, Chemist.

V

1896. Van der Linde, Harold, 47, Front Street West, and (Journals) 101, Tyndall Avenue, Toronto, Canada, Chemist (India-rubber and Gutta-percha Manufacturing Co.).

1895. Vanderpoel, Dr. Frank, 153, Center Street, Orange, N.J., U.S.A., Chemist.

1902. Van der Sleen, Nicolaas, Gedempte Oude Gracht, 47, Haarlem, Holland, Consulting Chemist and Bacteriologist.

1903. Van Dyck, Edwin M., Bureau of Engraving and Printing, Washington, D.C., U.S.A., Chemist and Ink Maker.

1897. Van Gelder, Arthur P., c/o Climax Powder Manufacturing Co., Emporium, Pa., U.S.A., Superintendent.

1903. Van Gilder, H. P., 234, Bushkill Street, Easton, Pa., U.S.A., Analytical Chemist.

1891. Van Gundy, Chas. P., Laboratory, B. & O. R. R., Baltimore, Md., U.S.A., Metallurgical Chemist.

1896. Van Ingen, Dudley A., New Jersey Zinc Co., Newark, N.J., U.S.A., Chemist.

1896. Van Laer, Norbert, Truman's Brewery, Burton-on-Trent, Brewer and Chemist.

1897. Van Marken, J. C., 150, Queen Victoria Street, E.C., Chemical Engineer.

1902. Vanwinckel, W. H., c/o Lyman Bros. and Co., Ltd., 71, Front Street East, Toronto, Canada, Chemist.

1902. Van Zwaluwenburg, Jas. G., 607, East Ruby Avenue, Argentine, Kansas, U.S.A., Analytical Chemist.

1888. Vargas-Vergara, J. M., Apartado No. 237, Bogota, Republic of Colombia, S. America, Metallurgical Chemist.

O.M. Vasey, T. E., 6, South Parade, Leeds; (Journals) P.O. Box 1149, Montreal, Canada, Chemical Engineer.

1894. Veitch, Geo., Chemical Works, Crieff, N.B., Manufacturing Chemist.

1898. Verity, Ben, Magog, Prov. Quebec, Canada, Printworks Chemist.

1897. Verity, Victor, 83, Lexington Street, East Boston, Mass., U.S.A., Chemical Works Foreman.

O.M. Vickers, Wm., c/o Thos. Vickers and Sons, Miles Platting, Manchester, Chemical Manufacturer.

1895. Vigelius, Carl, 175, Pearl Street, New York City, U.S.A., Shellac Bleacher.

1896. Vincent, Jos. A., Rooms 207–8, 421, Chestnut Street, Philadelphia, Pa., U.S.A., Mechanical Engineer.

1897. Vlies, Leonard E., Fernroyd, Wellington Road, Whalley Range, Manchester.

O.M. Voelcker, E. W., 22, Tudor Street, London, E.C., Agricultural Chemist.

1887. Voelcker, Dr. J. A., 20, Upper Phillimore Gardens, Kensington, W., Agricultural Chemist.

1901. Vogel, G. C., 583, Cass Street, Milwaukee, Wis., U.S.A., Tanner.

1897. Vogel, Julius L., 91, Blackfriars Road, S.E., Engineer.

1899. Vogeler, Gustav, 17, Philpot Lane, London, E.C., Merchant.

1900. Volney, Dr. Carl W., Keyport, N.J., U.S.A., Chemist (Smokeless Powder Co.).

1897. Voorhees, Louis A., Box 55, New Brunswick, N.J., U.S.A., Agricultural Chemist.

1899. Voorhees, Samuel S., c/o Supt. Architect, Treasury, Washington, D.C., U.S.A., Chemist.

1902. Vorisek, Dr. Anton, College of Pharmacy, 115—119, West 68th Street, New York City, U.S.A., Instructor.

1888. Vörster, Fritz, Cöln-Marienburg, Germany, Manufacturing Chemist.

1885. Voss, Hermann, 19, Beckenham Road, Beckenham, Kent, Manure Works Manager.

1899. Voss, Walter A., Melrose, Whitworth Road, South Norwood, S.E., Manufacturing Chemist.

1899. Vreeland, Cornelius D., Upper Montclair, N.J., U.S.A., Manufacturing Chemist.

W

1896. Wachtel, Gregory, 6, Manejny Pereulok, St. Petersburg, Russia, Chemical Engineer.
1895. Waddington, Thos. W., 74, Blackburn Road, Padiham, Lancashire, River Inspector.
1902. Wade, Frank, 10, Shirley Road, Southsea, Analytical Chemist.
1890. Wade, Jas. L., 28, West Kensington Gardens, London, W., Chemical Manufacturer.
1889. Wadman, W. E., 102, Lord Avenue, Bayonne, N.J., U.S.A., Manufacturing Chemist.
1897. Wagner, Dr Theodore B., 1444, Wilson Avenue, Chicago, Ill., U.S.A , Chemist.
1893. Wagner, W. G., Glyndhurst, Ealing Common, W., Manufacturing Chemist.
1903. Wainwright, J , 15, Bolton Road, Port Sunlight, near Birkenhead, Soap Works Manager.
1884. Wainwright, Dr. J. H., 159, Front Street, New York City, U.S.A., Analytical Chemist.
1895. Wainwright, Wm., c/o Spooner and Bailey, Chemical Manure Works, Eling, near Southampton, Chemist.
1901. Waite, C. Nelson, c/o General Artificial Silk Co., 32, South Broad Street, Philadelphia, Pa., U.S.A., Chemist.
1899. Wakefield, Wm. C., c/o Savile Town Chemical Co., Ltd., Savile Town, Dewsbury, Chemist.
1894. Waldman, Louis J., P. O. Box 162, Albany, N.Y., U.S.A., Aniline Dye Manufacturer.
1895. Waldstein, Dr. Martin E., 107, Murray Street, New York City, U.S.A , Manufacturing Chemist.
1887. Walker, Archibald, 8, Crown Terrace, Glasgow, Distiller.
1900. Walker, David C., Gibbonsville, Idaho, U.S.A., Analytical Chemist.
1897. Walker, H. V., 38, Clinton Street, Brooklyn, N.Y., U.S.A., Chemist.
1894. Walker, Dr. Jas., University College, Dundee, Professor of Chemistry.
1902. Walker, Jas., Knowle House, Mirfield, Yorks, Woollen Manufacturer.
1897. Walker, Jas. W., Fernlea, Irvine, N.B., Chemical Manufacturer.
1902. Walker, Jno. H., Gourepore Works, Naihati, E.B.S.R., Bengal, India, Chemist.
1884. Walker, S. R., 19, Wolsey Street, Radcliffe, Manchester, Foreman Dyer.
1895. Walker, W. Sloane, c/o Walker, Ltd., Litherland, near Liverpool, Tanner.
1900. Walker, Dr. Wm. H., Massachusetts Inst. of Technology, Boston, Mass., U.S.A., Chemical Expert.
1897. Wallace, Edwin C., P.O. Box 42, Cambridgeport, Mass., U.S.A., Chemist.
1897. Wallace, Robt. A., Dorset Hall, Merton, Surrey, Chemical Manufacturer.
1883. Wallace, Robert, 20, Murrayfield Avenue, Edinburgh, Distiller.
O.M. Waller, Dr Elwyn, 7, Franklin Place, Morristown, N.J., U.S.A., Professor of Chemistry.
1899. Wallerstein, Dr. Max, 105, East 91st Street, New York City, U.S.A., Chemist.
1886. Walsb, F. T., 195, Nesmith Street, Lowell, Mass., U.S.A., Colour Printer.
1901. Walsh, Lionel O. P., c/o Burt, Boulton, and Haywood Ltd., Prince Regent's Wharf, Silvertown, E., Chemist.
1903. Walsh, Peter H., P.O. Box 469, Magog, Quebec, Canada, Analytical Chemist.
1904. Walther, Wm., Holzapfel's Compositions Co., Ltd., Heworth Shore, Felling-on-Tyne, Chemist and Works Manager.
1902. Walton, Thos. U., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1895. Want, W. Philip, 44, Bishopsgate Street Without, London, E.C., Pharmacist and Editor.
1901. Warburton, Frank, 5, Rosebery Gardens, Muswell Hill, N., Manager.
1896. Warhurton, Thos., 12, Seymour Road South, Clayton, Manchester, Chemist.
1903. Ward, Dudley R., 251, Peckham Rye, London, S.E., Analytical Chemist.
O.M. Ward, Geo., Messrs. Hirst, Brooke, and Hirst, Millgarth Mills, Leeds, Chemical Works Manager.
1891. Ward, G. J., The Cottage, Hallam Fields, near Nottingham, Civil Engineer.
1884. Ward, Howard Chas., Yeatton, Hordle, Lymington, Hants, Deputy Chairman of Gas Co.
1898. Ward, John, Barnstone Blue Lias Lime Co., Ltd., Barnstone, Notts, Manager.
1899. Ward, Wm. J., c/o Olive and Partington, Broughton Bridge Paper Mills, Manchester, Chemist.
O.M. Wardale, J. D., Redheugh Engine Works, Gateshead-on-Tyne, Engineer.
1892. Warden, Jno. B., P.O. Box 701, Deadwood, S. Dakota, U.S.A., Analytical Chemist.
1897. Wardle, Sir Thos., 54, St. Edward Street, Leek, Staffordshire, Silk Dyer.
1902. Waring, W. Geo., Webb City, Mo , U.S.A , Metallurgical Chemist.
1885. Warington, Robt., F.R.S., Harpenden, Herts, Agricultural Chemist.
1899. Warnes, Arthur R., c/o T. L. Willson, 117, Boyson Road, Walworth, S.E., Soapworks Chemist.
1890. Warren, Fiske, 161, Devonshire Street, Boston, Mass., U.S.A., Paper Manufacturer.
1902. Warren, H. D., The Gutta Percha and Rubber Manufacturing Co., Ltd., 45—49, West Front Street, Toronto, Canada, President.
1890. Warren, Jno. Davis, 7, Essex Road, Acten, W., Manufacturing Chemist.
1901. Warren, Jno. E., Eagle Chemical Works, Barchester Street, Poplar, E., Tar Distiller.
1885. Warren, T. T. P. Bruce, Tamworth Villa, Earlham Grove, Forest Gate, Essex, Analytical Chemist.
1885. Waterfall, W. B., c/o Avon Manure Co., Bristol; and (Journals) Thirlmere, Clavering Road, Redland, Bristol, Manure Manufacturer.
1890. Waterhouse, Major-General Jas., Oak Lodge, Court Road, Eltham, Kent, Assistant Surveyor-General of India (retired).
1891. Waterhouse, Robt., 7, Lyme Grove, Altrincham, Cheshire, Analytical and Agricultural Chemist.
1902. Watkins, E. J., (communications) 81, Montpelier Road; (Journals) c/o Mellin's Food, Ltd., Stafford Street, Peckham, S.E., Works Chemist.
1900. Watkins, Norman, Box 767, Honolulu, Hawaiian Islands, Chemist.
1898. Watkins, Willard H., c/o Schoellkopf, Hartford, and Hanna Co., 163, Oliver Street, Boston, Mass., U.S.A., Colourist.
1894. Watmough, Benj., 1, Ryeburn, Stanley Road, and (Journals) c/o Messrs. Brotherton and Co., Ammonia Works, Calder Vale, Wakefield, Analytical Chemist.
1894. Watson, Alex. Forbes, St. James's Gate Brewery, Laboratory, Watling Street, Dublin, Chemist.
1884. Watson, Chas., Dawsholm Chemical Works, Maryhill, Glasgow, Manufacturing Chemist.
1894. Watson, Chas. Ernest, c/o Peter Spence and Sons, Manchester Alum Works, Manchester, Chemical Assistant.
1890. Watson, Eric E., (Journals) The Queensland Smelting Co., Aldershot, Maryborough, Queensland, Australia; (subs.) c/o S. Watson, Queen Insce. Buildings, Dale Street, Liverpool, Metallurgical Chemist.
1895. Watson, H. Ard, Ashwood, North Hill Road, Headingly, Leeds, Tar Distiller.
1901. Watson, Herbert J., Glenarm Villas, Cavendish Street, Mansfield, Notts., Chemist.
1903. Watson, H. M., 22, Coleraine Road, Blackheath, S.E., Paint Manufacturer.

1903. Watson, H. W., 111, Brudenell Road, Hyde Park, Leeds, Analytical Chemist.
1894. Watson, Jas., 60, West Park Terrace, South Shields, Alkali Works Manager.
O.M. Watson, Jno., c/o City and Suburban Gold Mining Co., Box 1026, Johannesburg, Transvaal, South Africa, Technical Chemist.
O.M. Watson, Jno. C., Schluesselberg, near St. Petersburgh, Russia, Technical Chemist.
1891. Watson, Jno., 56, Cantwell Road, Woolwich Common, S.E., Analytical Chemist.
O.M. Watt, A., c/o Macfie & Sons, 34, Moorfields, Liverpool. Sugar Works Chemist.
1901. Watt, Francis L., 111, Lauderdale Mansions, Lauderdale Road, Maida Vale, W., Student.
1900. Watts, Chas. J., 40, City Road, London, E.C., Manufacturer.
1893. Watts, Jno. Isaac, Fairleigh, Hartford, Cheshire, Alkali Works Manager.
1903. Wayland, Wm. A., 12, Albert Road, Brockley, S.E., Manufacturing Chemist.
1900. Webb, Jno. F., 20, Louvaine Road, St. John's Hill, Battersea, S.W., Mining and Electrical Engineer.
1901. Webb, Wm. J., 90, Ash Street, Yonkers, N.Y., U.S.A., Superintendent of Printing Department.
1891. Weber, C. Otto, Heathfield, Middleton Road, Crumpsall, Manchester, Analytical Chemist.
1884. Webster, C. S. Stanford, Malvern House, Redland, Bristol, Professor of Chemistry.
1901. Webster, Geo J., Standard Chemical Co., Ltd., Gooderham Building, Toronto, Canada, Secretary.
1902. Webster, Jno., Chemical Laboratory, Guy's Hospital, S.E., Analyst.
1897. Wedge, Utley, Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., U.S.A., Chemist.
1902. Weed, Hy. T., 408, Third Street, Brooklyn, N.Y., U.S.A., Teacher of Chemistry.
1893. Weeks, H. B., 2, Infield Park Road, Barrow-in-Furness, Analytical Chemist.
1895. Weems, Dr. J. B., Iowa Agricultural College, Ames, Iowa, U.S.A., Agricultural Chemist.
1898. Weeple, Lawrence, Pinchin's Wharf, Stratford, E., Colour Works Chemist.
1903. Weinberg, J., Rosa, United Provinces, India, Chemist.
1902. Weiskopf, Erich, Dynamite Factory, Modderfontein, Transvaal, South Africa, Chemist.
1902. Weiss, Georg A., Chemische Fabrik, Ahlden a/Aller, Hannover, Germany, Chemical Manufacturer.
1898. Weissmüller, Rudolf E. *See* Miller, R. E. W.
1899. Weldon, Leonard E., Lime Villas, Egypt Road, Nottingham, Dyer.
1903. Wellcome, Henry S., Snow Hill Buildings, London, E.C., Manufacturing Chemist.
1891. Wells, Jas. Gray, Trent House, Branston, Burton-on-Trent, Brewing Chemist.
1894. Wells, Pierson L., 86, Joralemon Street, Brooklyn, N.Y., U.S.A., Patent Lawyer and Engineer.
1885. Welsh, Jas., Horrocks Lane Dyeworks, Red Bank, Manchester, Printworks Manager.
1890. Welsh, Thos. L., 3, Prince's Gardens, Dowanhill, Glasgow, Analytical Chemist.
O.M. Welsh, W., Holt Town, Manchester.
1897. Wense, Dr. W., Chem. Fabr. Griesheim-Elektron, Griesheim a/Main, Germany, Manager.
1890. Werner, Emil A., 5, Church Avenue, Rathmines, Dublin, Chemical Demonstrator.
1903. Wesener, Dr. John A., 103, State Street, Chicago, Ill., U.S.A., Consulting Chemist.
1884. Wessel, Carl, (communications) Geheimer Commerzienrath, C. Wessel, Bernburg; and (Journals) Deutsche Solvay-Werke, Act. Ges., Bernburg, Anhalt, Germany, Alkali Manufacturer.
1889. Wesson, D., P.O. Box 458, Savannah, Ga., U.S.A., Technical Chemist and Cotton-Oil Expert.
1903. West, Leonard, 203, Uttoxeter New Road, Derby, Manufacturing Chemist.
1900. Westenfelder, B. D., c/o American Oak Leather Co., Cincinnati, Ohio, U.S.A., Chemist.
1885. Westmoreland, J. W., 3, Love Lane, Eastcheap, E.C., Metallurgical Chemist.
1898. Weston, David B., Box 503, Sharon, Mass., U.S.A., Chemist.
1894. Weston, Robt. S., 14, Beacon Street, Boston, Mass., U.S.A., Chemist and Bacteriologist.
1885. Weston, Wm., H.M. Dockyard, Portsmouth, Analytical Chemist.
1902. Wethered, Wm. P., Redcourt, Carnatic Road, Mossley Hill, Liverpool, Manager.
1890. Wetter, Jasper, 37–39, Essex Street, Strand, W.C., Patent Agent.
1883. Wetzel, H. A., Box 488, Detroit, Michigan, U.S.A., Manufacturing Chemist.
O.M. Whalley, L. J. de, 172, Erlanger Road, New Cross, S.E., Sugar Chemist.
1904. Whatmough, Dr. Wm. H., Woodleigh, Cheadle, Cheshire, Chemist.
1898. Wheeler, Edw. J., 79, Chapel Street, Albany, N.Y., U.S.A., Analytical Chemist.
1903. Wheeler, Ernest, 335, Park Road, Oldham, Lancashire, Analytical Chemist (Platt Bros. and Co.).
1895. Wheelwright, Dr. E. W., Greenholme, Westfield Road, Acock's Green, near Birmingham.
1898. Whichelo, Matthew A., 9, Eversfield Road, Eastbourne, Aërated Water Manufacturer.
O.M Whiffen, T., Lombard Road, Battersea, London, S.W., Manufacturing Chemist.
O.M. Whiffen, Thos. J., Harefield, Southfields, S.W., Manufacturing Chemist.
O.M. Whiffen, W. G., Lombard Road, Battersea, London, S.W., Manufacturing Chemist.
1902. Whipple, G. C., Mount Prospect Laboratory, Flatbush Avenue, and Eastern Parkway, Brooklyn, N.Y., U.S.A., Chemist.
1893. Whitaker, Alf., Newlaithes Grange, Horsforth, Leeds, Dyer.
1899. Whitaker, Milton C., c/o Welsbach Light Co., Gloucester City, N.J., U.S.A., Chemist.
1895. Whitaker, Thos., Newlay Hall, near Leeds, Dyer.
O.M. Whitaker, Thorp, (Journals) Bradford Dyers' Association, Ltd.; and 35, Pemberton Drive, Bradford, Yorks, Dyer's Chemist.
O.M. White, A. Dowler, 65, Cedar Gardens, Deodar Road, Putney, London, S.W., Chemical Manufacturer.
1898. White, Alf. H., 1003, East University Avenue, Ann Arbor, Mich., U.S.A., Instructor in Chemical Technology.
1893. White, Arthur F., 30, Cornwall Terrace, Manningham, Bradford, Yorks, Manufacturing Druggist.
1902. White, Geo. Arthur, P.O. Box 70, Vandergrift, Pa., U.S.A., Chemist.
1901. White, H. Graham, 24, Bidston Road, Oxton, Birkenhead, Works Chemist.
1889. White, Henry, 245, Western Road, Crookes, Sheffield, Manufacturing Chemist.
1887. White, J. Campbell. *See* Overtoun, Lord.
1898. White, Jno., County Offices, St. Mary's Gate, Derby, Public Analyst to County of Derby.
O.M. White, Paul T., Horton Field House, West Drayton, Chemical Manufacturer.
1903. White, Ralph, 35, The Cedars, Middlewich Road, Northwich, Engineer.
1894. White, W. Gilchrist, 86, Bay Street, Port Glasgow, N.B., Calico Printer's Chemist.
1892. Whitehead, J., 8, West Street, Rochdale, Dyer.
1903. Whitehouse, P. L., 10, Victoria Street, West Bromwich, Staffordshire, Oil Chemist.
1885. Whiteley, R. Lloyd, 5, Bagnall Street, West Bromwich, Staffordshire, Chemical Lecturer.
1892. Whiteside, Jno. L., 376, St. Helen's Road, Bolton-le-Moors, Chemical Lecturer.
1885. Whittaker, C. J., West Bank, Lytham, Lancashire, Chemical Engineer.
1901. Whitton, Jas. T., c/o Nobel's Explosives Co., Ltd., Ardeer, Stevenston, N.B., Chemist.
1884. Whowell, F., Carr Bank, Tottington, Bury, Lancashire, Bleacher.

1899. Wiarda, Jno. C., 259—273, Green Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1897. Wiborg, F. B., The Ault and Wiborg Co., Cincinnati, Ohio, U.S.A., Manufacturer.
1890. Wickens, B. Foster, 31, Bermondsey Wall, London, S.E., Managing Director (Wickens, Pease & Co., Ltd.).
1887. Wielandt, Dr. Wm., Maltkestrasse, 8^1, Magdeburg, Germany, Chemist.
1904. Wieler, Eric E., 4, Palatine Road, Withington, Manchester, Chemical Merchant.
1900. Wiener, Aug. F., c/o Vanadium Alloys (1901), Ltd., 31, Lombard Street, London, E.C., General Manager.
1904. Wigg, Chas. E., Rockshaw, Merstham, Surrey, Electrical Engineer.
1883. Wiggin, W. W., Wiggin Street, Birmingham Heath, Birmingham, Nickel Refiner.
1897. Wigglesworth, Henry, 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
O.M. Wightman, C., 1, Fenchurch Avenue, London, E.C., Chemical Merchant.
1899. Wild, Roland C., The Grange, New Eltham, Kent, Analytical Chemist.
1893. Wilder, F. L., Morro Velho, Villa Nova de Lima, Estado de Minas Geraes, Brazil, Assayer.
1902. Wilder, Salmon W., jun., Merrimac Chemical Co., 77, Broad Street, Boston, Mass., U.S.A., Treasurer.
1899. Wildman, Arthur J., 17, Streatfield Avenue, East Ham, E., Chemist.
1902. Wiley, Harvey W., Bureau of Chemistry, Department of Agriculture, Washington, D.C., U.S.A., Chief.
1903. Wilkie, Jno. M., 83, Henry Road, West Bridgford, Nottingham, Analytical Chemist.
1885. Wilkin, Sir Walter, K.C.M.G., Appold Street, Finsbury, E.C., Yeast Manufacturer.
1901. Wilkins, Albert D., P.O. Box 34, Elizabeth, Pa., U.S.A., Chemist.
1895. Wilkins, Charles, 40, Church Lane, Hornsey, N., Manufacturing Perfumer.
1899. Wilkins, H. A. J., c/o New Jersey Zinc Co., 71, Broadway, New York City, U.S.A., Mining Engineer.
1900. Wilkins, W. G., (Journals) c/o Derby Chemical Colour Co., 17, Bridge Street; and 59, Uttoxeter Road, Derby, Colour Manufacturer.
1886. Wilkinson, J. B., Tong Street, Dudley Hill, Bradford, Yorks, Chemical Manufacturer.
1898. Wilkinson, Walter S., P.O. Box 835, Baltimore, Md., U.S.A., Asphalt Block Manufacturer.
1884. Will, W. Watson, 1, St. Agnes Place, Kennington Park; and (Journals) 162, Kennington Park Road, S.E., Professor of Organic Chemistry.
1903. Willard, C. T., 41, State Street, Schenectady, N.Y., U.S.A., Chemist.
1893. Willcox, Benjamin, 47, Lincoln's Inn Fields, London, W.C., Patent Agent.
1898. Willcox, Frank A., 18, Holmlands Park, Sunderland, Explosives Chemist.
1900. Willenz, Dr. Michel, Rue Haringrode, 4, Antwerp, Belgium, Leather Trades Chemist.
1903. Williams, Chas. Ed., Thornhayes, Sleaford, Seed Crusher.
1895. Williams, David T., 9, Calvert Terrace, Swansea, Chemist.
1903. Williams, Harvey L., P.O. Box 410, Bristol, Tenn., U.S.A., Manufacturer of Barium Salts.
1891. Williams, Henry J., 161, Tremont Street, Boston, Mass., U.S.A., Chemical Engineer.
1896. Williams, Jno. Taylor, 2, Queen Street, Wellington, Salop, Brewer.
1904. Williams, Jno. T., Glenbrook Avenue, Stamford, Conn., U.S.A.
1904. Williams, Naboth, 28, Rolleston Street, Warrington, Technical Chemist.
1902. Williams, Percy, British Uralite Co., Ltd., Higham,, near Rochester, Kent, Chemist.
1885. Williams, Rowland, Hale Cote, Haverbreaks, Lancaster, Analytical Chemist.
1900. Williams, Saml. H., Glastonbury, Conn., U.S.A., Soap Manufacturer.
1903. Williams, S. M., 269, Springdale Avenue, East Orange, N.J.. U.S.A., Chemist.
1885. Williams, T. Howell. *See* Idris, T. H. W.
1884. Williams, Prof. W. Carleton, Firth College, and 23, Broomgrove Road, Sheffield, Professor of Chemistry.
1902. Williams, Walter Scott, Arnold Printworks, North Adams, Mass., U.S.A., Chemical Engineer.
1887. Williams, W. Collingwood, 68. Grove Street. Liverpool, Analytical Chemist.
O.M. Williams, W. J., 5004, Franklin Street, Frankford, Philadelphia, Pa., U.S.A., Analytical Chemist.
1899. Williamson, G. N., 14, Dey Street, New York City, U.S.A., Manufacturing Chemist.
1894. Williamson, J. Alex., 14, Milton Avenue, Highgate, N., Analytical Chemist.
O.M. Williamson, Robt., Low Walker, Newcastle-on-Tyne, Technical Chemist.
1903. Wills, J. L., 133, Midwood Street, Brooklyn, N.Y., U.S.A., Technical Chemist.
1895. Willson, Thos. L., St. Catherine's, Ont., Canada, Electrical Engineer.
1891. Wilson, A. Poole, 16, Nora Terrace, Glasnevin, Dublin, Ireland, Analytical Chemist.
1890. Wilson, Alf., c/o Messrs. J. and E. Sturge, 18, Wheeley's Lane, Birmingham, Manufacturing Chemist.
1884. Wilson, Anthony W., 20, Westcott Street, Hull, Colour Works Manager.
1888. Wilson, Cecil H., c/o Sheffield Smelting Co., Ltd., Sheffield, Metallurgical Chemist.
O.M. Wilson, C. J., 14, Old Queen Street, Westminster, S.W.
1888. Wilson, David, jun., Carbeth, Killearn, by Glasgow.
1885. Wilson, Frank, 7, Bedford Square, London, W.C., Brewer.
1903. Wilson, Geo. C., Mysore Gold Mines, Marikuppam, Mysore State, India, Chemist.
O.M. Wilson, G. E., The Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.
1902. Wilson, Geo. W., 18. Dinting Vale, Dinting, near Manchester, Works Chemist.
1899. Wilson, Gordon (Jnls.), c/o Lavenga Herms., Mineral Animas, Pueblo Nuevo, Durango, Mexico; and (subscriptions) Benallan, Kirkintilloch, N.B., Chemist and Assayer.
1886. Wilson, Jno., Tyneside, Hagley Road, Birmingham, Technical Chemist.
1896. Wilson, Jno., The Vines, Oxford Road, Runcorn, Chemical Engineer.
1902. Wilson, Jno. B., Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, Mining Engineer.
O.M. Wilson, J. H., 6, Fenchurch Buildings, E.C., Chemical Manufacturer.
1902. Wilson, Leonard P., Stocksfield, Church Road North, Hanwell, W., Technical Chemist.
O.M. Wilson, R. H., Egglescliffe, R.S.O., Co. Durham, Chemical Manufacturer.
1900. Wilson. Walter A., Ardeer, Stevenston, Ayrshire, N.B.
1885. Wilson, Dr. W. H., Presidency College, Madras, India, Lecturer on Physics.
1890. Wilson, W. W., The Grange, Carbrook, near Stalybridge, Analytical Chemist.
1884. Wilton, Thos., Winsor House, Beckton, E., Tar Works Manager.
1901. Wing, Herbert H., Monticello, N.Y., U.S.A., Chemical Engineer.
1892. Wing, J. D., 22, William St., New York City, U.S.A., Merchant.
1893. Wingate, Hamilton M., 24, Wynell Road, Forest Hill, S.E., Technical Chemist and Metallurgist.
1892. Wingfield, T. R., 5, Bromwich Street, Bolton, Brewer.
O.M. Wingham, A., Livermead House, Torquay, Metallurgical Chemist.
O.M. Winser, P. J., Moor House, Biddulph Moor, Congleton, Cheshire, Soap Works Manager.

O.M. Winsloe, H., c/o Tennants & Co., Clayton, Manchester, Manufacturing Chemist.

1892. Winstanley, Hy., Mayfield, Sutton Road, Heaton Norris, near Stockport, Technical Chemist.

1886. Winstone, E. H., Members' Mansions, 36, Victoria Street, London, S.W., Ink and Paint Manufacturer.

1892. Wirtz, Dr. Quirin, 28, Great Ormond Street, W.C., Consulting Chemist.

1900. Wishart, Harlan L., c/o Lake Superior Powder Co., Marquette, Mich., U.S.A., Chemist.

1889. Wishart, Jno., 39, St. Vincent Place, Glasgow, General Manager (Oakbank Oil Co., Lim.).

1902. Withers, Prof. W. A., State A. and M College, West Raleigh, N.C., U.S.A., Professor of Chemistry.

1899. Withinshaw, John G., Penketh, near Warrington, Tanner.

O.M. Witt, Dr. Otto N., Siegmundshof, 21, Berlin, N.W., Professor of Chemistry.

1892. Witthaus, Dr. R. A., Cornell Medical College, First Avenue and 28th Street, New York City, U.S.A., Professor of Chemistry.

1903. Wolf, Jacques, c o Jacques Wolf and Co., Passaic, N.J., U.S.A., Manufacturing Chemist.

1894. Woltereck, Dr. H. C., 3, Edinburgh Mansions, Howick Place, Victoria Street, S.W., Consulting Chemist.

1903. Wolton, Wm. R., c/o Joseph Fison and Co., Ltd., Ipswich, Manager.

1890. Wood, Ebenezer. Stephenson Street, Canning Town, E., Manufacturing Chemist.

1900. Wood, Frank, Hazelhurst, Doncaster Road, Barnsley, Yorks, Assistant Manager (Glass Works).

1901. Wood, Frank S., 25, Suffolk Street, Newland, Hull, Cement Works Chemist.

1887. Wood, Jos. T., 62, Park Road, Nottingham, Tanner.

1886. Wood, Wm. 20, Rue Général van Merlen, Antwerp, Belgium, Bleacher and Dyer.

O.M. Woodcock, R. C., American and Continental Sanitas Co., 636–642, West 55th Street, New York City, U.S.A., Technical Chemist.

1888. Woodham, Kingston G., 5, Lethbridge Road, Southport; and (Journals) c/o Price's Patent Candle Co., Ltd., 3, Cross Street, Manchester, Oilworks Manager.

1902. Woodhead Chas. E., 40, Westwood Street, Moss Side, Manchester, Chemist.

1881. Woodhead, Jas., Inglewood, Slaithwaite, near Huddersfield, Tar Distiller.

1890. Woodman, Dr. Durand, 127, Pearl Street, New York City, U.S.A., Analytical Chemist.

1900. Woodrow, John, 12, Park Road, Hull, Chemist.

1902. Woodside, F. Frank, Chesco Chemical Co., Uwchland, Pa., U.S.A., General Manager.

1896. Woodward. Jas., 31, Coventry Road, Ilford, Essex, Government Analyst.

1904. Woolcott, Geo. H., 26, Birdhurst Road, Croydon, Brewer's Chemist.

1896 Woolf, Julian, 51, Buckland Crescent, South Hampstead, N.W., Manufacturer.

1889. Woolf, Mortimer, Yeatman and Co., Denmark Street, E.; and (Journals) Mayfield, Mortimer Road, St. John's Wood, N.W., Vinegar Brewer.

O.M. Woolley, G. S., Victoria Bridge, Manchester, Pharmaceutical Chemist.

1891. Woolworth, J. G., 11, Halsey Street, Providence, R.I., U.S.A., Consulting Chemist.

1901. Worden, Edw. C., c/o Clark Thread Co., Newark, N.J., U.S.A., Analytical Chemist.

1888. Worms, Emil, Elabouga, Govt. of Viatka, Russia, Technical Chemist.

O.M. Worrall, H., Crimsworth, Whalley Range, Manchester, Dyer.

1903. Worstall, Robt. A., c/o Chicago Varnish Co., Chicago, Ill., U.S.A., Chemist.

1895. Worth, F. G., The Acetylene Illuminating Co., 3, Victoria Street, London, S.W., Managing Director.

1900. Worthington, Arthur, Starrcliffe Terrace, Great Lever, Bolton, Chemist and Sub-Manager.

1894. Wotherspoon, Peter, 135, Bede Burn Road, Jarrow-on-Tyne, Chemist.

1896. Wrampelmeier, T. J., E. I. du Pont de Nemours Powder Co., 39, Victoria Street, Westminster, S.W., Chemist and Representative.

O.M. Wray, O. J. P., Haslemere, Coleraine Road, Blackheath, S.E., Technical Chemist.

1901. Wren, E. Cecil, Glencoe, Egglescliffe, R.S.O., Co Durham, Vinegar Brewer.

1895. Wright, Arthur C., c o Turner, Morrison and Co., 6, Lyons Range, Calcutta, India, Chemist.

1901. Wright, Harold E., c o Sir B. Samuelson and Co., Ltd , Middlesbrough, Chemist.

1885. Wright, Jos., 19, Arboretum Street, Nottingham, Lace Dresser.

O.M. Wright, L. T., The Mountain Copper Co., Keswick, Cal., U.S.A.

1894. Wright, Sidney B.,
,Chemist.

1900. Wright, Walter J., 11, Albion Terrace, Faversham, Kent, Chemist (Cotton Powder Co.).

1890. Wülfing, Dr. Charles, Hönningen a/Rhein, Germany, Technical Chemist.

1890. Wyatt, Dr. Francis, 39, South William Street and 29, Stone Street, New York City, U.S.A., Consulting Chemist.

O.M. Wyld, Jno., The Avenue, Lidgett Park, Roundhay, Leeds, Chemical Works Manager.

Y

1900. Yamaoka, S., 10, Nishikatamachi, Hongo, Tokio, Japan, Chief Engineer.

1901. Yardley, Frank, c/o Henry Jutson and Sons, Liverpool Street, Birmingham, Chemical Manufacturer.

1899. Yates, Arthur, Lebong Donok, Bencoelen, Sumatra, Netherlands Indies, Metallurgist.

O.M. Yates, F., 64, Park Street, Southwark, London, S.E., Chemical Manufacturer.

1897. Yates, Wm. H., 11, Lansdowne Road, Southport, Lancashire, Technical Chemist.

1898. Yetton, Thos., Fen Villa, Queen's Road, Loughton, Essex, Distiller's Chemist.

1894. Yocum, Dr. Jno. H., 325, Academy Street, Newark, N.J., U.S.A., Chemist.

1886. Yoshida, Dr. H., Imperial University of Kyoto, Kyoto, Japan, Prof. of Chemistry.

1900. Yoshitake, E., 18, Tatsuokacho, Hongo, Tokyo, Japan, Chemist.

1885. Young, Alfred C., 53A, Algiers Road, Ladywell, S.E.

1901. Young, A. Henry I., Capaunenstrasse, 10, Greifswald, Pomerania, Germany, Student.

1885. Young, Brougham, 2A, Sigdon Road, Dalston, N.E., Analytical Chemist.

1902. Young, Chas. C., 40, Stone Street, New York City, U.S.A., Colourist.

1890. Young, Dr. Geo., Firth College, Sheffield, Chemist.

1900. Young, J. Bertram, 1639, North 19th Street, Philadelphia, Pa., U.S.A., Chemist.

O.M. Young, Jno., 2, Montague Terrace, Kelvinside, Glasgow, Technical Chemist.

1886. Young, Jno., (Journals,) Claremont House, Beverley Road, Hull; and Gasworks, Sculcoates, Hull, Gas Engineer.

1904. Young, Jno. H., c/o The Cassel Gold Extracting Co., Ltd., Shuna Street, Maryhill, Glasgow, Technical Chemist.

1898. Young, J. W., 4, Portland Terrace, Newcastle-on-Tyne, Inspector under Alkali Acts.

1902. Young, Roland F., c/o Wouldham Cement Co., West Thurrock, near Grays, Essex, Cement Works Chemist.

1883. Young, Prof. Sydney, F.R.S., University Chemical Laboratory, Trinity College, Dublin, Professor of Chemistry.

O.M. Young, W. C., Chemical Laboratory, 19 and 20, Aldgate, London, E.C., Gas Examiner and Consulting Chemist.

1898. Young, W. Gathorne, Analyst's Office, G.N.R., Doncaster, Yorks, Chief Chemist.

1902. Youtz, Dr. Lewis A., Lawrence University, Appleton, Wis., U.S.A., Professor of Chemistry.

Z

1899. Zabriskie, C. B., 100, William Street, New York City, U.S.A., Manager (Pacific Coast Borax Co.).

1897. Zacharias, Dr. P. D., Philhellinon Street, 22, Athens, Greece, Industrial Chemist.

1902. Zahn, Edw., , Chemist.

1897. Zahorski, Dr. Boleslas, Maywood, N.J., U.S.A., Technical Chemist.

1898. Zehetmayr, Ferd. F , 85, Gracechurch Street, London, E.C., Merchant.

1904. Zieme, Carl H., c/o Incandescent and Chemical Co., Youngstown, Ohio, U.S.A., Chemist.

1899. Zilz, Henry, 22, Bush Lane, London, E.C., Agent (Badische Anilin und Soda Fabrik).

O.M. Zimmermann, A., 3, Lloyd's Avenue, London, E.C., Chemical Agent.

1897. Zinsser, Dr. Fred. G., Hastings upon-Hudson, N.Y., U.S.A., Manufacturing Chemist.

1895. Zoeller, E. V., Tarboro', N.C., U.S.A., Cotton-Seed Oil Refiner and Pharmacist.

1899. Zumbeck, Aug., 66, Mark Lane, London, E.C., Chemical Merchant.